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A composite review of Berberis in service of humanity-in-trouble: an ethnopharmacological and pharmacognosic perspective

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Key words: *Berberis*, Pharmacognosy, Diseases, Ethnopharmacology, Berberine, Therapeutic, Cancer, Diabetes, HIV/AIDS.

Abstract

Berberis, being one of the oldest therapeutic sources has been frequently used in traditional and modern health care systems across the globe. It is included in pharmacopoeia of British, India, China and several other Homeopathic Materia Medica. Out of 29 (6-7%) *Berberis* species reported for their various ethnobotanical uses, seventeen (n=17, 3-4%) were found are used to treat almost hundred (n=100) human diseases ranging from skin irritation to diabetes, cardiac ailments and acquired immune deficiency syndrome (HIV/AIDS). Among these species, *B. lyceum* exhibited the widest utility scope with thirty seven (n=37) diseases followed by *B. aristata/ chitria* (n=32), *B. pseudumbellata* (n=18), *B. holstii* (n=18), *B. vulgaris/kunawurensis* (n=17), *B. asiatica* (n=16), *B. jeshkeana* (n=11), *B. aquifolium* (n=4), *B. petiolaris* (n=3), *B. ulicina* (n=3), *B. tinctoria* (n=2), *B. haematocarpa* (n=2), *B. walichina* (n=2), *B. crataegina* (2), *B. pachyacantha* (n=1) and *B. coriacea* (n=1). Different diseases showed differential number of *Berberis* species used for their treatment. Jaundice and hepatic disorders are treated with ten (n=10, 5.92%) different species. Eye (opthalemic), malaria and fever were treated using 8 (4.73%), 6 (3.55%) and 5 (2.96%) species respectively. Fifty seven percent (n=53, 57%) diseases are treated with different but single species. Review revealed that *Berberis* species a great potential source for alternative, safer, effective, less expensive use, instead of various in-effective, expensive and unsafe allopathic medication. Study was aimed at exploration of various *Berberis* species used for different human diseases along with their scale and scope.

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Introduction

According to World Health Organization (WHO), about 80% (almost 3 billion) people in developing countries are dependent on traditional practices for healthcare (Kala, 2000). Medicinal plants have been critical source for healthcare of indigenous communities around the world and have helped humanity in advancement of health management (Basak *et al.,* 2010; Muthu *et al.,* 2006; Makkar *et al.,* 2007). Even in present day, several societies rely on phyto-therapy (Muthu *et al.,* 2006; Uniyal *et al.,* 2006; Shinwari, 2010). Moreover, among many others', they were the ultimate source of medicinal therapy until synthetic drugs were developed in the 19th century (Djeridane *et al.*, 2006; Mollik *et al.* 2010). Ethnobotany compliments ethno pharmacological practices which have enhancing effect on advancement of modern medicine used to treat most pressing medical issues faced by the humanity today (Sheng-Ji. 2001).

Berberis is the largest genus among other *ca.* 16 genera of dicotyledonous family, Berberidaceae. It contains almost 70-80% (n=450) of total species in the family (Khan *et. al.* 2014; Perveen and Qaiser 2010; Bottini *et al.* 2007; Duke *et al.* 2002; Loconte, 1993). Almost all the members of the genus found across the Northern Hemisphere (Perveen and Qaiser, 2010; Loconte, 1993). *Berberis* being one of the very important medicinal plant species used extensively across several herbal medication systems including Eastern, Ayurvedic, Unani, Homeopathic and Modern systems (Sing *et al.*, 2008, Chopra *et al.*, 1981; Chandra and Purohit, 1980; Jain, 1994). Besides, several Homeopathic Materia Medica it is also included in British, Chinese, Indian and Iranian Herbal Pharmacopoeias (Minaiyan *et al.* 2011; Chopra & Chopra, 1933; Xaio, 1983). With known scientific understanding, Berberis contains Berberine, which is one of the most active therapeutic agents (Ji & Shen, 2011; Joshi *et al.* 2011; Tang *et al.* 2009).

Berberis species are used for treatment of several diseases and some most important are cancer, Cutaneous leishmaniasis; diabetes mellitus, jaundice, enlargement of spleen, acquired immune deficiency syndrome (AIDS), osteoporosis, postmenopausal osteo-porosis, cardiovascular ailments, digestive com-plaints, ocular trachoma, hypertension, infectious diseases, cholera, diarrhea, Giardiasis, dysentery, eye troubles, leprosy and bone fractures etc. (Khan *et al.*, 2013; Yogesh *et al.* 2011; Sing *et al.*, 2008; Ahmad *et al.* 2008; Gulfraz *et al.* 2008; Asif *et al.*, 2007; Fata *et al.* 2006; Fatehi *et al.*, 2005; Caraballo *et al.*, 2004; Kuo *et al.*, 2004; Villinski *et al.*, 2003; Janbaza and Gilanib, 2000; Hwang *et al.*, 2002; Ivanoska and Philipov, 1997; Koo and Seang, 1996; Chopra *et al.*, 1981; Chandra and Purohit, 1980; Gupte, 1975).

