



COMPREHENSIVE ANALYSIS OF DARUHARIDRA (*Berberis aristata* DC.)

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ABSTRACT-

Daruharidra (*Berberis aristata* DC) belongs to *Berberidaceae* family is a medicinal plant. In Daruharidra is a medicinal plant mentioned since ages in Ayurvedic Samhitas in management of different diseased condition like *Prameh* (Diabetes mellitus), *Mukha Rog* (Mouth diseases), *Netra Rog* (Eye diseases), *Karna rog* (Ear disease), *Pandu* (Anemia), *Kamla* (Jaundice), *Shoth* (Swelling), *Twakvikara* (Skin disease), *Kusth* (Skin disease), *Jwara* (fever), *Visarpa* (erysipelo), *Kandu* (itching), *Vatrakta* (gout), *Stanyadoshnashaka* (galacto depurant), *Visarpa* (erysipelo) etc. Berberine, is main chemical constituents which shows different pharmacological activity to cure disease. it shows antihyperglycemic, antioxidant, anti-inflammatory, hepatoprotective, antimicrobial, antioxidant, antiplasmodial, anticancer activity. The stem of Kaleyaka, (*Coscinium fenestratum*) is used as a substitute for *Daruharidra*.

(Keywords- Daruharidra, *Berberis aristata*, Daruhaldi, Hepatoprotective)

INTRODUCTION

Vedas, Samhitas, Nighantus, Chikitsa Granthas, Ayurvedic Pharmacopoeia of India are the source of information of about the Medicinal plants which are described in Ayurveda. Botanical name of Daruharidra is *Berberis aristata* DC as described in API, belongs to *Berberidaceae* family. It is also known as tree turmeric and Indian barberry. Daruharidra is erect, glabrous, spinecent shrub found in the Himalayan region at an altitude of 2-3 thousand feet and in Nilgiri mountain.¹ Its dried stem used as bitter tonic in fever and berries are edible. It has been used for management of different diseased condition like *Prameh* (Diabetes mellitus), *Mukha Rog* (Mouth diseases), *Netra Rog* (Eye diseases), *Karna rog* (Ear disease), *Pandu* (Anemia), *Kamla* (Jaundice), *Shoth* (Swelling), *Twakvikara* (Skin disease), *Kusth* (Skin disease), *Jwara* (fever). The dry extract of root known as **Rasanjana (rasaut)** is an important formulation of Daruharidra is used in eye disease and as purgative and blood purifier.²



1. *Berberis aristata* DC stem

SYNONYMS-³

In different classical text of Ayurveda following synonyms have been cited. Synonyms accredited to describe morphological and therapeutically property of plant.

Table 1

Synonym	Meaning
Daarunisha, pitadaru, peeta, pitak	Yellow colour of stem like Haridra
Darvi	Important part of plant is woody stem
Parjani, Parjanya	Fruiting in rainy season
Kantkateri	Having specular leaves
Kaliyak, Kaleyak, Pachampacha	Improve liver function

REGIONAL LANGUAGE NAMES ⁴

Table 2

English	Indian barberry
Bengali	Daruharidra
Gujrati	Daruhaldar
Hindi	Daruhaldi daruhalad, chitra
Malayalam	Maramaanjal
Maratha	Daruhalad
Oriya	Daruhald
Nepal	Daruhalad
Punjabi	Chitra, Sumlu, Simlu, Daarhaldi
Telgu	Manupasupu
Urdu	Zarisk

PROPERTIES ⁵-

Daruharidra comprises *Tikta*, *Kashaya* (astringent) *Ras*, *Laghu* (light), *Ruksh*(dry) *Guna*, *ushna*(hot) *Virya* and *Katu* (pungent) *Vipaka*, with the help of these property it pacifies *pittadosha*. Berries comprises *Madhur*(sweet), *amla*(sour) *Ras* and *sheet*(cold) *Virya*.

BOTANICAL DESCRIPTION-**Macroscopic characters of root⁶**

The roots are thick, woody yellowish brown, cylindrical, more or less knotty and covered over by a thin brittle bark. Bark is internally pale brown, rough, closely and rather deeply furrowed. Cut surface bright yellow, rough, fibrous with small fine ridges; growth rings discernible, wood diffused porous, fracture hard, texture short, odourless and bitter in taste.

