

## Review

# Ethnobotanical aspects of *Rauvolfia serpentina* (L.) Benth. ex Kurz. in India, Nepal and Bangladesh

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***Rauvolfia serpentina* has long been used in India for the treatment of snakebites, hypertension, high blood pressure and mental illness. The present review deals with the extensive amount of work undertaken in recent years at different parts of the Indian subcontinent to explore the use of this plant in the treatment of different ailments by the tribals or the aboriginals as a part of their ethnomedical system. Different ethnic groups use this plant to treat snake, insect and animal bite, mental illness, schizophrenia, hypertension, blood pressure, gastrointestinal diseases, circulatory disorders, pneumonia, fever, malaria, asthma, skin diseases, scabies, eye diseases, spleen diseases, AIDS, rheumatism, body pain, veterinary diseases etc. This plant is also being used to prepare fermented food products.**

**Key words:** *Rauvolfia serpentina*, sarpagandha, ethnobotany, ethnomedicine, review.

## INTRODUCTION

Since time immemorial the human society has developed in close association, with the plant life (De, 1980a). Plants have influenced the culture, thought and economic activity of human beings through the ages (De, 1980b). The relationship between the indigenous people and their plant surroundings forms the subject of Ethnobotany, a science (De, 1968), which includes a study of the plants used by the tribals for food, medicine and clothing (Jain and De, 1966). Proper investigation on this acquired knowledge of the contemporary tribal communities, who are closely linked with the past (De, 1979), may yield effective results (De, 1969). *Rauvolfia serpentina* (L.) Benth. ex Kurz. (Apocynaceae) commonly known as Sarpagandha is an important medicinal plant of Indian subcontinent and South East Asian countries (De and Dey, 2010). Its roots are used as a remedy for high blood pressure, insomnia, anxiety, excitement, schizophrenia and insanity. The plant grows generally in the region with

annual rainfall of 200 to 250 cm and up to an altitude of 1000 m and favours deep fertile soil rich in organic matter (Dey and De, 2010). Poor seed viability, low seed germination rate, low vegetative propagation rate, over exploitation and loss of habitat are the major causes of decline of this species from its natural habitat.

Propagation of this plant is difficult due to production of large number of non-viable seeds (Mitra, 1976). Seed germination was reported by few authors (Nayar, 1956; Dutta et al., 1962). Cultivation of this important plant species in India was reported by many authors (Biswas, 1956; Dutta et al., 1963; Badhwar et al., 1955). This plant has been designated as threatened with extinction, endangered and threatened, critically endangered in India (Mamgain et al., 1998; Singh et al., 2010; Sukumaran and Raj, 2008; Mao, 2009). Because of overexploitation, need for conservation and low propagation rate, there are several reports of *in vitro* propagation and manipulation of this plant (Sehrawat et al., 2001; Pandey et al., 2007; Ilahi et al., 2007).

Phytochemical analysis of this plant has been a popular research field for many decades and several works have been carried out in this area (Hofmann, 1954; Schlittler et

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al., 1954; Pakrashi and Akkhari, 1968; Shimolina et al., 1984). The major bio-active alkaloids of this plant are ajmaline, deserpidine, rauwolscine, rescinnamine, reserpine, serpentinine, yohimbine etc.

## ETHNOMEDICINE

This plant was found to be used very commonly by tribes indicating the authenticity of their usefulness (Saxena et al., 1988; Sarkar et al., 1999). Rout et al. (2010) have reported the use of *R. serpentina* while discussing the role of tribals in collection of commercial non-timber forest products in Mayurbhanj district, Orissa. Kala (2005) while discussing the current status of medicinal plants used by traditional "Vaidyas" in Uttaranchal state of India has mentioned this plant species. Rajendran and Agarwal (2007) have reported medicinal use of fruits and seeds of this species by the ethnic tribals of Virudhunagar district, Tamil Nadu, India. Sanilkumar and Thomas (2007) have documented this rare plant while exploring the indigenous medicinal usages of some macrophytes of the Muriyad wetland in Vembanad-Kol, Ramsar site, Kerala. Sarmah et al. (2008) has mentioned the name of *R. serpentina* in a report on traditional medicobotany of Chakma community residing in the northwestern periphery of Namdapha National Park in Arunachal Pradesh, India.

