



## Review Article

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### A REVIEW ON *HEMIDESMUS INDICUS* (L.) R.BR. (SARIVA): VALIDATION OF AYURVEDIC PHARMACOLOGICAL PROPERTIES THROUGH EXPERIMENTAL AND CLINICAL STUDIES

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#### ABSTRACT

Sariva (*Hemidesmus indicus* (L.) R.Br.), commonly known as Indian Sarsaparilla is a well-known drug of ayurvedic Materia medica. Acharya Charaka has included this plant in *agraya prakarana* (best among their class drugs) which signifies its role in various digestive and blood diseases. Sariva is reputed for its, *deepana* (appetizing) and *raktashodaka* (blood purifying), *dahaprasamana* (alleviates burning sensations) properties. Traditionally used for curing ailments like stomach pain, fever, venereal diseases like syphilis, *upadansha*, skin disease, diarrhoea, diabetes, rheumatism and as well-known blood purifier. It has been demonstrated to possess various pharmacological properties like anti-inflammatory, anti-pyretic, antioxidant, anti-venom, anti-diarrhoeal, anti-leprotic, wound healing activity. Present paper is an attempt towards validation of therapeutic potential of the drug through animal studies and clinical studies.

**Keywords:** Sariva, Anantmool, Indian Sarsaparilla, Ayurvedic Medicine, Pharmacological properties.

#### INTRODUCTION

Sariva is widely used in preparation of Ayurvedic drugs since ages due to its amazing health benefits. According to reports of National Medicinal Plants Board, market demand of sariva root is 500-100 million tonnes per annum<sup>1</sup>, hence justifying the fact that sariva is one of the most employed plant species in medicinal practices. Roots of *Hemidesmus indicus* have been accepted as official source of classical drug sariva which are known to be rich in aromatic aldehydes and their derivatives. It is also a rich source of alkaloids, steroids, terpenoids, flavonoids, saponins, lupeol, phenolic compounds, tannins, lignin and cardiac glycosides. In Ayurveda, sariva has a wide range of pharmacotherapeutic applications. Present paper focuses on validation of classical pharmacological properties through modern pharmacological evidence.

An extensive review of literature (regarding sariva- *Hemidesmus indicus* Linn.) available in texts from Vedic literature, Samhita texts, contemporary publications including research papers published in different journals was done in a stepped manner for the study.

#### Sariva in Classical Texts

Acharya Charaka described sariva (Ananta) as “Sangrahi Deepaniya Rakta Prashamanam”.<sup>2</sup> Sariva has been classified in different group of drugs on the basis of its therapeutic utility in *brihatrayi* being listed in Table 1.

#### Synonyms in various *nighantus*

Sariva<sup>10,11,13-15</sup>, Sharda<sup>10,11,12,14</sup>, Gopa<sup>10,11,13</sup>, Gopavalli<sup>10,12-15,17</sup>, Gopangana<sup>12</sup>, Pratanika<sup>10-14</sup>, Gopakanya<sup>10-15</sup>, Latasphota<sup>10-15</sup>, Sweta<sup>10,13,14</sup>, Kasthsariva<sup>10,12-14</sup>, Utpalsariva<sup>11,14,16</sup>, Sugandhamula, Karala, Gajajivihika<sup>11</sup>, Phaljihva, Sugandhika<sup>14</sup>, Dhavala, Krisodari<sup>15</sup>, Chandana<sup>15,16</sup>, Kapurilatika, Dughdgarbha<sup>17</sup>, Ananta<sup>16</sup>.

