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Review Article

Utilization Of Radix Rauwolfia As Therapeutic Agent: A Comprehensive Review

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ABSTRACT

Rauwolfia serpentina is an important medicinal plant in the pharmaceutical world due to the presence of its immense therapeutic properties. The plant is known for curing various disorders because of the presence of alkaloids, carbohydrates, flavonoids, glycosides, phlobatannins, phenols, resins, saponins sterols, tannins and terpenes. The plant parts, root and rhizome have been used since centuries in Ayurvedic medicines for curing a large number of diseases such as high blood pressure, mental agitation, epilepsy, traumas, anxiety, excitement, schizophrenia, sedative insomnia and insanity. The plant contains more than 50 different alkaloids which belong to the monoterpenoid indole alkaloid family. The major alkaloids are ajmaline, ajmalicine, ajmalimine, deserpidine, indobine, indobinine, reserpine, reserpiline, rescinnamine, rescinnamidine, serpentine, serpentinine and yohimbine. R. serpentina is also known for its antimicrobial, antifungal, anti-inflammatory, antiproliferative, antidiuretic and anticholinergic activities. The herbal medicine is still the basis of primary health care for 75– 80% of the world population because of its cultural acceptability, better compatibility with the human body and lesser side effects. Therefore, there is a need for us to search alternative, naturally available remedies for curing millions of people worldwide. Due to all these properties, the present review aims to evaluate the various pharmacological, phytochemical and therapeutic properties of R. serpentina.

INTRODUCTION

Rauwolfia serpentina L. Benth. Ex Kurz. is an evergreen, woody, glabrous and perennial shrub with maximum height up to 60 cm. The plant possesses tuberous root with pale brown cork and elliptic to lanceolate or obovate leaves in whorls of three. The plant belongs to the family Apocynaceae and occurs in habitats of tropical and subtropical regions. The family includes 50 species, distributed worldwide in the region of the Himalayas, Indian peninsula, Burma, Indonesia and Sri Lanka and is indigenous to India, Bangladesh and other regions of asia. The plant is commonly known as Sarpagandha, Chandrabagha,

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Snake root plant, Chotachand, Chandrika and Harkaya etc. The roots, leaves and juice are of medicinal importance and have attracted the attention of practitioners of indigenous system of medicine, as it contain a large number of secondary metabolites (Ncontaining indole alkaloids) localized mainly in the roots and rhizomes.It has been used in India as a part of the Ayurvedic medical system for the treatment of various ailments.In Ayurvedic medicines, the roots of R. serpentina is used as a remedy for curing hypertension, insomnia, mental agitation, gastrointestinal disorders, excitement, epilepsy, traumas, anxiety, excitement, schizophrenia, sedative insomnia and insanity. In Siddha medicine, R. serpentina roots are used for curing hypertension-associated headache, dizziness, amenorrhea, oligomenorrhea and dysmenorrhea like abnormalities.

SNONYMS: Sarpagandh, Snakeroot, Chotachand, Chandrika Etc.

FAMILIY: The plants belong to family Apocynaceae.

Figure:1 Rauwolfia

HISTORY:

The root of Rauwolfia serpentina benth has been used in India from century. In Ayurveda sarpgandha refers to use as an antidote for snake bite. Rauwolfia has been used in Africa for hundreds of years, in India for at least 3000 years. Rauwolfia was mentioned in Indian manuscripts as long as 1000 B.C. and also known as Sarpagandha and Chandra. On the name of German physician Dr. Leonhard Rauwolf (16th century) the name of this plantae said to be Rauwolfia sarpentina. In 1949 A.D. Jal Vakil published a watershed paper on the antihypertensive properties of Rauwolfia serpentina in the British medical journal.

TAXONOMICAL CLASSIFICATION:

- Kingdome- Plantae
- Phylum- Angiosperms
- Subphylum- Eudicots
- Order- Gentianellas
- Family- Apocynaceae
- Genus-Rauwolfia
- Species-Serpentina.

MORPHOLOGY:

Serpentina rauwolfia or Sarpagandh is a climbing herb or shrub having height near about 60 cm.15 this tree has cylindrical stems, have pale bark and latex is viscous and light in colour. Leaves are pale green that are elliptical or lanceolate shaped.

- Fruits are shiny, black or purple.
- Roots- 10-18 cm long
- Size- 1-3 cm
- Diameter Shape- Sub-cylindrical. Fracture short and irregular
- Colour- Greyish yellow to brown.