Mao et al. (2009) have reported this plant as a part of the ethnobotanical wealth of Northeast India. Ethnomedicinal importance of this plant was reported by Dey and De (2010). This plant's medicinal importance was recorded in a survey in Barind tract of Bangladesh (Siddique et al., 2004). This plant was described from the wetlands of Terai region of Nepal by Siwakoti (2006). Bhattarai (2009b) has referred to the traditional use of this plant in dysentery, fever, cut, wounds, boils, stomachache, menstrual problems and disorders while reporting biological activities of some Nepalese medicinal plants used in treating bacterial infections in human beings. Rijal (2008) has mentioned this plant while quantitatively assessing the indigenous plant uses among two Chepang communities in the central mid-hills of Nepal.

## SNAKE, INSECT AND ANIMAL BITE

There are many folk-lore about this plant. One of which is that a mongoose would first chew upon its leaves to gain power before combating a cobra. According to another, it's freshly ground leaves when applied to the toes could serve as an antidote for snake poison. Pattanaik et al. (2009) has reported the use of this plant (Known as Patalgaruda locally) by the local people of Eastern Ghats, India against snakebite. Singh (2008) has reported the ethnomedical use of this plant against snake bite. The plant is used as an antidote to snake bite in

'Chatara' block of district Sonebhadra, Uttar Pradesh, India (Singh et al., 2010). In case of snake-bite, juice extracted from leaves taken twice a day for three days. 15 g of roots along with roots of *Cassia tora* and *Holarrhena pubescens* paste applied twice a day for two days by Khamptis of Arunachal Pradesh, India (Sen et al., 2008).

Rahamatullah et al. (2010b) have reported the plant to be used against snakebite by the folk medicinal practitioners in three villages of Natore and Rajshahi districts, Bangladesh. Squeezed root is tied on the snake bitten area as a folk medicine of NR Pura taluk in Chikmagalur district of Karnataka, India where it is locally named as Sarpagandhi (Prakasha et al., 2010). Roots and leaf bud of this plant are crushed with milk and made into a paste and used internally and externally on the affected area in case of snakebite by the people of Bhadra wildlife sanctuary in Karnataka (Parinitha et al., 2004). The plant is used in snake bite, insect and animal bite by the "kavirajes" (local medical practitioners) of Rampal upazilla of Bagerhat district of Bangladesh (Mollik et al., 2010). This plant is used to treat insect bite in the Kalahandi district of Orissa, India (Nayak et al., 2004). *R. serpentina* and some other plants are administered orally at 50 gm/day for three days to treat snakebite and scorpion sting in traditional medicine in Tamil Nadu, India (Srivastava and Pandey, 2006). Rhizome and leaf decoction are orally given in snake bite in the rural areas of Kanyakumari district, India (Jeeva et al., 2006).

While working with the Garhwali, Kumauni and Bhojpur of Uttarakhand, Singh (2008) has mentioned the use of the roots of *R. serpentina* against snake bite. Tribals of Rayagada District, Orissa, India uses this plant (local name: *Patala garuda*) to treat snake bite. Root paste is taken orally to serve the purpose (Pattanaik et al., 2006). The plant is used in infections due to touching of snake poison. Crushed roots are mixed with any good oil and applied to infected area touched by snake poison in the villages of Narayanpur, Kalidaskhali, Durduria, Khayarhat, Alaipur, and Bagha beside the Padma river, Rajshahi district, Bangladesh. This plant is used against dog bite in the same locality. Crushed roots are taken for 7 days (once daily on an empty stomach) for dog bites (Rahamatullah et al., 2010a). Root decoction is being used as an antidote to snake venom in some tribal rich district of Orissa, India (Behera et al., 2007). About 10 g of root juice is drunk for snake bite to minimize the rapid circulation of poison in the blood by the people of Nawalparasi district, Central Nepal. Over dose may kill the patient (Bhattarai et al., 2009a).

