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REVIEW ARTICLE

ETHNOBOTANICAL REVIEW OF *HEMIDESMUS INDICUS* R.BR.

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ABSTRACT

The use of medicinal properties of plant is called herbal medicine. Plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological functions and to defense against attack from insect, fungi, bacteria etc. *Hemidesmus indicus* R.Br. is being used widely in ayurvedic medicine. The roots have a sweet smell like camphor. Medicinal plants are being widely used, either as single drug or in combination in health care delivery system. *Hemidesmus indicus* R.Br. is the most widely used traditionally and has been distributed by humans throughout the tropics. *Hemidesmus indicus* R.Br. is used for treatment of cancer, viral, lithic, hypotensive, fungal, bacterial and also used in diabetes. With all these potential benefits, this plant is not widely utilized. The most useful part of *Hemidesmus indicus* R.Br. is root which shows different activity like antimicrobial activity, anti-enterobacterial activity, anti-acne activity, anti-oxidant activity, natriuretic and saliuretic activity, renoprotective activity, anti inflammatory activity, anti-venom activity.

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INTRODUCTION

Indian Sarsaparilla, *Hemidesmus indicus* R.Br (Family: Asclepiadaceae) is a commonly known Indian Medicinal Plant, which is widely recognized in traditional systems of Medicine. It contains various phytoconstituents like glycoside, flavonoid, tannin, sterol and volatile oil. It has been reported that *Hemidesmus indicus* R.Br. is used in blood diseases, dysentery, diarrhoea, respiratory disorders, skin diseases, syphilis, fever, leprosy, leucoderma, leucorrhoea, itching, bronchitis, asthma, eye diseases, epileptic, kidney and urinary disorders, loss of appetite, burning sensation, dyspepsia, nutritional disorders, ulcer and rheumatism. (http://www.bionity.com/en/encyclopedia/Hemidesmus_ indicus.html) *Hemidesmus indicus* R.Br. is also used for treatment of various diseases like cancer, viral, lithic, hypotensive, fungal, bacterial and also used in diabetes. (Aiyer, 1951) The most useful part of *Hemidesmus indicus* R.Br. is root which shows different activity like antimicrobial activity, anti-enterobacterial activity, anti-acne activity, anti-oxidant activity, hepatoprotective activity, natriuretic and saliuretic activity, renoprotective activity, anti inflammatory activity, anti-venom activity, anti-arthritic activity, wound healing activity and anti-nociceptive activity. (http://www. globalherbalsupplies.com/hemidesmus_indicus.htm)

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Figure 1. *Hemidesmus indicus* R.Br. of rhizomes

Plant profile

Hemidesmus indicus R. Br.

Synonym

Periploca indica L.

Family

Asclepiadaceae

English name

Hemidesmus, Indian sarsaparilla, East Indian sarsaparilla.

Sanskrit names

Anantamula, Sariva, Naga-jihva, Gopakanya.

Local names in India:

Hindi- Anantamul, Kapuri, Hindi-salsa, Magrabu.

Bengali-Anantamul.

Marathi-Anantamul, Upalasari.

Gujarat- Sariva, Upalasari, Durivel.

Telugu- Sugandhi-pala, Gadisugandhi, Muttavapulagamu.

Tamil- Nannari.

Kannada- Karibandha, Sogade.

Malayalam- Naruninti.

Oriya- Onontomulo.

Morphology:

Root

The roots are aromatic, woody or slender. Root of the plant is used for medicinal purpose. (Jagtap and Singh, 1999)

Stem

The stems and branches which twine anticlockwise are elongate, narrow, terete and wiry of a deep purple or purplish brown colour with the surface slightly ridged at the nodes. (http://www.pioneerherbs.com/*hemidesmus_indicus*.htm)

Leaves

Leaves of the basal parts of the shoots are linear to lanceolate.

