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COMBATING SUN DAMAGE: HEMIDESMUS INDICUS AND SANDALWOOD ALBUM FOR TAN REMOVAL ACTIVITY: A REVIEW

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Abstract:
Medicinal herbs are frequently employed, either as a single medicine or in combination in the health-care delivery system. Hemidesmus indicus R.Br, also known as 'Anantmul' in Marathi, 'Sariva' in Sanskrit, and 'Indian sarsaparilla' in English, is a semi-erect shrub from the Asclepiadaceae family.[3] It is widely disseminated across India.It contains a variety of phytoconstituents including glycosides, flavonoids, tannins, sterols, and volatile oils.[3] Hemidesmus indicus contains various phytochemicals which are used in allopathic and unani It has traditionally been used to treat skin ailments, dysentery, diarrhoea, syphilis, dyspepsia, leucoderma, and burning sensations.[5] Hemidesmus indicus is one of the most valuable multipurpose plants in nature.[5] Plant roots and leaves are employed in the Ayurvedic medical system. These plants possess bacteriostatic, anti-cancer, anti-viral, anti-biotic, anti-inflammatory, and antibacterial properties.[5] Hemidesmus indicus contains the following compounds: pragnane glycoside, coumarinolignoids, B amyrin acetate, A amyrin, lupeol acetate, B sitosterol, hexadecenoic acid, hexatriacontane, lupeoloctasonate, etc.[8] Hemidesmus indicus has properties such as analgesic, anti-inflammatory, anti-oxidant, anti-acne, anti-pyretic, anti-arthritic, antipsychotic, anti-diarrheal, wound healing, anti-ulcer, anti-venom, anti-hyperlipaedaemic, anti-microbial, and anti-carcinogenic.[8] Santalum album is also known as Eastern Indian Sandalwood, Shrigandha, sandalwood, and Chandana.[4] Sandalwood is also used in timber.[4] this plant is noted for its distinct aroma; it is also regarded sacred, and its significance and application are described in the Vedas, Puranas, Buddhism, Epics, and Scriptures.[4] The plant is utilized in improvement, anti-poison, and blood purifier.[4] Sandalwood qualities include expectorant, diuretic, astringent, stimulant, cooling, and sedative agent, as well as pharmacological properties such as anti-oxidant, anti-cancer, anti-viral, anti-bacterial, anti-fungal, and cardioprotective.[4]

Key Words: Anantmool, sariva, antioxidant, anti-inflammatory, Ayurveda

INTRODUCTION:
Ayurveda, a traditional system of medicine that started thousands of years ago in India, is well-known for its use of plant-based items to treat ailments. Despite the availability of synthetic drugs in

contemporary medicine, Ayurvedic treatments remain popular because they are thought to be safe and effective.[1]
Many Ayurvedic remedies are applied topically as creams, soaps, oils, and ointments to treat a variety of skin conditions such as acne, wounds, eczemas, and ringworms. These products frequently include active ingredients obtained from natural sources, such as herbs, roots, flowers, and fruits, which are thought to have therapeutic characteristics. Ayurvedic goods are deemed safe because they are usually created from natural components and do not contain dangerous chemicals or synthetic additions.[1]
Many people are becoming more cognizant of the substances in their beauty and cosmetic products, and they are actively looking for natural alternatives.[1] Natural soaps, in particular, have gained appeal since they are frequently made without the use of synthetic chemicals and instead contain beneficial components sourced from natural sources, such as essential oils or plant extracts.[21]

This process results in the formation of soap through a process called saponification.. In a Natural soaps are typically manufactured using natural oils or fats, such as olive oil, coconut oil, shea butter, or cocoa butter, which are chosen for their beneficial benefits to the skin. Natural soaps are often created using traditional soap-making techniques, which entail mixing oils or fats with an alkaline solution, such as lye.[1] In addition to natural oils and fats, natural soaps frequently include useful components derived from natural sources, such as essential oils or plant extracts. Essential oils are concentrated plant extracts recognized for their fragrant characteristics and potential skin benefits.[26]