The tribes of Chhatarpur district, Madhya Pradesh, India use this plant against snake bite (Arjariya and Chaurasia, 2009). This plant has been used by local people of Himalayan Mountains for snake bite (Ghorbani et al., 2006). Fresh root of *Aristolochia indica* is grounded along with the roots of *R. serpentina* (vernacular name:

Amalpori) and mixed in water and taken twice daily for three days against snake bite by the Kurichayas of Kannur district, Western Ghats, Kerala, India. A decoction of powdered rhizome and leaves is also given in snake bite (Rajith and Ramachandran, 2010). About 10 ml of root paste is taken orally for treatment of snake bite by the forest dwellers of the Daitari range of hills of Orissa, India (Mohapatra et al., 2008).

### **MENTAL ILLNESS, SCHIZOPHRENIA, HYPERTENSION, BLOOD PRESSURE**

The roots of this plant, which is very common in lower and upper Gangetic plains of India, are used in high blood pressure, mental agitation, insomnia, sedative and as hypnotic in Indian Ayurvedic system (Meena et al., 2009). Ethnomedical use of this plant as an antihypertensive and tranquilizer (Reserpine, Deserpidine and Rescinnamine) was reported by Fabricant and Farnsworth (2001). The plant is used in insomnia, high blood pressure and madness in 'Chatara' block of district Sonebhadra, Uttar Pradesh, India (Singh et al., 2010). The plant is used in hypertension by "kavirajes" of Rampal upazilla of Bagerhat district of Bangladesh (Mollik et al., 2010). About 10 gm of root powder is taken orally twice a day for seven days to cure hypertension by the tribals of Amarakantak region of Madhya Pradesh, India (Kumar et al., 2004). The Unani formulation *Pitkriya* capsule contains arsol (*R. serpentina*). It acts as Musakkin-wo-Munawwim (sedative and hypnotic), Mudir (Diuretic), Musakkin-e-Asab (nervine sedative) and Mukhaddir (anesthetise) (Shamsi et al., 2006). This plant is used to treat anxiety, epilepsy and nervous disorders by the Jaunsari tribe of Garhwal Himalaya, Uttaranchal (Bhatt and Negi, 2006).

Root extract of this plant (locally known as Sarpaganthi, is given in blood pressure in the rural areas of Kanyakumari district, India (Jeeva et al., 2006). Root paste is taken either with raw milk or honey in empty stomach twice a day for 21 days to cure mental disorder by the Kandhas of Kandhamal district of Orissa (Behera et al., 2006). To treat high blood pressure, *R. serpentina* root extract is given to drink 2 to 3 times a day by the Chakma tribe in hill tracts districts of Bangladesh (Rahman et al., 2007). Mullu kuruma tribe of Wayanad district of Kerala, India uses rhizome of this plant (local name: Amalpori) juice internally to treat high blood pressure and mental disorders (Silja et al., 2008). This plant has been treated as a highly prioritised medicinal plant of Barak valley, Northeast India, where leaf juice is taken as soup for curing and controlling high blood pressure (Barbhuiya et al., 2009). Root powder is given twice a day for two days in case of mental depression as folk medicine in Meerut district, Uttar Pradesh (Tomar, 2009). Roots of this plant are used as an ethnomedicine to cure high blood pressure at the Manas National Park,

Assam, Northeast India (Das et al., 2009). Root juice and powder of this plant (locally known as Surchan) is used to control blood pressure by the tribal people of Chittagong Hill tracts, Bangladesh (Biswas et al., 2010). Roots of this plant are used in mental disorders, nervous disorders and psychosis as a part of forest medicinal plants of Karnataka, India used in primary healthcare (Shiddamallayya et al., 2010). Root decoction is being used for curing of blood pressure in some tribal rich district of Orissa, India (Behera et al., 2007).