Flowers

Greenish yellow to greenish purple outside, dull yellow to light purplish inside, calyx deeply five lobed, corolla gamopetalous, about twice the calyx, Stamens five, inserted near base of corolla with a thick coronal scale. (http://www.herbsforever.com/herbs/anantamul.asp)

Fruit

Fruit of anantmool are two straight slender narrowly cylindrical widely divergent follicles, Seeds many, flat, oblong, with a long tuft of white silky hairs. (http://www.herbsforever.com/herbs/anantamul.asp)

Ethnopharmacology: The plant is used as tonic, alterative, demulcent, diaphoretic, diuretic and blood purifier. (Sultana *et al*., 2003) It is also used in nutritional disorders, syphilis, chronic rheumatism and other urinary diseases and skin affections. It is administered in the form of powder, infusion or decoction as syrup. It is also used as component of several medicinal preparations. It is used as a alternate for Sarsaparilla (from *Smilax spp*.) and involved as a vehicle for potassium iodide. Syrup prepared from the roots is used as a flavoring agent and in the preparation of a sharbat which have cooling properties. (Chatterjee and Bhattacharya, 1955)

As medicine 'Anantmool' holds a reputed place in all systems of medicine in India. The roots are used in main treatment of snake bite and scorpion sting. It improves the general health, plumpness and clearness, said to be useful in affections of the kidneys, rheumatism, skin diseases, nephritic complaints, syphilis, gonorrhea and appetite. (http://www.pioneerherbs.com/*hemidesmus_indicus*.htm)

Hemidesmus indicus R.Br. root is said to be tonic, diuretic, and alterative. The native healers in India are said to use it in nephritic complaints, syphilis and in the sore mouth of children. It promotes health and energy and always cures all kinds of diseases caused by vitiated blood. The plant is said to be alterative, depurative, diaphoretic, tonic, used in autoimmune disease, rheumatoid arthritis, chronic skin disorders, asthma, bronchitis, gonorrheal neuralgia, syphilis, nephritic complaints, chronic skin diseases, ulcers etc. (http://www.globalherbalsupplies.com/*hemidesmus_indicus*.htm)

According to Ayurveda, root is cooling, antipyretic, alexiteric, antidiarrhoeal, astringent to bowels and useful in treatment of fevers, asthma, bronchitis, blood disorders, leucorrhoea, dysentery, diarrhoea, thirst, burning sensation, piles, eye troubles, epileptic fits, poisoning, rat bites etc.

According to Unani system of medicine, root and stem are laxative, diaphoretic, diuretic and useful in treatment of syphilis and leucoderma. Roots are useful in hemicrania, joint pains and syphilis whereas stem is good in treatment of brain, liver and kidney related diseases. It is also useful in treatment of urinary discharges, uterine complaints, paralysis, cough, asthma etc. (http://www.pioneerherbs.com/*hemidesmus_indicus*.htm)

In central India, a special "Herbal Mala" is made from the root pieces of Anantmool and Semal *(Bombax ceiba)* which is used in the treatment of Marasmus. They also prepare a special herbal tea from bark and give twice a day for treatment of impurities of blood. Sometimes 'Kevatch' (*Mucuna pruriens*) and 'Gokhru' (*Tribulus terrestris*) are also added in this mixture. The natives use the roots internally in treatment of

premature graying of hairs, jaundice, eye related diseases. A decoction is prepared by adding roots of anantmool, *Vetiveria zizanioides*, dried ginger, *Cyperus rotundus* and *Holarrhena antidysenterica* for the treatment of chronic fever and appetite. To take away extra heat from body, root powder is fried in ghee and given to the patients for up to one month. The root is also used with cow milk for treatment of renal calculi. (Ravishankara *et al*., 2002)

The root is an alterative tonic, diuretic, demulcent, diaphoretic and carminative. It is said to be good for gout, rheumatism, colds, fevers and catarrhal problems as well as for relieving flatulence, skin problems and ringworms. It is blood purifier and said to be promoting health and cure all kinds of diseases caused by vitiated blood. It is useful in venereal diseases, herpes, skin diseases, arthritis, rheumatism, gout, epilepsy, insanity, chronic nervous diseases, abdominal distention, intestinal gas, debility, impotence and turbid urine in Ayurvedic system. It also purifies the urino-genital tract, blood and helps cleanse the mind of negative emotions; therefore it is useful in many nervous disorders. It promotes health and vigor. Decoction of stalks and leaves is used for skin eruptions, hearing disorders, fevers etc. Root decoction helps in skin diseases, syphilis, elephantiasis, loss of sensation, hemiplegia, loss of appetite, blood purification and for kidney and urinary disorders. (http://www.kalyx.com/store/proddetail.cfm/ItemID/39184.0/CategoryID/1000.0/SubCatID/2565.0/file.htm)

The roots are used by the tribals India to cure gonorrhoea, leucoderma, bleeding piles, jaundice and dysentery. (Fimognari *et al*., 2011) The tribals of Rajasthan use the paste of roots in scorpion sting. Syrup is prepared for flavoring medicinal mixtures; found in many medical and cosmetic facial packs. It is often called 'Sugandha' because of the wonderful fragrance of its roots.

