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Physico-chemical, phyto-chemical and elemental analysis of stem bark and roots of *Berberis asiatica*

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ABSTRACT

Berberis asiatica commonly known as Daruhaldi / Kilmora belongs to family Berberidaceae. It has been traditionally used for its anti-inflammatory, analgesic, antipyretic, diuretic, hepatoprotective, antimicrobial, antioxidant, strong wound healer, anti-rheumatic and immunogogue properties. In the present investigation physicochemical parameters viz. ash values (total ash and acid insoluble ash), extractives values (ethanol soluble and water soluble), elements viz. Na, Ca ,Zn, K, Cu, Mg, Co, Fe and Li along with biochemical parameters viz. moisture content, total carbohydrate and crude fibre and phytochemical constituents were determined. Results of physicochemical analyses revealed from the present study can be used as a diagnostic tool for the standardization and identification of plant. Phytochemical screening suggests that there is similarity in phytochemical profile of root and stem bark. Elemental analysis would be beneficial for determining effectiveness of Berberis asiatica stem bark and root in treating various diseases which occur due to mineral deficiency.

Keywords: *Berberis asiatica*, biochemical**,** Berberidaceae**,** phytochemical.

INTRODUCTION

The medicinal properties of plant species have made an outstanding contribution in the origin and evolution of many traditional herbal therapies [1]. Medicinal plants are important source for the therapeutic remedies of various ailments [2**]**. Plants continue to be a major source of medicine, as they have throughout human history [3]. Now-a-days there is a widespread interest in evaluating drugs derived from plant sources. This interest primarily stems from the belief that herbal medicine is safe and dependable, compared to costly synthetic drugs which are invariably associated with adverse effects [4]. It has been estimated by the World Health Organization that approximately 80% of the world's inhabitants rely mainly on traditional medicines for their primary health care [5]. The use of traditional medicine has increased in developed countries also, mainly due to the failure of modern medicine to provide effective treatment for chronic diseases and emergence of multi-drug resistant bacteria and parasites [6].

Berberis asiatica is a pretty evergreen thorny shrub, 1.8 to 2.4 m in height; commonly occur on the dry outer Himalaya from 600-2550 m from Kumaun eastwards and in Assam, Madhya Pradesh and Mount Abu. Its bark is light brown, rough, furrowed and somewhat corky. Twigs are glabrous or shortly pubescent, pale yellow. Leaves are 2.5-6.3 cm by 1.3-3 cm long, oblong, elliptic or broadly obovate, usually with large distinct spines. Fruits are 7-10

mm long and blue black in colour [7-11]. Diagnostic features of the root of *Berberis asiatica* include patches of pericyclic fiber, pitted sclerieds, berberine containing cells and heterocyclic medullary rays [12]. Root and stem bark of *Berberis asiatica* form a reputed drug in Ayurvedic Medicine. It contains several alkaloids *viz*., berberine, palmitine, jatrorrhizine, columbamine, tetrahydropalmitine, berbamine, oxyberberine, and oxyacanthine [13-15]. Its root is used for healing ulcer, in leucorrhea, opthalmia and jaundice. The dried extract of the root known as Rasault is bitter, tonic, cholagogue, used as a blood purifier, antipyretic, antiseptic, purgative for children and for external application in conjunctivitis. It has also been recommended for gastric and duodenal ulcers and for haemorrhoids both locally and internally [6,16,17,18]. Thick decoction of stem bark of *Berberis asiatica* was used to cure fever and bacterial infections [19].

The present investigation is important as *Berberis asiatica* plant comes under endangered plant species due to overexploitation of its root for medicinal uses. Similarity in phytochemical profile of root and stem bark may also show similarity in their pharmacological activities, so its root can be substituted with stem bark. This will be very beneficial to conserve *Berberis asiatica* plant. Although further study is required to establish similarity in their pharmacological activities. Evaluation of physicochemical parameters and elemental analysis would be helpful in the standardization and identification of crude drug.

MATERIALS AND METHODS

1. Collection and authentication of plant material

Berberis asiatica stem bark and root were collected from the herbal garden of Defence Institute of Bio-Energy Research (DIBER) field station Pithoragarh, Uttarakhand, India; which is situated at 5500 feet altitude in 29°35'N 80°13'E in the Western Himalayan region. The plant was authenticated by Botanical Survey of India, Dehradun, the voucher specimen were deposited to the herbarium of BSI with reference number BSI/NRC/Tech(ident.)/2011-12/257. The stem bark and root samples were dehydrated in a dehydration chamber below 40^{o}C, powdered with a mechanical grinder and stored in an air tight container for present study.

2. Physico-chemical evaluation

The various physico-chemical parameters like ash values (total ash, acid insoluble ash values) and extractives values (ethanol soluble and water soluble) were carried out according to the reported methods [20, 21].

3. Biochemical composition

The moisture content of stem bark and root was determined by AOAC method [22]. Total carbohydrate contents in plants were estimated by phenol-sulphuric acid method [23] and crude fibre was estimated by serial alkali and acid treatment method [23].

4. Mineral analysis

Macro and microelements were estimated by wet digestion method. 0.5 gram of dried sample (3 samples each) was first digested with 10 ml of triple acid mixture (10 parts of HNO_3 + 4 parts of $HClO_4$ + 2 parts of H_2SO_4) at 110^{o} C and reduced to about 1.0 ml. The digested residue was dissolved in double distilled water, filtered and diluted to 50 ml. This solution was used for the estimation of minerals. Macroelements *viz*., Na, K, Ca and Li were estimated by AIMIL flame photometer, while microelements *viz*., Fe, Cu, Mn, Zn and Co were estimated by Atomic Absorption Spectrophotometer Model 4129, electronic Corporation of India ltd.