#### Pharmacological attributes (Karma) of Anantmool mentioned in *Nighantus*

Madhura (Sweet)<sup>12,13,14,15,17</sup>, Tikta (Bitter)<sup>14</sup> in rasa (taste), snigdha, guru<sup>12,14,15</sup>, sheeta veerya<sup>14,16</sup>, madhur vipak<sup>16</sup>, tridoshshamak<sup>12,14,15,16</sup>. In *Dhanvantari Nighantu*, sariva has been described as *Kanduhara* (destroys itching), *Raktapittahara* (Useful in *Raktapitta* disease), *Kapha-vata-asra nashanam* (alleviates *Kapha-Vata-rakta* diseases),<sup>10</sup> *shukrakar* (spermatogenic activity)<sup>12,13,14,15</sup>, alleviate *Kustha* (leprosy/skin diseases)<sup>13</sup>, *Durgandha nashan* (destroys foul smell)<sup>13</sup>, fever<sup>13,14,15</sup>, and relieves from *prameha* or obstinate urinary disorders<sup>13</sup>. In *Kaiyadev Nighantu* and *Bhavaprakasa Nighantu*, it has been said to be useful in *agnimandya* (dyspepsia / loss of appetite), *aruci* (anorexia), *svasa* (dyspnoea), *kasa* (cough), *aamdosh*, *vishnashan*, *raktshrav*, *raktapradar* (menorrhagia/leucorrhoea) *atisara* (diarrhoea)<sup>14,15</sup>, best *rakta shodhana*, *balya*, *sangrahi*, *deepana*, makes *raktasaarvaan* (best haemopoiesis promoting drug)<sup>17</sup>.

Table 1: Classification of Sariva in Brihatrayi

S.N.	Group of drugs	Text	Therapeutic utility/ indications
1.	Jvarhara Mahakashaya <sup>3</sup>	C.S.	Anti-pyretic
	Varnya Mahakashaya <sup>3</sup>	C.S.	Cosmetically useful, complexion enhancing drugs
	Kanthy Mahakashaya <sup>3</sup>	C.S.	Beneficial for throat and voice
	Dahaprashmana Mahakashaya <sup>3</sup>	C.S.	Alleviates burning sensation
	Stanya shodhana Mahakashaya <sup>3</sup>	C.S.	Purifies Breast Milk
	Pureesha sangarhaniya Mahakashaya <sup>3</sup>	C.S.	Consolidation of bowel
	Madhura skandha (as gopvalli) <sup>4</sup>	C.S.	Group of Sweet Taste drugs
2.	Kashaya skandha (as Ananta) <sup>4</sup>	C.S.	Group of Astringents
	Sarivadi gana <sup>5,6,7</sup>	S.S., A.S., A.H	Alleviates Pitta-Rakta dosha, thirst, bleeding disorders, fever due to Pitta dosha, especially relieves burning sensation.
	Vidarigandhadi gana <sup>5</sup>	S.S.	Alleviates Pitta and Vata dosha, Rajayaksha (tuberculosis), Gulma (abdominal lump) anga-marda (body ache), urdhvasvasa (short breath) and Kasa (cough).
3.	Valli panchmoola <sup>5</sup>	S.S.	Alleviates bleeding disorders (raktapitta), three type of oedema (shoph), all types of urinary disorders (prameha) and destroys seminal disorders (shukra dosh)
	Vamanopayogi Dravya <sup>8</sup>	A.S.	Useful in vaman karma (vomiting)
	Prayogika dhoomopayogi dravya <sup>8</sup>		Drugs for inhalation of medicated smoke.
	Varnya gana <sup>9</sup>		Cosmetically useful, complexion enhancing drugs
	Kanthyajanana gana <sup>9</sup>		Beneficial for throat and voice
	Stanyashuddhikar gana <sup>9</sup>		Breast milk improver
	Vidgrahan gana <sup>9</sup>		Stool binder
Vidaryadi gana <sup>6,7</sup>	A.S., A.H.	Increase physical strength, beneficial for heart, alleviates pitta and vata dosha, rajayaksha (tuberculosis), gulma (abdominal lump) angamarda (bodyache), urdhvasvasa (short breath) and kasa (cough).	
4.	Priyavadi gana <sup>6</sup>	A.S.	Alleviates chronic diarrhoea, disease due to Pitta dosha, promotes wound healing, union of fracture and dislocation of joints.
	Pitta nashak gana <sup>7</sup>	A.H.	Alleviates diseases due to Pitta dosha
<b>Abbreviation:</b> C.S.- Charaka Samhita, S.S.- Sushruta Samhita, A.S.- Ashtanga Samgraha, A.H.- Ashtanga Hridaya			