This study was aimed at investigations into available literature, both online and prints, to document *Berberis* and its therapeutic uses (pharmacological and pharmacognosic) across global community in practice for treatment of various human diseases and ailments. Different excellent review are available which focus either species, or their certain feature or a geographic location or region or any of their character like taxonomic characters and present review focus on genus and therapeutic character specific but without any geographical limitation which was missing in global literature.

Material and methods

Historical background

One can find good reviews on different medicinal plants including *Berberis,* however, there was a definite need to consolidate all available globally stretched and dispersed data into one window on therapeutic features of *Berberis* species without any discrimination of location, country, region, species, character and need.

Geographical and material scope

Review details with global literature inclusive of all *Berberis* species reported with pharmacological and pharmacognosic features in general and traditional uses practiced across various cultural communities of the world in particular. This review does not focus

any community, region or any species and have been included without any discrimination.

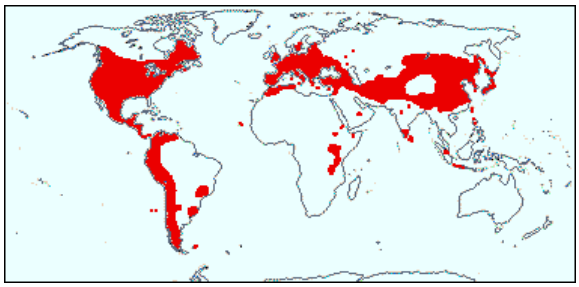

Fig. 1. Distribution of Berberis species across the globe. Map taken from Ahrendt 1961 and optimized.

Sources of review

Review has focused on available online research papers, journals, data bases (i.e. PubMed, Phytochemical and Ethnobotanical Databases (Dr. Duke's Phytochemical and Ethnobotanical Databases), Plants for a Future, Patents Database, International Bibliographic Information on Dietary Supplements (IBIDS), HerbMed, AGRICOLA (AGRICultural OnLine Access), American Indian Ethnobotany Database, Operated by the Natural Products Alert Project (NAPRALERT), AyuHerbal Catalog of Indian Medicinal Plants, CAM on PubMed, EthnobotDB and American Indian Ethnobotany Database), other digital resources in access at libraries and print material. We do not claim to access 100% material however, maximum efforts have been made to include reported *Berberis* species with different ethnobotanical uses, various treatments in practice among traditional communities and their pharmacological and pharmacognosic features.

Data analysis

Data so gathered has been processed, analyzed and projected using Microsoft Excel-2010, Microsoft Office Picture Manager and Statistical Package for Social Sciences (SPSS).

Results

Berberis for treatment

At least 29 *Berberis* species have been reported to be used infrequently for almost hundred (100) diseases across the globe (table 1). *Berberis* is used for treatment of various infectious, non-infectious and several physiological diseases ranging from its use as an antiseptic agent to dealing with cancer and AIDS. Different *Berberis* species with differential use scope have been reported which can be categorized into five different groups. These groups may be as following;

1. *Berberis* without Pharmacognosy
2. One disease-one *Berberis* (Mono-Barberry)
3. *Berberis* for two diseases (Di-Barberry)
4. *Berberis* for 3-9 diseases (Oligo-Barberry)
5. *Berberis* for more than 10 diseases (Poly-Barberry)

1. Berberis without Pharmacognosy

There are hundreds of *Berberis* species reported taxonomically and even with ethnobotanical uses but without any utility reported for treatment of any diseases. Such members of *Berberis* are grouped into '*Berberis* without pharmacognosic' use. Out of 29 *Berberis* species reported for various ethnobotanical uses, at least 13 found no record available under the given scientific name about its use as drugs or medicine (fig. 2). Some of these *Berberis* species are *B. aetnensis*, *B. aetnensis, B. holstii, B. brandisiana, B. orthobotrys, B. orthobotrys* subsp. *orthobotrys, B.* subsp. *umbellata, B.* subsp. *gilgitica, B. parkeriana, B. thunbergii, B. sargentiana, B. buxifolia, B. canadensis, B. ruscifolia*. However, in some cases, these species or subspecies are used as drugs but have been mentioned its species nomenclature and not its subspecies, e.g.

B. pseudumbellata subsp. *gilgitica* and

B. pseudumbellata subsp. *pseudumbellata*.

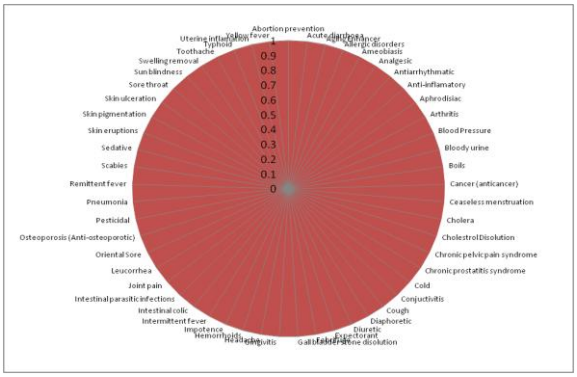

Fig. 2. Shows diseases treated using only one berberis species.

Table 1. Comprehensive details of diseases and various *Berberis* species reported for their pharmacognosic and ethnobotanical uses globally.

