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Review Article

THE PHYTOCHEMICAL AND PHARMACOLOGICAL PROPERTIES OF A MIRACLE HERB ACACIA CATECHU (L.F.) WILLD.: A REVIEW

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ABSTRACT

Acacia catechu (L.F.) Willd commonly known as *Khadira*, has number of therapeutic properties and is also known as Catechu, Cachou and black cutch. *Acacia catechu* is an economically important plant for medicinal uses. Seeds are good source of protein namely mucilage. The *Katha* prepared from its heartwood, is an important constituent of *Paan* (Betel preparation). *Khadira* is described under *Kashaya skandha, Kushthagna, Udardaprashamana gana* by *Charaka* and *Salsaradi gana* by *Sushruta*. The plant contains *tannin, catechin, epicatechin, kaemferol alkaloids, flavonoids* and *toxifolin*. In Ayurvedic texts *Khadira* is considered as a *Kushthaghna* and single used drug for all types of skin disorders thoroughly internal and external mode. In addition, the heartwood extract is found to be an effective Antibacterial agent, Antimycotic, Anti-oxidant and Anti-diarrhoeal activity. The classical preparation of *Khadira* are *Khadirarishta, Mahakhadira ghrita, Kanaka bindu arishta* and *Madhwasava* have been indicated in *skin disorders*. *Khadira* therapeutically used in the various diseases like *Kushtha, Medoroga, Krmi,* and act as *Raktashodhaka* (blood purifier). The present article gives important information on therapeutic uses, traditional medicinal uses mentioned in various Samhitas and latest research updates in phytochemical and pharmacological properties.

INTRODUCTION

The whole plant kingdom has very rich source of medicinal plant. It helps to reviving the human beings in every critical stage. In development stage of human beings medicinal plants are used as drug. In classical texts i.e. *Atharveda*, drugs are described in four categories i.e. *Atharvini, Angirasi, Daivi* and *Manushyaja* & the total number of drugs about 248 is mentioned with indications[1]. *Acharya Charaka* has described three types of *Dravyas* i.e. *Dosha prashamaka, Dhatu pradoshaka* and *Swastha kara*[2]. *Charaka* quoted that "in this universe every plant having medicinal purpose"[3].

The mode of taking drug is changing with availability and action property of the drug. In this order present study is done to find out morphological, pharmacological, chemical and clinical properties of the *Acacia catechu* or *Khadira*. *Khadira* is classified in *Kashaya skandha*[4], *Kushthagna*[5], *Udarda-prashamana*[6] *gana* by *Charaka* and *Salsaradi gana*[7] by *Sushruta*. *Khadira* is described as a *Danta dawana* medicine in *Sushruta samhita*[8] and as a *Mukha sugndhikara dravya* in *Yoga ratnakara*[9]. *Hareeta* has said that use of *Khadira datuna* provides body appearance like the gold[10].

Acacia catechu contains many biologically active constituents like catechin, epicatechin, kaempferol, dihydrokaempferol, quercetin, dihydroquercetin, catechutannic acid, tannins etc[11]. Catechin present in *Acacia catechu* possess significant antioxidant and antimicrobial effect[12]. It also possesses cyclooxygenase-2 and 5-lipooxygenase enzyme inhibitory effect which are ultimately responsible for rheumatoid arthritis, osteoarthritis, alzeimer's disease and certain type of cancer [13]. Epicatechin improves the blood flow which has potential for cardiac health[14]. Low concentrations of condensed tannins suppress the growth of MCF-7 breast cancer cells, and effect was related to their activity of fatty acid synthatase (FAS) inhibition[15].

The decoction is an effective gargle in sore throat, cough and hoarseness of voice. The paste is beneficial, externally, in skin diseases and wounds. The bath of its decoction is an effective panacea for various skin diseases. In stomatitis, halitosis, dental caries and cavities, halitosis, dental caries and cavities, *Acacia catechu* is used with great benefit[16].

