RESEARCH ARTICLE

The pharmacognostical studies of *Berberis aristata* DC

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Abstract

Aim: To evaluate the Pharmacognostical studies of Berberis Aristata DC. **Material & Methods:** The plant was carefully collected and air dried under shade. The air dried materials was powdered and passed through 40 mesh sieve size and stored in an airtight container for further use. All WHO quality control standardization parameters like Microscopical characters, Macroscopical characters, Ash value, Extractive value, successive extraction, moisture content, foaming index, swelling index, fluorescence Analysis were perform according to standard prescribed methods. **Results & Discussion:** The current study was therefore carried out to provide requisite pharmacognostic details. Morphological, Microscopical, Physiochemical and Phytochemical aspects were carried out to identify the diagnostic features of *B. asiatica* root. Some of the diagnostic features of the root drug noted from the Microscopical study; lignified fiber, pitted sclerieds, prismatic calcium oxalate crystal, stone cells and medullary rays. Physicochemical studies revealed the presence of total ash value 3.10%; acid insoluble ash 0.4%; alcoholic extractive 10.8%; water soluble extractive 15.16%. Phytochemical screening shows the tannins, alkaloids, glycosides, starch so many chemical constituents present in *Berberis aristata* root. **Conclusion:** The study indicates that all standardization parameters of Berberis aristata was successfully evaluate and theses have diagnostic importance in authentication and quality control of Berberis aristata DC for the further use of this drug.Key words: *Berberis asiatica,* daruharidra, microscopical, physiochemical studies, phytochemical screening

INTRODUCTION

Berberis aristata DC, belonging to the family Berberidaceae, is a medicinal plant that is native to Nepal, India, Pakistan, and Jammu and Kashmir. It is commonly known as daruharidra. It is a large deciduous shrub, usually 1.7–3.5 m in height. The plant has glossy dark green and ovate leaves, stalked flowers and woody, yellowish brown roots with a thin covering of bark.[2,3,25,28] The roots, stems, leaves, and fruits of *B. aristata* are traditionally used to treat wounds, diabetes, inflammations, and jaundice.[4,6,8] The extracts of this plant have reported used as antibacterial, antiviral, antifungal, rheumatic arthritic treatment, anti-cancer, anti-inflammatory, and antidiabetic profiles.[18,19,22] The chemical constituent of Berberis is berberine,[1] xyacanthine, berbamine, berberrubine, columbamine, isotetrandrine, jatrorrhizine, oxycanthine, palmatine, stigmasterol glucoside, carbohydrates, organic acids, some vitamins, polyphenolic compounds, pectin, tannin, and mineral elements.[6-9] The most important constituent of the plant is berberine, a quaternary isoquinoline alkaloid that is typically found in the roots and stems [7,9,11,23,24] Various clinical trials on this alkaloid have established its therapeutic effects against cholera, severe diarrhea, amoebiasis, malaria neurological, and cardiovascular disorders.[14,20,22,23] The bark and root are the medicinal part of the plant. It is used as a single plant remedy or in polyherbal formulations, particularly in organized systems of medicine such as Ayurveda, Siddha, and Unani.

Standardization of Berberis root is done for the establishment of quality and identity profile of the drug for the purpose of safety monitoring and overall quality assurance of the industrially as well as commercially important drug. Therefore, in the present investigation, an attempt has been made to standardize *B. aristata* root using macroscopic and microscopical characters, powder microscopy, fluorescence analysis, physiochemical values,

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and phytochemical screening according to described methods.[10,17,21]

Therefore, the current study has been undertaken to establish the data for this species, which will be useful to pharmaceutical industries for the authentication of their commercial samples.

MATERIAL AND METHODS

Plant Material

The plant material was collected from the local market of New Delhi. The plant was identified as *B. aristata* DC family Berberidaceae by Dr. H.B Singh Ex. chief Taxonomist, National Institute of Science Communication and Information Resources New Delhi and in present chief scientist Herbology, Aimil pharmaceutical Pvt. Ltd. The plant was carefully collected and air dried under shade. The air-dried materials were powdered and passed through 40 mesh sieve size and stored in an airtight container for further use.

