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PHARMACOGNOSTICAL AND PHARMACOLOGICAL ASPECTS OF *BERBERIS ARISTATA*

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ABSTRACT

For so many years Plants have been the basis of many traditional medicines throughout the world and continue to provide new remedies to mankind. *Berberis aristata* is an erect spiny shrub native to northern Himalaya region contains protoberberine and bis-isoquinoline type of alkaloids, mainly yellow colored alkaloids Berberine, oxyberberine, berbamine, aromoline, a protoberberine alkaloid karachine, palatine, oxyacanthine and taxi amine and tannins, sugar and starch. It is one among the 73 plants which are used in reducing toxicity and unnecessary fats, anti-haemorrhoidal, as lactode purant, a wound healer, promotes sweating, rejuvenative, anti-pruritic and skin diseases traditionally in Nepal and other surrounding villages. Rasaut a preparation of *Berberis aristata* is used in the treatment of aphthous sores abrasions and ulcerations of the skin. The hydro-alcoholic extract showed wide antibacterial activity against Gram-positive bacteria also had antifungal activity against the fungal species tested, except Candida Kruse. The plant also showed pharmacological activities as anti-inflammatory, analgesic, antipyretic activities, hypoglycaemic, antibacterial, antifungal, hepatoprotective, antioxidant, anticancer, antidepressant activity and immunomodulatory effect**.** The plant has effective pharmacological action and shows promising future for further researches also**.**

KEYWORDS: *Berberis aristata*, Alkaloids, Extracts, Anti-cancer, Hepato-protective.

INTRODUCTION

Berberis aristata DC belonging to the family Berberidaceae known as 'Daruharidra' in Ayurveda, is one among the plants having medicinal properties and extensively used in

almost all indigenous systems of medicine. It is a spinous shrub commonly found in mountainous parts of North India and Nepal. They are distributed throughout the Himalayas, from Bhutan to Kuna war (altitude 610,000 ft), Nilgiri hills (altitude 6-7,000 ft) and Sri Lanka (altitude 6-7,000 ft).[1,2] Ethnobotanical studies indicate that the decoction of its leaves, commonly known as Rasaut, is an alternative and De-obstruent, and it majorly treats skin diseases, menorrhagia, diarrhoea, cholera, jaundice, eye and ear infections, as well as urinary tract infections. The decoction of the root is used as a wash for infected wounds and ulcers, and is used for healing and promoting cicatrisation.[1,2] Like many other herbal drugs, this plant is also used traditionally in inflammation, wound healing, skin disease, menohrrhagia, diarrhea, jaundice and affection of eyes. Pharmacological studies on the plant reveals the proven activity of its as hypoglycemic[28-36], antibacterial, antifungal[40], antipyretic[38], analgesic[37,38], anti-inflammatory[49], hepatoprotective[3,24-27], antioxidant, anticancer[42-47], antidepressant activity[48], immunomodulatory effect.[39]

Taxonomical classification

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Ranunculales

Family: Berberidaceae

Genus: Berberis

Species: aristata.[4]

Vernacular Names

Sanskrit: Katamkateri, Dirvi

Bengali: Daruharidra

English: Indian Berberry

Hindi: Daruhaldi, Darhald

Physicochemical and Qualitative-Chemical Analysis

Ash values, extraction values, and moisture content and Qualitative chemical analysis were performed and measured in Both aqueous and alcoholic extracts of *Berberis aristata* roots.[7]

Aqueous extracts

Fresh root of *Berberis aristata* were thoroughly washed in sterile double distilled water (DDW), surface sterilized in 70% ethanol, and then washed with sterile DDW. The sterilized materials were ground with a pestle and mortar in sterile distilled water. The homogenized tissue was centrifuged and supernatant was filtered, sterilized and used as the aqueous extract.

Alcoholic extracts

To prepare alcoholic extracts, fresh roots were homogenized using ethanol and centrifuged. The supernatant was put in a hot water bath at to evaporate the organic solution. The extract was re-dissolved in ethanol to achieve the desired concentrations (100 mg/ml). The extracts were filter-sterilized before use.

Aqueous extract of dried root

The roots were thoroughly washed and surface-sterilized as described above, and subsequently dried completely before being ground into a powder. The powdered root material was dissolved in sterile distilled water and kept overnight.

PHYTOCHEMICAL STUDIES

Berberis aristata contains protoberberine and bis isoquinoline type of alkaloid. Root of plant *B. aristata* contains alkaloid which are berbamine[8], Berberine, oxycanthine, epiberberine, palmatine, dehydrocaroline, jatrorhizine and columbamine[9,10], karachine[11], dihydrokarachine, taximaline[12], oxyberberine, aromoline.[13] Four alkaloids, pakistanine, 1-Omethylpakistanine, pseudopalmatine chloride and pseudoberberine chloride were also isolated from *Berberis aristata*.

The known quantity of dried powder was extracted in Soxhlet with various solvents chloroform, acetone, ethanol and water successively and tested for different constituents[14] and the Results of preliminary phytochemical studies are detailed in the Table 1.