CULTIVATION:

Rauwolfia grows under various climatic conditions. It flourishes in hot humidity conditions and grows satisfactory in shade. For cultivation, the clay loamy soil with much amount of humus and good drainage are favourable. It grows best at 10-38'C temperature and PH around to 4 Rainfall should be from 250-500 cm. The plant can be cultivated easily by seed propagation but can also be propagated by stem or root.

Fig:2 Rauwolfia Serpentina (Pale Green Leaves)

PHYTOCHEMICAL CONSTITUENTS:

Rauvolfia serpentina has been a prevailing field of research for decades and several workers have explored this area due to its phytochemical properties.The various phytochemical compounds or secondary metabolites present in R. serpentina include alkaloids, phenols, tannins and flavonoids.

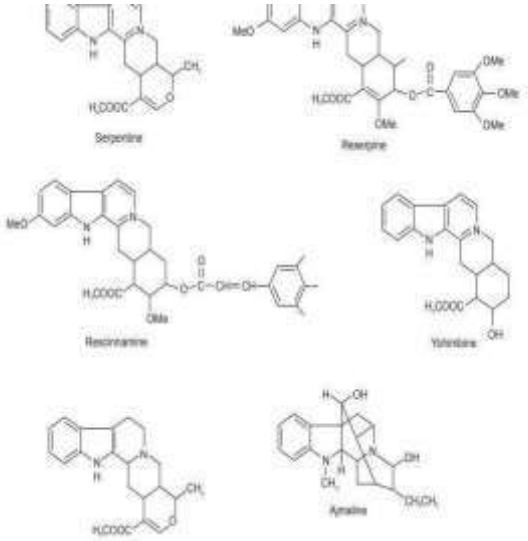
All alkaloids are broadly classified into the following types:

1. Indole alkaloids
2. Indolenine alkaloids
3. Oxindole alkaloids
4. Pseudo indoxyl alkaloid
5. Indole alkaloids.

ALKALOIDS

Alkaloids are large group of organic molecules which contain a heterocyclic nitrogen ring. These are brought about by different organisms such as animals and microbes, but a particularly diversearry of alkaloids is produced by plants. Approximately 10 % of plant species are believed to produce alkaloid as a secondary metabolites, where they work predominantly in providing defence against herbivores pathogens. Pure isolated alkaloids and their synthetic derivatives are used as a medicinal agents for their analgesic, antispasmodic and bactericidal effects. The alkaloids obtained from the root extract acts directly on central nervous system and thereby reduces blood pressure as compared to other blood -pressure lowering agents. R. serpentina root is reported to contain 0.7 – 3.0 % of total alkaloids and about 0.1% of the active principal reserpine which is an indole alkaloid, present in the root. Hence, root biomass production of this plant could be of economic importance. On the basis of the structure there are three types of alkaloids namely, weak basic indole alkaloids, alkaloids of a intermediate basicity and strong anhydronium bases. The various alkaloids identified in Rauvolfia (Figure 3) include ajmaline, ajmalimine, ajmalicine, deserpidine, indobine, indobinine, reserpine, reserpiline, rescinnamine, rescinnamidine, serpentine, serpentinine and yohimbine etc.

Figure:3 Chemical structures of some alkaloids present in Rauwolfia serpentina



Amongst all, resperine is the principle alkaloid which shows large number of clinical applications. Along with resperine, yohimbine, serpentine, deserpidine, ajmalicine and ajmaline are used to treat hypertension and breast cancer.

RESEPRINE:

The antihypertensive actions of reserpine are due to its depressant action on central nervous system (CNS) and peripheral nervous system by binding to catecholamine storage vesicles present in the nerve cell. It interferes with the function of autonomic nervous system by depleting the transmitter substance from the adrenergic neurons and possibly by activating the central

parasympathetic system. These substances are mostly involved in controlling heart rate, cardiac contraction and peripheral resistance. It also helps in sedation and lowering of blood pressure, especially in cases of hypertension exacerbated by stress and sympathetic nervous system activity. Reserpine causes the release of 5hydroxytryptamine (5- HT) from all tissues in which it is normally stored and results in increase of urinary metabolites**.**

SERPENTINE: Serpentine, a type II topoisomerase inhibitor, exhibits antipsychotic properties. The enzyme peroxidase (PER) is responsible for oxidation of ajmalicine to serpentine by catalyzing bisindole alkaloid localized in the vacuole Rescinnamin.

DESEPRIDINE: Deserpidine is an ester alkaloid isolated from Ruvolfia. It differs from reserpine only by means of absence of a methoxy group at C-11, which is synthesized from reserpine. It is used mainly for its antipsychotic and antihypertensive properties. It is capable of reducing high blood pressure by controlling nerve impulses along various nerve pathways. As a result, they act on the heart and blood vessels to lower blood pressure and also for antisychotic activity.

