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Review on medicinal and phytochemicals aspects of *Hemidesmus indicus* (L.) R. Br.

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Abstract
Hemidesmus indicus (L.) R. Br. A valuable medicinal plant has been investigated by many workers with all aspects of medicines. Plant is widely distributed all over the India and in a medicine it called as "Anantmoot". The current review paper is to elaborate the research work done for H. *indicus* for its phytochemical investigations, its chemical contents, and study in pharmacology and in the field of tissue culture practice with various treatments of hormones on H. *indicus* culture plants.

Keywords: *Hemidesmus indicus*, sarsaparilla, medicinal plants and phyto-chemistry

Introduction
Hemidesmus indicus (L.) R.Br. is widely distributed medicinal plant in India commonly known Indian Sarsaparilla. It is found growing under mesophytic to semi dry condition in the plains and up to the altitude of 800 meters (Satheesh *et al.,* 2008) [39]. Micro and macro morphological studies of the vegetative and reproductive characters with phytochemical studies of the accession from different agro climatic zones of India have been reported by George *et al.,* (2006) [17]. Jagtap & Singh, 1999 [21], studied on the Chromosome Number: 2n=22. Chromosome analysis of *in vivo* and *in vitro* plants, are done by Soma *et al.,* (2003) [45].

Fig 1: *Hemidesmus indicus*

Classification
Division: Angiosperms
Sub Division: Dicotyledonous
Class: Asterids
Order: Gentianales
Family: Apocynaceae
Subfamily: Periploceae
Genus: *Hemidesmus*
Species: *indicus*
Binomial name: *Hemidesmus indicus* (L.) R.Br.
Synonyms: *Periploca indica* L.

The plant has been used as a traditional medicine in the treatment of various diseases (Nadana Saravanan & Namasivayam Nalini, 2008) [28]. Medicinal properties of H indicus were reported by Hiremath *et al.,* (1997) [20], Ahmad *et al.,* (2001) [1], Prabhakar *et al.,* (2000) [32] and Ravishankara *et al.,* (2002) [36]. Chemical properties were reported by Prakash *et al.,* (1991) [33], Deepak *et al.,* (2005) [11], Roy *et al.,* (2000) [37], Nagaragan *et al.,* (2001) [26], Anonymous (2005) [5] and Nandana Saravana and Namasivayam Nalini (2008) [28].
H. indicus (L.) R. Br is highly valued in Indian system of medicine. Extracted plant materials are used in manufacture of Ayurvedic, Unani and Homeopathic medicine. This plant useful in treatment of Inflammatory condition, Fever, Rheumatism, Leprosy, liver disorders (Nadana Saravanan and Namasivayam Nalini 2008) [29], Leucoderma, (Satoskar *et al.,* 1962) [40], Itching, Skin disease, Asthma, Bronchitis, Leucorrhoea, Dysentery, Diarrhea, Piles, Sypilis, Paralysis and also in several free radical-mediated disease (Neeta *et al.,* 2005) [30]. It contains Aromatic, Anti-microbial, Anti-cancer, Anti-viral, Anti-inflammatory, Anti-pyretic, Anti-dysenteric actions Anti-oxidant, & Anti-hepatotoxic activities (Satheesh et *al.,* 2008) [39]. Roots are used as addition in main treatment of snakebite and scorpion sting (Sultana *et al.,* 2003) [48]. It improves the general health; plumpness, clearness, and strength, succeeding to emaciation, said to be useful in affections of the kidneys, scrofula, cutaneous diseases, thrush, scrofula, venereal disease, nephritic complaints, for sore mouths of children. It promotes health and energy and always cures all kinds of diseases caused by vitiated blood (Rao *et al.,* 2000 and Rao *et al.,* 2005) [37, 35]. As medicine *"Anantmool"* holds a reputed place in all systems of medicine in India (Neeta *et al.,* 2005) [30]. Due to multiple use of this plant has been indiscriminately collected from its natural habitat and becoming extremely rare by overexploitation (Sreekumar *et al.,* 2000a) [46]. The natives use the roots internally in treatment of premature graying of hairs, jaundice, eye related diseases.

Phytochemical Studies
Phytochemical studies of volatiles of *H. indicus* were reported by Nagarajan *et al.,* (2003) [27] with steam

distillation methods. Roy *et al.,* (2000) [37] have done phytochemical studies of H. indicus in comparison with other plants. Two novel glycosides, namely *hemidescine* and *emidine*, were isolated from dried root of *H. indica* by Chandra *et al.,* (1994) [8]. Baheti *et al.,* (2006) [7] reported the Hepatoprotective activity of *H. indicus* in rats. And the ethanol extract of *H. indicus* significantly prevented *rifampicin* and isoniazid induced hepatotoxicity in rats are reported by Nadana *et al.,* (2008) [29]. Pharmacognostic validations of root of *H. indicus* are reported by Shanthi *et al.,* (2010) [41]. Enhancement in the absorption of water and electrolytes from rat intestine by water extract of roots of *H. indicus* has also been reported by Evans *et al.,* (2004) [15] and protection from radiation induced damage of DNA and membrane *in vitro* by extract of *H. indicus* has been reported by Shetty (2005) [43].

