



## A REVIEW ON IDENTIFICATION AND CHARACTERIZATION OF SERPENTINA ON MDR AGAINST *STAPHYLOCOCCUS AUREUS*

Aishwarya Pillewan<sup>1</sup> and Prabhakar Bhandari<sup>2</sup>

<sup>1</sup>Student of Post Graduate Teaching Department of Microbiology

<sup>2</sup>Head of Post Graduate Teaching Department of Microbiology

Sevadal Mahila Mahavidyalaya and Research Academy Nagpur

Corresponding Email: - [aishwaryapillewan15@gmail.com](mailto:aishwaryapillewan15@gmail.com)

Communicated :22.11.2024

Revision: 24.11.2024 & 19.12.2024

Accepted: 28.12.2024

Published: 30.01.2025

### ABSTRACT:

*Rauwolfia Serpentina* has many medicinal uses and therapeutic properties. *Serpentina*, also called sarpagandha, is a medicinal plant that belongs to the Apocynaceae. Many chemical constituents such as alkaloids are a part of plant. *Serpentina* contains several key alkaloids, including ajmaline, ajmalimine, deserpidine, indobine, indobinine, reserpine, reserpiline, rescinnamine, rescinnamidine, serpentine, serpentinine and yohimbine. This plant shows antimicrobial, antifungal as well as anti-inflammatory properties. *Serpentina* is also utilized in the treatment of high blood pressure, mental health conditions, and various other ailments. *Staphylococcus aureus* is one of the most interactable pathogenic bacteria and it is multi drug resistance to many bacterial species. *Staphylococcus aureus*, especially Methicilline-resistant *Staphylococcus aureus* (MRSA), have a remarkable to global health caused by increasing resistance to antibiotic. This review focuses on identifying and characterizing the effects of *Serpentina* on multi-drug resistant *S. aureus*.

**Keywords:** - Sarpagandha, Alkaloids, hypertension, Medicinal Herb, MDR, MRSA.

### INTRODUCTION :

*Rauwolfia Serpentina* belonging to the family Apocynaceae is a medicinal herb (Alshahrani et al., 2021). *Serpentina* is found wild in the sub-Himalayan tracts in India Indonesia, Myanmar and Thailand (Ahmad et al., 2002). This plant is commonly used to treat conditions such as high blood pressure, insomnia, anxiety and various central nervous system disorders, Reserpine a powerful indole alkaloid initially extracted from this plant, is extensively utilized as an antihypertensive agent (Deshwal and Vig 2012). R. Serpentina it is important to analyze the main motive of its before acceptable them for large scale cultivation and medicine uses (Negi et al., 2014). This plant show the presence of various chemical substances such as glycosides, alkaloids, volatile oils, resins, fatty acids, carbon, hydrogen, nitrogen, tennis and gums (Kumari et al., 2013).

*Serpentina* is a well-known medicinal plant due to its diverse pharmacological effects, including

antibacterial, antifungal and anti-inflammatory properties. *Staphylococcus aureus* has developed resistance to several antibiotics, with methicillin and vancomycin being the most notable (Hiramatsu et al., 2014). Methicillin-resistant *Staphylococcus aureus* (MRSA) is a prevalent pathogen responsible for a wide spectrum of human infections, ranging from minor skin problems to severe, systemic diseases. Traditionally, MRSA has been associated with healthcare settings (HA-MRSA), affecting individuals with prior hospitalization and underlying health conditions (AlSaleh et al., 2023). Their antimicrobial metabolites of pharmaceuticals and biotechnological importance (Pal et al., 2020).

### PHYTOCHEMICAL COMPONENTS:

*Rauwolfia Serpentina* has been a significant focus of research for many years, with numerous researchers investigating its phytochemical properties (Kumari et al., 2013). *Serpentina* contains a variety of phytochemical compounds

or secondary metabolites, including alkaloids, phenols, terpenoids and flavonoids.

#### **Alkaloids:**

Alkaloids present in *Rauwolfia Serpentina* are a varied group of compounds distinguished by a heterocyclic ring structure that contains nitrogen. Synthetic derivatives of alkaloids can be used as bactericidal effects, as well as antispasmodic. This plant has high economic importance, alkaloids found in *R. Serpentina* such as ajmalimine, ajmaline, ajmaciline, indobine, deserpidine, reserpine, indobinin, rescinnamin, reserpiline, rescinnamidine, serpentinine, serpentine and yohimbine etc. (Kumari et al., 2013). *Rauwolfia Serpentina* is studied using methods like high-performance liquid chromatography (HPLC) and high-performance thin-layer chromatography (HPTLC) (Negi et al., 2014).

