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Review Paper

An Integrative Review on Khadira in Twak vikara with Special Reference to Brihatrayi

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ABSTRACT

Khadira (Acacia catechu) is a wel-known medicinal plant in Ayurveda, extensively indicated in twak vikara(skin diseases), particularly in the classical texts of the brihatrayi- charaka Samhita, Sushruta Samhita and ashtanga Hridaya. This integrative review aims to compile and analyze the traditional references and correlate them with contemporary pharmacological findings to understand its therapeutic potential in dermatological skin diseases. In ayurveda literature, Khadira is described with tikta and Kashaya rasa, possessing properties such as kushtaghna, kandughna, vishaghna, and ropana, making it highly effective in managing various skin diseases. These actions are primarily attributed to its ability to balance kapha pitta dosha, reduce kleda and promote tissue healing.Modern studies support these classical claims by demonstrating khadira's significant antioxidant, anti-inflammatory, antimicrobial and wound healing activities, largely due to the presence of flavonoids, tannins, and catechins. These pharmacological actions help mitigate oxidative stress, suppress inflammatory mediators, inhibit microbial growth and enhance tissue repair. The integrative analysis highlights that Khadira acts through both systemic and local mechanisms, addressing the root pathology of skin disorders. Thus, Khadira emerges as a promising Ekamoolika therapy

INTRODUCTION

Khadira, scientifically known as *Acacia catechu* willd which belongs to family *Fabaceae*. *It* is one of the commonly used herbs in folklore or traditional medicine. It is commonly known as *khaira,* cutch tree, *karangali* and *kaggali.* [1] Charaka has mentioned *Khadira* in *kushtaghna mahakashaya, udaraprashamana* and *Kashaya skanda*. Sushruta included it under *salasaradi ghana* and Vagbhata has mentioned *Khadira* in *asanadi ghana*. *Khadira* is used as medicine and

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also in rituals.[2] *Khadira* is considered as drug of choice for treatment of *kushta*(skin diseases)both internally as well as external application.[3] It contains specific chemicals that induce contraction of skin cells, reducing the inflammation and helps in recovering the wounds.[4] One of the most used part of *khadira* is *khadira sara*(heart wood extract) which is known for its antibacterial, antimycotic, antioxidant and antidiarrheal activity.[5] It contains polyphenolic compounds, tannins, alkaloids, carbohydrates and flavonoids. Catechin present in this plant play an important role as anti-oxidant. [6] Parts of the tree utilized for medicinal purpose are its bark and heart wood. [7] *Khadira* and *kadara* are two varieties described in classics. [8] *Khadira* possesses *Kashaya, tikta rasa, laghu* and *ruksha guna, sheeta veerya, katu vipaka,* and it is *kaphapitta shamaka, vranaropaka, medoghna, Shophahara, pramehaghna. [9]*

Skin acts as protective barrier that prevents internal cells and tissues from harmful chemicals, extreme temperature and radiations etc. In ayurveda skin is described as *twacha* or *twak. Twak* is the *upadhatu* of *mamsadhatu*. All the acharyas have mentioned different layers of skin along with its thickness and diseases associated with particular layer. [10] All the skin diseases are explained under the heading *kushta.* Prolonged practice of causative factors leads to vitiation of *tridosha(vata, pitta, kapha)* and affects the *twak*(skin), *rakta*(blood), *mamsa*(muscle) and *lasika* (lymphatic tissue). *Kushta* is classified into *mahakushta* and *kshudra kushta*. *Mahakushta* are further subdivided into seven types and *kshudrakushta* are divided into eleven types based on the characteristic features and *doshas* involved in it. [11]

MATERIALS AND METHODS:

An extensive literature review was done from classical ayurvedic texts to compile information on the traditional properties, uses and therapeutic indications of *Khadira* (*Acacia catechu* willd). References were primarily gathered from the *brihattrayi,* where details regarding its indications, formulations containing *Khadira* and various dosage forms were systematically identified and compiled. Additionally, data on its chemical constituents, pharmacological activities and therapeutic effects on skin disorders were collected from various research articles, online sources and scientific databases.