TANNIN:

The oxidation inhibiting activity of tanni is due to the presence of gallic acid and diagallic acid. Tannins have stringent properties, they hasten the healing of wounds and inflamed mucous membranes. Thus, explain the use of R. serpentina in treating many disorders by traditional medicine healers in South eastern India.

PHENOLS:

Phenols are the secondary plant metabolites widely distributed in the plant kingdom mainly herbs, shrubs, vegetables and trees. The presence of phenols is considered toxic for the growth and development of various pest and pathogens. Presence of high quantity of total polyphenolic compounds in R. serpentina shows significant antidiabetic and hypolipidemic properties. In medicine, it is used as an expectorant and emulsifying agent. The presence of phenolic compounds indicates that this can be used as anti-microbial agent.

Saponins are glycoside of both triterpenes and sterols and have been detected in over 70 families of plants. Some of the characteristics of saponins include formation of foams in aqueous solutions, hemolytic activity, cholesterol binding properties and bitterness. Saponin has the property of coagulating red blood cells. The high saponin content of Rauvolfia serpentina substantiates the use of this extracts to stop bleeding and in treating wounds.

PHARMACOLOGY OF RADIX RAUWOLIFAE:

1. ANTIHYPERTENSIVE ACTIVITY:

Rauwolfia serpentina is the most likely known to be as an antihypertensive drug due to presence of alkaloid called Reserpine. Reserpine is a major alkaloid present highest in root and leaves and also in lowest part of stem. The first man, SEN And BOSE published modern paper on Reserpine in 1931 A.D. in Indian medical journal. The Reserpine content of per gram root is 33 mg of 496 mg of total alkaloids. In the study of vakil's 50 patients, 85% patient found to be a drop in systolic blood pressure and 81% of patient found to be a drop in diastolic blood pressure. Reserpine is effective orally and parentally for the treatment of hypertension. After a single intravenous dose, the

onset of antihypertensive action usually begins in about 1 hour. After intramuscular injection, the maximum effect occurs within approximately 4 hours and lasts about 10 hours. When it given orally, the maximum effect occurs within about 2 weeks and may persist up to 4 weeks after the final dose. When used in conjugation with other hypotensive drugs in the treatment of severe hypertension, the daily dose varies from 100 to 250 micrograms.

MECHANISUM OF RESEPRINE: Reserpine lowers the blood pressure by depleting
the stores of catecholamine at nerves ending. It prevents reuptake of nor epinephrine at storage sites, allowing enzymatic destruction of neuronal transmitter. Reserpine binds to vesicular monoamine transporter (VMATs) in organelle membrane of presynaptic neurons. Reserpine irreversibly blocks the H+ coupled vesicular monoamine transporters, VMAT1 and VMAT2. VMAT1 is rich in Neuro-endocrine cells. VMAT2 is rich in neurons. Thus, Reserpine block neuronal system that inhibits uptake and reduces stores of the monoamine neurotransmitters, nor epinephrine, dopamine, serotonin and Histamine in the synaptic vesicles of neurones.

2. PROSTATE CANCER: Prostate cancer is considered to be major causes of cancer related deaths among men. Modern techniques such as chemotherapy and radiotherapy have not provided significant survival benefits to patients with prostate cancer. Natural products have proven to be a major resource for identification of bioactive compounds used in the treatment of a variety of ailments and diseases, including cancer as compared to chemotherapy and radiotherapy. Various parts of this plant have been used as a traditional medicine for centuries to treat a variety of ailments including fever, general weakness, intestinal diseases, liver problems and mental disorders. Extracts from the root bark of this plant are enriched with compounds of ß-carboline alkaloid family of which the main constituent is alstonine. This compound has been previously reported to reduce tumour cell growth in mice inoculated with YC8 lymphoma cells or Ehrlich ascitic cells. The plant extract has anti-prostate cancer activity in both in vitro and in vivo model systems which, based upon analyses of gene expression patterns of treated prostate cancer cells, may be modulated by its effects on DNA damage and cell cycle control signalling pathways.

3. ANTI-DIARRHOEAL ACTIVITY: Dr. EZEIGBO II in its research to evaluate the
Antidiarrhoeal activity of methanolic extract of leaves of Rauwolfia serpentina in experimental diarrhoeal induced by castor oil in mice found that the extract of Rauwolfia serpentina leaves has significant Anti-diarrhoeal activity.