Microscopic characters of root

The young root shows a single layered epidermis comprising of larger mostly radially elongated cells covered over by a cuticle. This is followed by cortex, 5-7 layers of cells wide, comprising of circular, isodiametric, polyhedral and tangentially elongated cells enclosing within it a polyarc stele. Cork cambium arises in the 5th-6th layer of cortex. As the secondary growth proceeds, cork cambium produces cork on the outer side and phelloderm on the inner side. Thus in the mature root, the cork is 9-10 layers of the cells wide whose cells are tangentially elongated and thin walled. This is followed by a narrow zone of phelloderm 3-5 layers wide with thick walled ellipsoidal cells having very few intercellular spaces. Following this, is a wide zone of secondary phloem composed mostly of phloem parenchyma with intact sieve tubes and sieve plates, which are more on inner side of the phloem. Some of the parenchymatous cells of the phloem are converted into fibers as well as stone cells. The fibers are much more in number than stone cells. The stone cells are in ones or twos embedded within the groups of fibers, which are present in 2-3 discontinuous circular rings surrounding the xylem. The fibers are strongly lignified and are of two types. The first ones are relatively thinner, pointed at their respective ends, without pits with a few of them having outgrowth toward their ends. The other ones are relatively larger in diameter, but smaller in length than their first counterparts with profuse thickening and bordered pits on their walls. The number of fibers with pits are much less in number than the fibers without pits. Stone cells are also strongly lignified, much shorter in dimensions, with highly thickened walls and having vertical pits on their walls. The medullary rays become wider and funnel shaped as they traverse the region of the secondary phloem. The wood is diffused, porous and consists of trachea, tracheids, fibers, fiber tracheids and xylem parenchyma traversed by 2-3 celled wide medullary rays. All the elements of xylem except medullary rays are strongly lignified. The xylem vessels are drum shaped and have mostly bordered pits on their walls with distinct perforation rims and some possess pointed tail like ends. The tracheids have blunt to pointed ends and possess bordered pits on their walls. Xylem fibers are long, thickened with perceptible lumen and pointed ends. Seldom one finds fibers with outgrowth on their walls near its ends. The fiber tracheids are long with bordered pits on its walls and are thicker when compared to xylem fibers. Xylem parenchyma is rectangular or polygonal in shape and contains simple pits on their walls.

Macroscopic characters of stem⁷⁻

A large deciduous shrub usually 1.8-3.6m height but attaining 4.5m with stem 20cm diameter. Twig whitish and pale yellowish brown in color. Bark pale brown and deeply furrowed, rough. Leaves 3.8-10 by 1.5-3.3cm, obovate or elliptic, spinous-toothed, based gradually narrowed, with prominent reticulated nerve, glossy dark green above, glossy pale green beneath. Inflorescence a simple drooping raceme 2.5-7.5cm. long, ovoid, blue- black with a thick pale bloom.

Microscopic characters of stem-

Daruharidra stem shows rhytidoma with cork consisting of 3-45 rectangular and squarish, yellow coloured, thin-walled cells, arranged radially; sieve elements irregular in shape, thin walled, a few cells containing yellowish, brown contents; phloem fibres arranged in tangential rows, consisting of 1-4 cells, each fibre short thick walled, spindle-shaped, lignified having wide lumen; half inner portion of rhytidome traversed by secondary phloem rays; phloem rays run obliquely consisting of radially elongated parenchymatous cells, almost all phloem ray cells having single prismatic crystals of calcium oxalate, a few cells of rhytidome also contain prismatic crystals of calcium oxalate; stone cells also found scattered in phloem ray cells in groups, rarely single, mostly elongated, a few rounded; secondary phloem, a broad zone, consisting of sieve elements and phloem fibres, traversed by multiseriate phloem rays; sieve elements arranged in tangential bands and tangentially compressed cells alternating with single to five rows of phloem fibres, secondary xylem broad consisting of xylem vessels, tracheid, xylem fibres and traversed by multi striate xylem rays; xylem vessels numerous, small to medium sized, distributed throughout xylem region in groups or in singles, groups of vessels usually arranged radially; isolated vessels cylindrical with rounded or projected at one or both ends with spiral thickenings; fibres numerous, lignified, large, thick-walled with wide lumen, and pointed tips; xylem rays quite distinct, straight, multiseriate, consisting of radially arranged rectangular cells, each ray 30-53 cells high, 8-12 cells wide, a few ray cells containing brown contents.

Stem powder –

Fine powder of Daruharidra may shows mostly fragments of cork cells, yellow coloured phloem fibres entire or in pieces, stone cells in singles or in groups, numerous prismatic crystals of calcium oxalate, xylem vessels having spiral thickenings, thick-walled, lignified xylem fibres and ray cells.

Identity Purity and Strength of Stem Powder

Foreign matter: not more than 2.0%

Loss on drying: not more than 12.0%

Total ash: not more than 14.0%

Acid insoluble ash: not more than 5.0 %

Alcohol-soluble extractive: not less than 6.0%

Water soluble extractive: not less than 8.0 %

Phytochemical constituents -

Berberis aristata contains protoberberine and bis isoquinoline type of alkaloid. Root of plant *B. aristata* comprises alkaloid which are berbamine, Berberine, oxycanthine, epiberberine, palmatine, dehydrocaroline, jatrorrhizine and columbamine,^{8,9} dihyrokarachine, taximaline,¹⁰ oxyberberine, aromoline¹¹ Four alkaloids, pakistanine, 1-Omethylpakistanine, pseudopalmatine chloride and pseudoberberine chloride were also isolated from *Berberis aristata*.¹² A secobisbenzisoquinoline or simple isoquinoline alkaloid was isolated from *B. aristata*.¹³

