ISSN 2278 – 4799

International Journal of Drug Discovery and Medical Research

URL: www. ijddmr.org Email : editor@ijddmr.com

BIOACTIVE POTENTIAL AND PHYTOPHARMACOLOGICAL ACTIVITY OF ACACIA *CATECHU*

VANDANA YADAV[1] AND YOGESH CHAND YADAV[2]*

[1]SVN Institute of Pharmaceutical sciences, Barabanki, Lucknow, Uttar Pradesh, India
[2]*Faculty of Pharmacy, Uttar Pradesh University of Medical Sciences, Saifai, Etawah, 206130, Uttar Pradesh, India
*Corresponding Author, Email ID: drycy31@gmail.com

ABSTRACT
Acacia catechu is also known as Cutch tree, and black cutch heartwood tree. It has bitter and astringent taste. The chief phytoconstituents as catechi and epicatechin. Wood contains 50% tannins, mainly cattechutannic acid 20-35%, acacatechin 2-10%, catechins 13-33%, epicatechin 2.5%, isorhamnetin, quercetin, phlobatannins 25-33%, tannic acid 22-50%, catechu-red, gum 20-35%. It is used for teeth disorders, itching of skin, cough, anorexia, obesity, worm infestation, diabetes, fever, ulcers, leukoderma, and anaemia. Acacia catechu is the best herb for the management of internal as well as external health problems. The pharmacological activity of acacia catechu has been reported such as antiviral, antimicrobials, antioxidant, anti-inflammatory, antipyretic, antidiabetic and hepatoprotective etc.
Keywords: Acacia catechu, bioactive chemical and Pharmacological activities.

INTRODUCTION

Acacia catechu is a commonly known as Cutch tree, and black cutch heartwood tree, khadira, khair. It is an important medicinal plant. It is a deciduous tree with a light feathery crown and dark brown, green leaves with 50 pairs of leaflets. It reaches the height up to 9 to 12 meters. It is medium height tree belonging to the fabaceae family. The average height reached by the plant is approximately 15 meters. Colour of the bark is greyish brown that exfoliates into long and narrow strips. Flowers of these plants are pale yellow in colour with cylindrical spikes. Fruits are flat and glabrous with oblong pods. Acacia catechu is fairly growing plant in variable climate conditions. It is widely distributed throughout India and China except humid and cold regions. It is easily available in Himalayan tract and outer Himalaya from Jammu to Assam. A. catechu has been used traditionally in various diseases, particularly gastrointestinal and stomach-related ailments, leprosy, and skin diseases [1, 2].

Acacia catechu is plant which is used in a variety of medicinal preparations to treat skin disorders of all kinds. Acacia catechu is used in variety of tablets, capsule and syrup formulations for any kind of temporary or permanent skin problem. It is great blood purifier and skin rejuvenating herb [3].

As per Ayurveda Acacia catechu is the best for the treatment of leprosy and similar types of skin problems. Acacia catechu has bitter and astringent taste and best used herb for teeth disorders and also useful in itching of skin, cough, anorexia, obesity, worm infestation, diabetes, fever, ulcers, leukoderma, and anaemia. For external as well as internal use. Acacia catechu is the best herb for the management of internal as well as external health problems. Acacia catechu has been studied for its great antioxidant properties and antiviral anticancer immunodialatory properties. It is also showing antibacterial activity against selected group of bacteria [4]

Bioactive compounds

The heartwood, bark, and wood extract called catechu are used in traditional medicine. The concentrated aqueous extract known as khayer gum or cutch, is astringent. The chief phytoconstituents as catechi and epicatechin. Wood contains 50% tannins, mainly cattechutannic acid 20-35%, acacatechin 2-10%, catechins 13-33%, epicatechin 2.5%, isorhamnetin, quercetin, phlobatannins 25-33%, tannic acid 22-50%, catechu-red, gum 20-35%. Naik et al. (2003) demonstrated that the aqueous extracts of *A. Catechu* [4] Burnett et al. (2007) isolated flavonoids from *A.catechu* reduce the production of proinflammatory eicosanoids. Guleria et al. (2011) reported acetone, ethyl acetate, and metabolic extracts of the heartwood, leaves, and bark of *A. catechu* not only scavenges free radicals but also protects DNA against strand breaks. 70% methanol of *A. catechu* is found to have DNA protective properties.Li. et. Al (2011) isolated bioactive compounds from A catechu. Like free radical scavenging catechin (polyhydroxylated benzoic acid), rutin, isorhamnetin. Stohs and Bagchi, (2015) isolated other compounds like epicatechin, epicatechin-3-*O*-gallate, epigallocatechin-3-*O*-gallate [6].