4. ANTISYCHOTIC ACTIVITY : Reserpine has also used for treatment of
schizophrenia and tardive dyskinesia. It is used as febrifuge or fever relieving drug.A review found that in person with schizophrenia, Reserpine and chlorpromazine had similar rates of adverse effects but that Reserpine was less effective than chlorpromazine for improving a person's global state

5. TREATMENT OF HYSTERIA: Rauwolfia is useful in treating hysteria. 1 gm of powdered root can be administered thrice with milk. Treatment should be continued till a complete cure is obtained.

6. OTHER USES: The products of Rauwolfia serpentina are also useful in treatment of disease like: Fever, malaria, eye disease, pneumonia, asthma, AIDS, headache, skin disease and spleen disorder.

CONCLUSION

Worldwide large number of peoples are suffering from several chronic diseases, due to significant variation in the climate and environment. To cure large number of people there is an urgent need for an herbal drug that can be utilized to treat various

diseases with better cultural acceptability, compatibility with the physical body and lesser side effects. Thus, to fulfil this requirement R. serpentina is a promising herbal option in the pharmaceutical world due to the presence of significant chemical compounds in roots. The present review work will shed new insights on the potential of R. serpentina as antioxidant, anticancerous, antidiuretic, antiarrhythmic, antidysentry, antidiarrhoeal antihypotensive, anticontractile, and tranquillizing agent. Reserpine has a great affinity for treatment of hypertension along with other pharmacological action as well defined in above whole literature. Although Rauwolfia serpentina is affective in hypertension but it appears safe and well effective when taken at lower dose. A patient has hypertension should take less than 500 mg of drug per day, even in most of the cases physician prefer 250 mg per day. Rauwolfia serpentina consist of many photochemical like alkaloids, flavonoids, phenolic compounds etc. The presence of phenolic compound in the plant indicates that this plant may be anti-microbial agent. Pure isolated alkaloids and their synthetic derivatives may used as basic medicinal agent for their analgesic, antispasmodic and bactericidal effects.

REFERENCES

1. Deshmukh SR, Dhanashree SA, Patil BA, Extraction and evaluation of indole alkaloids from Rauvolfia serpentina for their antimicrobial and antiproliferative activities, International Journal of Pharmacy and Pharmaceutical Sciences, 4(5), 2012, 329-334.
2. Ghani A, Medicinal plants of Bangladesh chemical constituents and uses. Asiatic Society of Bangladesh, second edition, 1998, 36.
3. Singh P, Singh A, Shukla AK, Singh L, Pande V, Nailwal TK, Somatic embryogenesis and in vitro regeneration of an endangered medicinal plant sarpgandha (Rauvolfia serpentina. L), Life Science Journal, 6(3), 2009, 74-79.
4. Mittal B, Meenakshi, Sharma A, Gothecha VK, Phytochemical and pharmacological activity of Rauvolfia Serpentina - a review, International Journal of Ayurvedic & Herbal Medicine 2(3), 2012, 427-434.
5. Mallick SR, Jena RC, Samal KC, Rapid in vitro multiplication of an endangered medicinal plant sarpgandha (Rauvolfia serpentina), American Journal of Plant Sciences, 3, 2012, 437442.
6. Poonam, Agrawal S, Mishra S, Physiological, biochemical and modern biotechnological approach to improvement of Rauvolfia serpentina, Journal of Pharmacy and Biological Science, 6(2), 2013, 73-78.
7. Pant KK, Joshi SD, Rapid multiplication of Rauvolfia serpentina Benth. Ex. Kurz through tissue culture, Scientific World, 6, 2008, 58-62.
8. Meena AK, Bansal P, Kumar S, Plants-herbal wealth as a potential source of ayurvedic drugs, Asian Journal of Traditional Medicines, 4(4), 2009, 152-170.
9. Rajendran SM, Agarwal SC, Medicinal plants conservation through sacred forests by ethnic tribals of Virudhunagar district, Tamil Nadu, Indian Journal of Traditional Knowledge, 6(2), 2007,328-334.
10. Joseph Monachino, Rauwolfia serpentina – Its history, Botany and Medical use, Economic Botany 1954; 8(4): 349-365.
11. Gupta K. Ajay, Chitme Havagiray, Dass K. Sujata and Misra Neelam, Hepatoprotective Activity of Rauwolfia serpentina Rhizome in Paracetamol Intoxicated Rats, Journal of Pharmacology and Toxicology 2006; 1(1): 82-88.
12. Yarnell E., Abascal K. Treating hypertension botanically. Altern Complement Ther 2001; 7(5): 284-290.
13. Kokate C.K, Purohit A.P., Gokhale S.B., Pharmacognosy, Nirali Prakashan, 15.23.