Qualitative Tests	Chloroform	Acetone	ethanol	Water
Alkaloid	+	-	+	+
Glycoside	-	-	+	+
Bitter principle	-	+	+	-
Flavanoid	-	-	-	-
Tannin	-	+	+	+
Saponin	-	+	+	+
Coumarin	-	-	-	-

- Implies absent; + implies present

PHARMACOGNOSTICAL STUDIES

It is an erect spiny shrub, about 2 and 3 metres long wood, hard and yellow; bark, yellow to brown outside and deep yellow inside, removable by hands in longitudinal strips; spines (which are modified leaves), three-branched and 1.5 cm long. Leaves in tufts of 5 to 8, phyllotaxy verticillate, lanceolate, simple spiny, toothed, leathery, sessile, acuminate, with reticulate pinnate venation, 4.9 cm in length, 1.8 cm in width, deep green dorsally and light green ventral surfaced.[15]

Ethnopharmacology & Traditional medicinal uses

Traditionally *B. aristata* is well-known for its properties such as Lekhaniya — reducing toxicity and unnecessary fats, Arshoghna — anti-haemorrhoidal, Stanyasodhana — lactode purant, Ropana — a wound healer, Svedala — promotes sweating, Rasayana — rejuvenative, Kandughna — anti-pruritic and can also be used for treating skin disorders. Daruharidra resembles in its properties to those of Turmeric i.e. Haridra, hence both the herbs have been mentioned together as Haridra dvaya, meaning two Haridras viz. Haridra and Daruharidra. It is of paramount importance in the folklore medicine of India used for allergies, metabolic disorders, ophthalmia, other eye diseases and as a laxative. It is one among the 73 plants which are used to treat skin diseases traditionally in Nepal and other surrounding villages.[16] A multi-herbal formulation containing *B. aristata* is used for treating bleeding piles in some rural parts of India.[17] Traditional anti-osteoporosis activity of *B. aristata* was confirmed when ovariectomized (OVX) rats were tested for the aqueous methanol extract of the plant. These findings suggested that the ethnic use can be continued in treatment of osteoporosis, joint pain and menopause.[18]

Rasaut a preparation of *Berberis aristata* used mixing with honey is found to be effective in the treatment of aphthous sores abrasions and ulcers of the skin. The plant is an emmenagogue and also useful in the treatment of jaundice, enlargement of spleen, etc. the drug is also used as laxative, diaphoretic, antipyretic and antiseptic. Majorly in the Unani system of medicine, it is used for the treatment of leprosy. Decoction of root bark of *Berberis aristata* is externally used as a wash in painful eye affections, ulcers, haemorrhoids, for skin troubles and in blood purification in decoction form.[19-22]

PHARMACOLOGICAL ACTIVITIES

Berberis aristata DC is often given as a cooling laxative to children. The stem is said to be diaphoretic and laxative and useful in Rheumatis. The dried extract of the roots is used in treating Ophthalmia. It is also a very good medication in the case of sun-blindness. The bark of its root is a valuable medicine in intermittent and remittent fevers and even the root is found to be one of the few really good medicines in India. In efficacy, it is almost equal to quinine and Warburg's tincture. It does not show any bad effects on the stomach, the bowels, the brain and the organs of hearing.[22,23]

Hepatoprotective Activity

B. aristata (Daruharidra) was tested for hepatoprotective activity on the hydraulic permeability of water in the presence of bile salt through a transport cell model, which showed prevention of the toxic effect of bile salts in various hepatic disorders by cell membrane stabilizing property.[24] Berberine, a known compound from the plant *Berbris aristata*, was studied for its possible anti-hepatotoxic action in rats. Pre-treatment of animals with berberine showed hepatoprotection and Post-treatment with three continuous dosing of berberine decreased the hepatic damage induced by acetaminophen when given orally, while CCl4 - induced hepatotoxicity was not modified, suggesting the curative effect against acetaminophen. Also, Pre-treatment of animals given berberine, induced elongation of the pentobarbital induced sleeping time, enhanced strychnine induced toxicity, and suggested inhibitory effect on microsomal drug metabolizing enzymes, cytochrome P450s CYPs.[25,26,27]

Diabetes Mellitus

An uncontrolled clinical trial investigated the effect of berberine on 60 patients with type II diabetes mellitus. The patients varied in severity of this disorder. Oral doses were prescribed for 1-3 months, together with a therapeutic diet prescribed for a month. Major symptoms of diabetes disappeared, patient strength improved, normalised blood pressure and blood lipids decreased. Fasting glycaemic levels in about 60% of patients are controlled. Further testing in animal models indicated that treatment with berberine led to healthier pancreatic tissue compared to controls. It is suggested that the mechanism of action of berberine may be associated with promoting regeneration and functional recovery of βcells.[28-36]