### Vernacular Names

English: Indian Sarasaparilla, Hindi: Anantmool, Bengali: Anantmool, Shvetashariva; Gujrati: Upalsari, Kabri, Durivel; Marathi: Upersari, Dudhasali, Anantmul; Punjabi: Anantmool, ushbah; Tamil: Nannari, Saribam; Urdu: Usbah.<sup>18</sup>

### Official drug for Sariva

In Ayurvedic texts like Bhavaprakasa Nighantu and Dhanvantari Nighantu, two varieties of Sariva namely sweta sariva and krishna sariva, both with similar therapeutic attributes, are described. According to API, Root of *Hemidesmus indicus* (L.) R.Br. is identified as the official drug for sweta sariva and *Cryptolepis buchanani* Roem. & Schult is identified as the source of krishna sariva.<sup>18,19</sup>

### Formulations

Sariva siddha yavagu, Sarivadi vati, Sarivadyasava, Sarivadi churna, Sarivadi lepa, Ashwagandhadi lehya, Dashamularishta, Jatyadi ghrita, Manjishthadi Kashayam, Balaashwagandha taila, Ashtamangal ghrita, Pinda tailam, Chandrakala rasa, Chandanadi taila, Anu taila<sup>20</sup>, Mahapanchgavya Ghrita<sup>21</sup>, Kalyanaka Ghrita<sup>22</sup>.

### Some Therapeutic uses as per classical texts

**Fever** - Decoction of patola, sariva, musta, patha and katuka checks malarial fever. Sariva is one of the ingredients of pippalyadi ghrita indicated in chronic fever.<sup>23</sup>

**Intrinsic haemorrhage** - Priyangu, Candana, Lodhra, Sariva, Madhuka, Musta, Usira, Dhataki and Haridra are mixed with clean *clod*, madhuyasti decoction and sugar. It is an excellent remedy for checking haemorrhage. In epistaxis, snuffing should be done with milk or Kamala and Utpala with Sariva.<sup>24</sup>

**Kushtha** - Like Vasa and Triphala, Brhati, Usira, Patola, Sariva and Katuka should be used as intake, bath, as an ointment and paste. Sariva is a constituent of Mahatiktaka ghrita.<sup>25</sup>

**Erysipelas** - Decoction of Sariva, Amalaka, Usira, and Musta is tried remedy for erysipelas. Local application of paste of Sariva,

Lotus stamens, Usira, Nilotpala, Manjistha, Candana, Lodhra and Haritaki alleviates the disease.<sup>26</sup>

**Poisoning** - Intake of Madhuka, Kustha, Sirisa, Haridra, Patala, Nimba and Sariva mixed with honey is efficacious in spider poisoning. Sariva is also one of the ingredients in amrita ghrita indicated in poisoning.<sup>27</sup>

**Pediatric Rasayana** - To the child taking only milk-diet, ghee cooked with yellow mustard, Vaca, Mamsi, Payasya, Apamarga, Satavari, Sariva, Brahmi, Pippali, Haridra, Kustha and saindhava should be given. It promotes strength, intellect and vitality.<sup>28</sup>