5. Preliminary Phytochemical evaluation

Freshly prepared extracts of root and stem bark were tested for the presence of phytochemical constituents by using reported methods [24, 25].

RESULTS AND DISCUSSION

1. Physico-chemical analysis

Ash value is a criterion to judge the identity and purity of crude drugs [26]. Extractive value is useful for the evaluation of a crude drug as it gives idea about the nature of chemical constituents present in it and is useful for estimation of chemical constituents, soluble in that particular solvent used for extraction [27]. The physico-chemical constants of root and stem bark were carried out as per reported methods and the results have been shown in Table 1. It is evident from data that in roots of *Berberis asiatica* total ash (2.88%), acid insoluble ash (0.26%), water

soluble extractives (15.51%) and alcohol soluble extractives (13.50%) were found higher in comparison to stem bark.

2. Biochemical Composition

The biochemical composition of the stem bark and root of *Berberis asiatica* are shown in Table 2. In the present investigation percentage of moisture content was found higher (54.41%) in stem bark than in root (51.97%). Crude fibre consists largely of cellulose, lignin and some mineral matter. Crude fibre content is useful technique for differentiation of similar drugs [28], the results showed that *Berberis asiatica* root contains higher crude fibre (3.97 %) then stem bark (2.65%). There was not very significant difference in the carbohydrate content in roots and stem bark which were (31.82%) and (31.76%) respectively.

3. Mineral analysis

The results of elemental analysis are cited in Table 3. The data reveals that both root and stem bark of *Berberis asiatica* contains ample amount of macro and micro elements. Root of *Berberis asiatica* was found to be a good source of sodium (36.00 mg/100g), calcium (536.40 mg/100g) and zinc (20.00 mg/100g). While, stem bark was rich in potassium (301.10 mg/100g), lithium (6.83 mg), copper (3.06 mg), cobalt (.014 mg), manganese (15.76 mg) and iron (26.73 mg/100g) as compared to roots of the plant.

4. Preliminary Phytochemical screening

The phytochemical constituents present in plant exhibit great deal of medicinal importance of the drug. The present study interpretates the presence of phytoconstituents like tannins, flavonoids, alkaloids, steroids, saponins, phenols, carbohydrates, proteins and free amino acids in *Berberis asiatica* stem bark and root while glycosides was absent in both [Table 4]. Preliminary phytochemical screening suggests that there is similarity in phytochemical profile of root and stem bark. Different phytochemical constituent possess different pharmacological activities.

Table 1: Physico-chemical parameters of *Berberis asiatica* stem bark and root

S. No	Physico-chemical parameters	Results (% w/w)	
		Root	Stem bark
1.	Total ash	2.88 ± 0.015	2.30 ± 0.130
2.	Acid insoluble	0.26 ± 0.056	0.15 ± 0.045
3.	Water soluble extractives	15.51 ± 0.470	14.88 ± 0.699
4.	Alcohol soluble extractives	13.50 ± 0.650	11.52 ± 0.635

**all values are expressed as mean ±SD*

Table 2: Biochemical composition of *Berberis asiatica* stem bark and root

S. No	Biochemical Parameters	Composition	
		Root	Stem bark
1.	Moisture (%)	51.97 ± 1.60	54.41 ± 1.81
2.	Total carbohydrate (mg/100gm)	31.82± 0.95	30.76± 0.83
3.	Crude fiber (%)	3.97 ± 0.06	2.648 ± 0.05

**all values are expressed as mean ±SD*

Table 3: Elemental analyses of *Berberis asiatica* stem bark and root

S. No	Mineral	Composition (mg/100g)	
		Root	Stem bark
1.	Sodium (Na)	36.003 ± 1.603	20.893 ± 1.766
2.	Potassium (K	167.223 ± 1.845	301.106 ± 2.482
3.	Calcium (Ca)	536.40 ± 4.537	431.66 ± 1.322
4.	Lithium (Li)	5.006 ± 115	6.833 ± 0.305
5.	Iron (Fe)	21.35 ± 2.45	26.73 ± 3.557
6.	Copper (Cu)	2.166 ± 0.208	3.06 ± 0.321
7.	Manganese (Mn)	8.7 ± 1	15.76 ± 1.350
8.	Cobalt (Co)	nd[#]	0.143 ± 0.035
9.	Zinc (Zn)	20 ± 4.3	4.26 ± 0.832

**all values are expressed in mean ±SD, [#]not detected*

Table 4. Qualitative Phytochemical screening of *Berberis asiatica* stem bark and root

S. No	Phytoconstituents	Inference	
		Root	Stem bark
1.	Tannins	+	+
2.	Flavonoids	+	+
3.	Alkaloids	+	+
4.	Steroids	+	+
5.	Saponins	+	+
6.	Proteins and Free amino acids	+	+
7.	Glycosides	-	-
8.	Phenols	+	+
9.	Carbohydrates	+	+

+ present, - = absent

CONCLUSION

The present study could be used as a diagnostic tool for the standardization and identification of *Berberis asiatica*. Preliminary phytochemical screening suggests that there is similarity in phytochemical profile of roots and stem bark which are responsible for its pharmacological activities. *Berberis asiatica* roots and stem bark are very good source of macro and micro elements which also proves its effectiveness in curing different mineral deficiency related disorders.

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