RESULTS:

Utility of *Khadira* in *twak vikara*

Charaka Samhita-

Charaka described *Khadira* under *kushtaghna mahakashaya, udaraprashamana* and *kashaya skanda.* [12]

SI.NO	Formulation	Indication	Reference
1	*Madhvasava*	*Kushta and kilasa*	Cha.chi.7/73
2	*Kanaka bindu arishta*	*Mahakushta and kshudra kushta*	Cha.chi.7/76
3	*Ashta Kashaya yoga*	*Kushta*	Cha.chi.7/97
4	*Triphaladi Kashaya*	*Vataja kushta*	Cha.chi.7/101
5	*Sarshapadi taila*	*Sarvakushta*	Cha.chi.7/119
6	*Vataja kushtahara yoga*	*Vataja kaphaja kushta*	Cha.chi.7/124
7	*Khadira jala Snana and pana*	*Kushta*	Cha.chi.7/129
8	*Khadira ghrita*	*Rakta and pitta pradhana kushta*	Cha.chi.7/135
9	*Mahakhadiradi ghrita*	*Sarvakushta*	Cha.chi.7/152

10	*Khadira jala Snana, pana and lepa*	*Krimi and kushta*	Cha.chi.7/158
11	*Kushtahara krimighna Dravya prayoga*	*Krimi and kushta*	Cha.chi.7/159
12	*Khadirodaka*	*Shwitra*	Cha.chi.7/166
13	*Khadiradi lepa*	*Visarpa*	Cha.chi.21/88

Sushruta Samhita- *Sushruta* has described *Khadira* under *salasaradi ghana.* [13]

SI.NO	Formulation	Indication	Reference
1	*Khadirakashaya*	*Kushta*	Su.chi.9/5
2	*Khadira yoga*	*Medogata kushta*	Su.chi.9/6
3	*Khadira jala snana*	*Kushta*	Su.chi.9/66
4	*Yavagu prepared from khadirambu*	*Kushta*	Su.chi.9/67
5	*Khadira jala Snana, pana, anna*	*Kushta*	Su.chi.9/70-71
6	*Mantha Kalpana*	*Mahakushta*	Su.chi.10/4
7	*Khadira kashaya*	*Mahakushta*	Su.chi.10/4
8	*Sura*	*Mahakushta*	Su.chi.10/8
9	*Avaleha*	*Mahakushta*	Su.chi.10/9
10	*Ayaskrti*	*Kushta*	Su.chi.10/11
11	*Khadira Vidhana*	*Kushta*	Su.chi.10/12
12	*Khadira sara*	*Kushta*	Su.chi.10/13
13	*Khadirodaka siddha mruduodana*	*Sarvakushta*	Su.chi.10/15
14	*Khadira kashaya*	*Vidarika*	Su.chi.20/16
15	*Khadira kashaya*	*Ahiputana*	Su.chi.20/58

Ashtanga Hridaya- *Vagbhata* has mentioned *Khadira* under *asanadi ghana.* [14]

SI.NO	Formulation	Indication	Reference
1	*Khadira lepa*	*Visarpa(kaphaja)*	Ah.chi.18/15
2	*Seka, lepa, abhyanga*	*Visarpa(vataja)*	Ah.chi.18/17
3	*Sakhadira jala*	*Sarvakushta*	Ah.chi.19/14
4	*Food processed with khadira*	*Sarvakushta*	Ah.chi.19/26
5	*Khadira kashaya*	*Kushta*	Ah.chi.19/37
6	*Khadira kashaya*	*Kushta*	Ah.chi.19/37.5
7	*Khadira Kashaya and ghrita*	*Vataja kushta*	Ah.chi.19/39
8	*Khadira churna with ghrita and madhu*	*Kitibha, svitra, dadru*	Ah.chi.19/48
9	*Khadira and dhava lepa*	*Vatakaphaja kushta*	Ah.chi.19/86

Phytochemicals present in *Khadira* [15]

S.NO	Plant part	Phytochemicals
1	Wood	1)3,6,7-Trihydroxy-2-(4-hydroxy-3-methoxyphenyl)chromen-4-one 2)Aromadendrin 3)Kaempferol 4)Quercetin 5)Isorhamnetin 6)(+)-Gallocatechin 7)Taxifolin 8)Afzelechin 9)Cianidanol 10)(-)-Epicatechin 11)Catechin tetramer
2	Seed	1)[3-[Hydroxy-(2,3,4,5,6-pentahydroxycyclohexyl) oxyphosphoryl] oxy-2-octadecanoyloxypropyl]octadecanoate 2)1-(11Z-icosenoyl)-2-(9Z,12Z-octadecadienoyl)-sn-glycero-3-Phosphoethanolamine 3)Oleic acid 4)Linoleic acid
3	Plant exudate	1)L-(+)-Arabinose 2)D-Glucuronic Acid 3)3-o-beta-d-Galactopyranosyl-d-galactose 4)D-Rhamnose 5)Aldobiouronic acid 6)D-Galactose 7)L-Arabinose 8)L-Rhamnose
4	Leaf	1)Quercetin 2)Hyperoside 3)Quercitrin
5	Flower	1)Leucocianidol 2)Isoquercitrin 3)Astragalin
6	Bark	1)D-Rhamnose 2)D-Galactose 3)L-Glucurono-3,6-lactone 4)L-Arabinose