**Wounds** - Sariva root alone is capable of cleansing all types of wounds.<sup>29</sup>

**Bronchial asthma** Ghee cooked with the double quantity of the decoction of Sariva is useful.<sup>30</sup>

### Ethnomedicinal Uses

1. Powder of roots of *Hemidesmus indicus* (L.) R.Br. is locally named as Nannari in Kouthalai of Tamil Nadu along with fruit of few other plants (*Calophyllum inophyllum*, *Diospyros ebenum*, *Terminalia chebula*, *Terminalia bellerica* and *Phyllanthus emblica*) and honey is taken to increase the semen production.<sup>31</sup>
2. The roots are ground with those of 'Nachki' (*Mimosa pudica* L., Mimosaceae) and taken orally every morning, during the menstrual period to treat leucorrhoea. Root powder is dissolved in milk and taken daily as a body tonic.<sup>32</sup>
3. Leaf paste is used by ethnic groups of eastern Himalayan zone of Arunachal Pradesh in bone fracture.<sup>33</sup>
4. Two teaspoonful decoction of fresh root *H. indicus* taken cure stomach-ache and snake venom poisoning is used among the Santal medicine men of Birbhum district, West Bengal.<sup>34</sup>
5. The root paste, when taken orally relieves menstrual disorder, The extract of the entire plant is given for fever and is also used as good antidote for snake bite by tribal groups of the Tirunelveli District, Tamil Nadu.<sup>35</sup>
6. Fresh roots boiled in coconut oil with cumin seeds on a moderate flame is filtered after cooling. The filtered oil is

applied on the affected part for relief from burning sensation during rheumatism. One teaspoon of shade dried root powder is added to lukewarm water, filtered and taken orally twice a day for 5-7 days for relief from rheumatic complaint.<sup>36</sup>

7. The decoction of root is used for purifying the blood in Chandrapur district of Maharashtra.<sup>37</sup>

### **Hemidesmus indicus in Contemporary Texts**

There are many modern formulations introduced in the market which consist of *H. indicus* like anti-dandruff shampoo, cream, Sarivadi syrup, soothing skin balm, skinelle cream, Mahanarayan oil, De-Tox herbal tea, blood cleaner syrups, styplon tablets and many more. Modern science utilized its effect for commercial benefits.<sup>38</sup>

### **Validation of Ayurvedic Pharmacological Properties by Animal Studies and Clinical studies**

Therapeutic activities of *H. indicus* have been reported in several research articles. Many *in-vitro* and *in-vivo* studies are mentioned below defining the various pharmacological activities of *H. indicus*.

**Anti-inflammatory and Analgesic Activity:** Acharya Sushruta has classified Sariva in Valli Panchmool (group of drugs containing roots of five climbers) which has been indicated for the treatment of inflammation. It has also been classified in Priyangvadi Gana indicated for wound healing, healing of fractured bone and dislocation of joints. These indications stand revalidated by demonstration of anti-inflammatory activity of ethanolic extracts of root of *H. indicus* in rat models which was found to be comparable to diclofenac sodium gel.<sup>39</sup> Oral administration of the ethanolic extract of *Hemidesmus indicus* roots in mice showed dose-dependent antinociceptive effect. It blocked both the neurogenic and inflammatory pain. Three models were used to study the effects on nociception induced by acetic acid (Writhing test), formalin (Paw licking test) and hot plate test in mice.<sup>40</sup>

**Anti-pyretic Activity:** Acharya Charaka classified Sariva in Jwarhar Mahakashaya (group of ten drugs indicated in treatment of pyrexia) and Dahaprashaman mahakashaya (group of ten drugs indicated in treatment of burning sensation). It has also been used in the treatment of malarial fever and chronic fever in Charaka Samhita. This classical claim has been revalidated by the demonstration of anti-pyretic activity of hydro-alcoholic extract of *H. indicus* roots at a dose level of 300 mg/kg body weight in Wistar albino rat model (brewer's yeast induced pyrexia). The anti-pyretic effect was comparable to paracetamol (100 mg/kg body weight, orally).<sup>41</sup> Anti-pyretic-analgesic effect was also demonstrated in animal models in an experimental study using aqueous extract of Jwarhar Mahakashayan, an Ayurvedic preparation having the roots of Sariva (*H. indicus*) as one of its ingredient.<sup>42</sup>

**Hepatoprotective Activity:** Sariva has been considered to be one of the best pitta pacifying drugs. It also pacifies vata, has been included in Vidarayadi Gana indicated to increase physical strength. It is madhur, tikta in rasa, Rakta-Pittahar and deepana. Such drugs are considered to be effective in the management of disorders of liver and gastrointestinal tract. These claims regarding pharmacological properties of Sariva stand revalidated by the demonstration of hepato-protective activity against rifampicin and isoniazid induced hepato-toxicity in Wistar rats.<sup>43</sup>

**Renoprotective Activity:** Sariva has been considered to be one of the best blood purifying drugs, used therapeutically as detoxificant, in bleeding disorders and promotor of haemopoiesis.