Rahman et al. (2008) have reported that the juice made from the roots of this plant (locally known as Sarpogondha) is used in blood pressure and tonic while exploring the medicinal plants in the graveyards of Rajshahi city, Bangladesh. Use of the leaves of this plant (local name: Chandmaruwa) in mental illness in Bantar of Bhaudaha, Morang, Nepal was reported by Acharya and Pokhrel (2006). Fresh root juice or dried root powder of this plant (locally known as Chakma- Surchan) soaked in water is prescribed orally in high blood pressure (Dose: one teaspoonful twice daily) by the ethnic groups of Betbungia of Rangamati district, Bangladesh (Yusuf et al., 2006). Roots of this plant (local name: Surchan) is used in blood pressure by the Chakma community of Bangladesh (Roy et al., 2008).

The tribes of Chhatarpur district, Madhya Pradesh, India use this plant in insomnia (Arjariya and Chaurasia, 2009). About 5 mg root paste is taken twice daily in empty stomach for a week for the treatment of high blood pressure by the forest dwellers of the Daitari range of hills of Orissa, India (Mohapatra et al., 2008).

### **GASTROINTESTINAL DISEASES**

Local people of Madhupur, Tangail, Bangladesh use *R. serpentina* (Local name: Do-grek-mi) root juice to treat liver pain (Anisuzzaman et al., 2007). Juice of tender leaves is given on empty stomach pain by the tribals of Mayurbhanj district of north Orissa. Root powder is mixed with black pepper and one tea spoonful is taken with a cup of water twice daily for two days (Rout et al., 2009a). Roots are chewed for stomach pain and fever by Khamptis of Arunachal Pradesh, India (Sen et al., 2008). The plant is used in gastrointestinal disorders by the "kavirajes" of Puthia upazilla of Rajshahi district of Bangladesh (Mollik et al., 2010). This plant (locally known as patalagoruda) is used to treat dysentery and to expel intestinal worms in children in the Kalahandi district of Orissa, India. For this purpose root (about 3 gm) decoction along with ginger (4 to 15 gm) is given before meals in the morning (Nayak et al., 2004). Roots of this plant are used in intestinal disorders by the Jaunsari tribe of Garhwal Himalaya, Uttaranchal (Bhatt and Negi, 2006). Root extract is given in stomach pain and intestinal worms in the rural areas of Kanyakumari district, India (Jeeva et al., 2006). Root extract (no

specific dose was mentioned) of *R. serpentina* (locally called Amalpori) is used to treat intestinal disorders by the Malamalar tribe of Parambikulam wildlife sanctuary, Kerala, India (Yesodharan and Sujana, 2007).

In abdominal pain, leaf and fruit extract of two plants, *R. serpentina* and *Ixora villosa* are given to drink frequently by the Chakma tribe in hill tracts districts of Bangladesh (Rahman et al., 2007). 10 gm root paste of this plant (locally known as Chivanamelipodi), is taken twice a day for two days against stomach-ache by the Kattunayakas tribes of Mudumalai Wildlife Sanctuary, Nilgiris district, Tamil Nadu (Udayan et al., 2007). Roots of this plant are used in intestinal trouble as a part of forest medicinal plant lore of Karnataka, India used in primary healthcare (Shiddamallayya et al., 2010). *R. serpentina* (locally known as Pathalagaridi) leaves are consumed or leaf paste is applied to treat dysentery by the Savaras of Srikakulam district, Andhra Pradesh, India (Rao et al., 2010).

Rahman et al. (2008) have reported that the decoction made from the roots is used in diarrhoea, dysentery and colic while studying the medicinal plants in the graveyards of Rajshahi city, Bangladesh. Roots of this plant are used in stomach-ache by the Chakma community of Bangladesh (Roy et al., 2008). About 100 g root paste of *Cyperus rotundus* is mixed with 100 g whole plant paste of *Polygala arillata*, 100 g root paste of *R. serpentina*, 100 g root paste of *Cissampelos pareira*, three leaves of Citrus lemon and one bird [Chatailbird in Gurau (Traditional medicinal practitioners of this area)]. This is mixed with two bottle of local alcohol and cooked for some time. Whole mixture is then given once a day for any stomach diseases until recovery. This protocol is used by the people of Nawalparasi district, Central Nepal (Bhattarai et al., 2009a). About 10 g root paste is mixed with a cup of water and drunk early in the morning for fever and stomach-ache by the people of Nawalparasi district, Central Nepal (Bhattarai et al., 2009a).