1.Hemidesmus indicus:
Hemidesmus indicus is also known as Indian sarsaparilla and Sanskrit (sariva).[4] This plant lives in uncultivated soil and scrap forests.[2] Hemidesmus indicus includes a variety of phytochemicals that are used in the allopathic and unani medical systems.[2] Plant roots and leaves are employed in the Ayurvedic therapeutic system. These plants have bacteriostatic, anticancer, antiviral, antibiotic, and antibacterial properties. Traditional applications of this plant's roots include blood purification, skin disease, and urine-related ailment.[2]

Hemidesmus indicus (L.) R. Br., often known as Indian Sarsaparilla/Anantamul, belongs to the family Asclepiadaceae.It is a perennial, diffusely twinning, or prostrate semi-erect shrub with a woody rootstock and numerous slender wiry laticiferous branches with purple brown bark.[2]

This plant can be found across India, thriving in mesophytic to semi-dry conditions in the plains and at elevations of up to 600 metres.[2] It is very prevalent in open scrub jungles, hedges, and uncultivated soil. It is found in India, Sri Lanka, Pakistan, Iran, Bangladesh, and Moluccas.[2] Though practically all of its parts are employed in traditional medicine, the leaves, stem, and roots are the most essential medicinal components. It is a well-known traditional medicinal plant widely used in Ayurveda, Siddha, and Unani systems of medicine to treat a variety of diseases such as dysentery, diarrhoea, syphilis, dyspepsia, leucoderma, diuretic, blood purifier, burning of the body, chronic fever and asthma, liver diseases, venereal diseases, leprosy, urinary tract infection, asthma, arthritis, bronchitis, epileptic seizures, high blood pressure, skin diseases (eczema and psoriasis), rheumatism, chronic nerve.[2] Herbal medications are gaining popularity worldwide since they have fewer or no negative effects than synthetic drugs. Ayurveda asserts therapeutic potentials of this plant, and a lot of pharmacological research work has been done, therefore the present review compiles known material in a thorough manner.[2]

Figure.1. Leaves of Anantamula[2]

Figure.2. Flower of Anantamula [2]

Taxonomical Classification:

Taxonomical rank	**Taxon**
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Gentianales
Family	Apocynaceae
Subfamily	Asclepiadoideae
Genus	Hemidesmus
Species	Indicus

Table no. :1. Taxonomical classification of Hemidesmus indicus[8,56]

Chemical constituents:

It includes essential oil, starch, coumarin, tannic acid, triterpenoid saponins, and hemidesmin.[3]

Phytochemical studies:

The phytoconstituents of Hemidesmus indicus range from hydrocarbons, glycosides, oligoglycosides, terpenoids, and steroids. Phytoconstituents extracted from several sections of Hemidesmus indicus.[3]

Roots –

Numerous phytochemical research have been conducted on H. Indicus. Pregnane glycoside (Hemindicusin) and coumarinolignoids (Hemidesmin-1 and Hemidesmin-2) are derived from H.indicus roots. Other compounds include β-amyrin acetate, α-amyrin, β-amyrin, lupeol acetate, β-sitosterol, hexadecanoic acid, hexatriacontane, and lupeol octasonate. The oil consists of 80% crystalline substance, glucose, hemidesmol, hemidesterol, 2-hydroxy-4-methoxy benzaldehyde, resin acid, glucoside, α-amyrin triterpene, β-amyrin triterpene, and benzaldehyde.[3,33,35]

Stem-

Glycosides like indicine and hemidine, Pregnane glycosides include hemidescine and emidine.[3]
Pregnane oligoglycosides, namely demicunine and heminine, Desinine, Indicusin, Medidesmine, Hemisine, and Demicine Steroidal substances include Calogenin-3-o-β-Ddigitoxopyranosteroid, desminine steroid, and hemisine steroid. Triterpenes include 3-keto-lup-12-ene-21->28 olide and lup-12-ene-3-β-ol acetate.[33]

