A review on Acacia catechu Willd

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Objective: To review the medicinal importance of Acacia catechu Willd as an antidiabetic, anti-oxidant, hepato-protective and anti-bacterial activity

Abstract

Acacia catechu willd has a great importance due to its medicinal properties. It is a historical plant; widely used in traditional medicine especially in Asia. Modern technology has made it easy to study pharmacological properties of traditional medicine so great interests have been developed in historical traditional plants. There is a great use of Acacia catechu in dermatology and sore throat. Now a days antimycotic, hypoglycaemic activity has also been reported. Phenols or polyphenols are the natural chemicals which are found in Acacia catechu. Phenolic compounds have similar basic structural chemistry as that of aromatic compounds and they contain a basic phenolic ring. They are also found in citrus fruits, chocolate and in many other plants. They have an astringent effect and are widely used in tanning of lathers. They are also used in cancer treatment, dermatological disorders and possess anti-microbial activity. One of the most important feature of these compounds is their anti-oxidant effect. Due to the presence of these compounds in Acacia catechu willd; this plant has gained a vital role in medicinal use. In this paper, effort is made to sum up the researches which have been done on Acacia catechu willd which will be helpful to know that how many aspects of this plant are yet to be explored.

Keywords: Acacia catechu willd, catechin, flavonoids, tanning, alkaloids, arachidonic acid.

Introduction:

Acacia catechu belongs to family Fabaceae which is also called pea family or legume family due to presence of single chambered legume in all species of this family. Acacia catechu willd is a small to moderate sized plant widely distributed throughout Asia. The main origin of this plant is Pakistan, India, Thailand and Bangladesh. It contains polyphenolic components, tannins, alkaloids, carbohydrates, flavonoids and seeds of this plant are good source of protein. Catechin present in this plant plays a vital role as anti-oxidant. In vivo Catechins are extensively and rapidly metabolized and impart to its anti-oxidant property. It is very famous for its astringent and tanning effect. The most common use of this plant is in the treatment of sore throat.

Botanical description:

Acacia catechu willd is also known as black catechu. Word acacia came from Greek word “Throns” meaning “point or a barb”. The species name is derived from word”cutch”which is a tanning extract obtained from heartwood of Acacia catechu. Acacia catechu willd belongs to family “Fabaceae” and sub family is “Mimosoideae” while order is “Fabales”. Acacia catechu willd is Angiosperm widely distributed throughout the central Asia especially Pakistan, India and Bangladesh. Plant is of small to moderate size of about 15m height. Bark is dark grey or grayish-brown.

Plant description:

Leaves are bipinnately compound, with 9-30 pairs of pinnae and a glandular rachis; leaflets 16-50 pairs, oblong-linear, 2-6 mm long, glabrous or pubescent. Flowers are 5-10 cm long
auxiliary spikes, pentamerous), white to pale yellow and with a campanulate calyx of 1-1.5 mm length, and a corolla of 2.5-3 mm length. Stamens are numerous and far exerted from the corolla, with white to yellowish white filaments.

**Family description:**

Family *Fabaceae* is also known as *Leguminosae* or pea family (bean family). It is counted as third largest family among angiosperms. *Fabaceae* family contains many important species regarding genetic studies and genomic model system. The most common and well known examples include pea *pisum sativum* and trefoil. *Fabaceae* have three subfamilies which are *Caesalpiniaceae*, *Mimosaceae*, and *Papilionaceae* besides this, there are more than 19000 species.

Leaves of this family are simple to compound. Flowers are actinomorphic to zygomorphic, bisexual and have single superior carpel. The most common identifying point of the family *Fabaceae* is its fruit which is one chambered pod (a legume).

**Local names:**

Katha, catechu and kachu

**Chemical constituents:**

Major chemical constituents of *Acacia catechu* are catechin, epicatechin, epicatechin gallate, proocatechinic acid, tannins, alkaloids quercetin and kaempferol, porifera sterol glucosides , (+)-afzelechin gum are also present in minor quantity.

**Biology:**

*Acacia catechu* becomes leafless in hot season. In centra Asia leaves shed in February and new leaves appears at the end of April or during May. The flowers appear at the same time as new the leaves grow. Pods develop rapidly in September or October and turn from green to reddish-green and finally brown. Pods dehisce not long after ripening and commence falling in January. The seeds get damaged by insects exclusively. The wind- dispersed seeds germinate with the onset of rains.

**Synonyms:**

- *Acacia catechu* (L.f.) Willd. var. *catechuoides* (Roxb.) Prain
- *Acacia catechuoides* (Roxb.) Benth.
- *Acacia sundra* (Roxb.) Bedd.
- *Acacia wallichiana* DC.
- *Mimosa catechu* L.f.
- *Mimosa catechuoides* Roxb

**Ecology:**

Naturally *Acacia catechu* occurs in mixed deciduous forests and in areas of savannas of lower mountains and hills. *Acacia catechu* grows in the drier regions on sandy soils and banks of rivers especially in watersheds.