#### **Reserpine:**

Reserpine, a pure crystalline alkaloid, was first isolated in 1952 from the root of *Rauwolfia*. Reserpine is a mild tertiary base present in the oleoresin extract of the roots and is used in the treatment of hypertension, neurological disorders and heart-related diseases. Reserpine lowers blood pressure by exerting a calming effect on both the peripheral and central nervous systems, primarily through its interaction with vesicles in nerve cells that store catecholamines (Kumari et al., 2013). Reserpine has been used to treat high blood pressure, particularly in patients with mild to moderate hypertension. (Alshahrani et al., 2021).

#### **Ajmalicine:**

Ajmalicine is a naturally occurring alkaloid extracted from the roots of *Rauwolfia Serpentina*. Ajmalicine's (Deshwal et al., 2012). Ajmalicine has a wide variety of applications in cardiovascular diseases and providing relief to normal cerebral blood flow. Ajmalicine is produced from tryptophan, which undergoes conversion to tryptamine through several

intermediates such as cathenamine, strictosidine and secologanin. The reduction of cathenamine to ajmalicine is catalyzed by enzyme NADPH and tryptophan decarboxylase (TDC) (Kumari et al., 2013).

#### **Ajmaline:**

In 1931, Salimuzzaman Siddiqui first isolated ajmaline from the roots of *Rauwolfia serpentina*. The use of this alkaloid in patients with certain arrhythmias is referred to as the "Ajmaline Test". Additionally, it has been observed to enhance respiratory function and stimulate intestinal activity. The effects of ajmaline on both systemic and pulmonary blood pressure are comparable to those of serpentine (Kumari et al., 2013). Ajmaline hypotensive effects make it a potential candidate for the treatment of hypotension, which may contribute therapeutic effects (Alshahrani et al., 2021).

#### **Antibacterial activity:**

*Rauwolfia Serpentina* cultivated in Uttarakhand contains a significant amount of reserpine and shows moderate to potent antibacterial activity against a range of human pathogens. As a result, the species is recommended for extensive cultivation, and the findings support the potential for developing of new antimicrobial medications from this plant (Negi et al., 2014). Many plants are recognized for their antibacterial properties (S. B. Patil and Shruti B 2015)

#### **Pharmacology:**

In 1952, reserpine was first introduced as Serpasil treating hypertension, tachycardia, and thyrotoxicosis. It is widely distributed across various body tissues, including the brain, liver, spleen, kidneys, and adipose tissue. Its initial half-life in the blood is between 4 to 5 hours, while its elimination half-life in plasma has ranges from 45 and 168 hours. The prolonged elimination time is due to its binding to proteins and cells. About 62 % of reserpine degradation occurs through relatively hepatic metabolism, its elimination is primarily carried out through

faecal excretion. Between 30% to 60% of the excreted metabolites are attributed to reserpine itself (Dhomase et al., 2022)

#### **Medicinal Uses:**

The roots of the plant have traditionally been used to manage high blood pressure, treat mental disorders, alleviate insomnia, and help calm individuals experiencing agitation or hysteria. *Rauwolfia serpentina* is a plant known for its therapeutic indole alkaloids, with the majority of these compounds found in its roots. Extracts of the roots finds applications in the treatment of cholera, colic and fever. The leaf juice is used to treat corneal opacity. Different parts of the plant, particularly the root and bark, contain compounds from the B-carboline alkaloid family, with alsonine being the primary component. The plant extract demonstrates anti-prostate cancer effects in both in laboratory and animals model (Mishra et al., 2024).

#### **Multi-Drug Resistance:**

Multi-Drug Resistance (MDR) refers the ability of microorganism, such as bacteria, viruses, or fungi to resists the effects of multiple antimicrobial agents. MDR microorganisms such as Methicillin-resistant *Staphylococcus aureus* are resistant to several different antibiotics, including methicillin and Vancomycin. Methicillin-resistant *Staphylococcus aureus* (MRSA) is a current pathogen linked to various human infections (AlSaleh et al., 2023). MRSA develops when methicillin-sensitive *Staphylococcus aureus* (MSSA) obtains *mecA* gene, which confers resistance to methicillin, through horizontal gene transfer facilitated by a mobile genetic element known as the staphylococcal cassette chromosome (SCC). Vancomycin resistance, which poses a significant challenge to the treatment of MRSA infections, is also gained through genetic mutation. In 1997, the first VISA strain, Mu50, was identified from a surgical wound of a new born in Japan, whose the infection showed poor

response to prolonged vancomycin treatment (Hiramatsu et al., 2014).

