

ANTIBACTERIAL AND ANTIFUNGAL ACTIVITY OF KHADIRA W.S.R. TO  
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## ABSTRACT

Khadira commonly referred to as Kattha, it is a tree found extensively across the Himalayan region and the northeastern states of India. Primarily, the wood and bark of the Khadira tree find significant use for medicinal purposes. Khadira contributes to skin tightening, exerting its astringent effect on skin cells or other body tissues. Khadira is employed for conditions like mouth ulcers, gingivitis and cuts, etc. These effects of plant can be attributed to its antibacterial and antifungal activities. This versatile plant exhibits robust healing properties attributed to its anti-inflammatory, antioxidant and antimicrobial characteristics. Its therapeutic applications include Kasaghana, Kandughana, Shothahara, Amahara, Panduhara, Kushtahara, Stambana and Vranaropana, etc. This article emphasizes general features of Khadira with special reference to its Krimighna Karma.

**KEYWORDS:** Ayurveda, Khadira, Kattha, Acacia catechu.

## INTRODUCTION

*Khadira* scientifically known as *Acacia catechu* utilized in *Paan* (chewing betel leaf) which is used as mouth freshener. According to Ayurveda, the consumption of *Khadir* with lukewarm water aids in managing diarrhea due to its antidiarrheal properties. Additionally, *Khadir* powder contributes to weight management by enhancing metabolism, exhibiting anti-obesity effects. The *Karmas* of *Khadir* as depicted in **Figure 1** are the attributes of its inherent properties. The primary formulations of *Khadira* include *Khadirarishtam*, *Khadiradi vati*, *Khadiradi gutika*, *Mahamanjishthadi Kwath*, *Dashmoolarishtam* and *Khadiradi kashaya*, etc.<sup>[1-3]</sup>

Figure 1: Therapeutic actions of *Khadira*.

*Khadira* valued primarily for its medicinal properties found in its wood and bark. The tree features short hooked spines and bipinnately compound leaves with 50 pairs of leaflets. Reaching a height of 9-12 meters, it produces pale yellow flowers arranged in cylindrical spikes, leading to flat, oblong pods as fruits. These pods exhibit a dark brown exterior and a red interior. The bark of the *Khadira* tree is ranging from dark brown to grayish. *Khadira* is abundant in compounds known for their anti-inflammatory, antioxidant and antimicrobial properties. It is well known for its effectiveness in

addressing skin issues such as eczema and psoriasis, as well as managing blood disorders. *Khadira* is widely employed in treating diverse conditions, including diarrhea, fever, worm infestations, asthma, bronchitis, cough, stomatitis and mouth ulcers, etc. *Khadira* possesses a bitter and astringent taste, a pungent post-digestive effect and a cold potency. These properties help to alleviate *Kapha* and *Pitta Dosh*.

The rich composition of *Acacia catechu* includes biologically active constituents such as epicatechin, catechin, kaempferol, quercetin, catechutannic acid, dihydroquercetin, flavonoids and tannins, etc. These components play crucial roles in managing various diseases. *Acacia catechu* serves multiple functional purposes, including food seeds, fodder, fuel, timber, gum, resin and dyestuff, etc.<sup>[2,3]</sup>

#### Scientific Classification of *Khadira* (*Acacia catechu*)

- Kingdom: *Plantae*
- Phylum: *Spermatophyta*
- Class: *Dicotyledonae*
- Order: *Fabales*
- Family: *Fabaceae*
- Subfamily: *Mimosoideae*
- Genus: *Acacia*
- Species: *Acacia catechu*

#### Synonyms of *Khadir*

- *Kharira*
- *Khadira*
- *Khara*
- *Khayar*
- *Khera*
- *Khayera*
- *Khair*
- *Kathe*
- *Kaggalinara*
- *Kath*
- *Kattha*

#### Ayurvedic Properties of *Khadira*

- ✚ *Rasa:* *Tikta* and *Kshaya*
- ✚ *Guna:* *Laghui* and *Ruksha*
- ✚ *Virya:* *Shita*
- ✚ *Vipaka:* *Katu*
- ✚ *Doshagnatha:* *Kapha* and *Pittahara*

#### *Krimighana* Attributes of *Khadira*

*Khadir* exhibits antibacterial and antifungal attributes, effectively impeding the proliferation of bacteria and fungi responsible for skin problems. Consequently, it holds potential for addressing various skin diseases. In the case of skin conditions such as eczema, *Khadir* proves beneficial in managing symptoms when applied to the affected area. The application or washing of the affected area with *Khadir Kwath* contributes to reducing inflammation and arresting bleeding, this is attributed to its *Kashaya*, *Ropan* and *Krimighana* characteristics.

*Khadir* is also recognized for its ability to facilitate wound healing due to its antibacterial and antifungal attributes. It comprises specific chemicals that induce the contraction of skin cells, diminishing inflammation and fostering the recovery of wounds. Additionally, its antimicrobial properties thwart potential infections, providing support for the healing process. The *Ropan* (healing) attribute of *Khadir* contributes to the expeditious recovery of wounds, diminishes swelling, and restores the skin's normal texture. Moreover, *Khadir* plays a role in controlling bleeding from wounds, due to its *Sita* and *Kashaya* nature. The *Krimighana* characteristic of *Khadir* prevent reoccurrence and restrict infections thus resist pathological progression of wound.<sup>[1-3]</sup>

#### *Khadira* for Bacterial Infection

*Khadira* boasts an extensive antibacterial spectrum, demonstrating bactericidal efficacy against *E. coli*, *S. aureus* and *S. enterica*. Its mechanism of action seems associated with the disruption of bacterial membrane permeability. The principal chemical markers identified in *Khadira* include gallic acid, ellagic acid, eugenol and catechin.<sup>[4,5]</sup>