Though there is no direct classical reference of its reno-protective activity, but above-mentioned pharmacological properties certainly indicate towards its efficacy in maintaining the normal functioning of kidney. These classical claims stand revalidated by efficacy of *H. indicus* root powder in the management of gentamicin induced nephrotoxicity in Wistar albino rats.<sup>44</sup>

**Spermatogenic Activity:** Sariva has been classified in Valli Panchmool, indicated in the management of seminal disorders. Most of the Nighantu texts have accepted its spermatogenic activity. These claims stand revalidated by the demonstration of spermatogenic activity of hot infusion of *H. indicus* root in adult male Wistar albino rats. The study demonstrated a significant effect on improving sperm count, sperm motility and increase in testosterone levels.<sup>45</sup>

**Anti-diabetes and Anti-cataractous Activity:** Valli Panchmool having sariva as one of its constituents, is indicated in urinary disorders (prameha). It has also been considered to be useful in prameha by Raj Nighantu. Cataract is fast progressing disease in diabetics. Anti diabetic potential of *H. indicus* and subsequently its efficacy in delaying the progression of cataract in streptozotocin induced diabetes in rodent models revalidates anti-diabetic potential of *H. indicus*. The methanolic root extract of *H. indicus* significantly inhibited aldose reductase activity, had lowering effect on blood glucose, decreasing osmotic stress and preventing the loss of antioxidants.<sup>46</sup> The active principle  $\beta$ -amyryn palmitate present in root extract of *H. indicus* has anti-diabetic potential in alloxan and streptozotocin induced diabetic rats.<sup>47</sup> Oral administration of HMBA (2-hydroxy 4-methoxy benzoic acid) isolated from *H. indicus* roots in rats had ameliorative effect on liver, kidney and pancreas injury due to streptozotocin induced diabetes in rats.<sup>48</sup>

**Diuretic Activity:** Valli panchamoola which includes Sariva as one of its constituents has been indicated in prameha (All types of Urinary Disorders). Raj Nighantu has indicated Sariva in the treatment of prameha. Diuretic activity of aqueous and ethanolic crude extract of *H. indicus* roots in animal models revalidates classical claim *H. indicus* root extracts significantly increased the urine output in higher doses in rats which was found to be comparable to that of frusemide and hydrochlorothiazide. Aqueous Extract of *H. indicus* root also caused marked increase in urinary Na (+) and K (+) levels. However, the routine urinalysis showed non-significant alterations in pH and specific gravity by either dose of crude extracts of *H. indicus* roots.<sup>49</sup>

**Antivenom Activity:** *H. indicus* has been reported to be used in the management of snake bite by various ethnic communities. Acharya Bhavmishra and Acharya Kaiyadev has mentioned alexipharmic (Vishaghna) properties of Sariva. This classical claim and ethnomedicinal practices stand revalidated by the demonstration of viper venom neutralising activity of methanolic root extract of *H. indicus* in albino rats and mouse.<sup>50</sup>

**Anti-angiogenic Activity / Anti-cancerous Activity:** Sariva has been classified in Vidarigandhadi Gana by Acharya Sushruta which has been indicated in the treatment of gulma (non-specified abdominal lump). This classical indication may be equated with the capacity of a drug to suppress malignant growths. A decoction of *H. indicus* roots has been found to exhibit anti angiogenic potential *in-vitro* on human umbilical vein endothelial cells.<sup>51</sup> Thus giving a lead towards use of *H. indicus* roots as anti-cancerous agent. A decoction of *Nigella sativa* seeds, *H. indicus* roots and *Smilax glabra* rhizome have been found to exhibit a strong dose dependent cytotoxicity on human hepatoma Hep G2 cell lines. The three individual plant extracts were cytotoxic in the order of potency *N. sativa*>*H. indicus*>*S. glabra*.<sup>52</sup>