OTHER SPECIES OF BERBERIS¹⁴-

Table 3

S. N.	Name	Botanical Description	Alkaloids
1.	<i>Berberis asiatica</i>	<p>Shrub- Spiny shrub 1.8 to 2.4 m in height, armed with trifold spines.</p> <p>Leaves- long-ovate or obovate, acute, mucronate, long petiole leaves with aristato-dentate margin.</p> <p>Flowers- Yellow flowers in umbellate racemes,</p> <p>Berries- Oblong-ovoid edible berries,</p> <p>Other- Commonly occurring in the Himalayas from Himachal Pradesh at 600-2,700 m eastwards to Bhutan and Assam at 1,500-1,800 m, and on Paras nath hills in Bihar, Pachmarhi in Madhya Pradesh.</p>	Berberine, berbamine, jatrorrhizine, palmatine, oxycanthine, oxyberberine, columbamine, tetrahydropalmatine.
2.	<i>Berberis lycium</i>	<p>Shrub- It is a sub-erect, rigid, spiny shrub 2.7 3.6 m in height with oblanceolate,</p> <p>Leaves- Cute to sub-acuminate mostly entire leaves,</p> <p>Flowers- Small pale yellow flowers in 20-flowered racemes.</p> <p>Berries- Ovoid black berries,</p> <p>Other- Occurring abundantly in the Himalayas from Kashmir to Kumaun at 900-2,700 m. It is abundant in the moist temperate forests of Chamba in Himachal pradesh and about four tonnes of roots can be procured annually.</p>	Berberine, baluchistanamine, chenabine, gilgitine, jhelumine, palmatine, punjabine, sindhamine

3.	<i>Berberis chitria</i>	<p>Shrub- It is an erect, spiny shrub up to 3.6 m in height</p> <p>Leaves- Obovate or elliptic-acute, spinose-serrate leaves,</p> <p>Flowers- Deep yellow flowers in loose corymbose panicles</p> <p>Berries - Dark red-brown oblong-ellipsoid berries,</p> <p>Other- Occurring in the Himalayas from Kashmir to Nepal at altitudes of 1,500-2,400 m. The root and the stem bark are the richest source of alkaloids</p>	Berberine, jatrorrhizine, O-methylcorydine-N-oxide, palmatine, oxyacanthine,
4.	<i>Berberis tinctoria</i>	<p>Shrub- It is a 1.8 to 24 m tall shrub</p> <p>Leaves-Leaves when young purplish, obovate, entire or with a few spiny teeth, glabrous, 1 to 2 1/2 inches.</p> <p>Flowers- Racemes of flowers drooping, sometimes branched; pedicels slender, red 1/2-inch; petals notched.</p> <p>Berries-Berry sausage-shaped when young, eventually top-shaped, 1/3 by 1/6 inch, purplish red, turning to a dark-blue with glaucous bloom, with the dry style and large round stigma still attached.¹⁵</p> <p>Other - Occurring in the Nilgiri and Palni hills at an altitude of 1,800 m, and in Shevaroy hills of South India. The yield of berberine is 2.3per cent.</p>	Berberine, berbamine, jatrorrhizine palmatine,
5.	<i>Berberis petiolaris</i>	<p>Shrub- Deciduous, 2.4-3 m. high, twigs glabrous, spines usually simple, often wanting.</p> <p>Leaves- Leaves 2.5-10 by 1.5-3.8 cm., ovate, obovate or oblong or oblong-lanceolate, thin, membranous, closely but rather irregularly toothed or entire, narrowed towards the base; petiole distinct up to 1.3 cm. long. Racemes simple, lax, glabrous, exceeding the leaves, pendulous.</p> <p>Berries- Lower pedicels 10 mm long Fruit oblong-ovoid, red 7.5-10 mm. long; style very short; stigma large.</p> <p>Other- Distribution: W. Himalaya, from Kashmir to Nepal, up to 12,000 ft.</p>	Berberine, berbamine, Palmatine, tetrandrone.
6.	<i>Berberis umbellata</i>	<p>Shrub- It is a shrub with 0.60-1.21 m in height, sometimes attaining height of 2.43 m.</p> <p>Leaves-Leaves obovate, entire or with a few spiny teeth, glabrous, 2.5 to 6.35</p> <p>Flowers-Umbel flowers, pedicel slender, red 1.2 cm; petals notched.</p> <p>Berries-Berry sausage-shaped when young, eventually top-shaped 0.84 cm by 0.44 cm, purplish red, turning to dark-blue with glaucous bloom.¹⁶</p>	Umbellatine

		Other- Occurring in the Himalayas from Garhwal and Kumaun to Sikkim and Bhutan.	
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Chromatogram¹⁷ -

Hydroalcohol extract of Daruharidra- For preparation of Hydroalcohol extract of Daruharidra, it should be taken suitably sized (powder or pieces) add 50 per cent aqueous alcohol about 3 times the quantity of raw material and heat under a reflux at a temperature between 80-85⁰ for 3-4 hours than filter the extract through a filter and concentrate the combined filtrate to a syrupy consistency and should be dried under vacuum. The yield may obtained about 13%.

Identity purity and strength of Hydroalcohol extract

Loss on drying: not more than 7.0%

Total ash: not more than 12.0 %

Acid-insoluble ash: not more than 2.0%

pH: 6.0-8.0

Total soluble solids: not less than 90.0 %

Chromatography - Rf value of berberine at 0.5 of Daruharidra hydro-alcoholic extract was found.

Water extract of Daruharidra- For preparation of Water extract of Daruharidra, it should be taken Daruharidra suitably sized (powder or pieces) add water, about 3 times the quantity of raw material and heat at a temperature between 80-85⁰ for 3-4 hours. Filter the extract through a filter (preferably 10 µm pore size) to a suitable sized vessel. Concentrate the combined filtrate to a syrupy consistency and dry under vacuum. The yield may obtain about 16%.