Most of the people in Kerala use boiled *Khadira* water (*Karingali* water) for drinking purpose [17]. There are number of *Ayurvedic taila* (oil) formulation, which

contain *Khadira* as one of the active ingredient [18]. *Acacia catechu* is highly valuable for its powerful astringent and antioxidant activities.

Plant Description [19]

It is a medium sized, thorny deciduous tree grows up to 13 meters in height. Leaves are bipinnately compound, leaflets 30-50 paired, main rachis pubescent, with large conspicuous gland near the middle of the rachis. Flowers are pale yellow, sessile, found in axillary spikes. Fruits show flat brown pods, with triangular beak at the apex, shiny, narrowed at base. There are 3-10 seeds per pod. The gummy extract of the wood is called *Katha* or cutch. (Table 1)

Table 1: Botanical classification of *Khadira*

Kingdom	:	Plantae - Plants
Sub kingdom	:	Tracheobionta - Vascular plants
Spermatophyta	:	Seed plants
Division	:	Magnoliophyta - Flowering plants
Class	:	Magnoliopsida - Dicotyledons
Subclass	:	Rosidae
Order	:	Fabales
Family	:	Fabaceae - Pea family
Genus	:	*Acacia* Mill. - *Acacia*
Species	:	*Acacia catechu* (L. f.) Willd. - black cutch

Synonyms

Sanskrit	:	*Raktasara, Gayatri, Dantadhavana, Kantaki, Balapatra, Bahushalya, Yagiya*
English	:	Black catechu, Cutch tree
Gujrati	:	Khair, Kathe, Kher
Hindi	:	Khair
Malayalam	:	Karingali
Marathi	:	Khair
Telugu	:	Chandra
Tamil	:	Karungali
Urdu	:	Chanbe Kaath

Origin Place

Native: India, Myanmar, Nepal, Pakistan, Thailand

Exotic: Indonesia, Kenya, Mozambique.

Ecology of *Acacia catechu* [20]

Historical View

Description of *Khadira* is found from the Vedic periods especially in *Rigaveda* and *Atharveda*. The use of *A. catechu* as tanning agent (cutch) in India is believed to go back as far as history relates. In 17th century, a European writer first described *A. catechu* as 'cacho' and mentioned it as being exported from Cambay to Malacca. By the early 19th century, due to commercial importance, catechu was much used in France. The first *A. catechu* to reach European countries had been re-exported from Japan and was called 'terra japonica', being thought at that time to be a natural earth or of mineral origin.

Natural Habitat

Acacia catechu grows naturally in mixed deciduous forests and Savannas of lower mountains and hills. It is especially common in the drier regions on sandy soils of riverbanks and watersheds.

Useful Parts of *Acacia catechu*

Bark, Leaves, Heartwood

Khadira sara is made up of wood of *Acacia catechu* also known as a *Kattha*.

***Ayurvedic* Properties of Heartwood [21]**

Rasa (taste)	:	*Tikta, Kasaya*
Guna (property)	:	*Laghu, Ruksa*
Virya (potency)	:	*Shita*
Vipaka (post digestive effect)	:	*Katu*
Karma	:	*Kaphapittahara, Raktasodhaka, Kushtaghna, Medohara, Krmighna, Dantya*

Important Formulations

Khadirarista, Erimedadi Taila, Khadiradi Gutika, Lavangadi vati, Kanakabindu arishta, Samvardhana ghrita [22].

Therapeutic Uses

Kustha, Vrana, sotha, Prameha

Functional uses of *Acacia catechu* [23]

Food Seeds

It contains water-soluble mucilage (6.8%), a good protein source [24]. It is also used as an ingredient in paan. It is an Indian and South East Asian tradition of chewing betel leaf (Piper betle) with areca nut and slaked lime paste. Seeds have been reported to have an antibacterial action [25].