Phytochemical Constituents: The flavanoid glycosides recognized in the flowers, were hyperoside, isoquercitin and rutin whereas in the leaves, only hyperoside and rutin were identified. (Subramaniam and Nair, 1968) Tannins 2.5 % present in leaves and roots are reported to contain sitoserol. (Kumara and Nishteswar, 2013) A new ester identified as lupeol octacosanoate in addition to the known compounds viz., lupeol, (α-amyrin), lupeol acetate, (α-amyrin acetate), and hexatriacontane. (Chatterjee Ipshita *et al*., 2006) Coumarins, triterpenoid saponins, essential oil, starch, tannic acid, triterpenoid saponins present. (Joseph *et al*., 1918) A stearopten smilasperic acid is also obtained by distillation with water. The herb is mildly immuno-suppressant. The aqueous, alcoholic and steam distilled fractions of the crushed roots had no significant diuretic activity. The 50% ethanolic extract of the whole plant did not exhibit any effect on respiration, normal blood pressure and also on pressor response to adrenaline and depressor response to acetylalcholine and histamine in experimental animals.

The extract also had no antispasmodic effect on guinea pig ileum. A saponin from the plant is found to have anti-inflammatory activity against formalin induced edema. (Nadkarni, 2005) The antioxidant activity of methanolic extract of *Hemidesmus indicus* R.Br. root bark is evaluated in several *in vitro* and *in vivo* models. Preliminary phytochemical analysis and TLC fingerprint profile of the extract was established to characterize the extract which showed antioxidant properties. (Anoop Austin and Jegadeesan, 2002) Modern studies have confirmed the antibacterial activity of the root extract and essential oil. Clinical trials have shown a benefit in ringworm infection and for malnutrition. The clinically used doses are considered safe and beneficial, but overdose can be toxic. (Daniel *et al*., 2008) *Hemidesmus indicus* R.Br. has been shown to have significant activity against immunotoxicity and other pharmacological and physiological disorders. (Neetha *et al*., 2003)

Pharmacological activity

1. Antimicrobial activity

Gayathri and kannabiran reported aqueous root extract of *Hemidesmus indicus* along with barks of *F. bengalensis* and *P. marspium roxb* showed antimicrobial activity against *S. aureus, P. aeruginosa, K. pneumoniae.* Screening of antibacterial activity of *Hemidesmus indicus* methanolic and ethanolic root extract and *vettivaria zizanoids* (Ratha *et al*., 2012) were tested against five human pathogenic organisms agar well diffusion method is done and *Hemidesmus indicus* R.Br. ethanolic root extract shows maximum zone of inhibition against *E. coli* and *V. cholerae* than other extracts tested. Hence exhibits significant antibacterial activity.

2. Antienterobacterial activity

It inhibits the growth of enterobacteria and very effective against *S. flexneri*. *Hemidesmus indicus* R.Br. root extract shows potent anti-enterobacteria activity. (Das Sarita and Niranjali Devaraj, 2006)

3. Anti acne activity

it was carried out in terpenoidal fraction of *Hemidesmus indicus* R.Br. root. Anti-acne effect is tested against *Propionibacterium acnes* and *Staphylococcus epidermidis* which is responsible for acne vulgaris. Disc diffusion & Broth dilution method is done, minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC) values suggest the extract exhibited significant anti acne effect against these organism tested. (Kumar *et al*., 2008)