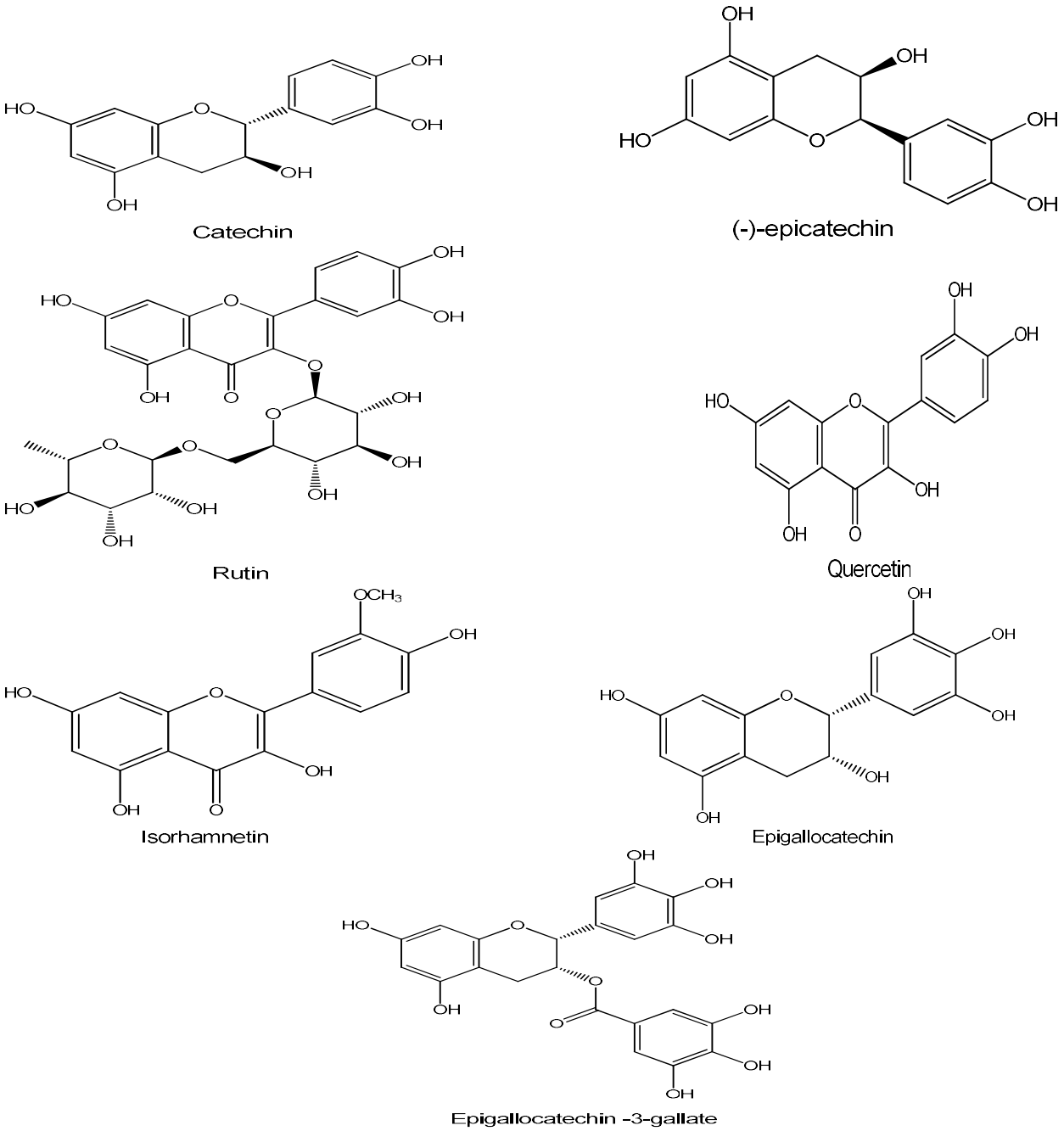

Figure 1. Structure of bioactive compound

Pharmacological activity

1. Antiviral activity

The bark extracts exhibited potent anti-HIV effects, owing to its effect on viral protease and via hampering the interaction of viral Tat protein to its HIV-1 promoter sequence of LTR. The antiviral compound isolated from A. catechu can overcome the conventional problem of generation of a drug resistant HIV-1 strain [7, 8].

2. Antimicrobial activity

Various part of A. catechu extracts show antimicrobial properties against a number of pathogens including Salmonella typhi (Rani and Khullar, 2004), Pseudomonas aeruginosa, Candida albicans (Negi and Dave, 2010), an ethyl extract of heartwood exhibited antimicrobial activity against Bacillus subtilis, Staphylococcus aureus, Klebsiella pneumoniae, and Shigella spp [9].

3. Anticancer activity

A. catechu bark (methanol and hexane) extracts have antiproliferative, cytotoxic , and anticancer properties against various cancer cell lines but does not show any effect on human peripheral lymphocytes, this property can be used in designing safe anticancer drug(Nadumane and Nair , 2011) . Methanol extract A. catechu heartwood showed 50% cytotoxic activity in breast adenocarcinoma cell line MCF-7, which is due to the enhancement in Bax/Bcl2 ratio leading to the

activation of caspases and subsequent cleavage of polyadeno ribose polymerase [10].

4. Immunomodulatory activity

A. catechu shows its Immunomodulatory effect on both cell-mediated humoral immunity. In a study, the aqueous extract of A, catechu was orally administered (5 and 50 mg/kg), and it was observed that the treated mice showed an increase in the neutrophil adhesion to the nylon fibres, produced a significant increase in the phagocytic index, and a significant protection against cyclophosamide induced neutropenia indicating its effect on cell -mediated immunity. A. catechu extract produced a significant increase in the serum immunoglobulin levels, increase in the hemagglutination titer values, and decrease in the mortality ratio in mice, suggesting enhanced humoral immunity [11].