Fuel

The tree is often planted for use as firewood and its wood is highly valued for furniture and tools.

Fodder

Branches of tree are quite often cut for goat fodder and fed to cattle.

Timber

Timber is used for agricultural implements and wheels. Spent chips are left over after extraction of Katha and cutch can be used for the manufacture of hardboards.

Tannin or dyestuff

Cutch, which is marketed as a solid extract, is isolated from the heartwood. The dark catechu or Pegu cutch is used to tan heavy hides into sole leather, often in a mixture of tan stuffs. Catechu extract is also used

for dyeing silk, cotton, canvas, paper and leather to a dark-brownish colour [26].

Gum or resin

The bark exudes a light gum of very good quality and is one of the best substitutes for gum arabic.

Acacia fiber

It is helpful in increasing the levels of the good cholesterol, HDL, in the body. It possesses a unique characteristic of detoxifying the body. The fiber binds itself with the toxins and gets rid of them as body waste matter [27].

Bark

It is often used to sooth the digestive system, mitigate skin rashes, and reduce inflammations. On oral use, ailments of the respiratory and digestive tracts and urinary disorders are relieved. The bark of acacia catechu possesses antifungal, antimicrobial, anti-inflammatory, and to a good extent, antioxidant

Phytochemical Study [31]

properties. Antioxidants are heart healthy compounds that allay the onset of cardiac problems. Thus, acacia is helpful in the lowering of high blood pressure in individuals. The bark of *Acacia catechu* in combination with other drug is prescribed for Snake bite [28].

Acacia honey

It is a good sweetener and is high in its fructose content. It possesses good disinfectant and digestive properties.

Leaves

Leaves were ground into a paste and applied on the forehead. This was believed to be a good remedy for mitigating the intensity of headache [29].

Khersal

It is a crystalline form of cutch sometimes found deposited in cavities of the wood is used medicinally for the treatment of coughs and sore throat [30].

Table 2: Phytochemical action of *Acacia catechu* willd

S.N.	Active constituent	Therapeutic application
1	Tannins	Acts topically as astringent to mucosal surfaces and following oral ingestion it consequently get hydrolyzed and alter the fluidity of the bowel contents (so used in anti-diarrheal remedies). They are also attributed with anti-hemorrhagic, anti-inflammatory and antacid properties.
2	Catechin	Have significant antioxidant and antimicrobial effects. It is considered to be the best antioxidant [32].
3	Flavonoids	Increase secretion of insulin and inhibit cycloxygenase and lipoxygenase. Thus it possesses anti diabetic and anti-inflammatory effect [33].
4	Taxifolin	Potent Antibacterial agent.

Table 3: Phytochemical analysis of *Acacia catechu* willd bark extract [34]

S.N.	Phytochemical constituents	Ethanolic bark extract
1	Saponins	++
2	Tannins	++
3	Phenol	+
4	Carbohydrates	+
5	Proteins	-
6	Amino Acids	-
7	Flavonoids	++
8	Phlobatanins	-
9	Alkaloids	+
10	Glycosides	+

++ = high concentration, + = moderate concentration, - = Absence

Pharmacological Activity

Table 4: Pharmacological activity of various parts of *Acacia catechu* willd [35]

S.N.	Parts used	Pharmacological activity
1	Bark	Dysentery, diarrhoea and in healing of wounds, Antioxidant, healing of sore throat, gingivitis, Antidiabetic activity.
2	Leaf	Hepatoprotective, Anti-secretory and Anti-ulcer, Antioxidant and Antibacterial, Anti-mycotic activity.
3	Heartwood	Anti-bacterial, Anti mycotic, to treat mouth sore, gingivitis, dental caries It possess anti-oxidant and anti diarrhoeal activity.

		Ethyl acetate extract of *Acacia catechu* possess analgesic, antipyretic Hepatoprotective and Antidiabetic activity. Heartwood is used as a dyeing agent in textile industry.