4. Antioxidant activity

The *in vitro* and *in vivo* antioxidant potential of root bark of *Hemidesmus indicus* R.Br. was evaluated for radical scavenging activity by DPPH reduction, superoxide radical scavenging activity in riboflavin/light/NBT system (nitro blue tetrazolium), nitric oxide (NO) radical scavenging activity in sodium nitroprusside/Greiss reagent system and inhibition of lipid peroxidation induced by iron-ADP-ascorbate in liver homogenate and phenyl hydrazine induced haemolysis in erythrocyte membrane stabilization study. The extract was found to have different levels of antioxidant properties in the models tested. In scavenging DPPH and superoxide radicals, its activity was intense, while in scavenging NO radical, it was

moderate. It also inhibited lipid peroxidation of liver homogenate and the haemolysis induced by phenylhydrazine confirming the membrane stabilization activity. (Ravishankara *et al*., 2002)

5. Natriuretic and Saliuretic activity

Hemidesmus indicus R.Br. root extracts as diuretic agents is proven by a study conducted. A single individual dose of aqueous and ethanolic extract of *Hemidesmus indicus* R.Br. root (200 mg/kg and 400 mg/kg, p.o., each) were compared with frusemide and hydrochlorothiazide, (25 mg/kg, p.o., each) as reference diuretic drugs . These were administered orally to dehydrated rats. Control group rats were fed with normal saline (25 ml/kg, p.o.). All rats were caged in metabolic cages in a pair and their urine output was monitored at 5 and 24 hrs intervals. Both extracts significantly increased the urine output in higher doses. Although, the onset of this diuretic action was gradual (within 5 hrs), it lasted throughout the studied period (up to 24 hrs). Further, the intensity of diuresis induced by aqueous extract (400 mg/kg) in 5 h was almost similar to that of frusemide and hydrochlothiazide. Aqueous extract of *Hemidesmus indicus* R.Br. root also caused marked increase in urinary Na^+ and K^+ levels. (Navneet *et al*., 2011)

6. Anti nociceptive activity: Oral administration of *Hemidesmus indicus* R.Br. extract in mice revealed dose-dependent antinociceptive effect in all the mice models for antinociception and it blocked both the neurogenic and inflammatory pain and the nociceptive activity was comparable with the reference drug. (Verma *et al*., 2005)

7. Renoprotective activity: Efficacy of *Hemidesmus indicus* R.Br. root extract evaluated against gentamycin induced hepatotoxicity in wister albino rats 5 g⁄kg single dose, p.o. 90, last 6 days of treatment reduced renal impairment, induced by ***genetically modified*** (GM) in rats. (Verma *et al*., 2005)

8. Hepatoprotective activity: Hepatoprotective activity of methanolic root extact of *Hemidesmus indicus* R.Br. was evaluated in paracetomol and CCl_4 induced acute liver toxicity in rats. Rat model which received the extract showed rise in the level of enzymes like SGOT, SGPT, ALP. But this was less when compared to rat that received CCl_4 or paracetomol alone. The results of the methanolic extract of *Hemidesmus indicus* R.Br. were compared with standard hepatotoxic drug silymarin (100 mg/kg) maximum hepatoprotective effect is seen in 250mg/kg bodyweight in CCl_4 induced hepatic damage and (500 mg/kg) body weight in case of paracetamol induced liver damage, the study concludes methanolic root extract of *Hemidesmus indicus* R.Br. showed higher level of hepatoprotective activity. (Bahati *et al*., 2006)

9. Wound healing activity: A clinical study was conducted in 30 patients of chronic wounds of either sex, the patients were kept on observation depending upon the progress of epithelialization on complete cure (Ratha *et al*., 2012) it was reported that *Hemidesmus indicus* R.Br. root extract as applied in paste form to wounds, showed wound healing activity. (Prabakan *et al*., 2000)

10. Anti-arthritic activity: Hydroalcoholic extract and ethyl acetate fraction of, *Hemidesmus indicus* R.Br. showed significantly higher anti-arthritic activity than chloroform and residual fraction. Histopathological analysis demonstrated that both of hydroalcoholic extract and its ethyl acetate fraction had comparable anti-arthritic activity with methotrexates. (Sariba, 2012)