S.No. & Citation #	Diseases	jeshkeana	Aristata/ Chitria	Asiatica	aetnensis	tinctoria	holstii	Lycium	Brandisiana	orthobotrys	orthobotrys	Pseudumbe	sb.umbellata	sb. gilgitica	pachyacantha	parkeriana	thunbergii	aquifolium	sargentiana	vulgaris/kunawurensis	buxifolia	canadensis	haematocarpa	holstii	petiolaris	ulicina	walichina	coriacea	ruscifofia	crataegina
	Spp #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1	Abortion prevention																							x						
2	Acute diarrhoea											x																		
3	Aging Enhancer																			X										
4,.1	AIDS																	x		X										
5	Allergic disorders		x																											
6	Ameobiasis											x																		
7	Analgesic																													x
8	Antiarrhythmic																			X										
9	Anti-inflammatory																													x
10	Aphrodisiac																							x						
11	Arthritis		x																											
12,.1	Asthma			x																				x						
13,.1	Astringent	x																		X										
14,.1-.3	Backache							x				x												x						
15,.1,.2	Bleeding piles		x					x																						
16	Blood Pressure		x																											
17,.1-.3	Blood Purifier	x						x												X										
18	Bloody urine																							x						
19,.1	Body pains							x																x						
20	Boils		x																											
21,.1,.2	Bone fractures							x				x																		
22,.1-.3	Cancer (anticancer)		x																											
23,.1	Cardiac		x																	X										
24	Ceaseless menstruation																							x						
25	Cholera											x																		
26	Cholesterol Dissolution																			X										
27	Chronic pelvic pain syndrome																						x							
28	Chronic prostatitis syndrome																						x							
29	Cold		x																											
30,.1	Conjunctivitis		x																											
31,.1	Cough							x																						
32,.1-.8	Diabetes		x					x												X										
33	Diaphoretic							x																						
34,.1-.9	Diarrhea (anti-diarrhea)		x			x		x																						
35,.1	Diuretic	x						x												X										
36	Ear Troubles			x				x																						
37,.1	Enlarge liver		x					x																						
38	Expectorant							x																						
39,.1-.13	Eye (Ophthalmic)	x	x	x				x				x								X					x	x				

S.No. & Citation #	Diseases	jeshkeana	Aristata/ Chitria	Asiatica	aetnensis	tinctoria	holstii	Lycium	Brandisiana	orthobotrys	orthobotrys	Pseudumbe	sb.umbellata	sb. gilgitica	pachyacantha	parkeriana	thunbergii	aquifolium	sargentiana	vulgaris/kunawurensis	buxifolia	canadensis	haematocarpa	holstii	petiolaris	ulicina	walichina	coriacea	ruscifofia	crataegna
	Spp #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
40,.1-.5	Febrifuge							x																						
41,.1-.5	Fever	x	x									x												x		x				
42	Gall bladder stone dissolution																			X										
43	Gingivitis							x																						
44	Headache																							x						
45,.1	Hemorrhoids		x																											
46	Impotence																							x						
47,.1	Inflammation (anti)acute and chronic			x																X										
48	Intermittent fever							x																						
49,.1-.8	Internal wounds							x				x																		
50,.1	Intestinal colic							x																						
51,.1,.2	Intestinal disorder							x				x																		
52	Intestinal parasitic infections					x																								
53,.1-.14	Jaundice	x	x	x				x				x						x		X				x	x		x			
54	Joint pain							x																						
55,.1	Kidney related																													x
56,.1	Leucorrhea		x																											
57,.1-.3	Liver (hepatic)	x	x	x				x										x		X					x		x	x		
58,.1	Liver congestion																			X										
59,.1-.4	Malaria	x	x	x								x								X				x						
60,.1-.3	Menorrhagia	x	x					x																						
61,.1	Mouth ulcer		x	x																										
62	Oriental Sore											x																		
63,.1	Osteoporosis (Anti-osteoporotic)		x																											
64	Pesticidal							x																						
65,.1	Piles			x				x																						
66	Pneumonia																							x						
67	Pustules		x					x																						
68	Remittent fever							x																						
69,.1-.3	Rheumatism		x					x				x																		
70	Scabies							x																						
71	Sedative																			x										
72,.1	Sexually transmitted infections																	x						x						
73,.1-.3	Skin Diseases	x						x				x								x										
74	Skin eruptions		x																											
75	Skin pigmentation			x																										
76,.1	Skin ulceration		x																											
77	Snake bite		x	x																										
78,.1	Sore throat																							x						
79,.1	Spleen enlargement		x					x																						