Identity purity and strength Water extract

Loss on drying: not more than 7.0%

Total ash: not more than 12.0 %

Acid-insoluble ash: not more than 2.0 %

pH: 6.0-8.0

Total soluble solids: not less than 90.0 %

Chromatography - Rf value of berberine at 0.5 of Daruharidra water extract was found.

Comparative study of berberine concentration contained in different species of the same genus¹⁸

Table 4

Species	Higher berberine content different species of the same genus	Higher berberine content in root	Seasonal variation of berberine concentration
<i>B. asiatica</i>	4.3%	2.4%	
<i>B. lycium</i>	4.0%		
<i>B. aristata</i>	3.8%	2.8%	winter harvest (1.9% by roots)
<i>B. pseudumbellata</i>			Summer harvesting (2.8% by roots, 1.8% by stem bark)

Low altitude plant contain more berberine as compare to high altitude plants in Berberis species and different research have reported that maximum berberine concentration accumulates in root (1.6–4.3%) as compared to stem and other part.

PORTRAYAL OF DARUHARIDRA AS PER AYURVEDIC LITERATURE-

In Ayurveda *Berberis aristata* has been classified in following *Varga* and *Gana* with its therapeutic uses/indications.

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Table 5

Samhita/ Nighantu	Gana/ Varga	Indication / <u>Therapeutic Uses</u>
Charak Samhita	Aarshoghana Mahakashaya,	<i>Arsha</i> (hemorrhoid)
	Kusthaghana Mahakashaya,	<i>Kustha</i> (skin disease)
	Kandughana Mahakashaya	<i>Kandu</i> (itching) ¹⁹
Sushruta Samhita	Haridradigana	<i>Stanyashodhana</i> (galacto depurant), <i>Amatisara</i> (diarrhoea associated with ama), <i>Doshpachana</i>
	Mustadigana	<i>Yonidoshara</i> (gynecological disorder), <i>Stanyashodhana</i> (galacto depurant), <i>Pachana</i> (digestion), <i>Shleshmasudana</i>
	Lakshadi gana	<i>Kaphapittanashana</i> , <i>Kusthhara</i> (skin disease) <i>Krimihara</i> , <i>Dustvranavishodhana</i> (wound healing). ²⁰
Astang Hridaya	Vachaharidradigana	<i>Aamatisarnashaka</i> , <i>Medakaphanashaka</i> , <i>Vatrakta</i> (gout), <i>Stanyadoshnashaka</i> (galacto depurant) ²¹
	Mustadigana	<i>Yoni-Stanya-Rognashaka</i> , <i>Malapachana</i> .
Astang Nighantu	Vachadigana, Haridradigana	<i>Aamatisarnashaka</i> , <i>Medkpha</i> , <i>Vatrakta</i> , <i>Stanyadoshnashaka</i> ²²
Dhanvantari Nighantu	Guduchyadi varga;	<i>Vrananashaka</i> (wound), <i>Mehajeet</i> , <i>Karna- Netra-Mukha Rognashaka</i> (mouth disease), <i>Ruja</i> (painkiller), <i>Kandu</i> (itching) ²³
Kaiyadev Nighantu	Oshadhivarga	<i>Karna Rogajeeta</i> (ear disease), <i>Netrarogajeeta</i> (eye disease), <i>Aasyarogjeet</i> (mouth disease) ²⁴
Bhavprakash Nighantu	Haritakyadi Varga	<i>Netraroganashaka</i> (eye disease), <i>Karnaroganashaka</i> (eardisease), <i>Aasya Roganashaka</i> (mouth disease) ²⁵
Raj Nighantu	Pipalyadi varga	<i>Vrana</i> (wound), <i>Mehanashaka</i> (diabetes mellitus), <i>Kandu</i> (itching), <i>Visarpa</i> (erysipelo), <i>Twakadosh</i> (skin disease), <i>Akshidosh</i> (eyedisease) ²⁶

PHARMACOLOGICAL ACTIVITY –

Antihyperglycemic activity

1. Antihyperglycemic activity *Berberis aristata* root extract in alloxan -induced diabetic rats. five groups of albino wistar rats were used, two dose of 71.42 and 100mg/kg body weight ethanol extract of *B. aristata* were selected for anti hyperglycemic activity. In oral glucose tolerance test ethanol extract of *B. aristata* increase the glucose tolerance. It is concluded that the ethanol extract of *B. aristata* possess anti-diabetic activity in alloxan induced diabetic rats.²⁷

2. 50% aqueous ethanolic root extract of *Berberis aristata* alloxan 250mg/kg was administered in induce diabetic rat and standard drug glybenclamide 0.6mg/kg and it lowered the blood glucose significantly without any hypoglycemic effect on their control counter parts.²⁸

3. Induce experimental diabetes mellitus using streptozotocin in normal adult male wistar rats. Oral administration of the methanolic extract of *Berberis aristata* stem (MEBA) 250-500mg/kg shows antiglycemic activity and also show reduction in the level of triglycerides and significant increase in HDL cholesterol level.²⁹

4. *Berberis aristata* root extract is helpful to decrease blood sugar level. *Berberis aristata* and *Berberis asiatica* both species have antihyperglycemic properties. Stem solidify aqueous extract(ghana tablets) was given in the dose of 6gm/day for 6 week with lukewarm water as anupana. Significant improvement was seen in chief complaints. In clinical experiment both drugs didn't show hypoglycemic action in normal rats.³⁰