Methanolic extract of *H. indicus* roots showed cytotoxic effect on the colon adenocarcinoma cell line (Caco-2) with IC<sub>50</sub> 60 µg/mL by MTT assay.<sup>53</sup> The decoction of *Nigella sativa* seeds, *H. indicus* roots and *Smilax glabra* rhizome has the potential to protect rat liver against DEN (diethylnitrosamine) induced hepatocarcinogenesis in male Wistar rats.<sup>54</sup>

**Anti-HIV Activity:** There is no direct reference supporting anti-HIV activity of *H. indicus* but Sariva has been considered as balya and hridaya, indicated in the management of rajyakshama (Tuberculosis) (Vidaryadi Gana). It is tridoshshamak. Classical properties indicate antimicrobial properties in Sariva. As per the reported study lupeol present in *H. indicus* exhibited activity against HIV-1 virus. Roots of *H. indicus* was capable of inhibiting RT-associated RNAase function. It also inhibited HIV-1 RT-associated RNA dependent DNA polymerase and cellular α-glucosidase.<sup>55</sup>

**Anti-diarrhoeal / Antimicrobial Activity:** Acharya Charaka have described Sariva as sangrahi (stool binders) and it is also a constituent of Puresha Sangarhaniya Mahakashaya (group of ten drugs which binds the stool). In ayurvedic text Ashtanga Samgraha, Sariva is mentioned in Vidgrahan gana and Priyangvadi gana which are indicated for patients of chronic diarrhoea. Also, in Nighantu texts Sariva is said to be useful in atisara (diarrhoea). These classical claim stand revalidated by experimental study on methanolic extract of *H. indicus* roots (MHI), which showed significant anti-diarrhoeal activity in albino rats in In-vivo. MHI inhibited the castor oil induced diarrhoea and had an anti-enterobacterial effect against *Salmonella typhimurium*, *Escherichia coli* and *Shigella Flexneri*. The result indicated that MHI was more active than standard anti-diarrhoeal drug, Lomotil. Findings suggested that MHI might elicit an anti-diarrhoeal effect by inhibition of intestinal motility and by its bactericidal activity.<sup>56</sup> Das and coworkers reported potent in-vitro antimicrobial activity of methanolic extract of *H. indicus* roots against *Salmonella typhimurium*, *Escherichia coli* and *Shigella Flexneri*.<sup>57</sup>

**Nootropic / Anti-psychotic Activity:** Sariva has been used in the treatment of unmad (psychosis) as a constituent of Kalyanaka ghrita and Apasmar (epilepsy) as a constituent of Mahapanchgavya ghrita. Therapeutic uses of sariva have been substantiated by its nootropic and anti-psychotic activity in animal models. The n-butanol fraction of *H. indicus* root extract significantly improved learning and memory at all doses in mice. Hence, *H. indicus* might prove to be a useful memory restorative agent in the treatment of dementia seen in the Alzheimer's disease.<sup>58</sup> Aqueous root extract of *H. indicus* significantly inhibited the stereotyped behaviour induced by apomorphine in rats and also potentiate the catalepsy induced by haloperidol, thereby showing its anti-psychotic activity.<sup>59</sup>

**Wound healing Activity:** Sariva has been indicated for wound healing and healing of fractured wounds & dislocation of joints (Priyangvadi Gana). Sariva root has been indicated for cleansing and healing of all types of wounds in *Vrind Madhav*. This classical claim stand revalidated by the demonstration of wound healing activity of an ointment containing 5% (w/w) methanolic extract of *H. indicus* roots in Wistar rats.<sup>60</sup> In a clinical study on 30 patients of chronic wounds of either sex, wound healing property of sariva (*Hemidesmus indicus*) root's paste was evaluated. The result showed an increase in the rate of wound contraction and increase in percentage of epithelialization.<sup>61</sup>

