PHARMACOLOGICAL ACTIVITIES OF *BERBERIS ARISTATA:* A REVIEW

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ABSTRACT: *Berberis aristata* belongs to the family of berberidaceae.It is a spinous shrub mainly found in Pakistan India, srilanka, Nepal and Bhutan. *Berberis aristata* is a hard erect shrub having spine which is yellow in color. The important chemical components present in *Berberis aristata* are alkaloids which include protoberberine, bisbenzyl-isoquinoline, isoquinoline and flavonoids and phenolic acids. Its parts include leaves, roots, bark, rhizome, stem and fruits all are used in different ayurvedic medicine such as darvyadikvatha, rasaut, darvyaditaila, darvyadileha, rasanjana, dasangalepa and many more. Traditionally, it is utilized in treating various skin diseases, inflammations, diarrhea, healing of wounds, jaundice and problems of eyes.

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INTRODUCTION

It is a straight spinous shrub growing up to 2-3 meters in height, hard in texture, yellow in color, from outer side the color of berberis bark is yellow to brown and yellow from inner side. Its leaves are simple, toothed, spiny, leathery, lanceolate, sessile and acuminate and are present in tufts of 5-8 having length of about 4.8 to 5cm and width 1.9 to 2cm. The color of rear surface of its leaves is dusk green while front surface is pale green in color.

Flowers are yellow in color and are stalked, hermaphrodite. Their average diameter is about 12.5mm. Its fruits are aconite violet in color, spherical to ovoid in shape and normally covered with bloom like in plums. Fruits are approximately 7-8mm long, 4-5mm wide, weighing about 227miligram. Seeds vary in color from pink to yellow and are about 2-5 in number (Table 1) (Figure 1&2) (1).

PHOTOCHEMICAL CONSTITUENTS

Upon its phytochemical analysis it was seen that it contains bis isoquinoline and protoberberine alkaloids. When we classify whole plant according to presence of phytochemicals we see that in its root there are present berberine, epiberberine, berbamine, oxycanthine, karachine, palmatine, jatrorhizine, columbamine, dehydrocaroline, dihyrokarachine, aromoline, oxyberberine and taximaline (2). *Berberis aristata* also contains pakistanine, 1-Omethylpakistanine, pseudoberberine chloride and pseudopalmatine chloride (3). Berberine alkaloid is present in major amount having yield of about 2.23% and then palmatine. It was determined that there is variation in berberine content with altitude. It was seen that plants which are grown at lower altitude have more berberine amount. Presence of moisture and potassium content of soil also influence the amount of berberine amount (Figure 3) (4).

PHARMACOLOGICAL ACTIVITIES

HEPATOPROTECTIVE POTENTIAL

In Ayurveda the roots of *Berberis aristata* have been utilized for the cure of jaundice. Aqueous and methanolic extracts of dried upraised parts of *Berberis aristata* was evaluated for their hepatoprotective functions against liver injury induced by CCl4. Silymarine was considered as standard drug and results were compared with it (5). Crude extract of shoot and fruit of *Berberis aristata* was investigated and it

showed that it has protective effect against liver damage induced by CCl4 and paracetamol and it also specify that the extract protect liver by inhibiting microsomal drug metabolizing enzyme. Hepatoprotective effect of butanolic extract of *Berberis aristata* was showed by selective inotropic activity (6)

ANTIDIABETIC ACTIVITY

Extract of *Berberis aristata* root was evaluated for hypoglycemic effect. A normal and another alloxan induced diabetic albino rabbit were taken and were given dehydrated and crushed root that was drawn out with water along with methanol and crude extract. It was proved that strong and orally efficacious antidiabetic elements are present in *Berberis aristata* roots which are capable of enhancing the production of insulin or they give results similar to insulin. Diabetes was induced by alloxan and streptozocin for the screening of antidiabetic effect in albino witsar rat. Ethanolic extraction of *Berberis aristata* was utilize for the management of diabetic rats. Hence it was concluded that antidiabetic effect was present in the ethanolic extract (7).