Anti-oxidant-

1. 50% Aqueous ethanolic root extract of *Berberis aristata* 250mg/kg was administrated to alloxan induced diabetic rat shows antioxidant activity and antiglycemic activity.³¹

2. Methanolic extract of *Berberis aristata* showed the presence of antioxidants like alkaloid, saponin, terpenoids, coumarin, flavonoids, tannin, glycoside and steroid. Antioxidant assay like DPPH(Diphenyl-2-picrylhydrazyl) assay, hydrogen peroxide assay and reducing power assay was done. the extract of *Berberis aristata* (root) has strong potential to regulate glucose homeostasis through decreased gluconeogenesis and oxidative stress.³²

Anti- inflammatory-

1. Topical administration (*Aschyotana*) with decoction of rootbark of Daruharidra was scheduled for 5 days and *Aschyotana* procedure was repeated for the same time period at an interval of 7days follow was done for 1 month. Study revealed that it is beneficial in allergic conjunctivitis.³³

2. Anterior uveitis was induced in rabbits by intravitreal injection of lipopolysaccharide from *Escherichia coli* after pretreatment with *B. aristata* aqueous extract. Tropical instillation of aqueous extracts of *B. aristata* showed anti-inflammatory activity against endotoxin induced uveitis in rabbits.³⁴

3. *Berberis aristata* hydroalcoholic extract (BAHE) produce a dose dependent reduction in carrageenan induced paw edema and cotton pellet-induced granuloma model. BAHE treatment produced significant reduction in serum inflammatory cytokine level.³⁵

Hepatoprotective activity-

1. Aqueous Methanol extract of *Berberis aristata* (fruit) shows hepatoprotective activity against liver toxicity which is induced by paracetamol and CCl₄. Paracetamol produce 100% mortality at a dose of 1g/kg in mice while pretreatment of rat with crude extract (500mg/kg) reduce the death rate to 20%. Pretreatment of rats with Fruit Extract-500mg/kg (orally twice daily for 2days) prevented the Paracetamol(640mg/kg) as well as CCl₄ induced (1.5ml/kg) rise in serum transaminases (GOT and GPT).³⁶

2. Ethanolic extract of *Berberis aristata* EEBA and aqueous extract AEBA at (200mg/kg, p.o) showed significant anti-cirrhosis activity similar to that standard drug, silymarin against dimethylnitroamine induced liver cirrhosis in rat model. However, ethanolic extract of *Berberis aristata* is more effective than aqueous extract.³⁷

3. Ethnolic extract of stem bark of *Berberis aristata* against CCl₄ overdose induce liver damage in rat. EEBA have used in different doses 100mg/kg and 300mg/kg and significant reduction of serum SGPT (Serum Glutamate

Pyruvate Transaminase), SGOT(Serum Glutamate Oxaloacetate Trans aminase) , SALP(Serum Alkaline Phosphates) and Bilirubin were observed.³⁸

Antimicrobial activity-

1.The effect of Berberine (Berberine derived from *Berberis aristata*) sulphate salt on the growth of *Trichomonas vaginalis* in vitro was compared to the efficacy of metronidazole as a reference drug. Result shows that berberine sulphate was comparable to metronidazole as regards potency with the advantage of being more safe and possible replacement in metronidazole resistant case.³⁹

2.The antimicrobial activity of hydroalcoholic extract of berberis species was tested against eleven bacterial and 8 fungal strains. *B. aristata* root extract gave low MICs value against *Bacillus cereus*, *Escherichia coli*, *Staphylococcus aureus* and *Aspergillus flavus* while stem extract against *B. cereus* and *Streptococcus pneumoniae*.⁴⁰

3.Berberine extract from *Berberis aristata* stem to analyse their antimicrobial activity against eye infection microbe. 17.32% methanolic extract of berberine, both cold and 72 hrs Soxhlet extraction, resulted higher yield of berberine and showed better antimicrobial activity.⁴¹

Antiplasmodial activity-

1.Aqueous root extract of *Berberis aristata* (AREBA) was administered at a dose of 150 mg/kg/d, 250 mg/kg/d, 350 mg/kg/d and 650 mg/kg/d to *P. berghei* infected mice orally for 4 consecutive days. The suppressive and preventive activity were found to be 67.1% and 53.9% respectively.⁴²

Anticancer activity-

1. Antineoplastic activity of the ethanol and aqueous extracts (6.5 and 100mg /kg; respectively) was compared with that of cisplatin in Ehrlich ascites carcinoma (EAC) bearing mice. ethanolic extract of *Berberis aristata* possessed tumor growth inhibitory activity in late stage` of cancer.⁴³

2.The methanolic extract of *Berberis aristata* stem was used in human breast cancer cell line (MCF-7). Different concentration of the methanolic extracts 125, 250 and 500ug/ml were subjected to determine the cytotoxic effect by measuring the cell proliferations activity in MCF-7 breast cancer cells line up to 48 h of incubation. *Berberis aristata* methanolic extract shows anticancer activity significantly in MCF-7 breast cancer cell lines.⁴⁴

SUBSTITUTE-

The stem of Kaleyaka latin name *Coscinium fenestratum* (Gaertn) is used as a substitute for *Daruhardra*. The chief constituent of *Coscinium* is the yellow crystalline alkaloid, berberine; it also contains a saponin.