Leaves-
The leaves contain coumarinolignoids such as hemidesminine, hemidesmin1, and hemidesmin 2, as well as flavonoids such as hyperoside and rutin, and 2.50% tannins.Coumaarinolignoids are a new and rare class of naturally occurring chemicals that have cytotoxic and antihepatotoxic effects.[35]

Pharmacological Studies:

Antioxidant activity:

The aqueous extract of the whole plant of Hemidesmus indicus demonstrated considerable free radical scavenging activity, implying that the plant extract is a potential source of antioxidants and hence potentially prevent various radical illnesses. Because to the presence of polar components, a methanolic extract of Hemidesmus indicus roots inhibited 1, 1-diphenyl-2-picryl hydrazyl (DPPH) radical, superoxide radicals, and mild nitric oxide scavenging action at varying concentrations.[2] Lipid Peroxidation caused by ferric-ADP and ascorbate in rat liver homogenate was also suppressed. Phenylhydrazine substantially reduced the hemolysis of erythrocytes.Mohana and associates reported similar effects employing a 50% aqueous ethanolic extract of Hemidesmus indicus, along with hepatoprotective properties.[2,57]

Dermal use of a the ethanol extract of Hemidesmus indicus prior to use of cumene hydroperoxide demonstrated considerable reduction of cutaneous oxidative damage and enhanced the level of enzymes that protect cells by an unknown method.Ethanolic extract of Hemidesmus indicus showed substantial antioxidant action and offered protection against free radical-mediated oxidative stress in kidney in ethanol-induced nephrotoxicity in rats.[2]The administration of Hemidesmus indicus extract 500 mg/kg/day for 30 days significantly lowered serumurea, uric acid, creatinine, and kidney-thiobarbituric acid reactive substances (TBARS), lipid peroxides, and conjugated dienes.[57]

The extract enhanced the levels of kidney super antioxidant dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), and reduced glutathione (GSH).The terpenoidal fraction produced from serial extraction of Hemidesmus indicus roots has strong free radical scavenging activity.[2]In streptozotocin-induced diabetic rats, administration of aqueous extract of Hemidesmus indicus roots (500mg/kg/day) over a period of 12 weeks lowered lipid peroxidation index, which is related to its antioxidant activity.[57]

Antiacne activity:

Acne vulgaris is the most prevalent pilosebaceous skin condition, caused by the bacteria Propionibacterium acnes, Staphylococcus epidermis, and Malassezia furfue.[3] The majority of antiacne medications target Propionibacterium acnes and Staphylococcus epidermis, which are the primary culprits.Kumar and associates discovered that the roots of Hemidesmus indicus had a strong inhibitory impact on P. acne and S. epidermis. The minimum inhibitory concentrations for P. acne and S. epidermis were determined to be 0.051mg/ml and 1.25mg/ml, respectively.[3] However, significant quantities were necessary to serve as a bactericidal agent.[58]

Kumar and coworkers also investigated the antiacne activity of the terpenoidal fraction obtained following consecutive extractions of Hemidesmus indicus. This terpenoidal fraction showed significant antiacne activity, with minimum inhibitory doses measured by broth dilution assay being 38ug/ml for both P. acne and S. epidermis, and minimum bactericidal concentrations.[58]

Anti-inflammatory activity:

The ethylacetate extract of roots of Hemisdesmus indicus exhibited significant inhibition of inflammation in both acute and subacute inflammation induced by carrageenan, bradykinin, and S-hydroxy tryptamine, but was less active in granuloma pouch and cotton pellet implantation and ineffective in dextran-induced inflammation methods in rats.[2]

The treatment with the hydroalcoholic root extract of Hemisdesmus indicus at different doses (100, 200, and 300 mg/kg b.w., p.o.) significantly reduced the volume of paw edema and the formation of granulation tissue in a dose-dependent manner, with the maximum effect observed at 300 mg/kg b.w., which was comparable to phenylbutazone 100 mg/kg b.w., i.p.In carragenan-induced paw oedema, methanolic roots extract showed a considerable reduction in volume between 2-4 hours after treatment.A saponin from the Hemisdesmus indicus was reported to exhibit anti-inflammatory effect against formalin-induced edema at 38ug/ml and 46ug/ml, respectively.[2]