#### **CONCLUSION:**

The review highlights the potential of *Rauwolfia serpentina*, particularly its alkaloids, as a natural supplement or alternative to conventional antibiotics against MDR *Staphylococcus aureus*. The studies discussed in this review demonstrate the antibacterial activity of serpentina Against MDR *S. aureus*, including MRSA. *Serpentina's* alkaloids likely interact with the bacterial cell membrane, disrupting cellular processes and inhibiting biofilms formulation. Further research is needed to explore *Serpentina's* therapeutic potential against MDR *S. aureus*. Standardization, in vivo studies, and clinical trials are needed to confirm *Serpentina's* efficacy and safety against MDR *S. aureus*.

#### **REFERENCES:**

- Ahmed, S., Amin, M. N., Anjum, A., & Haque, M. E. (2002). In vitro antibacterial activity of *Rauwolfia serpentina* and its tissue culture. *Nigerian Journal of Natural Products and Medicine*, 6, 45-49.
- AlSaleh, A., Shahid, M., Farid, E., Saeed, N., & Bindayna, K. M. (2023). Multidrug-resistant *Staphylococcus aureus* isolates in a tertiary care hospital, Kingdom of Bahrain. *Cureus*, 15(4).
- Alshahrani, M. Y., Rafi, Z., Alabdallah, N. M., Shoaib, A., Ahmad, I., Asiri, M., ... & Khan, S. (2021). A comparative antibacterial, antioxidant, and antineoplastic potential of *Rauwolfia serpentina* (L.) leaf extract with its biologically synthesized gold nanoparticles (R-AuNPs). *Plants*, 10(11), 2278.
- Deshwal, V., & Vig, K. (2012). Study on the antibacterial effect of *Rauwolfia serpentina* on *Staphylococcus aureus*. *Int J Pharm Invent*, 2, 45-50.

- Hiramatsu, K., Katayama, Y., Matsuo, M., Sasaki, T., Morimoto, Y., Sekiguchi, A., & Baba, T. (2014). Multi-drug-resistant *Staphylococcus aureus* and future chemotherapy. *Journal of Infection and Chemotherapy*, 20(10), 593-601.
- Kumari, R., Rathi, B., Rani, A., & Bhatnagar, S. (2013). *Rauvolfia serpentina* L. Benth. ex Kurz.: phytochemical, pharmacological and therapeutic aspects. *Int J Pharm Sci Rev Res*, 23(2), 348-355.
- Negi, J. S., Bisht, V. K., Bhandari, A. K., Bisht, D. S., Singh, P., & Singh, N. (2014). Quantification of reserpine content and antibacterial activity of *Rauvolfia serpentina* (L.) Benth. ex Kurz. *African Journal of Microbiology Research*, 8(2), 162-166.
- Pal, A., & Paul, A. K. (2020). In Vitro antimicrobial activity screening of bacteria endophytic to ethnomedicinal plant *Rauvolfia serpentina* (L.) Benth. ex Kurz. *Journal of Applied Biotechnology Reports*, 7(3), 176-184.
- Patil, S. B., & B. Shruti (2015). Antimicrobial Screening of Various Extracts of *Rauvolfia Serpentina*. *International Advanced Research Journal in Science, Engineering and Technology*, 2(7), 56-58.
- Dhomase, O. B., Farde, J. S., Gugale, V. B., Gaikwad, P. J., Dhokale, M. A., Gadge, S. C., & Datkhile, S. V. (2022). Pharmacological Review on *Rauvolfia serpentina*. *International Journal of Advanced Research in Science, Communication and Technology*, 2(5), 580-585.
- Mishra, R. P. K., Bihari, K., Ahmad, R., Nishad, U., Maurya, A., & Kumar, S. (2024). Medicinal Uses of *Rauvolfia Serpentina* Plant. *International Journal of Innovative Research in Technology*, 11(2), 187-191.