11. Cytotoxic activity: Study was done to evaluate the *in vitro* cytotoxic activity in stems of *Berberis aristata*, and rhizomes of *Hemidesmus indicus* R.Br. on MCF_7 breast cancer cell lines. Viability Staining by Trypan blue dye exclusion method was followed. The maximum reducing power of the *Berberis aristata* and *Hemidesmus indicus* R.Br. extract at 680 nm was found to be 0.997 0.081 at 1000 g/ml and 0.956 0.067 at 1000 g/ml respectively. The inhibition percentage 0.997 0.081 at 1000 g/ml and 0.956 0.067 at 1000 g/ml with regard to cytotoxicity was found to be 89 % at 1000 µg/ml with IC_{50} value of 50+0.03 g/ml for *Berberis aristata* DC and 87 % at 1000 µg/ml with IC_{50} value of 48+0.02 g/ml for *Hemidesmus indicus* R.Br. respectively. Hence the study proves the anti cancer activity of the extract. (Mehta *et al*., 2012) The molecular basis of the antileukemic effects of *Hemidesmus indicus* R.Br. and identification of the mitochondrial pathways and (Ca^{2+}) as crucial actors in its anticancer activity was carried out. Anti cancer activity of *Hemidesmus indicus* R.Br. is performed by variety of cellular assays and flow cytometry, as well as a phytochemical screening on different leukemic cell lines. Study demonstrated that *Hemidesmus indicus* R.Br. modulated many components of intracellular signaling pathways involved in cell viability and proliferation and altered the protein expression, eventually leading to tumor cell death, mediated by a loss of mitochondrial transmembrane potential and increased Bax/Bcl-2 ratio. Automatic data processing (ADP), adenine nucleotide translocator and mitochondrial permeability transition pore inhibitors did not reverse *Hemidesmus*-induced mitochondrial depolarization. *Hemidesmus indicus* R.Br induced a significant (Ca^{2+}) raise through the mobilization of intracellular Ca^{2+} stores. (Mazumder *et al*., 2010) Moreover, *Hemidesmus indicus* R.Br significantly enhanced the antitumor activity of three commonly used chemotherapeutic drugs (methotrexate, 6-thioguanine, cytarabine). clinically relevant observation is that its cytotoxic activity was also recorded in primary cells from acute *myeloid leukemia***.** The *Hemidesmus indicus* R.Br. and *Periploca indica* root extracts significantly neutralized the viper venom-induced lethality and haemorrhagic activity in albino rat and mouse. Venom-induced coagulant and anticoagulant activity was also antagonized by both the extracts. No precipitating bands were observed between the plant extract and polyvalent snake venom antiserum. Maximum neutralization was achieved by *Hemidesmus indicus* R.Br. root extract. These observations confirmed that certain Indian medicinal plants possess significant snake venom neutralizing capacity and need further examination for their active constituents. (Alam and Gomes, 1998)

12. Anti inflammatory activity: A saponin from the plant is found to have anti inflammatory activity against formalin induced edema. (Alam *et al*., 1994)

13. Anti venom activity: Lupeol acetate isolated from the root extract of *Hemidesmus indicus* R.Br. could significantly neutralize lethality, haemorrhage, defibrinogenation, edema, PLA_2 activity induced by the *Daboia russellii* venom. (Bahati *Et al*., 2006 Prabakan *et al*., 2000) It also neutralized Naja kaouthia venom induced lethality, cardiotoxicity, neurotoxicity and respiratory changes in experimental animals. The methanol root extracts of *Hemidesmus indicus* R.Br. and *Pluchea indica* were explored for the first time for neutralization of the snake venom (*Vipera russellii*) activity. (Alam *et al*., 1996; Alam and Gomes, 1998)

Conclusion

The plants have been widely used as a curative agent for a variety of aliments. Roots are found in various herbal preparations that are in market today. Indian sarasaparilla preparations are widely available and employed by prectitioners of natural health for treatment of peptic ulcer disease (PUD), anti-oxidant, anti-inflammatory, anti-fertility agent. The plant serves various purposes in improving mucin content, inhibiting *H.pylori,* improving gastric defensive factors and decreases offensive factors, nephro-protective, anti-tumor, anti-carcinogenic and in the management of many diseases, wherein a research work on characterization and standardization is almost required for this potential plant. However, Various studies were carried out, an authenticated comparative study will explore much debth about the plants used in the name Indian sarasaparilla. This plant is believed as most vital herb. The whole series of traditional medicines and plants, which have been in use for thousands of years, will be threatened if plants like *Hemidesmus indicus* R.Br. are allowed to become damaged through excessive collection.

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