Uses of *Acacia catechu* in Classical Texts

In ancient time, *Khadira* was very famous drug. *Charaka* have mentioned the *Khadira* as a *Sutikagara* forming substance and useful drug among the twenty *Sarasava*. In many medicinal properties of drug *Khadira* have been described by the *Acharyas*. *Charaka* has used *Khadira* as an important ingredient in many formulations like *Nagabala rasayana, Brahma rasayana, Indrokta rasayana, Chandandi taila, Madhwasava, Kanakabindu arishta, Khadira ghrita, Maha khadira ghrita, Khadiradi gutika taila. Charaka* has also used the *Khadira* in *Raktapitta, Urugraha, Visarpa.*

Sushruta has used *Khadira* as an important ingredient in many formulations like *Khadira kashaya, Khadirambu, Khadira sara churna, Khadira sara kwatha. Sushruta* also used in *Kudapa shukra dosha, Shanehmeha, Kshaudrameha, Chaladanta, Putna graham, Sheeta putna graham, Rajayakshma. Vrana shodhaka* and *Ropaka* property of *Khadira* is also mentioned.

Hareeta used *Khadira mula* in the treatment of *Sthavara visha* [36]. *Sodhala* has used its gala *Rogahara* property [37]. *Chakrapani* has described *Khadira* as a *mukhadharana* use in hoarseness of voice [38]. *Kashyapa* has used the *Khadira* as an important ingredient in *Samvardhana ghrita* in the treatment of *Mooka* a Jadta roga (dumb & mental retardation) [39].

The popular preparation *Khadiradi guti* in *Ayurveda* is extremely helpful for chewing in sore throat, hoarseness of voice, and tonsillitis etc. due to vitiation of *Kapha doshas*. It dries up the mucous secretions and regains the taste sensation. The extracts of Acacia catechu exhibits various pharmacological effects like antipyretic, anti-inflammatory, antidiarrhoeal, hypoglycaemic, hepatoprotective, antioxidant and antimicrobial activities [40].

Khadira is one of the most potent drugs, used in various skin diseases. *Khadirarista* is a famous preparation used for that purpose. The plant is extremely beneficial in vaginal diseases, leucorrhea, menorrhagia etc. for which its decoction is commonly used. *Khadira* along with *Yastimadhu*, helps healing the wounds and ulcers in vaginal and anal mucosa. In anal fistula, the decoction of its bark skin and *Triphala* is given with ghee and *Vidanga* powder. In skin infections due to *Kapha dosa*, the decoction of *Khadira* and *Amalaki* is used with *Bakuchi* powder, with great benefit [41].

Acacia catechu is used in skin disorders, itching problems, diseases of teeth, diseases of mouth and throat, cough, obesity, worms, diabetes, fever, vitiligo, swelling, wound, bleeding disorders, anemia, eruptive boils, filaria and is used as *Rasayana* (longevity enhancer).

In Chinese medicine it is used for poorly healing ulcers, weeping skin diseases, oral ulcers, with bleeding and traumatic injuries [42].

Clinical Uses of *Acacia catechu*

Anti diabetic activity [43]

In type 2 diabetes, insulin is secreted in lesser amounts than required, thus causing much of the sugars to remain in the blood stream. Acacia is also believed to increase the level of beta cells, thus encouraging them to secrete more insulin. This is helpful for type 2 diabetes mellitus. At the same time, the underlying insulin resistance in the case of type 2 diabetic persons should also be addressed with other lines of treatment.

A variety of acacia, known as Blackbrush acacia, is used to help lose body weight. Its adrenergic amine content stimulates beta-receptors to break down the lipids in the body. This, in turn, enhances the rate of metabolism as cholesterol is broken down and hunger is curbed.

Effect in Acne vulgaris [44]

Acacia honey contains a large concentration of fructose sugar, hence it does not crystallize. This honey possesses antimicrobial properties to a great extent. Hence, it is used in conjunction with other medication as a remedy for abating the acne flare-ups in teenagers.