A remarkable antihyperglycemic activity is present in the ethanolic and methanolic extract of stem bark of *Berberis aristata* that is administered to diabetic rat. Diabetes induced rats were only administered by crude extract. The results proved that fifty per cent of aqueous ethanolic root extract of *Berberis aristata,* that was present in rats suffer from diabetes induced by alloxan had the antihyperglycemic and antioxidant potential. It was found that this extract was safe as it did not cause hypoglycemic action on their counter control parts and they succeeded in decreasing the blood glucose level effectively. The extract of *Berberis aristata* (root) is strongly capable of slowing down gluconeogenesis for the effective regulation of glucose homeostasis (8).

ANTICANCER ACTIVITY

The screening of methanolic stem extract of*Berberis aristata* to check for its antitumor ability and it was manifest to be very powerful for the management of human colon cancer cell line. Methanolic extract of stem of *Berberis aristata* can inhibit HT29 cells by depending on their concentration (9).Carcinogenesis was generated in small animals by 20-methlylcholanthrene or N-nitrosodiethylamine, in a rose dependent way, and this carcinogenesis was found to be effectively diminished by Berberine, an alkaloid which was extracted from the plant *Berberis aristata* (10).

ANTIMALARIAL ACTIVITY

Effectiveness of root bark extract of *Berberis aristata* has been identified in vitro, it inhibit schizont maturation of *Plasmodium berghei*(11).

ANTIMICROBIALACTIVITY

Antifungal activity was showed by ethanolic extract of roots of *Berberis aristata*. 3 extracts of *Berberis aristata* were prepared including alcoholic, aqueous and root powder in distilled water to check antifungal activity. All the three extracts manifested activity against tested *Aspergillus* and species of *Candida* excluding *C. krusei*. Greatest results were acquired by utilizing alcoholic extract out of all three extracts. Outstanding results were bring into being against *Candida* species and *Aspergillus* species. Great antibacterial activity was also showed by all above mentioned extracts especially against Gram +ve bacteria. Antibacterial effect of extract against Gram -ve bacteria including *Vibrio cholera*, *Escherichia coli*, *S. dysenteriae type 1* and *S. typhimurium* was also tested. Great results were obtained against *V. cholera*. All the above mentioned Gram-negative bacteria are the main pathogens of human which are responsible for the dysentery and diarrhea(12).

The root extract of *Anacyclus pyrethrum* have

various polyphenolic constituents. The phenolic parts have significantability to reduce oxidative stress in rats.These polyphenolic compounds performimportant functions including hepatoprotective, anti-thrombotic and antiviral activities. Root extracts of *Anacyclus pyrethrum* also have anticancer, vasodilatory and cardioprotective activities. The root of *Anacyclus pyrethrum* is also used as an appetizer, aphrodisiac and as a general tonic (18).

The methanolic extract of *M. pruriens*seeds showed importantimprovement in memory and learning. Treatment with *M. pruriens* increase the number of surviving neurons in the CA1 (cornuAmmonis)and CA3 regions in hippocampus. Its long term use also decrease the level of serum ALT, serum urea, and serum creatinine in arsenic intoxicated rats(19).

Themethanolic extract of *Mucuna pruriens* beans have antioxidant actiondue to the presenceofsomenon-protein amino acids like dihydroxyphenylalanine(Ldopa),tetrahydrois oquinoline and hydroxytryptophan (5HTP). These compounds have hydrogen donating capability so act as an antioxidant (20).

Hydro-alcoholic extract of*Anacyclus pyrethrum*roots have hepatoprotective action as it showed the defensive impact against INH in addition to RIF-prompted hepatotoxicity in rats *Anacyclus pyrethrum* contains different bio-active constituents which are used for different useful purposes.The roots are used for the treatment of different diseases in man for exampleto cure diabetes Mellitus, immunomodulating impact, antiepilepsy action, memory booster activity, enhanced libido, antimicrobial action, soothing effect andto kill insects (14).