#### *Khadira* for Fungal Infection

*Khadira* demonstrates noteworthy antifungal properties against various dermatophytes, yeasts, and pathogenic fungi such as *Microsporum gypseum*, *Epidermophyton floccosum*, *Trichophyton mentagrophytes* and *Trichophyton rubrum*. Its effectiveness extended to other fungi, including *Alternaria brassicae*, *Aspergillus niger*, *Rhizoctonia cerealis* and *Fusarium oxysporum*, etc.<sup>[5,6]</sup>

#### Role of Ayurveda Properties in Biological Activities of *Khadira*

*Khadira* is characterized by the *Tikta Kashaya Rasa*, imparting a bitter and astringent taste. These qualities endow it with pharmacological properties such as *Vishaghnatva*, *Kandu Prashamana*, *Tvakmamsa Sthirakarana*, *Pidana Ropana* and *Kledaupashosana*, etc. Together, these properties contribute to therapeutic actions such as detoxification, reducing edema, antihistaminic effects, restoration, healing, debris clearance and anti-microbial properties.

The comprehensive pharmacological profile of *Khadira* manifests as an anti-microbial response on affected areas. This proves beneficial in treating conditions like dental caries, gum infections and wounds, etc. *Khadira's* principal pharmacological action, as derived from the '*Saptadravyasangraha*,' is *Kusthaghna*, demonstrating its efficacy in eliminating various skin ailments. The medicinal use of *Khadira* becomes particularly significant in addressing buccal cavity disorders where it acts to counteract the accumulation and vitiation of *Tridoshaja* and prevent oral/dental infections by virtue of its *Krimighana* property.

In the context of infective pathologies such as dental caries or periodontal diseases, *Khadira* plays a pivotal role by obstructing the pathogenesis of infections. It creates an unfavorable environment for the convergence of *Dosha-Dushya Sammurchana*, effectively inhibiting the causative pathological factors. *Khadira* emerges as a potent therapeutic agent capable of addressing a diverse range of infections associated with the buccal cavity.

The various research investigations confirm antimicrobial and antifungal properties of *Khadira* extracts, both aqueous and alcoholic. The phytoconstituents present in this plant possess significant potential to impede microorganisms, offering promise in combating diseases caused by fungi and bacteria, particularly in the context of oral health.<sup>[4-6]</sup>

### Modern Aspect

*Acacia catechu*, commonly referred to as catechu, is a versatile medicinal plant employed for various therapeutic purposes. The bark of this plant possesses robust antioxidant, astringent, anti-inflammatory, antibacterial, and antifungal properties. Extracts derived from *Acacia catechu* are utilized to address ailments like sore throats and diarrhea. Additionally, they prove beneficial in managing conditions such as dysentery, high blood pressure, colitis, bronchial asthma, cough, leucorrhoea, leprosy and gastric issues, etc.

This plant extract serves as a mouthwash for oral hygiene, effectively addressing concerns related to the mouth, gums, sore throat, gingivitis, dental problems and oral infections. These properties of plant can be attributed to its anti-microbial action. The heartwood is a source of a concentrated aqueous extract known as cutch, renowned for its astringent, cooling, and digestive qualities. Cutch finds applications in managing conditions like cough, ulcers, boils, and skin eruptions. Internally, a decoction of the bark is administered for cases of leprosy.

The effectiveness against bacteria and fungi is attributed to the high terpene content in the leaf extracts. Terpenes, known for their biological activity, are integral components of plant defense mechanisms and are classified as 'phytoprotectants.' This plant demonstrates efficacy against both Gram-positive and Gram-negative bacteria, as well as the fungus like *C. albicans*. The plant-derived extracts hold potential for application in treating infectious diseases caused by microorganisms that have developed resistance to existing antibiotics. The primary chemical constituents found in *Acacia Catechu* encompass epicatechin, catechin, epigallocatechin, procatechuic acid, quercetin, phloroglucin, procyanidin, kaempferol, L-arabinose, D-rhamnose, aldobiuronic acid and lupenone, etc. These constituents contributed significantly towards the antimicrobial properties of *Acacia Catechu*.<sup>[7-10]</sup>

### CONCLUSION

*Khadir* possesses *Tikta* and *Kashaya rasa*, along with *Sita virya*, therefore effectively alleviating *Pitta* and *Kapha*. *Acarya Charaka* designates it as the premier *Kustahara dravya* in *Agyaparakarana*, attributing properties such as *Kustagna*, *Switraghna*, *Kandugna* and *Krimihara*. The decoction, enriched with catechin and catechu tannic acid, facilitates better absorption. The *Kashay rasa* of *Khadir* exhibits *Twakprasadak* and *Raktashodhak* properties, culminating in *Raktaprasadan* and the reduction of skin discoloration, establishing it as an exceptional immune-modulatory drug for skin diseases. *Acacia catechu* extract boasts a spectrum of beneficial properties, encompassing anti-bacterial, anti-diarrheal, anti-inflammatory, antimicrobial, antifungal, antipyretic, anti-ulcer, antioxidant, hypoglycemic and antisecretory effects. It exhibits *Dosha karma* with *Pitta* and *Kapha* pacifying qualities. Traditionally, it is employed for managing conditions such as *Medoroga*, *Prameha*, *Aruchi*, *Atisar*, *Jirnajwar* and *Kasa*. *Khadira* plays a vital role in preventing pathogenesis of infections; it effectively inhibits the causative pathological factors and restricts growth of fungi and bacteria by virtue of its *Tikta & Kshaya Rasa*, and *Ruksha Guna*.

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