Cosmetic Use:
Prevent or manage the safe development of pigmentation, such as pigmented Anantmool contains phytochemicals such as saponin, glycosides, flavonoids, and tannins, as well as diverse pharmacological properties, making it suitable for usage in a variety of herbal product formulations.[18]

Hemidesmusindicus is a good source of "saponin," a natural carbohydrate found in plants. They have been found in studies to have good antioxidant effects as well as "foaming" properties, thus it can be utilized in herbal shampoo preparation due to its foaming property. It also has good cleansing properties that aid to eliminate dirt and pollutants.Hemidesmusindicus contains flavonoids and nutrients such as copper, iron, manganese, vitamins A and D, and zinc, making it an effective anti-aging component for skin around the eyes.[59]Melanin production inhibitor. makes it possible to identify by age, sun tanning, and freckles. Root-based formulations are efficient in inhibiting elastase, collagenase, and tyrosinase activity, preventing and treating skin aging, pigmentation caused by insolation, senile plaque, freckles, chloasma, face mottling, and so on.[18]

Topical creams for relieving chronic skin disorders such as psoriasis, eczema, and lichen planus, as well as maintaining general health, contain combinations of hydrolyzed ghee (butterfat) and herbal extracts that include roots. Polyherbal formulation with numerous therapeutic uses that promotes healthy skin and other health benefits, especially as a skin nourisher, anti-acne, anti-microbial, anti-oxidant, immune-modulator, anti-inflammatory, cleanser, skin fairness, and protection from UV radiation from the sun.The plant is utilized as a lipase inhibitor in skin/hair external preparation.[18] The root included in polyherbal compositions is utilized as an anti-inflammatory agent. This minimizes the redness, swelling, and discomfort caused by inflammation.When applied to the skin, it can relieve the discomfort caused by ezema and psoriasis. Sarsaparilla's smoothening effects erase dry, itchy skin. H. indicus includes natural antioxidants that help protect against environmental stresses. The cosmetic formulation has an antioxidant impact that improves the appearance and health of the skin by removing wrinkles and lowering the appearance of age spots, as well as increasing skin luster and suppleness when applied or swallowed.[18]

Plant extracts are used to stimulate hair development and as ingredients in hair care products. Day-night cosmetic composition protects the skin from the sun's damaging rays and makes the skin lighter. The invention pertains to a skin composition with skin-lightening and rough skin-improvement properties.[18] An herbal composition has been reported to relieve discomfort. It includes natural lipids that help the skin moisturize itself. Aromatic oil in hemidesmusindicus plays a significant role on sweet and autumn fragrance, hence it is used in the formulation of deodorant talc.As a result, H. indicus extracts can be utilized in appropriate cosmetic formulations to prevent acne and dandruff due to their antibacterial qualities. Its antibacterial properties allow it to be utilized as hand sanitizer and medicated talcum powder. It has wound healing capabilities, thus it can be used in aftershaves and other foot cosmetics to treat chilblain and athlete's foot.[18]

2. Santalum album:
Santalum album L., often known as East Indian sandalwood, Chandana, or sandal, belongs to the Santalaceae family. Sandalwood is a Sanskrit name that refers to a wide range of woods noted for