MODE OF ACTION OF KHADIRA WSR TO ITS RASAPANCHAKA

Khadira exhibits its therapeutic action in *twak vikara* through its *Rasapanchaka* which collectively influence *Dosha, Dhatu* and *srotas. Khadira* possesses *tikta* and *Kashaya rasa. Tikta* rasa helps in *ama pachana, Rakta shodhana* and *kleda shoshana*, thereby reducing toxins and moisture in skin disorders. *Kashaya rasa* contributes to *stambhana*(Astringent action*), Ropana*(healing), and *kleda upashoshana*, which aids in reducing exudation, tightening tissues, and promoting wound healing. Its *laghu* and *ruksha* guna helps in kapha *shoshana* and *meda kshaya*, thereby reducing oiliness, discharge and heaviness associated with skin diseases. It possesses *sheeta veerya* which help in *pitta shamana*, reducing inflammation, burning sensation, and erythema commonly seen in skin diseases. *Khadira* has a special *kushtaghna* and *kandughna Prabhava*,

making it specifically effective in skin disorders by relieving itching and promoting skin health. Through its *rasapanchaka, Khadira* primarily balances *kapha* and *pitta dosha*, purifies *rakta dhatu,* reduces *kleda* and enhances tissue healing. This results in anti-inflammatory, anti-microbial, detoxifying and wound healing effects, making it highly effective in managing various skin disorders. (16)

COMTEMPARORAY MODE OF ACTION OF *KHADIRA* ON SKIN DISORDERS

QUERCETIN-

Quercetin is one of the organic compounds belonging to flavanol group which comes under class of flavonoids. Quercetin exhibits soothing effect on skin; it has been proved that quercetin has anti-oxidant, anti-histamic and anti-itching properties. Due to its antioxidant properties it reduces lipid peroxidation and restores the barrier function of damaged skin thereby reducing the erythema(redness)and itching and produce soothing effect.(17)Quercetin also prevents skin aging, wrinkle formation and inflammation in skin tissue.(18)Quercetin is used in many cosmetic products as it inhibits tyrosinase enzyme activity in the body and reduce melanin production acts as anti-melanogenesis.(19)Quercetin is used in many skin diseases especially in reducing oxidation processes, melanogenesis, scarring, aging ,wound healing and protection against UV radiations.(20)

CATECHIN-

Catechin are natural flavanols, type of polyphenolic compounds belongs to flavonoid family. Catechin is a good antioxidant. It produces and discards free radicals through direct and indirect antioxidant mechanisms. Direct mechanism refers to scavenging of reactive oxygen radicals and indirect mechanism refers to increased antioxidant enzymes and inhibition of pro-enzyme that participates in the oxidant stress. Catechin acts as anti-aging agent by inhibiting collagenase and elastase and maintain skin elasticity and dermal structure. It also reduces melanin production by inhibiting tyrosinase enzyme and acts as depigmentation agent. Catechin also known for its anti-bacterial activity it inhibits the growth of acne pathogens such as staphylococcus epidermidis and Propionibacterium acnes. (21)

EPICATECHIN GALLATE-

Epicatechin gallate is a catechin with antioxidant and anti-inflammatory properties, significantly speed up wound healing and improves scar quality. It also regulates vascular endothelial growth factor (VEGF) thus accelerates angiogenesis, increases early blood vessel formation, elevates inducible nitric oxide synthase activity and nitric oxide production which promotes collagen synthesis and tissue repair. It also stimulates cyclooxygenase 2(COX 2) activity during early healing supports in cell proliferation and resolving inflammation. It also reduces arginase activity and helps in preventing excessive collagen accumulation and fibrosis. (22)

EPIGALLOCATECHIN GALLATE-

Epigallocatechin gallate has anti-inflammatory, antioxidant and collagen protective effects. These properties play a vital role in preventing and repairing UV induced skin photoaging. It helps in preserving collagen and elastin structures and maintain skin elasticity. It reduces oxidative stress, promotes DNA repair, protects mitochondrial functions and improves skin hydration by regulating natural moisturizing factors. It also reduces pigmentation by inhibiting tyrosinase enzyme activity. (23) It improves skin barrier function by increasing hyaluronic acid synthesis and inhibiting its degradation under ultraviolet radiations. It exhibits anti-wrinkle effect by promoting keratinocyte proliferation. (24)

PHLOROGLUCINOL-

Phloroglucinol exhibits photoprotective action on the skin by its anti-oxidant and DNA repair enhancing properties. It decreases cyclobutene pyrimidine dimer formation by activating DNA repair mechanism and reduces UV induced damage. It also delays the onset of photo carcinogenesis and protects skin from UV induced carcinogenic changes. It acts as a cytoprotective, antioxidant, antiapoptotic agent and maintain the survival of skin cells under oxidative stress. [25,26]