The tribes of Chhatarpur district, Madhya Pradesh, India take the root decoction (3 gm) and black pepper to expel intestinal worms in children (Arjariya and Chaurasia, 2009). To treat stomach-ache, root of this plant is used by the tribal people of Raigarh, Chhatisgarh, India. Powder (about 2 gm) is taken internally for three days during the treatment. As a wormicidal, powdered root is given internally for three days to treat ulcer (Jain and Singh, 2010). Fresh crushed roots are used in the treatment of dysentery by the Kurichayas of Kannur district, Western Ghats, Kerala (Rajith and Ramachandran, 2010). Bark obtained from root is grinded with water and about 10 mg of this paste is taken with cold water to cure stomach ache by the forest dwellers of the Daitari range of hills of Orissa, India (Mohapatra et al., 2008).

Ethnic groups present in the Eastern Ghats in Andhra Pradesh, India use *Cassia fistula* stem bark along with the stem barks of Mango, *R. serpentina* and *Piper*

*longum* are ground and the mixture is given for jaundice (Naidu and Khasim, 2010).

## CIRCULATORY DISORDERS

Ethnomedical use of this plant to treat circulatory disorders (Ajmalicine) was reported by Fabricant and Farnsworth (2001).

## PNEUMONIA

Young shoot extract of this plant (ca 10 ml) is given three times daily to cure pneumonia in early stage by the Meche People of Jhapa District, Eastern Nepal (Rai, 2004).

## MALARIA

Local people of Madhupur, Tangail, Bangladesh use *R. serpentina* (Locally called Do-grek-mi) root and leaf paste to make pills and sun dried to use in malarial fever (Anisuzzaman et al., 2007). Garo tribe inhabiting the Madhupur forest region of Bangladesh uses this plant to treat malaria. A paste of root and black pepper is administered in malaria (dose only equal to 4 to 5 ratis, 1 rati = 1 tola = 11.66 g) (Mia et al., 2009). Juice extracted from the leaves along with the juice of *Andrographis paniculata* and *Azadirachta indica* with honey to cure malaria by Khaptis of Arunachal Pradesh, India (Sen et al., 2008). Roots of this plant (Local name: Chhedabag) are ground with roots of *Cissampelos pareira* in equal quantities with water and taken orally twice a day for 5 days to treat malaria by the Kol tribes in Simlipal Biosphere Reserve, Orissa, India (Rout and Thatoi, 2009). Root and leaf paste of this plant (local name: Dogrek-me) is made into pill, sun dried and used in malarial fever by the Mandi ethnic community in Bangladesh (Partha and Hossain, 2007).

## SKIN DISEASES AND SCABIES

Juice extracted from leaves of *A. paniculata* and *Nyctanthes arbor-tristis* is mixed with *R. serpentina* root juice to treat scabies (Mohanta et al., 2006). *Datura fastosa* seeds are mixed with *Rauvolfia* root, lime juice and boric acid to prepare a paste to apply externally in scabies in Bhadra wildlife sanctuary in Karnataka (Parinitha et al., 2004). This plant is used to treat urticaria patients in unani system of medicine (Shamsi et al., 2006). Root paste of this plant and *A. paniculata* is used on itches, boils and eczema by the Kandhas of Kandhamal district of Orissa (Behera et al., 2006).

## ASTHMA AND REPIRATORY PROBLEMS

Britto and Mahesh (2007), while exploring the Kani tribal Botanical knowledge in Agasthiayamalai Biosphere Reserve, South India, have reported that the leaves and the flowers of this species are consumed to treat Asthma. Fresh root juice or dried root powder of this plant soaked in water is prescribed orally in respiratory problem (Dose: 1 teaspoonful twice daily) by the ethnic groups of Betbunia locality of Rangamati district, Bangladesh (Yusuf et al., 2006).

## EYE DISEASES

Local people of Madhupur, Tangail, Bangladesh use *R. serpentina* (Locally called Do-grek-mi) fresh leaf juices to prevent eye inflammation (Anisuzzaman et al., 2007).

## SPLEEN DISEASES

Garo tribe inhabiting the Madhupur forest region of Bangladesh uses this plant to treat spleen diseases (Mia et al., 2009).