their cooling effects and perfume.[4]It is a tiny evergreen hemiparasitic tree that is prized for its aromatic heartwood. The sandalwood plant is considered sacred and holds religious importance.The plant has the highest oil content and is mostly utilized in perfumes, cosmetics, incense sticks (Agarvati), and pharmaceuticals.[4] The plant is a native species of India, primarily found in the deciduous forests of the Deccan region of peninsular India.It is an economically significant tree, primarily collected for heartwood oil. For over 5000 years, India has been the leading exporter of sandalwood oil for the pharmaceutical and perfume industries.Sandalwood is the world's second most expensive wood, after African blackwood. The sandalwood tree's value is determined by the volume of heartwood, as well as the quality and concentration of its oil.Various medicinal systems, including Ayurveda, Siddha, and Unani, employ the oil extracted from the plant's heartwood to treat a wide range of diseases and ailmentsTraditionally, sandalwood has been used as a diuretic, expectorant, stimulant, antiseptic, cooling, astringent, bronchial tract, and sedative. It is used to treat ailments such as jaundice, dysentery, and gastric irritation, as well as a tonic for the liver, heart, fever, memory improvement, anti-poisoning, and blood purification.[4] In Ayurveda, the herb is used to treat bleeding piles, vomiting, poisoning, hiccoughs, diarrhea with blood, intrinsic hemorrhage, urticarial, umbilicus irritation, and eye infection.Moreover, the sandalwood plant is considered sacred and is used in various religious The sandalwood plant's active ingredients include alpha and beta-santalols, which are responsible for its pleasant, unique aroma.Aside from that, the plant has been linked to a variety of medicinal and pharmacological qualities, including antioxidant, antiinflammatory, anticancer, hepatoprotective, ulcer, antibacterial, antifungal, antiviral, hemolytic, antipyretic, and cardioprotective.[4]

Sandalwood plant also known as ‘Royal tree’ in Indian subcontinent, is a traditional plant used since ages. The wood of the tree is used to extract oil. Sandalwood oil is used for the prevention and treatment of warts, skin blemishes, and tumors due to viral infection.The taxonomical classification of the plant is shown in table no. 3.[4]

Taxonomical rank	**Taxon**
Kingdom	Plantae
Sub-kingdom	Tracheophytes
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Santalales
Family	Santalaceae
Genus	Santalum
Species	S. album
Common name	Sandalwood,chandan

Table 3: Taxonomical Classification of Sandalwood[4]

Chemical constituents:

The Santalum album plant produces a high concentration of volatile oil, which is extracted from its roots and heartwood (core section of the trunk). These volatile oils are collected from the roots and heartwood after 30 years of growth. The oil is yellowish, colorless, and thick, with a strong sweet odor.[4]

The principal active ingredient in the volatile oil is santalol, a combination of two primary sesquiterpene alcohols, beta-santalol (16.0%) and alpha-santalol (19.6%), with the alpha form predominating. The plant's minor constituents include lanceol, bisabolol, nuciferol, and

S. album's anthocyanin pigment sesquiterpene hydrocarbons such as alpha and beta-santalenes (C15H24), betabisabolene, alpha, beta, and gamma-curcumenes, and bergamotene phenylpropanoids.The plant's reported main essential oil components include sesquiterpene alcohol such as epi-cis-beta-santalol, alpha-trans-bergamotol, cis-beta-santalol, and cisalpha-santalol. Heterocyclics, alpha-bisabolol, hydrocarbon santene, alpha-santalene, beta-santalene, epi-beta-santalene, alpha-bergamotene, alpha-curcumene, beta-curcumene, gammacurcumene, beta-bisabolene, alpha-bisabolol, trans-beta-santalol, and cis-lanceo.[4]

Pharmacological studies:

Antibacterial:

The essential oil derived from the sandalwood plant shown high antibacterial action against axilla bacteria, methicillin-resistant Staphylococcus aureus, antimycotic-resistant Candida species, and Herpes simplex virus type 1. The alpha and beta-santalol, as well as the crude extract of sandalwood oil, demonstrated antibacterial action against the gram-negative bacterium Helicobacter pylorus, which is significantly associated with duodenal, stomach, and gastric ulcers.[4]

Anticancer:

The plant's alpha-santalol component demonstrated chemopreventive and molecular effects on skin cancer development in both skin cancer cell lines and animal models.The plant's sandalwood oil shown anticancer activity against UV-B-induced skin carcinogenesis in SKH-1 mice, chemically-induced skin carcinogenesis in CD-1 and SENCAR mice, non-melanoma, and in vitro models of melanoma, prostate, and breast cancer. The ability to cause cell cycle arrest and apoptosis in cancer cells has also been discovered. In addition, alphasantalol inhibited 12-O-tetradecanoylphorbol-13-acetate (TPA)-induced ornithine decarboxylase (ODC) activity and DNA synthesis, which delayed the development of papillomas in CD-1 and SENCAR animals.In another investigation, the use of alpha santalol (5%) was found to prevent the development of skin tumor in a dose-dependent manner, reduce tumor multiplicity, and inhibit the liver microsomes and in vitro lipid peroxidation in the skin, thus acting as an anti-peroxidant by preventing the development of UVB-induced skin tumors in mice.Another study was conducted against the UV B-induced skin growth model in SKH-1 mice, in which alpha-santalol was revealed to enhance the levels of apoptosis-related proteins, tumor suppressor protein p53, and caspases 3 and 8 via an extrinsic mechanism. However, alphasantalol derivatives were found to have tumor-specific cytotoxicity in HL-60 human promyelocytic leukemia cells and TIG-3 normal human diploid fibroblasts.[4]

Antioxidant:

cyanidin-3-glucoside has been shown to be nutritionally essential as well as antioxidant.The plant's sandalwood oil demonstrated antioxidant efficacy against the liver of adult male Swiss albino mice, raising glutathione S-transferase (GST) activity and acid-soluble sulfhydryl (SH) levels.[4]

Cosmetic uses:

Sandalwood is regarded a sacred plant and is used in a variety of religious, ritual, and ceremonial rituals. Ancient literature provides detailed descriptions of the plant's medicinal and cosmetic benefits. The sandalwood plant holds a special spiritual significance in India. The heartwood of the shrub is burned at funerals and weddings.[4]Indian sandalwood incense is the oldest incense, having been used for more than 4000 years. Sandalwood is burnt during Buddhist prayers. Hinduism, Buddhism, and Jainism all employ the plant for sacred purposes.[4]

Sandalwood essence is thought to help shift cravings and keep people alert as they meditate. For millennia, the plant has been used in India to produce attar (a combination of sandalwood oil and floral oil such as rose petal, jasmine, kewda, and others).These attar products are used in the production of incense sticks and scented tobacco such as Zarada, Gutka, and Pan masala. The plant's oil is utilized in a variety of applications including Ayurvedic, medicinal, toiletry, detergent, and

perfume.Sandalwood extracts are used in Chinese medicine to treat gonorrhea, stomachaches, skin problems, nervousness, and dysentery.[4]

Conclusion:

The phytochemistry and pharmacology of Hemidesmus indicicus have been extensively studied, but investigations on the toxicity of plant extracts in various solvents are extremely rare.According to the literature, the plant has analgesic, anti-inflammatory, antipyretic, antiarthritic, antioxidant, hepatoprotective, nephroprotective, anticonvulsant, antileprotic, antiacne, antipsychotic, nootropic, antinociceptive, anti-diarrhoeal, antigenotoxic, antiangiogenic, wound healing, antiulcer, larvicidal, antivenom, antithrombotic, antihyperlipaedaemic, antimicrobial, and anticarcinogenic activities.Serious efforts for high-quality investigations are required to identify the plant's novel therapeutic qualities, as well as to identify and isolate the precise chemical responsible for the specific action. Furthermore, investigations on the pharmacokinetics and bioavailability of this plant are urgently needed to completely understand the mode of action of possible bioactive compounds for future medication development.

The sandalwood plant is recognized for its fragrant wood and essential oil collected from its heartwood. These essential oils are utilized in a variety of therapies, including perfumery, cosmetics, cuisine, and pharmaceuticals.The active ingredients of the plant include alpha-santalol and beta-santalol, which are responsible for the aroma.It is used in several traditional medicinal systems to treat fever, diarrhea, piles, scabies, common cold, bronchitis, urinary tract infection, mouth inflammation, liver problems, gall bladder disorders, and other ailments.

Furthermore, the plant has been associated with profound religious and cultural value since antiquity. The essential oil extracted from the plant has a high commercial value and is utilized as a vital ingredient in some foods. Furthermore, because to overexploitation and illegal felling, the sandalwood plant is categorized as an endangered species. As a result, there is an urgent need to develop conservative measures or plans to protect this essential medicinal plant, which is deemed economically vital and has considerable spiritual and commercial significance.

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