**Antithrombotic / Antioxidant Activity:** In the text of Ayurveda, Sariva is reputed as one of the best drugs for bleeding disorders, as blood purifier and as promoter of haemopoiesis. Study

reporting antithrombotic activity in methanolic extract of *H. indicus* roots on intravenous administration in rabbits cannot be explained on the basis of available references in classical texts. Intravenous administration of methanolic extract of *H. indicus* roots in rabbits delayed the plasma recalcification time, enhanced lipoprotein lipase activity and also inhibited ADP-induced platelet aggregation in-vitro, which was comparable to commercial heparin.<sup>62</sup> The methanol extract isolated from the root bark of *H. indicus* inhibited lipid peroxidation, hydroxyl and superoxide radicals in rat models.<sup>63</sup>

A polyherbal formulation called Caps HT2 having *H. indicus* as one of the ingredients showed antiatherogenic effect, antioxidant, anticoagulant, platelet antiaggregatory, lipoprotein lipase releasing, anti-inflammatory and hypolipidemic activity in rats. The formulation contained the methanolic extracts of selected parts of plants viz. *Commiphora mukul*, *Allium sativum*, *Plumbago indica*, *Semecarpus anacardium*, *Hemidesmus indicus*, *Terminalia arjuna*, *Tinospora cordifolia*, *Withania somnifera* and *Ocimum sanctum*.<sup>64</sup>

**Anti-hyperlipidaemic Activity:** Sariva is a constituent of Vidaryadi Gana indicated as hridaya. It has been considered to be tridoshshamak, deepana, pachana and aam dosh nashak. Drugs having stomachic, digestant properties and capable of digesting Aam dosh are considered to be capable of digesting improperly formed cholesterol, triglycerides, LDL cholesterol and phospholipids. The classical claim stands validated by the anti-hyperlipidaemic activity of cell culture extract of *H. indicus* in rat models. Cell culture extract of *H. indicus* (CCH) administered at a specific dose in hypercholesterolemic rats showed significant reduction in total cholesterol, triglycerides, LDL cholesterol and phospholipids. The possible mechanism of action for the above effect can be an increase in liver LDL receptor activity with a concomitant decrease in hepatic triglyceride (TG) synthesis. Also, the faecal excretion of cholesterol and phospholipids were increased.<sup>65</sup> As mentioned above the polyherbal formulation Caps HT2 was also found to possess hypolipidemic activity as it raised HDL cholesterol level in hyperlipidemic rats.<sup>64</sup>

**Antiacne Activity:** In Charaka Samhita and Ashtanga Samgraha, Sariva is mentioned in *varnya* mahakashaya and *varnya* gana respectively, which includes group of ten cosmetically beneficial drugs, also improves skin texture and complexion. In various Nighantu texts, Sariva is described as a blood purifier and kanduhara (prevent itching). In-vitro study of the terpenoid fraction of the roots of *H. indicus* showed strong inhibitory and bactericidal effect on *Propionibacterium acne* and *Staphylococcus epidermis*, which have been recognized as pus-forming bacteria triggering an inflammation in acne which are etiologic agents of *Acne vulgaris*.<sup>66</sup>

**Anti-leprotic Activity:** In Ayurveda leprosy can be understood as kustha (group of skin diseases). In Charaka Samhita various formulations for efficient treatment of kustha are mentioned, one of which is Mahatiktaka ghrita, having Sariva as its constituents. Acharya Charaka has also prescribed Sariva for intake, bath, as ointment and paste to Kustha patients. In Raj Nighantu, Sariva is said to be beneficial in kustha. All these classical claims stand revalidated by an experimental study where oral administration of 2% aqueous extract of *H. indicus* roots exhibited protective activity against infection of *Mycobacterium leprae* in mice in the form of delayed cutaneous hypersensitivity stimulation. *H. indicus* roots extract also demonstrated immunomodulatory activities.<sup>67</sup> Chloroform and 95% ethanolic extracts of *Hemidesmus indicus* roots showed antifungal activity against *Aspergillus niger*.<sup>68</sup>