The naturally occurring sugars or oligosaccharides in acacia contain a greater portion of the food energy of sugar and a lesser portion of the food energy of fat. In the body, they result in fatty acids that enhance the absorption of calcium, magnesium, and iron. Thus, they promote an overall raise in energy levels in the body.

Effect in Intestinal Problems [45]

Acacia contains water soluble fiber of plant origin. Fiber is an important requisite to provide roughage and smooth bowel movements of the intestines. Thus, acacia also enhances the colon cleanse process in the body. The effectiveness of acacia is felt more when it relieves the symptoms of irritable bowel syndrome in a natural way.

Constipation is characterized by difficulty to pass stools, bloating, abdominal cramps, and discomfort due to the internal trapped gas. The soluble fiber in acacia absorbs excess water from the colon and forms a thick gel. This passes through the gut without any decomposition. Hence, it adds a good extent of bulk to the stools and aids in their easy elimination. By regulating the speed of bowel movements, acacia helps in relieving the bloating and trapped gas in the digestive canal. Acacia also promotes the development of bifidobacteria and lactic acid bacteria, which are

healthy bacteria in the gut. Thus, acacia relieves constipation and promotes greater health to the alimentary canal.

Immunomodulatory activity [46]

Immunomodulatory activity of aqueous extract of *Acacia catechu* after oral administration of two doses of 5 mg/kg and 50 mg/kg were studied. The effect was studied in neutrophil adhesion test, mice lethality test, carbon clearance assay, cyclophosphamide induced neutropenia, serum immunoglobulin levels and the heamagglutination test. *Acacia catechu* extract showed an increase in the neutrophil adhesion to the nylon fibres, produced a significant increase in the phagocytic index and a significant protection against cyclophosphamide induced neutropenia indicating its effect on cell mediated immunity.

On the other hand, *Acacia catechu* extract produced a significant increase in the serum immunoglobulin levels, increase in the haemagglutination titre values and decreased the mortality ratio in mice, suggesting its effect on the humoral arm of the immune system. Hence, it can be concluded that the aqueous extract of *Acacia catechu* has a significant effect on both cell mediated and humoral immunity.

Hepato protective activity [47]

Cyanidanol, an active principle of *Acacia catechu*, is claimed to be effective in treating liver diseases[48]. Jayasekhar et al studied the hepatoprotective activity of ethyl acetate extract of *Acacia catechu* in albino rats [49]. Blood serum was assayed aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were assayed using a method reported by Reitman and Frankel. Significant increase in the levels of AST and ALT were found in the toxicant group (P <0.001) after 24hrs of administration of CCl_4 orally. Pretreatment with Acacia catechu (250 mg/kg) and silymarin (25 mg/kg) in test group and standard group, respectively, given daily for seven days showed highly significant (P <0.001) protective effect against CCI_4 induced hepatotoxicity when compared to toxicant alone group. There was no significant difference (P <0.5) between the protective ability of the test drug and the standard drug silymarin, when compared.

The hepatoprotective action of Acacia catechu heartwood extract on CCl_4 (Carbon tetra Chloride) induced liver damage in rats was investigated. Blood and tissue biochemical assays have been studied for evaluation of hepatoprotection. From the results of the parameters done it is clear that Acacia catechu gave best recovery for hepatoprotection [50].