**Biological activities:**

1) **Anti-oxidant property**

As the *Acacia catechu* Willd contain many potent flavonoids having great anti-oxidant property Altavilla, D., Squadrito, F., Bitto, A., Polito, F., Burnett, B., Di Stefano, V, and L, Minutoli,.. (2009) , so when studies was carried out on alcoholic extract of *Acacia catechu* Willd by using the method of DPPH radical scavenging assay it showed very similar anti-oxidant activity as that of ascorbic acid. Catechin and rutin are most important constituents which are free radical scavengers (Guleria, S,. Tiku, A,. Singh, G,. Vyas, D,. and Bhardwaj, A,. 2011), (Hazra, B,. Sarkar, R,. Biswas, S,. and Mandal, N,. 2011).
2) Hypoglycemic activity
In eastern traditional medicine Acacia catechu Willd is extensively used in management of diabetes in combinations with other medicinal plants. The most common chemical classes among these plants are flavonoid and other anti-oxidant principles. Polar as well as non-polar components of Acacia catechu Willd show hypoglycemic activity. Comparative studies show that water insoluble fraction of ethanolic extract of Acacia catechu Willd is more effective than the ethanolic extract and the activity is comparable to that of the standard, glibenclamide (5 mg/kg).

In an experiment, Ethyl acetate extract of Acacia catechu Willd at a concentration of 500mg/kg/day used for 7 days, significantly decreases blood glucose level of normal as well as alloxan induced diabetic albino rats but it was not effective as that of standard drug (Glibenclamide) as it is shown by following results. Ray, D., Sharatchandra, K., and Thokchom, I., (2006).

<table>
<thead>
<tr>
<th>Group</th>
<th>Blood glucose level in normal rats</th>
<th>Blood glucose level in diabetic rats</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fasting</td>
<td>After 2hr treatment</td>
</tr>
<tr>
<td>Test 1 (250mg/kg)</td>
<td>78.32±6.43</td>
<td>67.73±4.93</td>
</tr>
<tr>
<td>Test 2 (500mg/kg)</td>
<td>77.15±3.36</td>
<td>50.67±3.75</td>
</tr>
<tr>
<td>Glibenclamide (5mg/kg)</td>
<td>75.00±5.06</td>
<td>43.00±2.24</td>
</tr>
</tbody>
</table>

Hypoglycemic activity of extract of Acacia catechu Willd is assumed to be due to the presence of flavonoids which also show inhibition of cyclooxygenase and regenerate β cells. Jarald, E., Joshi, SB., and Jain, DC., (2009).


3) Anti-microbial activity:
In vitro Acacia catechu Willd is reported to have broad spectrum anti-microbial and anti-fungal activity. Phytochemical studies of Acacia catechu Willd leaves shows the presence of alkaloids, carbohydrates, flavones, glycosides, phenolic compounds, saponins, steroids and tannins which may be responsible for its anti-microbial activity.

Methanolic extract of Acacia catechu Willd has Anti-microbial activity against pathogenic as well as nonpathogenic bacteria e.g Bacillus subtilis, Staphylococcus aureus, Salmonella typhi, Escherichia coli, Pseudomonas aeruginosa and Candida albicans. It is effective against gram positive as well as gram negative bacteria. It was found to be most effective against Staphylococcus aureus with about 20mm zone of inhibition at minimum bactericidal concentration (MBC) of the crude extract 1,000 lg/ml. Experiments shows that anti-microbial activity of Acacia catechu Willd depends on nature of solvent used for extraction, thus organic solvents used in extraction of leaves are most effective than any other (Lakshmi, T., Geetha, R. V., and Roy, Anitha., 2011).
4) Hepato protective activity
Data from traditional medicine history and recent studies show that extract of *Acacia catechu* Willd exhibits very significant hepato protective activity and for this reason it has been extensively used in herbal remedies (Ray, D., Sharatchandra, K., and Thokchom, I., 2006), (Atmani, D., Chaher, N., Berboucha, M., Debbache, N., and Boudaoud, H., 2009).

5) Anti mycotic activity
*Acacia catechu* Willd has not only anti-microbial activity but it also possess anti mycotic activity. Experiments show that roots of *Acacia catechu* Willd have greater activity against fungi. Alcoholic and acetone extract shows very remarkable anti mycotic activity especially against *Rhizopus stolonifer* with a maximum zone of inhibition of 16.1mm and 22.1 mm in diameter. (TG, N., Sarang, S., and Jambhale, D., 2008).