Analgesic activity

Analgesic activity was determined according to the method with minor modifications.[37] Albino rats, were divided into groups. The initial reaction time of all the animals was

recorded by putting them on the hot plate before administering the drugs or distilled water. Licking of paw or jumping was taken as the index for reaction to heat. The reaction time of each animal was recorded after administration of the drug, at 20 min interval, for the next 2 h. The mean reaction time of test group, at each interval of the testing was compared statistically with the mean reaction time of the control group at the corresponding intervals by using ANOVA test.[38]

Antipyretic activity

Antipyretic testing was done by using the Diphtheria Pertussis-Tetanus (D.P.T.) vaccine as the pyrexia-inducing agent. Rabbits, were divided into three groups. Two groups served as test and control group. Initially the temperature of animals was recorded using a clinical thermometer, by inserted half inch deep into the rectum. Alcoholic and aqueous extracts were administered orally to the respective test groups, and the control group was administered water in the usual manner. The D.P.T. vaccine was injected i.v. in the ear vein. Rectal temperature was recorded after vaccine injections at 30-min for about 3 hr interval. The mean rectal temperature of the test group was compared with that of the mean rectal temperature of the control group at corresponding intervals and analysed statistically by using test of variance (ANOVA).[38]

Immunomodulatory activity

Crude extract formulation was tested in experimentation for immunomodulatory effect. The formulation of *Boerhavia diffusa*, *Tinospora cordifolia*, *Berberis aristata*, *Terminalia chebula* and *Zingiber officinale* like plants. In immunomodulatory studies humoral immunity was enhanced as evidenced by the hemagglutination titre. The count of T-cell remained unaffected in treatment with the formulation but cell-mediated immune response was stimulated as observed in the leukocyte migration inhibition (LMI) tests.[39,40]

Anti-microbial

Hydroalcoholic extract of *Berberis aristata*, was tested against bacterias, Micrococcus luteus, Bacillus subtilis, Berberis cereus, Enterobactor aerogenus, Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Pseudomonas aeruginosa, Staphylococcus aureus, Salmonella typhimurium, Streptococcus pneumoniae, and eight fungal strains as Aspergillus nidulans, Candida albicans, Aspergillus terreus, Trichophyton rubrum, Aspergillus spinulosus, Cryptococcus albidus, Aspergillus flavus and Aspergillus niger for anti-microbial and anti-fungal activities, which gave lower MICs against Bacillus cereus, Escherichia coli,

Staphylococcus aureus and Aspergillus flavus. The major alkaloid berberine may be found responsible for antimicrobial activity.[41]

Hepatic Amoebiasis

Crude extract formulation of the plants comprised of the *Boerhavia diffusa, Tinospora cordifolia, Berberis aristata, Terminalia chebula* and *Zingiber officinale* was evaluated in amoebic liver abscess in golden hamsters. The formulation had a maximum cure rate in hepatic amoebiasis reducing the average degree of infection (ADI) to low value.[42]

Anti-Carcinogenic Activity

Berberin, an alkaloid from the plant like *Berberis aristata*, has been found to inhibit significantly the carcinogenesis induced by 20-methylcholanthrene or N-nitrosodiethylamine in a dose dependent manner in small animals. Also, Administration of berberine could reduce significantly the incidence of Tumour in animals after an injection of 20- methylcholanthrene and increased their life span compared with the control.[48] When berberine was administered simultaneously with NDEA, liver injury markers were reduced significantly compared with animals treated with NDEA only, which resulted increased values. Similar depression was seen in the serum levels of lipid peroxide, bilirubin and glutamate pyruvate transaminase. Morphology of liver tissue and levels of marker enzymes helped in knowing that berberine offered protection against chemical carcinogenesis. Methanolic extract showing promising results against breast and colon cancer cell lines. Hence, it is effective against breast and colon cancers[43,44,45] and concentration dependent inhibition of HT29 cells.[46,47]

Anti-Depressant Activity

Berberine is ineffective in small doses for locomotor activity and barbiturate-induced sleep time, resulted in producing mild hypothermic action in rats and showed analgesic effect in mic. Both the findings demonstrate that berberine presented antidepressant-like effect in various by modulating brain biogenic amines (norepinephrine, serotonin and dopamine). Also, nitric oxide pathway or sigma receptors are responsible for mediating its antidepressant-like activity in mouse forced swim test.[49]

Detection of anti-inflammatory activity

Carrageenan induced rat paw oedema model was used with minor modifications[49] on Albino rats, which were divided into groups. Plethysmo meter was used to measure the volume of right hind paw, by dipping the animal paw up to the indelible mark just below the knee joint.

ANOVA test was used to calculate the mean of paw thickness of test/standard group in comparison with control group.[38]

CONCLUSION

Berberis aristata is an erect spiny shrub native to northern Himalaya region. Studies have revealed its use in antimicrobial, antifungal, hepatoprotective, immunomodulatory, and anti-depressant and antidiabetic. However not much information is there to prove this plant for anti-neoplastic, anti-fertility, anti-leprotic etc. So later on researches may be done to prove the potential of this plant. Since, plant is becoming endangered species so more research can be done on agricultural and climatic conditions to grow this plant. The translational potential clues to the possible novel bioactivities and novel targets are yet to be discovered with this amazing plant species.

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