S.No. & Citation #	Diseases	jeshkeana	Aristata/ Chitria	Asiatica	aetnensis	tinctoria	holstii	Lycium	Brandisiana	orthobotrys	orthobotrys	Pseudumbe	sb.umbellata	sb. gilgitica	pachyacantha	parkeriana	thunbergii	aquifolium	sargentiana	vulgaris/kunawurensis	buxifolia	canadensis	haematocarpa	holstii	petiolaris	ulicina	walichina	coriacea	ruscifofia	crataegna
	Spp #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
80,.1-.3	Stomach pain/Stomachache			x				x				x												x						
81	Sun blindness							x																						
82	Swelling removal			x																										
83,.1-.4	Throat pain							x				x																		
84	Tonic	x										x			x											x				
85	Toothache			x																										
86	Typhoid		x																											
87,.1	Ulcer stomach		x	x				x																						
88,.1,.2	Urinary problem			x								x																		
89	Uterine inflammation		x																											
90	Women specific																													
91,.1,.2	Wounds external		x					x																x						
92	Yellow fever																							x						
93,.1	Obesity reducing							x																						

2. One disease-one Berberis (Mono-Barberry)

During the study there are at-least three (3) species found to be used to treat only one human disease (fig. 2 & 3). These *Berberis* species are *B. pachyacantha, B. aquifolium and B. coriacea*. There are at-least fifty three (53) diseases are reported to be treated using only one *Berberis* species (table 1 & fig. 4). Results show, that on an average each *Berberis* species serve (treated) almost 18 (n=17.66) diseases.

3. Berberis for two diseases (Di-Barberry)

Study reveals that there are at-least four (4) *Berberis* species found with pharmacognosic characteristics used for treatment of only two (2) human diseases. These *Berberis* species *are B. tinctoria, B. haematocarpa, B. walichina, B. crataegina* (fig. 3). These species are used for diverse diseases and some common, however in total diversity, there are at-least twenty one (21) ailments are recorded. Furthermore, when averages are calculated between *Berberis* versus number of diseases, each *Berberis* is used to treat at-least 5 (n=5.25) diseases.

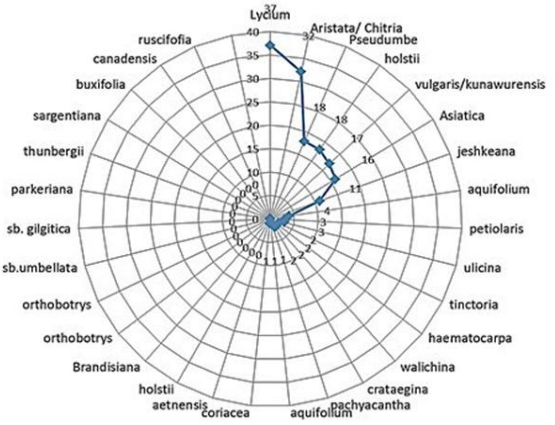

Fig. 3. Shows Berberis spp. used for various (number) diseases.

4. Berberis for 3-9 diseases (Oligo-Barberry)

There are two (n=2) *Berberis* species found having treatment record for three to nine (n=3-9) diseases (fig. 3). These species are *B. petiolaris* and *B. ulicina* (table 1, fig. 3 & 4). Under this category, only nine (n=9) diseases are recorded with a maximum average of 4.5 diseases for each species.

4. Berberis for more than 10 diseases (Poly-Barberry)

There are eight (n=8) *Berberis* species with wider pharmacognosic scope ranging from it use for treatment of 4 human diseases to a maximum of 37 ailments. These species are *B. lycium* (n=37), *B. aristata/chitria* (n=32), *B. pseudumbellata* (n=18), *B. holstii* (n=18), *B. vulgaris/ kunawurensis* (n= 17), *B. asiatica* (n=16), *B. jeshkeana* (n=11) and *B. aquifolium* (n=4). *Berberis Lycium* shows a maximum of thirty seven (n=37) which is the highest record of its pharmacognosic utility scope (fig. 3, 4 & table 1). There are eighty three (n=83) diseases recorded treated by these eight species in total making an average of 10 (10.4) for each species.

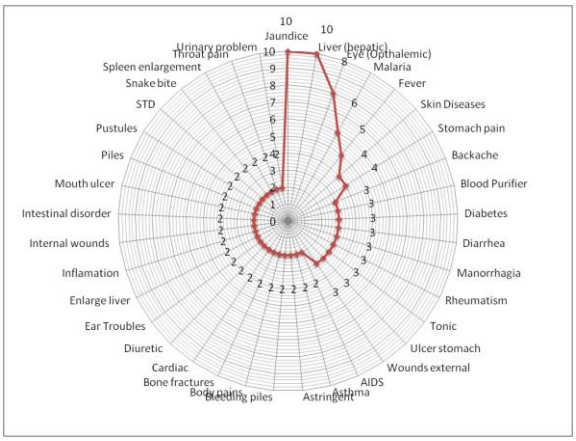

Fig. 4. Shows *Berberis* spp. used for various (number) diseases.

Discussion

Taxonomic and field based studies have documented almost 450 *Berberis* species from all over the world (Landrum, 1999; Ahrendt, 1961). Moreover, almost all of these species found across Northern Hemisphere except few species reported from Southern Hemisphere (Landrum, 1999; Chamberlain and Hu, 1975). Out of total described species, only six percent (6.0-6.5%) *Berberis* species have been stated for their ethnobotanical uses globally. Whereas, only 3-4% (n=17) have been explored for being used as drugs or medicine traditionally and allopathically. Most of the data gathered in this regard comes from Asia exhibiting and supporting the idea of previous researchers that Asia is home of *Berberis*. Traditional communities across these countries are valuable for their folk wisdom and ethnobotanical practices carried over thousands of years. However, ethnobotanical knowledge is on decline and therefore, it is important to explore ethnobotanical information, knowledge, skills and wisdom before it is further depreciated (Khan *et al.* 2013). Such documentation enables humanity to diversify and come up with alternatives for healthcare and challenging health issues.