The roots of *Coscinium fenestratum* contain alkaloids berberine, dihydroberberine, 12, 13-dihydro-8-oxo berberine, tetrahydroberberine, oxyberberine, and noroxy hydrastinine. Stems of *Coscinium fenestratum* from Thailand furnished the new protoberberine alkaloids oxypalmatine, (-)-8-oxotetrahydrothalifendine, (-)-8-oxoisocorypalmine and either (-)-8-oxothaicanine or (-)-8-oxo-3-hydroxy-2,4,9,10-tetramethoxyberberine in addition to berberine, the major alkaloid and (-)-8-oxocanadine.⁴⁵

Similar pharmacological activity of Daruharidra and Kaleyaka-⁴⁶

Table 6

S.NO.	Pharmacological activity	Research work
1.	Anti-hyperglycemic activity	<ul style="list-style-type: none"> The berberine at the same dose as the extract slightly increased insulin secretion by 1.33-fold over the basal control group. In addition, the extract inhibited the activities of both maltase and sucrase with the IC₅₀ value of 3.89 and 11.22 mg/ ml, respectively. Suggesting that the <i>C. fenestratum</i> ethanolic extract exerted anti-hyperglycemic activity by stimulating insulin secretion and α-glucosidase inhibition.
2.	Antimicrobial activity	<ul style="list-style-type: none"> Aqueous extracts of <i>Coscinium fenestratum</i> and its major alkaloid, berberine, inhibited the in vitro growth of <i>Clostridium tetani</i>. Thus, the traditional use of <i>C. fenestratum</i> as a prophylactic against tetanus must be based on its antibacterial activity rather than any inhibitory effect on the production or activity of toxin. Berberine alkaloidal fraction of <i>Coscinium fenestratum</i> stem showed potent antiacne activity. It showed maximum anti-acne activity and the Minimum Bactericidal Concentration against both <i>Propionibacterium acnes</i>, and <i>Staphylococcus epidermidis</i>. The mechanism of action of highly aromatic planar quaternary alkaloids such as berberine is attributed to their ability to intercalate with DNA. Berberine extracted from <i>Coscinium fenestratum</i> showed anti-phytopathogenic fungal activity against various fungi like <i>Phytophthora parasitica</i>, <i>Phytium</i> spp., <i>Colletotrichum gloeosporioides</i>, <i>Cercospora</i> spp., <i>Fusarium oxysporum</i>, and <i>Alternaria porri</i>.
3.	Anti-plasmodial activity	<ul style="list-style-type: none"> The methanol extract of <i>Coscinium fenestratum</i> had the strongest antiplasmodial activity with EC (50) value of 0.5-μg/ml of the 42 extracts from 14 medicinal plants used in Vietnamese traditional medicine to treat malaria. the activity guided fractionation led to identification of berberine as the major active constituent.

Conclusion-

After extensive review of literature of the plant it was found that, Daruharidra is a medicinal plant mentioned since ages in Ayurvedic Samhitas in management of different diseased condition like *Prameh* (Diabetes mellitus), *Mukha Rog* (Mouth diseases), *Netra Rog* (Eye diseases), *Karna rog* (Ear disease), *Pandu* (Anemia), *Kamla* (Jaundice), *Shoth* (Swelling), *Twakvikara* (Skin disease), *Kusth* (Skin disease), *Jwara* (fever), *Visarpa* (erysipelo), *Kandu* (itching), *Vatrakta* (gout), *Stanyadoshnashaka* (galacto depurant), *Visarpa* (erysipelo) etc. *Rasanjana* is prepared from Daruharidra (*Berberis aristata*) which is a very valuable drug to cure eye disease. Daruharidra known as *Berberis aristata DC.* (as per API). Berberine, is main chemical constituents which shows different

pharmacological activity to cure disease. Many species are found in *Berberis* genus, which also contain berberine with different morphology such as *Berberis asiatica* (Branch spread shrub with pale bark, leaves 2-3 in. long, broad ovate, usually with large spinous teeth), *Berberis lyceum* (Small shrub having white bark, leaves 1.5-2.5 inc. long, narrow oblanceolate, subsessile mucronate), *Berberis chitria* (Evergreen shrub 10-12ft high, branches usually bright red, leaves 2-3 in. long, ovate or oblanceolate, rather coriaceous, entire or with a few remote teeth), *B. tinctoria*, *Berberis petiolaris* (Small shrub with soft brown bark 8-10ft high. Leaves deciduous, 1-3 in long, broadly ovate), *Berberis umbellata* (Small shrub, leaves 1-2in. long oblanceolate to ovate) etc. On the basis of previous preclinical and clinical research, it shows antihyperglycemic, antioxidant, anti-inflammatory, hepatoprotective, antimicrobial, antiplasmodial, anticancer activity. The stem of Kaleyaka, (*Coscinium fenestratum*) is used as a substitute for *Daruharidra*. Its chief constituent is also berberine, due to which many pharmacological properties of Kaleyaka is similar to *Druharidra*. In North India, there is no adulteration for *Daruharidra* but in Mumbai different stems boiled in turmeric water are used as adulterant.