Standardization Parameters

Macroscopical characters

The morphological studies were carried out for shape, size, color, odor, and taste and fracture identification of the *B. aristata* root.[26]

Microscopic studies and powder analysis

The transverse sections of Berberis root were prepared using sharp razor then sections were treated with few amount of chloral hydrate. Best section was selected and mounted glycerin temporally and observed under light microscope.[15,16]

Powder microscopy

Powder of root was taken on glass slide and observed under light microscope.[16]

The behavior of the powdered drug with different chemical reagents was also studied under the fluorescence under ultraviolet (UV) 254 nm and UV 366 nm as per methods described.[10]

Quantitative microscopy

Leaf constants such as stomata index, stomata number, vein islet, vein termination, and palisade ratio of the drug were determined according to the method described.[16,17]

Physicochemical parameters

The various physiochemical values of seed such as ash values, extractive values, successive extraction, moisture content, foaming index, swelling index, and fluorescence analysis were determined according to the standard method.[21,27]

Phytochemical screening

The phytochemical evaluation of drug was carried out as per the method described (World Health Organization [WHO] Guidelines). *B. aristata* coarse dried root powder was extracted in a Soxhlet apparatus with petroleum ether, chloroform, acetone, methanol, and methanol: Water and aqueous successively. The extracts were evaporated to dryness under vacuum. These extracts were used for the analysis of different phytoconstituents, namely alkaloids, carbohydrate, phenolic, flavonoids, proteins, amino acids, saponins, steroids, mucilage, and resins.[12,13,20]

RESULTS AND DISCUSSION

The macroscopical characters of *B. aristata* root were thick woody yellow-brown, cylindrical, covered over the thin, brittle bark. Outer surface corky, grayish brown in color and prominently fissured both longitudinally and transversely. Bark was internally pale yellow, 4–6 mm in size, rough, fibrous with small fine ridges; hard fracture, short texture, internally smooth; phenolic odor present, and having bitter taste.

Leaves

The macroscopical characters of Berberis leaf are 3.7–8 by 1.4–3.2 cm, obovate or elliptic, entire or spinous-toothed, base gradually narrowed, with prominent reticulate nerves, glossy dark green in color, brittle, indistinct odor, and bitter taste.

Microscopical Characters Transverse Section

In the transverse section of root was found to be pith, xylem, phloem, stone cells, cork, medullary rays, phelloderm, secondary phloem, and pith.

Powder Microscopy

The powder of *B. aristata* root appeared to be yellow, fibrous with bitter taste. The fibers and stone cells are seen to be present almost everywhere. Fibrous and the stone cells are lignified and short; fibers are more thickened with vertical pits on their walls. Starch grains and prismatic calcium oxalate crystals were seen sparsely distributed Figures 1 and 2.

Quantitative Microscopy Leaf Constants

Leaf constants study such as stomata index, stomata number, vein islets, and vein termination was carried out. The results are present in Table 1.

Physiochemical Parameters

All physiochemical parameters ash value, extractive value, moisture contents, foreign matter foaming index, swelling

Table 1: Quantitative microscopy of *B. aristata* leaf

Vein termination number	Vein islets number	Stomata number	Stomatal index	Palasade ratio
5–10	10–15	6–8	10.34–12.76	4–6

B. asiatica: Berberis asiatica

Table 2: Physiochemical constants of *B. aristata*

Parameters	Results % w/w
Foreign matter	1.24
Loss on drying	6.8
Foaming index	<1
Swelling index	18.33
Ash values	
Total ash	3.16
Acid-insoluble ash	0.4
Water soluble ash	4.3
Extractive values	
Cold extract	
Pet ether	2.8
Chloroform	3.8
Acetone	1.2
Methanol	4.7
Hydro methanol	6.6
Aqueous	8.4
Hot extract	
Pet ether	2.1
Chloroform	4.4
Acetone	1.8
Methanol	6.1
Hydro methanol	7.65
Aqueous	8.08
Successive extract	
Pet ether	3.66
Chloroform	6.9
Acetone	3.3
Methanol	10.8
Hydro methanol	11.76
Aqueous	15.16

B. asiatica: Berberis asiatica

index, and fluorescence analysis were performed, and the results are present in Tables 2-4 and Figures 3-6.