Antisecretory and Antiulcer activity [51]

Karwani. G conducted a study on Antisecretory and Antiulcer activity of *Acacia catechu* against indomethacin plus pyloric ligation induced gastic ulcers in rats. The results of their study suggest that *Acacia catechu* causes an inhibitory effect on release gastric hydrochloric acids and protects gastric mucosal damage. (Table 5)

Table 5: showing effect of *Acacia catechu* heartwood extract on gastric ulcers [52]

S.N.	Groups	Dose ml/kg	Volume of gastric juice (ml/4hrs)	pH	Total acidity (meq/l)	Number of ulcers
1	Control (Gum acacia)	5	3.550 ± 0.1310	3.83 ± 0.085	1276 ± 34.58	1.778 ± 0.3643
2	Test	200	1.825 ± 0.0458*	4.39± 0.13*	918.5 ± 31.36	0.888 ± 0.2003*
3	Standard (Ranitidine)	100	1.433 ± 0.0918*	5.08± 0.088*	750.9 ± 39.26	0.666 ± 0.1667*

* p<0.05 when compared to the control group.

DISCUSSION

Indian medicinal herbs are used since ancient times to treat different diseases and ailments as these natural products exert broad-spectrum actions. *Katha* is an extract obtained from the *Acacia catechu* willd, it is generally used in different forms of the mouth ulcers treatment. According to *Ayurvedic* literature, *Khadira* is bitter and astringent in taste, pungent in the post digestive effect and has cold potency. It alleviates *Kapha* and *Pitta dosas*. It has a special potency to alleviate the skin diseases [53]. *Acharya Charaka* has described the best drug of choice in *Kushtha* is *Khadira* [54].

Acacia catechu contains many biologically active constituents like catechin, epicatechin, kaempferol, dihydrokaempferol, quercetin, dihydroquercetin, catechutannic acid, tannins, flavonoids and taxifolin etc. These constituents play important role in many diseases.

There are many functional uses of *Acacia catechu* are described as a form of Food Seeds, Fuel, Fodder, Timber, Tannin or dyestuff, Gum or resin, Acacia fiber, Bark, Acacia honey, Leaves, Khersal.

These parts of *Acacia catechu* contributes in various diseases like skin rashes, oral disease, urinary disorders, cardiac problems, snake bite, headache, cough and sore throat. These parts of *Khadira* possess antifungal, antimicrobial, anti-inflammatory, antioxidant properties, good disinfectant and digestive properties. *Acacia catechu* heartwood extract showed significant improvement in gastric ulcers.

Many important formulations of *Khadira* are *Khadirarista, Erimedadi Taila, Khadiradi Gutika,*

Lavangadi vati, Kanakabindu arishta, Samvardhana ghrita etc.

CONCLUSION

Acacia catechu is the multifunctional drug, which is mostly used in gastrointestinal tract disorders and Skin disorders. It possesses broad spectrum pharmacological activity in various systems to cure disease.

Hence, the review focussed on the various pharmacological activities and Ayurvedic literature about *Acacia catechu* which will surely help the researchers to further continue their studies based on the identification and isolation of the active compounds responsible for treatment of various infectious diseases. Thus *Acacia catechu* is considered as a potent medicinal plant a gift from Ayurveda to mankind.