Future prospects and limitations:

In Ayurvedic literatures it has mentioned such as *Arsha* (hemorrhoid), *Stanyashodhana* (galacto depurant), *Vatrakta* (gout), *Vrananashaka* (wound), *Netrarogajeeta* (eye disease) *Vrana* (wound), *Visarpa* (erysipelas) etc in which experimental studies/ clinical study has not been reported yet, for which more evidence based research may be done to support its therapeutic Activity. Percentage of Berberine in *Daruharidra* and Kaleyaka may be quantified for proper use of Kaleyaka in unavailability of *daruharidra* in different formulations and clinical study may be done for exploration of its activities in indicated diseased conditions.

Reference

1. The Ayurvedic pharmacopeia of India, Government of India, ministry of health and family welfare department of AYUSH, New Delhi, 2006; 1(9): page no. 16
2. Prof. Krishna Chandra Chunekar, editor Dr. Ganga Sahay Pandey; Bhavprakash Nighantu, Chaukhambha Bhartiya Academy Varanasi 2020; haritakyadi varga page no. 118
3. Sharma PV, Namarupavigyanam, Chaukhambha Bharti Academy Varansi, reprint year 2018, pg.n. 101-102
4. The Ayurvedic pharmacopeia of India, Government of India, ministry of health and family welfare department of AYUSH, New Delhi, 2008; 1(2): page no. 34
5. Ayurvedic Pharmacology and Therapeutic uses of medicinal plant, Dravya guna vigyana, Chaukhambha publication New Delhi, reprint 2009, page no. 395
6. Bhawana Rathi, Juhi Sahu, Sameksha Koul, and R. L. Kosha, Detailed pharmacognostical studies on *Berberis aristata* DC plant, *Anc Sci Life*. 2013 Apr-Jun; 32(4): 234-240. doi: [10.4103/0257-7941.131981](https://doi.org/10.4103/0257-7941.131981)
7. API Part 1, vol. 9 first edition Government of India Ministry of AYUSH 2016, page nu. 16-18
8. Karachine, G. blasko. Karachine, an unusual protoberberine alkaloid. *J of American chemical Society*. 1982; 104(7): 2039-2041.
9. Blasko, Sharma M. Taxilamine: a Pseudobenzlypyroquinoline alkaloid. *Heterocycle* 1982; 19(2): 257-9.
10. Atta-ur-Rahman and Ansari AA. Alkaloids of *Berberis aristata* - Isolation of Aromoline and Oxyberberine, *J. Chem. Soc. Pak* 1983; 5(4): 283.
11. Bhakuni DS, Shoheb A and Popali SP. Medicinal plants: chemical constituent of *berberis aristata*. *Indian journal of chemistry* 1968; 6(2): 123
12. Lect EJ, Elango V, Hussain FS. and Sharma M. Secobisbenzisoquinoline or simple isoquinoline dimer. *Heterocycle* 1983; 20(3): 425-9.
13. Chakarvarti KK, Dhar DC, Siddhiqui S. Alkaloidal constituent of the bark of *berberis aristata*. *J of scientific and industrial research* 1950; 9b (7): 161-4
14. wealth of india, publications & information directorate, CSIR hillside road, New Delhi, 1988, vol 2: B, pg. nu. 114-119
15. Sharad Kumar Srivastava, and Ajay Kumar Singh Rawat, Pharmacognostic Evaluation of the Roots of *Berberis tinctoria* Lesch, *Natural Product Sciences* 13(1): 27-32 (2007)