6) Anti pyretic and Anti-inflammatory properties
The chief major active chemical components of *Acacia catechu* Willd are flavonoids which inhibit Cyclooxygenase and 5-Lipoxygenase and hence decrease inflammation. Mixed extract of *Scutellaria baicalensis* and *Acacia catechu* inhibit Prostaglandin E2 generation in human osteosarcoma cells which express COX-2, and leukotriene production is also inhibited in human cell lines, immortalized THP-1 monocyte and HT-29 colorectal adenocarcinoma. Baicalin from *Scutellaria baicalensis* and catechin from *Acacia catechu* are responsible for dual inhibition of Cyclooxygenase and 5-Lipoxygenase (Altavilla, D., Squadrito, F., Bitto, A., Polito, F., Burnett, B., Di Stefano, V, and L, Minutoli,. 2009).

7) Sore throat
*Acacia catechu* Willd is one of most important ingredient used in Paan which is also called as beetle leaf. People of different ages use it for healing of sore throat, because of its astringent and soothing effect. Tannins present in *Acacia catechu* Willd are responsible for this property.
This is very common in Asia especially in central Asian countries like Pakistan and India and most common home remedy used for sore throat. (Atmani, D., Chaher, N., Berboucha, M., Debbache, N., and Boudaoud, H., 2009).

8) Potent wound healing property
In Asia crushed bark of *Acacia catechu* is used topical on wounds as it is very potent wound healing medicinal plant. It has astringent effect and also cause precipitation of skin which makes it very good wound healing plant. Furthermore it also exhibits antimicrobial property which prevent growth of microbes on wounds. This property is due to presence of tannins, flavonoids and other active ingredients (Alam, G., Singh, M, P,. and Singh, A,. 2011 ).

**Uses:**

**Medicinal use**
- The most common use of *Acacia catechu* is in sore throat. It is very old and very effective remedy. It provides astringent and soothing effect to throat.
- Tannins present in *Acacia catechu* are very useful in tanning (precipitation of skin) so burns and wounds are treated with extract of bark. It is very traditional method used for acute and chronic wound healing.
- Bark of *Acacia catechu* contain alkaloids and many other very potent active components which shows anti-microbial activity so for management of wounds and burns it also acts as a disinfectant which reduces the chances of infections at the site of wound.
- Due to presence of alkaloids and other active constituents it is used in many dermatological disorders.
- A combination of cinnamon and extract of Acacia catechu is given to treat diarrhea.
- *Acacia catechu* is also used as anti-pyretic and anti-inflammatory as it inhibits COX1 and COX2. Its anti-pyretic and anti-inflammatory property is not only confined to in-vivo studies but it is practically used in folk medicines.
- Biologically active major components have antioxidant property.

**As Food**
- Seeds of *Acacia catechu* are very good source of protein
- *Acacia catechu* extract is used in paan( chewing betel leaf) which is used after meal as sweet dish or along with tobacco for stimulant effect. Paan is a part of tradition of indo Asian culture.
- Leaves and branches are also food of goats and other animals

**As Wood**
- Wood of *Acacia catechu* is very good firewood so people also use it for fire purposes.
- Its wood is not only good for burning fire but also have a very high place in furniture manufacturing.

**Leather tanning**
- *Acacia catechu* contains tannic acid which causes the tanning of protein in leather industries. Although now a days leather industry use many other new chemicals for tanning process but *Acacia catechu* is still used in backward areas.
Other uses

- Hardwood of *Acacia catechu* is used in dyeing industry and somehow its extract is also used for preservation of fishing net due to its alkaloid property.

Conclusion

Literature studies indicate that *Acacia catechu* is biologically very active plant which makes it a very attention-able one, but there is a huge research gap. The need is to do more research to identify active constituents which are responsible for its biological activity. It has very potent anti-microbial, anti mycotic and hypoglycaemic activity due to the presence of alkaloids which also shows toxic effects at high doses. Medicinal use of *Acacia catechu* is confined to traditional or folk medicines which give clue that higher research should be made for new drug molecules of definite activity. As major constituents are reported to have very good anti-oxidant property which is comparable to ascorbic acid so its ethno-pharmacological studies should be conducted. As it has been used for very long time for sore throat and for dermatological disorders and there is a need to make better and modern preparations.
References


Web Resources:
http://en.wikipedia.org/wiki/Acacia_catechu
http://www.worldagroforestry.org/treedb2/AFTPDFS/Acacia_catechu.pdf
http://www.fao.org/docrep/V8879E/v8879e05.htm
http://www.worldagroforestrycentre.org/SEA/Products/AFDbases/AF/asp/SpeciesInfo.asp?SpID=21