5. Antioxidant activity

Catechu heartwood is an excellent source of catechins and epicatechins as well as flavonoids, which have a high degree of antioxidant activity. A number of bioactive compounds are isolated from acid *A.catechu* like free radical scavenging catechins (polyhydroxylated benzoic acid), isorhamnetin. The antioxidant activity has been demonstrated by both in vitro and in vivo studies [12, 13].

6. Anti-inflammatory activity

It was declared that Acacia catechu Bark shows considerable anti- inflammatory activity. The ethanol solvent form of Acacia bark exhibits an inhibitory activity when examined at 200-1000 µg/ml by inhibiting denaturation of protein and comparing its effect with diclofenac sodium as standard drug [14].

7. Antihyperglycemic activity

Khoyer is prepared by boiling the wood of *Acacia catechu* in water and then evaporating the resultant brew. The resultant hard material is powdered and chewed with betel leaves and lime with or without tobacco by a large number of the people of as an addictive psycho-stimulating and euphoria-inducing formulation. There are folk medicinal claims that khoyer helps in the relief of pain and is also useful to diabetic patients to maintain normal sugar levels. Thus far no scientific studies have evaluated the antihyperglycemic and antinociceptive effects of khoyer. The present study was carried out to evaluate the possible glucose tolerance efficacy of methanol extracts of khoyerusing glucose induced hyperglycaemic mice and antinociceptive effects with acetic acid-induced gastric pain models in mice. In antihyperglycemic activity tests, the extract at different doses was administered one hour prior to glucose administration and blood glucose level was measured after two hours of glucose administration (p.o.) using glucose oxidase method. The statistical data indicated the significant oral hypoglycaemic activity on glucose-loaded mice at all doses of the extracts tested [15].