KAEMPFEROL-

Kaempferol is a flavonoid with potent anti-oxidant, antimicrobial, anti-inflammatory and skin protective properties. It reduces oxidative stress by scavenging reactive oxygen species, enhancing the anti-oxidant enzymes and decreasing the lipid peroxidation. It also protects cells from apoptosis by regulating the pathways such as Bax/Bcl-2. It supresses cytokines like TNF, IL-6 And inhibits signalling pathways such as NF-kB, MAPK, and Akt by its anti-inflammatory properties. Kaempferol exhibits anti-microbial and antifungal activity including inhibition of bacterial growth and biofilm formation. In skin health it prevents photoaging, reduces ROS-induced damage, enhances epidermal cell proliferation, controls melanogenesis and improves skin structure. [27]

TAXIFOLIN-

Taxifolin is a naturally occurring flavonoid with significant antioxidant, anti-inflammatory, and protective effect on skin. It exhibits potent anti-inflammatory action by inhibiting key mediators and suppressing the major signalling pathways such as NF-kB, MAPK, and STAT3 and reduces inflammation and immune cell infiltration. Taxifolin plays a important role in preventing skin aging and maintaining skin elasticity. It exhibits photoprotective and anti-photo aging effects. It reduces wrinkle formation and improves skin elasticity by preventing the degradation of collagen and elastin. It reduces hyperpigmentation and promotes skin brightening by its anti-melanogenesis activity. It is beneficial in managing various skin disorders such as psoriasis, dermatitis, and eczema through its anti-inflammatory activity. It also promotes wound healing by stimulating cell proliferation, angiogenesis and tissue regeneration and reduces the risk of inflammation and infection. [28]

ISORHAMNETIN-

Isorhamnetin is a flavonoid which exhibits multiple pharmacological action on various biological systems, particularly on skin health and disease management. It shows potent anti ultraviolet activity by reducing UVB-induced intracellular reactive oxygen species thereby preventing oxidative damage to DNA, lipids and proteins. Isorhamnetin enhances melanogenesis by upregulating melogenic genes such as MITF, TYR, MC1R and used in the treatment of vitiligo. Isorhamnetin possess significant anti-inflammatory effects helps to regulate cytokines, inflammatory mediators and reactive oxygen species. Additionally, isorhamnetin shows strong antibacterial and antiviral properties. Its antibacterial activity includes inhibition of virulence factors like alpha-hemolysin in *staphylococcus aureus* and disruption of bacterial cell membrane through oxidative stress mechanisms. [29]

AROMADENDRIN-

Aromadendrin exhibits a diverse pharmacological activity particularly anti-tyrosinase, antioxidant, anti-inflammatory and antiviral effects. Its antioxidant activity is attributed to multiple hydroxyl groups enabling effective free radical scavenging activity. It also demonstrates significant anti-inflammatory activity by reducing pro-inflammatory mediators such as NO and PGE_2

through downregulation of iNOS and COX-2 expression. Additionally, aromadendrin exhibits antiviral activity by inhibiting main protease involved in viral replication. [30]

DISCUSSION

Khadira has been extensively described in classical ayurvedic literature for its efficacy in managing *twak vikara.* The therapeutic potential of *Khadira* can be attributed to its *Tikta* and *Kashaya* rasa which exhibit multifaceted pharmacological actions such as *shoshana, kleda upashoshana, kandu prashamana, vishaghna* and *ropana.* These properties collectively contribute to reducing exudation, alleviating itching, detoxifying tissues and promoting wound healing which are essential in the management of dermatological conditions.

From modern pharmacological perspective, *Khadira* demonstrates significant antioxidant, anti-inflammatory, antimicrobial and anti-allergic activities. These actions are crucial for interrupting the pathophysiology of skin disorders. The presence of bioactive phytoconstituents such as flavonoids, tannins and catechins enhances its ability to scavenge free radicals, stabilize cellular structures, and inhibit pro inflammatory mediators.

Additionally, the astringent nature of *Khadira* aids in tissue contraction, which helps in reducing secretions, tightening skin tissues and accelerating wound healing. The integration of classical ayurvedic principles with contemporary scientific findings supports the rationale for using *Khadira* as a single or adjunct therapeutic agent in skin diseases.

CONCLUSION

Khadira is a potent medicinal plant with significant therapeutic relevance in the management of *twak vikara*. Its classical properties of *tikta-kashaya rasa* combined with modern pharmacological activities such as antioxidant, anti-inflammatory, antimicrobial and wound healing effects make it valuable drug in dermatological practice. The herb not only alleviates symptoms like itching, discharge and inflammation but also promotes tissue repair and detoxification. The available evidence suggests that *Khadira* can be effectively utilized as an *ekamoolika prayoga* or as part of compound formulations for skin disorders.

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