REFERENCES

1. Mishra siddhinandan mishra abhinav bhaisajya kalpana vigyan Varanasi: choukhamba surbharti prakashan 2006 p:4
2. Shastri kashinath et al. Charaka samhita: Sutra sthana, Varanasi: Caukhambha Sanskrita Sansthana; 2009: verse no. 1/67: 30p.
3. Shastri kashinath et al. Charaka samhita: Sutra sthana, Varanasi: Caukhambha Sanskrita Sansthana; 2009: verse no. 26/10: 334p.
4. Shastri kashinath et al. Charaka samhita: Vimana sthana, Varanasi: Caukhambha Sanskrita Sansthana; 2009: verse no. 8/144: 685p.
5. Shastri kashinath et al. Charaka samhita: Sutra sthana, Varanasi: Caukhambha Sanskrita Sansthana; 2009: verse no. 4/8(11): 62p.
6. Shastri kashinath et al. Charaka samhita: Sutra sthana, Varanasi: Caukhambha Sanskrita Sansthana; 2009: verse no. 4/8(43): 67p.
7. Shastri Ambikadutta. Sushruta samhita: Sutra sthana, Varanasi: Caukhambha Sanskrita Sansthana; 2009: verse no. 38/12: 183p.
8. Shastri Ambikadutta. Sushruta samhita: Chikitsa sthana, Varanasi: Caukhambha Sanskrita Sansthana; 2009: verse no. 24/6: 131p.
9. Tripathi Indradeva et al. Yogaratnakara: Varanasi; Caukhambha Krishnadas academy; 2005: 502p.
10. Tripathi Harihar Prasad. Hareeta samhita: Tritiya sthana, Varanasi; Caukhambha Krishnadas academy; 2005: 390p.
11. V. H. Deshpande, A. D. Patil., Indian J. CHEM., 1980, 20B, 628.
12. G. H. Naik., Phytochemistry., 2003, 63(1), 97-104.
13. Q. Jia, T. C. Nichols, E. Rhoden, S. Waite., Isolation of a dual COX-2 and 5-Lipoxygenase inhibitor from Acacia United State Patent. Patent No. 7108868, September 19, 2006.
14. K. W. Lee, Y. J. Kim, H. J. Lee, C. Y. Lee., J. Agric. Food Chem., 2003, 51 (25), pp. 7292-5.
15. S. Zhang, C. Zhang, X. Yan, W. Tian., Biochemical and Biophysical Research Communications., 2008, 371, pp. 654-658.
16. Lakshmi et al. International Journal of Phytomedicine 3 (2011) 579-584.
17. Lakshmi et al. International Journal of Drug Development & Research., In Vitro Anti Bacterial Activity. (2011) 328-334.
18. Trease G. E., Evans W. C., Pharmacology. Saunders/ Elsevier, Amsterdam, 2002.4. Available form in http://www.annabellina.com/agingredients.html.
19. Saini et al. Journal of Medicinal Plants Research. Comparative pharmacognostical and antimicrobial studies of *acacia* species., Vol. 2(12), pp. 378-386, December, 2008.
20. Agroforestry data base available at http://www.worldagroforestrycentre.org/SEA/Products/AFDbases/AF/asp/SpeciesInfo.asp?SpID=21.
21. Gouri Chauhan, S.P. Singh, O.P. Singh, Anshuman Trigunayat., Khadir (acacia catechu) a unique ayurvedic remed. Indian Journal Of Research (2011)5,1-4.
22. Sharma Hemraj. Kashyapa samhita: Sutra sthana, Varanasi: Caukhambha Sanskrita series office; 1953: Leha adhyaya verse no. : 47p.
23. Hocking D. 1993. Trees for Drylands. Oxford & IBH Publishing Co. New Delhi.
24. Hong TD, Linington S, Ellis RH. 1996. Seed storage behaviour: a compendium. Handbooks for Genebanks: No. 4. IPGRI.
25. Available form in http://en.wikipedia.org/wiki/Acacia_catechu#cite_note-world-4.
26. Hocking D. 1993. Trees for Drylands. Oxford & IBH Publishing Co. New Delhi.
27. Acacia And Health., Available form in http://www.diethealthclub.com/herbs-and-natural-cures/acacia.html
28. Anonymous, The Wealth of India, Raw Material, Vol. 1, CSIR, New Delhi, 2004, 11.
29. Acacia And Health., Available form in http://www.diethealthclub.com/herbs-and-natural-cures/acacia.html
30. Hocking D. 1993. Trees for Drylands. Oxford & IBH Publishing Co. New Delhi.
31. Lakshmi et al. The Pharma Research Journal, Acacia Catechu Willd., (2011), 5(2); 273-293.
32. G.H.Naik, K.I. Priyadarshani, J.G.Satv, M.M. Banvalikar, D.P. Sohoni, M.K. Biyani (2002); Comparative antioxidant activity of individual herbal components used in Ayurvedic medicine. Radiation Chemistry and Chemical Division, Bhabha Atomic Research Centre, *Trombay, Mumbai, India.*
33. Noreen et. al; Planta Medica 64, 1998; United States.