Berberis species reported without any pharmacognosic characteristics are limited (n=13) because of lack of taxonomic description such as use of name of subspecies, varieties or forma. Which means that present number i.e. 17 species with pharmacognosic character is arbitrary and it can rise, even all of these species can be used for different diseases. In doing so *B. pseudumbellata* subsp. *gilgitica* and *B. pseudumbellata* subsp. *pseudumbellata* have also not been reported for their ethnopharmacological use and are represented as *B. pseudumbellata* only.

Berberis is an important medicinal plant with potential alternative to several allopathic medicines used to treat cancer, diabetes mellitus and several others described in the table. Furthermore, this medicinal plant offers safer, cheap and easy access. It also exhibit potential to replace available drugs used to cure cancer and other challenging diseases in future. Further scientific investigations can help thousands of traditional and pro-poor communities to impact their poverty if its products are diversified and made them available in the market.

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References

Ahmad R, Srivastava SP, Maurya R, Rajendran SM, Arya KR, Srivastava AK. 2008.

Mild antihyperglycaemic activity in Eclipta alba, Berberis aristata, Betula utilis, Cedrus deodara, Myristica fragrans and Terminalia chebula. Indian Journal of Science and Technology **1(5),** 1-6.

Ahrendt LWA. 1961. Berberis and Mahonia: a taxonomic revision. Journal of Linnaean Society of London, Botany **57,** 1–410.

Adhikari BS, Babu MM, Saklani PL, Rawat GS. 2007. Distribution, use pattern and prospects for conservation of medicinal shrubs in Uttaranchal State, India. Journal of Mountain Science **4(2)**, 155-180.

Afzal S, Afzal N, Awan MR, Khan TS, Gilani A, Khanum R, Tariq S. 2009. Ethno-botanical studies from northern Pakistan. J. Ayub. Med. Col. Abbott **21(1),** 52-57.

Ahamad J, Mir SR, Naquvi KJ. 2012. Hypoglycemic activity of aqueous extract of Berberis aristata stems bark in STZ induced rats. Int J Pharm Pharm Sci **4(2),** 473–474.

Ahmed E, Arshad M, Ahmad M, Saeed M, Ishaque M. 2004. Ethnopharmacological survey of some medicinally important plants of Galliyat areas of NWFP, Pakistan. Asian. J. Pl. Sci **3(4),** 410-415.

Ahmed M, Alamgeer, Sharif T, Zabta CHM, Akbar A. 2009. Effect of Berberis lycium Royle on Lipid Profile in Alloxan Induced Diabetic Rabbits. Ethnobot. Leaflets **13**, 702-708.

Ali M, Malik AR, Sharma KR. 2008. Vegetative propagation of Berberis aristata DC. An endangered Himalayan shrub. Journal of Medicinal Plants Research **2(12)**, 374-377.

Anonymous. 2014. Indian Science.org. retrieved from http://www.indianscience.org/essays/20-%20E--Himalayan%20Medicine%20System%20fine12.pdf on July 7, 2014.

Asif A, Kabub G, Mehmood S, Khunum R, Gulfraz M. 2007. Wound healing activity of root extract of Berberis Lyceum Royle in rats. Phytother. Research **21**, 589-591.

Awan MR, Jamal Z, Khan A. 2013. Ethno-Botanical Studies Of Economically Important Plants From Mountainous Region Of Gilgit-Baltistan, Pakistan. Sci., Tech. and Dev **32 (4),** 308-318.

Babber OP, Chhatwal VK, Ray IB, Mehra MK. 1982. Effects of berberine chloride eye drops on clinically positive trachoma patients Indian. J. Med. Res **76**, 83-88.

Baquar SR. 1989. Medicinal and Poisonous plants of Pakistan, (Karachi, Pakistan: Printas) p.55.

Basak S, Sarma GC, Rangan L. 2010. Ethnomedical uses of Zingiberaceous plants of Northeast India. Journal of Ethnopharmacology **132(1),** 286-296.

Bashir S, Gilani AH, Siddiqui AA, Pervez S, Khan SR, Sarfaraz NJ, Shah AJ. 2010. Berberis vulgaris root bark extract prevents hyperoxaluria induced urolithiasis in rats. Phytotherapy Research **24(8),** 1250-1255.

Bhupendra S, Adhikari *et al*. 2007. Distribution, Use Pattern and Prospects for Conservation of Medicinal Shrubs in Uttaranchal State, India. .Journal of Mountain Science **4(2),** 155-180. DOI: 10.1007/s11629-007-0155-8.

Bottini MCJ, De Bustos A, Sanso AM, Jouve N, Poggio L. 2007. Relationships in Patagonian species of Berberis (Berberidaceae) based on the characterization of rDNA internal transcribed spacer sequences. Botanical Journal of the Linnean Society **153(3),** 321-328. DOI: 10.1111/j.1095-8339.2007.00586.x.