Phytochemical Screening

Phytochemical screening is useful for the determination of the presence of significant chemical of constituents. The results are present in Table 4.

Figure 1: Berberis aristata root

Powder Microscopy

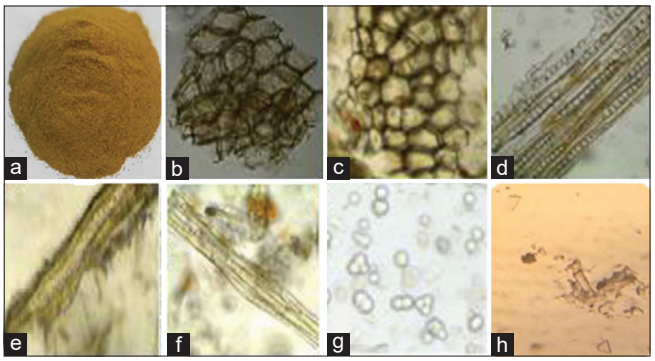

Figure 2: Powder microscopy – (a) Powdered root; (b) Cork cells; (c) Parenchymatous cells containing starch grains; (d) Tracheids and vessels along with medullary rays; (e) Lignified and pitted tracheid; (f) Fibers; (g) Prismatic crystals of calcium oxalate; (h) Starch grains

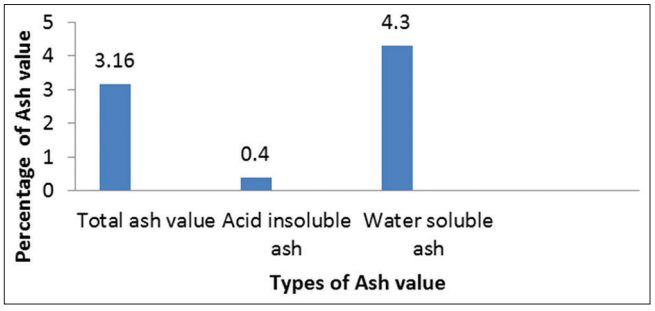

Figure 3: Ash value of *Berberis aristata*

CONCLUSION

To ensure reproducible quality of herbal products, proper control of starting material is utmost essential. Thus, in

Table 3: Fluorescence analysis of *B. aristata*

Reagent	Daylight	254 nm	366 nm
Drug powder as such	Gray	Light gray	Dark gray
Drug+Conc. HCl	Yellowish gray	Yellowish gray	Dark brown
Drug+Conc. HCl+Distilled water	Yellowish gray	Dark yellowish gray	Brown
Drug+Conc. HNO_3	Light yellowish brown	Brownish	Black
Drug+Conc. HNO_3+Distilled Water	Light yellowish brown	Brown	Black
Drug+Methanol	Yellowish gray	Yellowish brown	Black
Drug+Chloroform	Yellowish gray	Yellowish brown	Light brown
Drug+Petroleum ether	Light yellowish gray	Light brown	Brown

B. asiatica: Berberis asiatica

Table 4: Phytochemical screening of *B. aristata*

Chemical constituents	Pet ether	Chloroform	Acetone	Methanol	Methanol: water	Water
Alkaloids	–	–	+	+	+	+
Carbohydrates	–	–	–	+	+	+
Glycosides	+	+	–	–	+	–
Tannins	–	–	–	+	+	+
Flavonoids	–	–	–	–	+	+
Amino acids	–	–	–	–	+	+
Proteins	–	–	–	+	+	+
Mucilage	–	–	–	–	+	+
Starch	–	–	–	–	–	+
Terpenoid	+	+	–	–	–	–