16. Richa Singh, Shashi Shankar Tiwari, Sharad Srivastava and A KS Rawat, Botanical and phytochemical studies on roots of *Berberis umbellata* Wall. ex G. Don, Indian Journal of Natural Products and Resources Vol 311 March 2012, pp. 55-60
17. API Part 1, vol. 9 first edition Government of India Ministry of AYUSH 2016, page nu. 19-22
18. Maria A. Neag, Andrei Mocan, Javier Echeverría, Raluca M. Pop, Corina I. Bocsan, Gianina Crişan, and Anca D. Buzoianu, Berberine: Botanical Occurrence, Traditional Uses, Extraction Methods, and Relevance in Cardiovascular, Metabolic, Hepatic, and Renal Disorders, frontiers in pharmacology, published in 21 august 2018
19. Pandit Kashinath Pandey, Dr. Gorakhnath Chaturvedi; Chaukhamba Bhartiya Academy Varanasi, reprint year 2015, part-I: Charak sutra 4 page no. 81-82
20. Kaviraj Dr. Ambikadutt Shastri, Chaukhamba Sanskrit sansthana Varanasi reprint 2017 vol-I; Sushruta sutra 38 page no. 185
21. Dr. R. Vidyath, Chaukhamba Subharati prakashan Varansi, first edition 2013, Astanga Hridaya of vagbhata, Sutra sthana chapter 15/35, 36, 40; page nu-248, 250
22. copyright CCRAS New Delhi, e-Nighantu designed and developed by NIIMH, Astang Nighantu
23. copyright CCRAS New Delhi, e-Nighantu designed and developed by NIIMH, Dhanvantari Nighantu
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26. copyright CCRAS New Delhi, e-Nighantu designed and developed by NIIMH, Raj Nighantu
27. B C Semwal, Jitendra Gupta, Sonia Singh, Yogesh Mahendra Giri, anti-hyperglycemic activity of root of *Berberis aristata* DC in alloxan induced diabetic rats; IJGP3(3), 2009
28. Singh J, Kakkar P, Anti hyperglycemic and anti oxidant effect of *Berberis aristata* root extract and its role in regulating carbohydrate metabolism in diabetic rats, J Ethnopharmacology 2009 may 4; 123(1): 22-6
29. Nitinkumar Upwar, R Patel, Naheed Waseem, Naveen Kumar Mahobia Hypoglycemic effect of *Berberis aristata* DC stem on normal and streptozotocin induced diabetic rats, International journal of pharmacy and pharmaceutical sciences ; vol3, Issue 1, 2011
30. DR. G.C. Upadhyay, DR. M. Bhatkoti, DR. N.N. BHATT, DR. B. Ravishankar, Prof. P.P. Sharma, A comparative study of *berberis aristata* and *berberis asiatica* roxb. ex. D.C. in madhumehaharakarma ; IJPBA 2012; 3(6) :1472-1477
31. Singh J, Kakkar P, Anti hyperglycemic and anti oxidant effect of *Berberis aristata* root extract and its role in regulating carbohydrate metabolism in diabetic rats, J Ethnopharmacology 2009 may 4; 123(1): 22-6
32. Nitinkumar Upwar, R Patel, Naheed Waseem, Naveen Kumar Mahobia Hypoglycemic effect of *Berberis aristata* DC stem on normal and streptozotocin induced diabetic rats, International journal of pharmacy and pharmaceutical sciences ; vol3, Issue 1, 2011
33. N. Shrikanth, Mridula Dua, DK Mishra, effect of daruharidra aschyotana in allergic conjunctival inflammation a clinical study: aryavaidyan may 17(4), 235-240, 2004
34. Suresh kumar Gupta, Renu Agarwal, Shushma, Srivastava, Puneet Agrawal, Rohit Sasena, Niranjan Galpalli, The anti-inflammatory effects of *Curcuma longa* and *Berberis aristata* in endotoxin-induced uveitis in rabbits, Invest Ophthalmol Vis Sci, 2008 Sep; 49(9):4036-40.
35. Vijender Singh, Katiyar D Gunjan, D Katiyar, anti-inflammatory activity of alcoholic and aqueous heartwood extract of *Berberis aristata* DC; Asian J Pharm Clin Res 7(1), 210-212, 2014
36. Gilani AH, Janbaz KH, Preventive and curative effects of *Berberis aristata* fruit extract on paracetamol and CCl4 induced hepatotoxicity phytotherapy Research 1995; vol-9, issue 7:489-494
37. Prasant V. Ajmire, Effect of *Berberis aristata* DC against Dimethylnitrosamine induced liver cirrhosis in rat model; journal of pharmacy research, 2011, vol.4 (11), Pp. 4015-4017
38. Unkeshwar P, Nasiruddin M, Fayazuddin M, Khan Ra, Khan Aa, Tajuddin, evaluation of hepatoprotective activity of *berberis aristata* against carbon tetrachloride induced hepatotoxicity in rats, International Journal of Pharmacy and Pharmaceutical Sciences ISSN- 0975-1491 Vol 5, Suppl 4, 2013
39. S. A. Soffar, D. M. Mitwali, SS Abdel Aziz, H. S. el-Wakil, Ghada A Saad, Evaluation of the effect of a plant alkaloid (berberine derived from *Berberis aristata*) on *Trichomonas vaginalis* in vitro, journal of the Egyptian science society of Parasitology 31(3), 893-904+1p plate, 2001

40. M. Singh, S. Srivastava, AKS Rawat, Antimicrobial activities of Indian Berberis species, *Natural Product Science* 15(2), 60-65, 2009
41. T. Saravanakumar, P. Venkatasubramanian, NS Vasanthi, E Manonmani, Anti-microbial potential of Daruharidra (*Berberis aristata*) against the pathogen causing eye infection; *International Journal of Green Pharmacy*, 2014, vol.8(3), Pp. 153-157
42. S Chandel, U. Bagai, R. B. Semwal, D. K. Semwal, Antiplasmodial activity of aqueous extract of *Berberis aristata* against *Plasmodium berghei*-infected mice, *pharmaceutical biology* 53(12), 1735-1740, 2015
43. K.S.R. Pai, P. Srilatha, K Suryakant, M. M. Setty, P. G. Nayak, C. M. Rao & M.S. Baliga, Anticancer activity of *Berberis aristata* in Ehrlich ascites carcinoma-bearing mice: A preliminary study, *Pharmaceutical biology*, 50:3, 270-277, 2011
44. Mamatha Serasanambati, Shanmuga Reddy Chilakapati, Pavan Kumar Manikonda, and Jadeeswara Reddy Kanala, "Anticancer Activity of Methanolic Extract of *Berberis aristata* in MCF-7 Human Breast Cancer Cell Lines," *International Journal of Life Sciences Biotechnology and Pharma Research*, Vol. 4, No. 1, pp. 31-35, January 2015
45. Danapur V, Haleshi C, Sringswara AN. Endangered Medicinal Plant *Coscinium fenestratum* (Gaertn.) Colebr. - A Review. *Pharmacogn J.* 2020;12(5):1077-85
46. Vijay Danapur*, Haleshi C, Sringswara AN, Danapur, et al.: Endangered Medicinal Plant *Coscinium fenestratum* (Gaertn.) Colebr. - A Review, *Pharmacognosy Journal*, Vol 12, Issue 5, Sep-Oct, 2020