Caraballo A, Caraballo B, Rodríguez-Acosta A. 2004. Preliminary assessment of medicinal plants used as antimalarials in the southeastern Venezuelan

Amazon. Revista da SociedadeBrasileira de Medicina Tropical **37(2),** 186–188.

Chamberlain DF, Hu CM. 1975. A synopsis of Berberis section Wallichianae. Notes from the Royal Botanic Garden Edinburgh **42(3),** 529-557.

Chandra P, Purohit AN. 1980. Berberine contents and alkaloid profile of Berberis species from different altitudes. Biochemical Systematics and Ecology **8(4),** 379–380.

Chopra M, Chatterji A, Pakrashi SC. 1981. The treatise on Indian medicinal plants CSIR, New Delhi pp. 33-35.

Chopra RN, Chopra IC. 1933. Indigenous drugs of India. Academic publishers.

Das S, Das MK, Mazumder PM, Das S, Basu SP. 2009. Cytotoxic activity of methanolic extract of Berberis aristata DC on colon cancer. Global Journal of Pharmacology **3(3),** 137-140.

Das I, Singh Y, Ansari SA, Agrawal NR. 2005. In vitro dissolution of gallbladder stone by edible leaves, fruits and homoeopathic medicines. Journal of crystal growth **283(3),** 508-513.

Deepak P, Gopal GV. 2014. Ethnomedicinal Practices of Kurumba Tribes, Niligiri District, Tamil Nadu, India, In Treating Skin Diseases. Global J Res. Med. Plants & Indigen. Med.| Volume **3(1),** 8-16.

Dev S. 2006. A selection of prime ayurvedic plants drugs ancient- modern concordance. Anamaya Publishers, New Delhi.

Djeridane A, Yousfi M, Nadjemi B, Boutassouna D, Stocker P, Vidal N. 2006. Antioxidant activity of some Algerian medicinal plants extracts containing phenolic compounds. Food Chemistry **97(4),** 654-660.

Duke JA, Godwin MB, Decellier J, Duke PA. 2002. CRC- Hand Book on Medicinal Plants. Taylor and Francis. Inc pub.SBN-13, Edition 2, pp 821.

Fata A, Rakhshandeh H, Berenji F, Jalalifard A. 2006. Treatment of cutaneous leishmaniasis in murine model by alcoholic extract of Berberis vulgaris. Iranian J Parasitol **1(1),** 39-42.

Fatehi M, Saleh TM, Fatehi-Hassanabad Z, Farrokhfal K, Jafarzadeh M, Davodi S. 2005. A pharmacological study on Berberis vulgaris fruit extract. Journal of Ethnopharmacology **102(1),** 46–52.

Gilani AH, Janbaz KH, Aziz N, Herzig MJU, Kazmi MM, Choudhary MI, Herzig JW. 1999. Possible mechanism of selective inotropic activity of the n-butanolic fraction from Berberis aristata fruit. Gen Pharmacol **33(5),** 407–414.

Gosh AK, Bhattacharyya FK, Ghosh DK. 1990. Leishmania donovani: A mastigote Inhibition and mode of action of berberine. Exp. Para **60(3).** 404-413.

Gulfraz M, Mehmood S, Ahmad A, Fatima N, Praveen Z, Williamson EM. 2008. Comparison of the antidiabetic activity of Berberis lyceum root extract and berberine in alloxan-induced diabetic rats. Phytotherapy Research **22(9),** 1208-1212.

Gupte S. 1975. Use of berberine in treatment of giardiasis. American Journal of Diseases of Children **129(7),** 866-866.

Hamayun M, Khan A, Khan MA 2005. Common Medicinal Folk Recipes of District Buner, NWFP, Pakistan. Ethnobot. Leaflets **1,** 45.

Hamayun M, Khan SA, Sohn EY, In-jung L. 2006. Folk medicinal knowledge and conservation status of some economically valued medicinal plants of District Swat Pakistan. Lyonia **11(2),** 101-113.

Hedberg I, Hedberg O, Madati PJ, Mshigeni KE, Mshiu EN, Samuelsson G. 1982. Inventory of plants used in traditional medicine in Tanzania I. Plants of the families Acanthaceae - Cucurbitaceae. J. Ethnopharmacol **6,** 29-60.

Himalaya. 2014. Indian Berberry, Tree Turmeric (Berberis aristata DC.). Retrieved from http://www.himalayawellness.com/herbfinder/berberis-aristata.htm on June 28, 2014.

Hussain I, Bano A, Ullah F. 2011. Traditional drug therapies from various medicinal plants of central Karakoram National Park, Gilgit-Baltistan, Pakistan. Pak J Bot **10**, 79-84.

Hussain I, Bano A, Ullah F. 2011. Traditional Drug Therapies From Various Medicinal Plants Of Central Karakoram National Park, Gilgit-Baltistan, Pakistan. Pak. J. Bot., **43,** 79-84, Special Issue, December, (Medicinal Plants: Conservation & Sustainable use).