+Present, –Not present

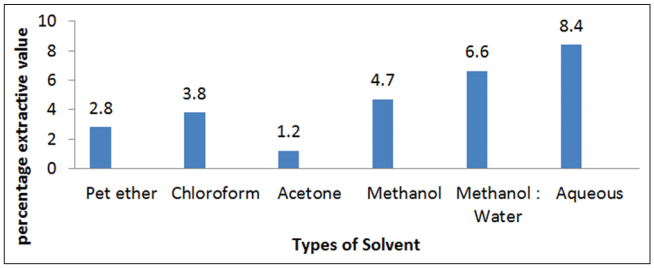

Figure 4: Cold extraction of *Berberis aristata*

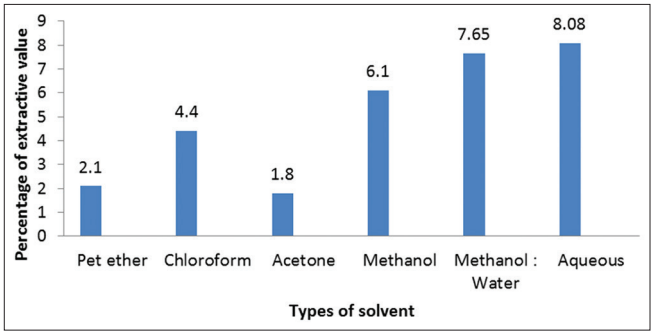

Figure 5: Hot extraction of *Berberis aristata*

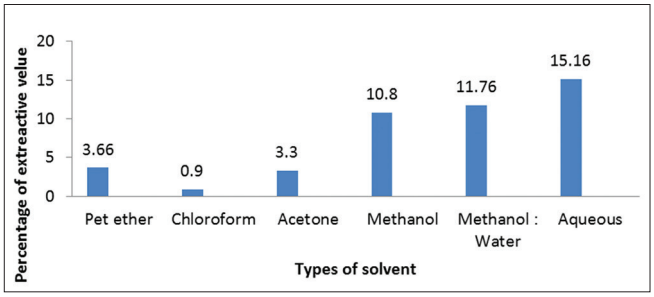

Figure 6: Successive extraction of *Berberis aristata*

recent years, there has been an emphasis on standardization of medicinal plants of therapeutic potential. According to the WHO, the macroscopic and microscopic description of a medicinal plant is the first step toward establishing its identity and purity and should be carried out before any tests are undertaken. Morphological evaluation is a technique of qualitative evaluation based on the study of morphological and sensory profiles of whole drugs. Evaluation of foreign matter was done for determination of contaminant and adulterative matters in drug. Evaluation of ash value helps to determine the quality and purity of crude drug. Evaluations of extractive values are useful for the qualitative and quantitative evaluation of crude drug. It shows the presence of specific constituents and their solubility in different solvents. In this study, hot extractive value was found to be more in comparison to cold extractive values and in the successive

solvent extraction polar solvents were had more extractive value in comparison to non-polar solvents. Phytochemical screening was useful for the determination of the presence of significant chemical classes of constituents. The results indicated the presence of (Berberine) alkaloid, flavonoids, amino acid, tannins, protein, starch, mucilage, and saponins. Swelling index is useful for the determination of presence of the mucilage content in the drug. Foaming index is useful for the determination of the presence of saponins contents in the drug. Fluorescence evaluation is the type of luminescence in which the molecule emits visible radiation passing from a higher to lower electronic state. This evaluation indicates the presence of constituents. All evaluation of *B. aristata* was successfully performed and theses are of diagnostic importance in authentication and quality control of *Berberis aristata* DC.