14. Yaffe D, Forrest LR, Schuldiner S. The ins and outs of vesicular monoamine transporters. J. Gen. Physiol. 2018; 150 (5): 671–682.
15. 15. Biradar Nitin, Hazarika Iswar, Chandy Vineet, Current Insight to the use of Rauwolfia: A Review, Research and Reviews: A Journal of Pharmacognosy 3: 2394-7276
16. Okwu DE, Okwu ME, Chemical composition of Spondias mombin linn plant parts, Journal of Sustainable Agriculture and Environment, 6(2), 2004, 140-147.
17. Pandey VP, Cherian E, Patani G, Effect of growth regulators and culture conditions on direct root induction of Rauvolfia serpentina L. (Apocynaceae) Benth. by leaf explants. Tropical Journal of Pharmaceutical Research, 9(1), 2010, 27-34.
18. Srivastava A, Tripathi AK, Pandey R, Verma RK, Gupta MM, Quantitative determination of reserpine, ajmaline and ajmalicine in Rauvolfia serpentina by reversed-phase highperformance liquid chromatography. Journal of Chromatographic Science, 44, 2006, 557-560
19. 19.. Schlittler E, Saner H, Muller JM, Reserpinin, ei neues alkaloid aus Rauvolfia serpentina. Experientia, 10: 1954, 109-133.
20. Howes LG, Louis WJ, Rauvolfia alkaloids (Reserpine), pharmacology of antihypertensive therapeutics, Handbook of Experimental Pharmacology, 93 (1), 1990, 263-285.
21. Weiss RF, Fintelmann V, Herbal medicine, 2nd ed. Thieme, Stuttgart, 2000, 229-230, 87416.
22. Pullaiah J, Medicinal plants in India, New Delhi, Regency Publ, 2, 2002, pp 441-443
23. Banerjee M, Modi P, A novel protocol for micropropagation of Rauvolfia serpentina: In low concentration of growth regulators with sucrose and phenolic acid. International Journal of Plant Sciences, 5(1), 2010, 93-97.
24. Srivastava A, Tripathi AK, Pandey R, Verma RK, Gupta MM, Quantitative determination of reserpine, ajmaline and ajmalicine in Rauvolfia serpentina by reversed-phase highperformance liquid chromatography. Journal of Chromatographic Science, 44, 2006, 557-560.
25. Goel MK, Mehrotra S, Kukreja AK, Shanker K, Khanuja SP, In vitro propagation of Rauvolfia serpentina using liquid medium, assessment of genetic fidelity of micropropagated plants and simultaneous quantitation of reserpine, ajmaline and ajmalicine, Methods in Molecular Biology, 547, 2009, 17-33.
26. Ihekoronye, AI, Ngoddy PO, Integrated Food Science and Technology for the Tropics, Macmillam Education Ltd, 1985.
27. Bonilla EP, Akoh CC, Sellappan S, Krewer G, Phenolic content and antioxidant capacity of muscadine grapes, Journal of Agriculture & Food Chemistry, 51, 2003, 5497-5503.
28. Naira VD, Panneerselvama R, Gopia R, Hong-bob S, Elicitation of pharmacologically active phenolic compounds from Rauvolfia serpentina Benth. Ex. Kurtz, Industrial Crops and Products, 45, 2013, 406-415. 73. Singh R, Sawhney SK, Adva.
29. Agoha RC, Medicinal plants of Nigeria, offset Drakkerij, Faculfcitder Wiskunde in Naturwetenschappen, the Netherlands, 1974, pp 41-33.
30. Sodipo OA, Akiniyi JA, Ogunbamosu JU, Studies on certain characteristics of extracts of bark of Pansinystalia macruceras (K. schemp) pierre Exbeille, Global Journal of Pure Applied Science, 6, 2000, 83-87.
31. American Cancer Society, Cancer Facts and Figures 2006, Atlanta: American Cancer Society, 2006.
32. PDRHealth.com. Rauvolfia. Available at: www.pdrhealth.com.

33. Bemis DL, Capodice JL, Gorroochurn P, Katz AE, Buttyan R, Antiprostate cancer activity of a beta-carboline alkaloid enriched extract from Rauvolfia vomitoria, International Journal of Oncology, 29(5), 2006, 1065-1073
34. B.V. Gawade and S.A. Fegade, Rauwolfia (serpentina) As a potential Antihypertensive Agent: A Review, International Journal of Pharmaceutical and Phytopharmacology Research 2012; 2(1): 46-49.
35. Kokate C.K, Purohit A.P., Gokhale S.B., Pharmacognosy, Nirali Prakashan, 15.23.

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