Anti-inflammatory Activity

Monga et al. (2011, 2013) have conducted a series of studies on the chemoprotective effects of A. catechu hardwood extract in mice. In each of these studies, 7,12-dimethylbenz[a]anthracene (DMBA) or DMBA plus 12-O-tetradecanoylphorbol-13-acetate was used to induce tumors in the mice. In the initial study, various solvents were used with a standardized aqueous extract being further tested because of the results of cytotoxicity testing on a human epithelial carcinoma cell line (Monga et al., 2011). The results showed that DMBA-induced squamous cell carcinomas in mice were inhibited by the aqueous extract in a dose-dependent manner with maximum tumor incidence being de-creased by 70%. In a second study, Monga et al. (2013) evaluated the A. catechu heartwood extract against a human breast adenocarcinoma cell line and DMBA-induced mammary carcinoma in mice. The extract was shown to exhibit a dose-dependent, potent antitumor activity. Furthermore, the extract increased the activities of the antioxidant enzymes superoxide dismutase, catalase, glutathione peroxidase, glutathione transferase and glutathione reductase. It also increased reduced glutathione content while inhibiting lipid peroxidation. The results suggested that the antineoplastic activity of the A. catechu extract was related to its antioxidant activity. In a third study, Monga et al. (2012) assessed the chemoprotective activity of A. catechu heartwood ex-tract against DMBA-induced hepatocarcinogenesis in mice. The extract reduced the liver tumor incidence by 63.5%, and modulated the various antioxidant defense systems described earlier. The authors concluded that the catechin-rich extract exerts a chemoprotective effect by promoting the antioxidant defense system and inhibiting lipid peroxidation, and that these processes are linked to the modulation of transcription factor ex-pression during hepatocarcinogenesis. The conclusion from the three studies of Monga et al. (2011, 2012, and 2013) is that an aqueous, catechin-rich heartwood extract of A. catechu exhibits potent anticancer activity as demonstrated by the prevention of squamous cell, mammary, and liver cancers in a dose dependent manner.

9. Antipyretic Activity

Ethyl acetate extract of Acacia catechu showed antipyretic activity in yeast induced pyrexia for albino rats. Antipyretic activity on rats saw with fever induced by 20% Brewer's yeast as described albino rats 150-200g fed uniformly till 24 hrs., before giving drugs, when food was withdrawn. After measuring rectal temperature for animal by introducing 1.5 cm of digital thermometer in rectum, pyrexia was induced by injecting subcutaneously, 20% suspension of dried yeast. After measuring rectal temperature of the animals by introducing 1.5 cm of digital thermometer in rectum, pyrexia was induced by injecting, subcutaneously, 20% suspension of dried yeast in 2% gum acacia in normal saline at dose of 20ml/kg of body weight [18].

10. Hepatoprotective Activity

Acacia catechu possesses hepatoprotective activity found in the heartwood. Methanol extract tract (70%) of Acacia catechu of heartwood or Katha (ACME) on liver injury induced by iron overload. Iron overload in mice was caused by intraperitoneal administration of 100mg/kg iron-dextran. ACME was administered orally for 21 days, starting from the day the first iron-dextran injection. The biochemical markers of hepatic damage & liver iron, protein carbonyl and hydroxyproline contents were

measured the response to the oral administration of ACME .The release of iron from ferritin by ACME to determine the efficiency of ACME as iron chelating drug. Treatment with doses of ACME is 50 100, and 200mg /kg body weight showed dose dependent reduction in liver iron, lipid peroxidation, protein oxidation liver fibrosis, serum, enzymes, and ferritin.

11. Antidiarrheal Activity

Ethyl acetate extract of Acacia catechu was evaluated for antidiarrheal activity with castor oil induced diarrhoea in albino rats. The antidiarrheal property of ethyl acetate extract of Acacia catechu shows to be due to its tannin content, which has astringent property [19].

12. Neurodegenerative Disorders

It has been reported that methanol extract of A. catechu has good potential to managed of neurodegenerative diseases by the anticholinesterase effect and significant antioxidant effect [20].

13. Wound Healing.

The extract A. catechu has been showed wound healing activities which were significant increase in collagen and granulation tissue on day 21 in guinea pigs on the excisional wound model [21].

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