## AIDS

The plant is used to treat AIDS by the folk medicinal practitioners in three villages of Natore and Rajshahi districts, Bangladesh (Rahamatullah et al., 2010b).

## HEADACHE

The plant is used to treat headache by the folk medicinal practitioners in three villages of Natore and Rajshahi districts, Bangladesh (Rahamatullah et al., 2010b).

## FEVER

*R. serpentina* is used in the treatment of fever in the Kalahandi district of Orissa, India (Nayak et al., 2004). This plant is used in fever by the Jaunsari tribe of Garhwal Himalaya, Uttaranchal (Bhatt and Negi, 2006). Rahman et al. (2008) have reported that the decoction made from the roots is used in fever while studying the medicinal plants in the graveyards of Rajshahi city, Bangladesh. The tribes of Chhatarpur district, Madhya Pradesh, India take the root juice raw or boiled to bring down the body temperature (Arjariya and Chaurasia, 2009).

## OTHER DISEASES

Root juice is taken with water to cure body ache,

anasarca and rheumatism by the Kandhas of Kandhamal district of Orissa (Behera et al., 2006). Roots of this plant are used to treat pain as a part of forest medicinal plants of Karnataka, India (Shiddamallayya et al., 2010). The root paste is applied on cuts, wounds or boils twice a day until recovery by the people of Nawalparasi district, Central Nepal. About 10 g root paste is mixed with a cup of water and drunk early in the morning for menstrual disorders (heavy menstrual periods, pain during menstrual periods), until recovery (Bhattarai et al., 2009a).

## ETHNOVETERINARY PRACTICES

Mixture of Satgandh (*R. serpentina*) roots (20 to 30 gm) and sugar (50 to 60 gm) is used for 2 to 3 days to treat loose motion with 60 to 70% efficacy by the tribal livestock owners in some villages of Madhya Pradesh (Singh and Sureja, 2007). About 10 g root paste or an increased dose is used for fever, stomach-ache, menstrual disorders (heavy menstrual periods, pain during menstrual periods), until recovery of livestock by the people of Nawalparasi district, Central Nepal (Bhattarai et al., 2009a).

## IN BEVERAGES

Root bark of *R. serpentina* is used to develop bitterness to prepare Ranu dabai which is utilized in the preparation of the beverage jhara as a source of starter culture. This is used as a traditional fermented product by Indian rural folks (Sekar and Marippan, 2007). Root bark of this plant (locally known as Nagbeli) is used to develop bitter taste in the preparation of rice beer by the tribal inhabitants of tea gardens in Terai of West Bengal. If this plant is available in sufficient quantity, then it replaces *Coccinia grandis* to prepare starter culture (Ghosh and Das, 2004).

From the above discussion it is evident that the major ethnic uses of *R. serpentina* is restricted in ethnomedicinal field for the treatment of human and livestock diseases. Very few reports were found where the plant is used in the preparation of beverages. These formulations used by the aboriginals must be verified with clinical trials to test their efficacy and also to develop advanced drugs based on herbal system of medicine for effective remedy of different disorders.

## CONCLUSION

From the above discussion, it is evident that *R. serpentina* is a major plant species of ethnic use. Over exploitation, loss of habitat, poor seed germination rate etc are the major factors of decline of this important plant species of southeast Asian countries. Although the roots

are the major source of active principles, leaves, stem, fruits, seeds and flowers are also being utilized by the aboriginals to treat different diseases. Several attempts have been made to conserve this threatened and endangered plant either by *in-situ*, *ex-situ* or *in-vitro* conservation strategies.

Apart from being used popularly in the treatment of hypertension, mental disorder and schizophrenia, its use in traditional system of medicine in the treatment of gastrointestinal problems, snake bites, skin diseases, malaria, AIDS, asthma etc. must be critically evaluated. So far little work has been done to bridge up the vast ethnomedicinal utilization of this plant species and its active principles related to the treatment of various ailments. It is to be noted that the tribal use of the plant species must be verified by further scientific experimentation and this rich folklore can be utilized in herbal therapy and drug discovery.

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