Chemical Components

The flavanoid glycosides recognized in the flowers, were hyperoside, isoquercitin and rutin in the leaves, only hyperoside and rutin were identified (Gupta *et al.,* 1992a and 1992b) [18, 19]. Tannins 2.5 % present in leaves. Roots are reported to contain sitoserol (Chatterjee RC and Bhattacharya 1955) [9], 2-hydroxy 4-methoxy benzaldehyde which is responsible for fragrance in root, 3-hydroxy 4-methoxy benzaldehyde, 2-hydroxy 4-methoxy benzoic acid, hemidesmin-1, hemidesmin-2, hemidesminine, phytosterol, hemidesterol, saponins, ledol, linalyl acetate (Das *et al.,* 1992, Gupta *et al.,* 1992a, Alam MI and Gomes A 1998 a & b, Sharma *et al.,* 2015) [10, 18, 3, 4, 42]. A new ester identified as lupeol octacosanoate in addition to the known compounds *viz*., Coumarins, triterpenoid saponin, essential oil, starch, tannic acid, and triterpenoid saponin present (Moses *et al.,* 2015) [25].

Pharmacology

The herb is mildly immuno-suppressant. The aqueous, alcoholic and steam distilled fractions of the crushed roots had no significant diuretic activity (Turrini *et al.,* 2018) [51]. The 50% ethanolic extract of the whole plant did not exhibit any effect on respiration, normal blood pressure and also on presser response to adrenaline and depressor response to acetylalcholine and histamine in experimental animals. The extract also had no antispasmodic effect on guinea pig ileum (Jung *et al.,* 2007) [22]. The aqueous ethanolic extract of root collected during flowering season shows significant antiulcer activity (Anoop *et al.,* 2003) [6]. A saponin from the plant is found to have anti-inflammatory activity against formalin induced edema. An organic acid isolated from root extract possesses viper venum inhibitory activity (Alam *et al.,* 1996) [2].

Growth Hormones and Tissue Culture Studies

Detailed studies on seeds germination have been done by Galhena *et al.,* (2017) [16]. Rao RS and Ravishankar (2002) [34] reported enhanced rooting when treated by 'quick dip' method with different concentration of different auxins (IBA, IAA, NAA). Rooting was slow in the absence of auxins treatment but all attained >70% rooting. Effect of cryopreservation on seed germination of H. indicus also been reported.

Tissue cultures studies are reported on vitro propagation of H. indicus by Malathy and Pia (1998) [24] and Saha *et al.,* (2003) [38]. Patnaik J and Debata (1996) [31] were reported Clonal propagation of H. indicus. Studies on steroids in cultured tissue and mature plant have been reported. Improvement in Clonal prorogation of *H. indicus* through adenine sulphate has been worked out. Somatic embryogenesis and plant regeneration from leaf cultures of *H. indica* have been reported by Lingaiah *et al.,* (2016) [23] with leaf extract effects on liver enzymes. Comparative *in vitro* on plant regeneration from axillary shoot derived callus was studied by Siddique *et al*., (2006) [44] with 92% of callus induction results on MS medium supplemented with 1.0 mg per lit NAA and 6-benzyladenine (BA). The synthetic seeds prepared using somatic embryos, sodium alginate and calcium chloride germinated even after 120 days of storage at 4 °C (Swathi *et al*., 2019) [49].

Methology for production, separation and enhancement of chemical compounds production from extract of *H. indicus* are also reported. Productions of 2-hydroxy 4-methoxy-benzaldehyde using root cultures were studied by Sreekumar *et al.,* (2000b) [47]. Validation of detection methods of 2-hydroxy 4-methoxy-benzaldehyde and 2-hydroxy 4-methoxy-benzoic acid from root organs of *H. indicus* are done. Di Pompo *et al.,* (2014) [12] reported the phenylalanine ammonia-lyase-mediated biosynthesis of 2-hydroxy 4-methoxy-benzaldehyde in roots of H. indicus by using elicitation treatments of chitosan increased in production of phenolic compounds and "*in vitro*" evaluation of the antiresorptive activity residing.

Anti-HIV-1 activity

Antiretrovirals activity also been recorded in *H indicus.* Compounds have been reported to possess their efficacy towards HIV-1 (Tramontano *et al.,* 2011, Upadhyay *et al.,* 2014 and Esposito *et al.,* 2017, Esposito et al., 2018) [50, 52. 13, 14]. The anti-HIV-1 activity of HI was evaluated and found to inhibit RT-associated RNase H function, HIV-1 RT-associated RNA-dependent DNA polymerase activity and cellular α-glucosidase (Esposito *et al.,* 2017 and Swathi *et al.,* 2019) [13, 49].

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