34. Lakshmi et al. International Journal of Phytomedicine., Phytochemical Analysis of Acacia Catechu Willd Bark Extract, 3 (2011) 579-584.
35. Lakshmi et al. International Journal of Drug Development & Research., In Vitro Anti Bacterial Activity., Pharmacological Activity of Acacia Catechu Willd (2011) 328-334.
36. Tripathi Harihar Prasad. Hareeta samhita: Chikitsa sthana, Varanasi; Caukhambha Krishnadas academy; 2005: verse no. 55/11: 467p.
37. Sharma P. V. Sodhala Nighantu first ed. Chikitsa sthana, Vadodara; University Publication Sales Unit; 1978: verse no. 115: 10p.
38. Tripathi Indradeva. Chakradatta: Caukhambha Sanskrita Bhavana; 2012: verse no. 13/7: 111p.
39. Sharma Hemraj. Kashyapa samhita: Sutra sthana, Varanasi: Caukhambha Sanskrita series office; 1953: Leha adhyaya verse no. : 47p.
40. Rao PR, Seshadri TR; L-Epi-catechin from *Acacia catechu. J. Scient. Ind. Res*., (7B); 59 ;1948.
41. Lakshmi et al. The Pharma Research Journal, Acacia Catechu Willd., (2011), 5(2); 273-293.
42. Gouri Chauhan, S.P. Singh, O.P. Singh, Anshuman Trigunayat., Khadir (acacia catechu) a unique ayurvedic remed. Indian Journal Of Research (2011)5,1-4.
43. Acacia And Health., Available form in http://www.diethealthclub.com/herbs-and-natural-cures/acacia.html
44. Acacia And Health., Available form in http://www.diethealthclub.com/herbs-and-natural-cures/acacia.html
45. Acacia And Health., Available form in http://www.diethealthclub.com/herbs-and-natural-cures/acacia.html
46. Syed Ismail, Mohammed Asad., Immunomodulatory activity of *acacia catechu* indian j physiol pharmacol 2009; 53(1).
47. Ray D, Sharatchandra KH, Thokchom IS, Antipyretic, antidiarrhoeal, hypoglycaemic and hepatoprotective activities of ethyl acetate extract of *Acacia catechu Willd.* in albino rats, Indian Journal of Pharmacology, 38(6), 2006, 408-413.
48. Jayasekhar P, Mohanan PV, Rathinam K. Hepatoprotective activity of ethyl acetate extract of *Acacia catechu.* Indian J Pharmacol 1997;29:426-8.
49. Rage N, Dahanukar S, Karandikar SM. Hepatoprotective effect of cyanidanol against carbon tetrachloride induced liver damage. Indian Drugs 1984;22: 556-60.
50. Shirish S. Pingale Hepatoprotection By *Acacia Catechu* In Ccl4 Induced Liver Dysfunction. International journal of pharmaceutical sciences review and research Volume 5, Issue 1, November – December 2010; Article-024.
51. Karwani, G., Singhvi, I., Gupta, S., kapadiya, N. And Sisodia, S. S.1, Antisecretory and antiulcer activity of *Acacia Catechu* against indomethacin plus pyloric ligation Induced gastric ulcers in rats. Journal of Cell and Tissue Research Vol. 11(1) 2567 - 2571 (2011)
52. Raghav Nikhil et al., Antiulcer Activity of Acacia Catechu Willd in Rats: IJRAP 2011, 2 (5) 1585-1587
53. Lakshmi et al. The Pharma Research Journal, Acacia Catechu Willd., (2011), 5(2); 273-293.
54. Shastri kashinath et al. Charaka samhita: Sutra sthana, Varanasi: Caukhambha Sanskrita Sansthana; 2009: verse no. 25/40: 319p.

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