**Anti-ulcer Activity:** In Ayurveda, gastric ulcer has been equated to annadrav shool which has been considered as a pitta predominant disease. In Ashtanga hridaya, sariva has been classified in pitta nashan gana. It has been considered to be having madhur, tikta rasa, snighdha, guru-guna, sheet- veerya and madhur vipaka and tridoshshamaka. Being Pitta shamak (tridoshshamaka). Sariva is constituent of Mahatiktaka ghrita indicated in the treatment of gastro-intestinal disorders and skin disorders. Classical pharmacological properties and therapeutic use of Sariva as antiulcer drug has been revalidated by the demonstration of anti-ulcer activity of *H. indicus* roots extract in albino Wistar rats. Anti-ulcer activity was attributed to mucoprotective action of *H. indicus* roots. significant inhibition of prostaglandins was also reported. Mucoprotective activity of *H. indicus* was comparable to standard drugs like omeprazole and ranitidine.<sup>69</sup> Warriar *et al.* (1988) carried out a comparative clinical study with Indukanta ghrita and Mahatiktaka ghrita for parinamashula (duodenal ulcer), where the effect of Mahatiktaka ghrita was found relatively better. *H. indicus* is a major ingredient in Mahatiktaka ghrita.<sup>70</sup>

**Anti-arthritic Activity:** Sariva has been indicated as a balya, union promoter in bone fracture and dislocation of joints as a constituent of Privangadi gana. Therapeutic potential of Sariva for the promotion of bone health has been revalidated by the demonstration of anti-arthritic activity. In animal studies, *H. indicus* roots has demonstrated anti-arthritic activity<sup>71</sup> and protective activity against bone loss due to oestrogen deficiency.<sup>72</sup>

**Anti-asthmatic Activity:** Acharya Sushruta has classified Sariva in Vidarigandhadi gana which is indicated in treatment of urdhva shvasa. He has also prescribed the decoction of Sariva cooked in ghee to the patients of asthma. Sariva has also been classified in Vidaryadi gana by Ashtanga Samgraha and Ashtanga Hridaya which is useful in treatment of urdhva shvasa (asthma). Nighantu texts also claim Sariva to be beneficial in Svasa. Thus, these classical assertions are validated by study of the effect of ethanolic extract of roots of *Hemidesmus indicus* at 25, 50, 100 mg/kg doses orally in the isolated goat tracheal chain preparation, passive paw anaphylaxis in rat, clonidine-induced catalepsy in mice. The extract showed significant dose-dependent anti-asthmatic activity in all these models.<sup>73</sup>

Most of the classical pharmacological properties and therapeutic applications of sariva reported in various texts of Ayurveda stand revalidated in reported studies on the *H. indicus*. Aromatic aldehydes and their derivatives have been reported to be the main bioactive metabolites present in the roots of *H. indicus*. It is one of the most commonly utilised herbs in indigenous system of medicine namely Ayurveda, Unani, Siddha, and ethnomedicine. Various other biologically active phytochemicals like alkaloids, steroids, terpenoids, flavonoids, saponins, tannins, lupeol, phenolic compounds have also been reported to be present in the roots of Indian sarsaparilla. Roots have been reported to exhibit biological activities namely anti-inflammatory, antimicrobial, antiulcer, antioxidant, anti-atherogenic, anti-carcinogenic, antileprotic. Due to over exploitation of the species plant has entered into the category of endangered species in various geographical areas. For sustainable utilization of the plant, there is an urgent need towards conservation of plant species in situ and largescale cultivation of the plant to meet growing demands. Some alternative sources may also be evaluated to protect the plant population from extinction.

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