Hussain MA, Khan MQ, Habib T, Hussain N. 2011. Antimicronbial activity of the crude root extract of Berberis lycium Royle. Adv Environ Biol **5(4),** 585–588.

Hwang Jin-Ming, Wang Chau-Jong, Chou Feu-Pi, Tseng Tsui-Hwa, Hsieh Yih-Shou, Lin Wea-Lung, Chu Chia-Yih. 2002. Inhibitory effect of Berberine on tert-butyl hydroperoxide induced oxidative damage in rat liver. Archives of Toxicology **76(11),** 664-670.

Ivanoska N, Philipov S. 1997. Study on the anti-inflammatory action of Berberis vulgaris root extracts, alkaloid fractions and pure alkaloid. International Journal of Immunopharmacology **18(10),** 553–561.

Jain SK. 1994. Ethnobotany and research in medicinal plants in India. Ethnobot. Search New Drugs **185**, 153-168.

Janbaza KH, Gilanib AH. 2000. Studies on preventive and curative effects of Berberine on chemical-induced hepatotoxicity in rodents. Fitoterapia **71(1),** 25–33.

Joshi PV, Shirkhedkar AA, Prakash K, Maheshwari VL. 2011. Antidiarrheal activity, chemical and toxicity profile of Berberis aristata. Pharm Biol **49(1),** 94–100.

Kala CP. 2000. Status and conservation of rare and endangered medicinal plants in the Indian trans-Himalaya. Biological Conservation **93(3),** 371-379.

Kala CP. 2006. Medicinal plants of the high altitude cold desert in India: diversity, distribution and traditional uses. The International Journal of Biodiversity Science and Management **2(1),** 43-56.

Karimov A. 1993. Berberis alkaloids. Chem Nat Compd **29(4),** 415–438.

Kaur C, Miani SB. 2001. Fruits and vegetables health foods for new millennium. Indian Hort **45(4),** 29-32.

Khan AA, Ashfaq A, Ali MN. 1979. Pharmacognostic Studies of Selected Indigenous Plants of Pakistan. (Peshawar: Spinezer Printers, Pakistan Forest Institute).

Khan M, Giessrgl B, Vonach C, Madlener S, Prinz S, Herbaceck I, Hölzl C, Bauer S, Viola K, Mikulits W, Quereshi RA, Knasmüller S, Grusch M, Kopp B, Krupitza G. 2010. Berberine and a Berberis lycium extract inactivate Cdc25A and induce α tubulin acetylation that correlate with HL-60 cell cycle inhibition and apoptosis. Mut. Res **683**, 123-130.

Khan MA, Kkan MA, Hussain M. 2012. Medicinal plants used in folk recipes by the inhabitants of Himalayan Region Poonch valley Azad Kashmir (Pakistan). J. Basic. Appl. Sci **8,** 35-45.

Khan SM, Page S, Ahmad H, Harper D. 2012. Anthropogenic influences on the natural ecosystem of the Narran valley in the western Himalayas. Pak. J. Bot **44**, 231-238, Special Issue May 2012.

Khan T, Khan IA, Ahmed K, Rehman A. 2014. Differential levels of susceptibility of Berberis species

to insect attack at various altitudes in Karakoram Ranges. International Journal of Biosciences **4(5),** 92-101. DOI: http://dx.doi.org/10.12692/ijb/4.5.92-101.

Khan T, Khan IA, Rehman A, Alam J, Ali S. 2013. Exploration of near-extinct folk wisdom on medicinally important plants from Shinaki Valley Hunza, Pakistan. International Journal of Biosciences **3(10),** 180-186.

Khan SM, Ahmad H, Page S, Harper DM. 2012. Anthropogenic influences on the natural ecosystem of the Naran Valley in the western Himalayas. Pakistan Journal of Botany **44**, 231-238.

Kiasalari Z, Khalili M, Ahmadi P. 2011. Effect of alcoholic extract of Berberis vulgaris fruit on acute and chronic inflammation in male rats. J Babol Univ Med Sci **13(1),** 28–35.

Kirtikar KR, Basu BD. 1998. Indian medicinal plants, vol 1 CSIR publication, India.

Kokwaro JO. 1993. Medicinal plants of East Africa. Kenya Literature Bureau, Nairobi.

Koo L, Seang K. 1996. Inhibitory effect of protoberberine alkaloids from the roots of Coptis japonica on chatecolamine biosynthesis in PC12 cells. PlantaMedica **62(1),** 31-34.

Kuo CL, Chi CW, Liu TY. 2004. The anti-inflammatory potential of Berberine in vitro and in vivo. Cancer Letters **203(2),** 127–137.

Landrum LR. 1999. Revision of Berberis (Berberidaceae) in Chile and adjacent southern Argentina. Annals of the Missouri Botanical Garden 793-834.

Loconte H. 1993. Berberidaceae. The Families and Genera of Vascular Plants. II. Flowering Plants-Dicotyledons.(Eds.): K. Kubitzki, J.G. Rohwer & V. Bittrich. Springer-Verlag: Berlín.