It was also found that four Berberis species in which *Berberis aristata* was present has the antimicrobial effect. Test was performed to check for effectiveness of *Berberis aristata* in opposition to eight fungal and eleven bacterial diseases. The extract from the stem of *Berberis aristata* provided low MICs values to fight in opposition to *Streptococcus pneumonia* and *Berberis aristata* at the same time extracts from root of *Berberis aristata* showed low MICs values to fight with *Staphylococcus aureus, Aspergillus flavus, Escherichia coli* and *Bacillus cereus* (13).

Almost seventy percent of the inhibition of alkaloid that is taken from the plant named *Berberis aristata* is done by the secretory responses of the thermolabile enterotoxins of *Vibrio cholera* and *Escherichia coli*in the ligated intestinal loop model of rabbit, this alkaloid called Berberin has been famous among people for a long time for its use as an antidiarrheal medicine. *Escherichia coli* are thermostable enterotoxin in the model of infant mouse and alkaloid Berberine was found to be effective in inhibiting significantly the secretory response of *Escherichia coli* (14).

Results have also shown that the plant, *Berberis aristata* is very efficacious for the treatment of hepatitis infection. To check for the antimicrobial effect of *Berberis aristata,* in vitro comparative study was done . To evaluate the in vivo and in vitro effectiveness against diarrhea and oral short term toxicity, the aqueous (by soxhlet) and ethanolic (by maceration) bark extracts *Berberis aristata* were taken (15).

Tests were performed including MBC by micro dilution and antimicrobial inhibitory concentration (MIC) and antidiarrheal (charcoal motility, castor oil induced diarrhea). The characterization of the vital principle, Berberin was done by a variety of chromatographic and spectroscopic experiments (16).

Inflammation in acne is triggered by *Staphylococcus epidermidis,* which are bacteria known for pus-forming activity. Broth dilution and disc diffusion techniques were

performed to check for antimicrobial effects of ethanolic extracts taken from *Berberis aristata. Berberis aristata* was found to be capable of inhibiting the development of Propionibacterium acnes by the results taken from disc diffusion experiment (17). Berberine, which is an alkaloid taken from this plant is observed to be an efficacious antigiardial medicine. Its antigiardial activity was studied by designing clinical trials, berberine was given orally and results showed up to the mark parasitological cure compared to the results of other provided antigiardial drugs (18). Berberine sulphate salt was checked in vitro for the growth inhibition of *Trichomonas vaginalis* and its results were compared with metronidazole efficacy which was taken as reference drug. The results manifested that its potency is equal to metronidazole and it can be utilized as replacement of metronidazole in cases of resistance development. Its additional benefit us that it is safe to use (19).

ANTIOXIDANT ACTVITY

50% aqueous ethanolic root extract of *Berberis aristata* was researched for antioxidant potential. In diabetic rats the action of extract on liver antioxidant enzymes was studied carefully following all safety parameters. Strong potential to reduce oxidative stress was presented by root extract of *Berberis aristata* (20). Methanolic and aqueous extract of dried upraised parts of plant and berberine was prepared to check its antioxidant potential against CCl4 induced liver injury, the significant results were obtained (18).

ANTI-INFLAMMATORY ACTIVITY

Anti-inflammatory effects of aqueous extract of Berberis aristata was seen in rabbits against endotoxin induced uveitis. Intravitreal injection of polysaccharide obtained from E.coli was used to induce anterior uveitis after pre-treatment with aqueous extracts of *Berberis aristata* (21).

To check the viable anti-inflammatory effect of *Berberis aristata*, 50% alcoholic extract of plant was screened. Moderate anti-proteolytic action regarding hydrolysis of bovine serum albumin induced by trypsin was found in this plant (22). Aqueous and alcoholic extracts of Berberis aristata manifest principle action in case of acute inflammation and noteworthy actions was obtained after 2 hours when injection of carrageenan was given. In early phase of acute inflammation aqueous extract was beneficial, while in later phase alcoholic extract was effective. This shows that aqueous extract block mediators that release in early phase such as serotonin, histamine and bradykinin while alcoholic extract block mediators that release in later phase such as prostaglandin, aqueous extract also block prostaglandin up to some extent (23).