REFERENCES

1. Affuso F, Mercurio V, Fazio V, Fazio S. Cardiovascular and metabolic effects of berberine. World J Cardiol 2010;2:71-7.
2. Ali M, Malik A, Sharma KR. Vegetative propagation of *Berberis aristata* DC. An endangered Himalayan shrub. J Med Plants Res 2008;2:374-7.
3. Annonymous. The Wealth of India *Berberis* Linn. (*Berberidaceae*). In: Ambastha SP, editor. New Delhi: Publication and Information Directorate, CSIR; 1988. p. 114-8.
4. Ernodubov AI, Berestovaja MM. The Wealth of India A dictionary Indian Raw Materials and Industrial Products, Raw Materials. New Delhi: Council of Scientific and Industrial Research, CSIR; 2007. p. 135.
5. Anonymous. Quality Control Methods for Medicinal Plant Materials. 4th ed. New Delhi: WHO, Pharma; 1992. p. 492-559.
6. Anonymous. The Ayurvedic Pharmacopoeia of India. Part I. 1st ed. Vol. I. New Delhi: Ministry of Health and Family Welfare, Government of India, Department of Indian System of Medicine and Homoepathy; 2001. p. 139.
7. Ansari SH. Essentials of Pharmacognosy. 1st ed. New Delhi: Birla Publication Pvt Ltd.; 2005. p. 357-84.
8. Anonymous. Ayuevedic Pharmacopeia of India. Vol. 1. Part I. New Delhi: Ministry of Health and Family Welfare; 1996. p. 1, 43.
9. Bhakuni DS, Shoeb A, Popli SP. Studies in medicinal plants: Part I-chemical constituents of *Berberis asiatica* Roxb. Indian J Chem 1968;6:123.
10. Chase CR, Pratt RJ. Fluorescence of powdered vegetable drugs with particular reference to development of a system of identification. J Am Pharm Assoc 1949;38: 324-31.
11. CSIR. The Wealth of India: A dictionary Indian Raw Materials and Industrial Products Raw Materials. Vol. I. A-I. New Delhi: Council of Scientific and Industrial Research; 2007. p. 135.
12. Farnsworth NR. Biological and phytochemical screening of plants. J Pharm Science 1966;55:225-76.
13. Harborne JB. Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. 3rd ed. London: Chapman and Hall; 1998. p. 32-8.
14. Indian Herbal Pharmacopoeia. Mumbai: Indian Drugs Manufacturing Association (Regional Research Laboratory Jammu Tavi); 1999. p. 1, 33.
15. Johansen DA. Plant Microtechnique. 1st ed. New York, London: McGraw Hill Book Co Inc.; 1940. p. 182-203.
16. Kay LA. The microscopical studies of drugs. 1st ed. London: Bailliere Tindal and Cox; 1938. p. 18-21.
17. Khandelwal KR. Practical Pharmacognosy Techniques and Experiments. 19th ed. Pune: Nirali Prakashan; 2008. p. 149-56.
18. Kirthikar KR, Basu BD. Indian Medicinal Plants. Vol. I. Dehradun: International Book Distributors; 2005. p. 1064.
19. Kokate CK. Purohit AP, Gokhale SB. A Text Book of Pharmacognosy. 50th ed. Pune: Nirali publication; 2014. p. 15.32-15.33.
20. Lamichhane B, Adhikari S, Shrestha P, Shrestha BG. Study of phytochemical, antioxidant, antimicrobial and anticancer activity of *Berberis aristata*. J Trop Life Sci 2014;4:1-7.
21. Mukherjee PK. Evaluation of Indian traditional medicines. J Drug Inform 1996;35:631-40.
22. Pareek A, Suthar M. Anti-diabetic activity of extract of *Berberis aristata* root in streptozotocin induced diabetic rats. Pharmacologyonline 2010;2:179-85.
23. Potdar D, Hirwani R, Dhulap S. Phyto-chemical and pharmacological applications of *Berberis aristata*. Fitoterapia 2012;83:817-30.
24. Rastogi RP, Mehrotra BN. Compendium of Indian Medicinal Plants. Vol. 3. New Delhi: CDRI Lucknow and PID CSIR; 1993. p. 3.
25. Srivastava S, Rawat A. Quality evaluation of ayurvedic crude drug daruharidra, its allied species, and commercial samples from herbal drug markets of India. Evid Based Complement Alternat Med 2013;2013:1-14.
26. Srivastava SK, Khatoon S, Rawat AK, Mahrotra S, Pushpangandan P. Pharmacognostical evaluation of the root of *Berberis aristata* DC. Nat Prod Sci 2001;7:102-6.
27. Chaukhamba S, Bhishagratna KK. Sushrut Samhita. Vol. 1. Varanasi: Sutrasthanam Lakshadi Group; 1963. p. 354.
28. Wallis TE. Practical Pharmacognosy. London: J and A Churchill Ltd.; 1946. p. 185-6.

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