CONCLUSION

It is concluded that *Berberis aristata* has wide range of medicinal use. It is already used as folk medicine in many disease because of it secondary metabolites. According to research studies it is proven that it carries strong potential to cure hepatic diseases and metabolic disorders like diabetes mellitus. As a folk medicine it is used in skin diseases, chronic bronchitis, jaundice and aging. In future its constituents and its different extracts are used for different diseases.

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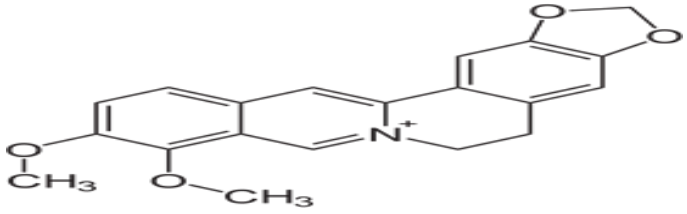
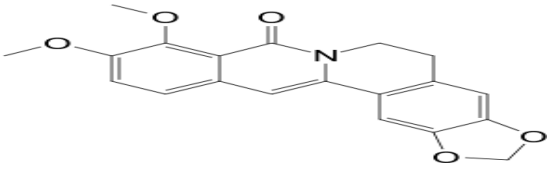
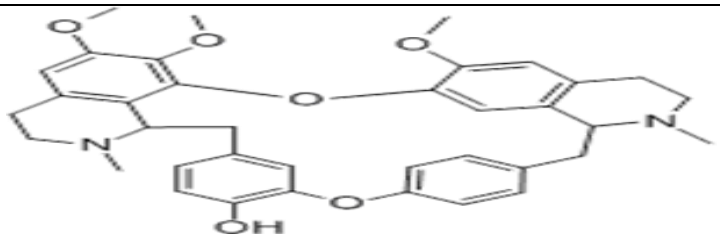
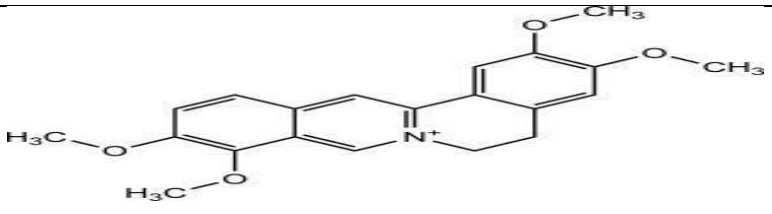
Table.1 Taxonomical classification of *Berberis aristata*

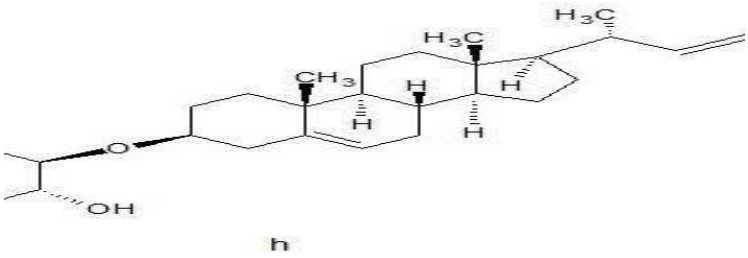
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Ranunculales
Family	Berberidaceae
Genus:	Berberis
Species	Aristata

Fig. 1 *Berberis aristata* fruit

Fig.2 *Berberis aristata* tree

Table.3 Structural presentation of chemical constituents present in *Berberis aristata*

Chemical Constituent	Structure
Berberine	
Oxyberberine	
Berbamine	
Palmatine	

Karachine	 h
Palmatine chloride