Mahmood A, Ahmad M, Jabeen A, Zafar M, Nadeem S. 2005. Pharmacognostic Studies of Some Indigenous Medicinal Plants of Pakistan. Ethnobot. Leaflets **9,** 20.

Mahmood A, Mahmood A, Malik RN. 2012. Indigenous knowledge of medicinal plants from Leepa valley, Azad Jammu and Kashmir, Pakistan. Journal of ethnopharmacology **143(1),** 338-346.

Makkar HPS, Francis G, Becker K. 2007. Bioactivity of phytochemicals in some lesser-known plants and their effects and potential applications in livestock and aquaculture production systems.

Meliani N, Dib MEA, Allali H, Tabti B. 2011. Hypoglycaemic effect of Berberis vulgaris L in normal and streptozotocin-induced diabetic rats. Asian Pac J Trop Biomed **1(6),** 468–471.

Minaiyan M, Ghannadi A, Mahzouni P, Jaffari -Shirazi E. 2011. Comparative study of Berberis vulgaris fruit extract and berberine chloride effects on acetic acid-induced colitis in rats. Iranian journal of pharmaceutical research: IJPR **10(1),** 97.

Mohan M, Pant MCR, Angea SK, Mahajan VM. 1982. Berberine in trachoma. Indian J. Ophthalmol **30**, 69-75.

Mollik *et al.* 2010. A survey of medicinal plant usage by folk medicinal practitioners in two villages by the Rupsha River in Bagerhat district, Bangladesh. American-Eurasian Journal of Sustainable Agriculture **4(3),** 349-356.

Muthu C, Ayyanar M, Raja N, Ignacimuthu S. 2006. Journal of Ethnobiology and Ethnomedicine. Journal of Ethnobiology and Ethnomedicine **2**, 43.

Negi CS, Nautiyal S, Dasila L, Rao KS, Maihkuri RK. 2002. Ethnomedicinal Plant Uses in a Small Tribal Community in a Part of Central Himalaya, India. J. Hum. Ecol **14(1),** 23–31.

Nyirenda CP. 2008. The conservation biology of Berberis holstii Engl. in Nyika National Park, Malawi.

Pandak JRWM, Zhou H. 2010. Berberine inhibits HIV protease inhibitor-induced inflammatory response by modulating ER stress signaling pathways in murine macrophages. PLoS One **5(2),** e9069.

Perveen A, Qaiser M. 2010. Pollen flora of Pakistan–LXV. berberidaceae. Pakistan Journal of Botany **42(1),** 1-6.

Peychev L. 2005. Pharmacological investigation on the cardiovascular effects of Berberis vulgaris on tested animals. Pharmacia **52**, 118-121.

Prihoda ND, Arjanova OV, Yurchenko LV, Sokolenko NI, Vihrova LA, Pylypchuk VS, Kutsyna GA. 2007. Open label trial of adjuvant immunotherapy with Dzherelo, Svitanok, and Lizorm, in MDR-TB, XDR-TB and TB/HIV co-infected patients receiving anti-tuberculosis therapy under DOT. Journal of Medicinal Plants Research **1(5),** 117-122.

Qureshi *et al.* 2009. Indigenous Medicinal Plants Used By Local Women In Southern Himalayan Regions Of Pakistan. Pak. J. Bot **41(1),** 19-25.

Rajasekaran A, Kumar N. 2009. Rasont-A traditional crude drug prepared from Berberis spp and its uses. Indian journal of traditional knowledge **8(4)**, 562-563.

Roy A, Sahu RK, Gupta R, Pandey P. 2011. Hepatoprotective activity of Berberis coriaceae on liver damage induced by CCL4 in rats. Pharmacologyonline **3,** 838–842.

Sack RB, Froelich JL. 1982. Berberine inhibits intestinal secretor response of vibro choleare and Escherichia coli enteroxian. Infected Immunology **35**, 471- 475.

Schaffer SaHM. 2005. Understanding local Mediterranean diets: A multidisciplinary pharmacological and ethnobotanical approach. Pharmacological Research, **52**, 353 - 366.

Shamsa F, Ahmadiani A, Khosrokhavar R. 1999. Antihistaminic and anticholinergic activity of barberry fruit (Berberis vulgaris) in the guinea-pig ileum. J Ethanopharmacol **64(2),** 161–166.

Sharma C, Aneja KR, Kasera R. 2011. Screening of Berberis aristata DC for antimicrobial potential against the pathogens causing ear infection. Int J Pharmacol **7(4),** 536–541; 56.

Sharma LN, Vetaas OR, Chaudhary RP, Måren IE. 2014. Ecological consequences of land use change: Forest structure and regeneration across the forest-grassland ecotone in mountain pastures in Nepal. Journal of Mountain Science **11(4),** 838-849. DOI: 10.1007/s11629-013-2849-4.

Sheng-Ji P. 2001. Ethnobotanical approaches of traditional medicine studies: some experiences from Asia. Pharmaceutical biology **39(s1),** 74-79.

Shinwari ZK. 2010. Medicinal plants research in Pakistan. J Med Plants Res **4(3),** 161-176.

Sing R, Tiwari SS, Srivastava S, Ravat AK. 2012. Botanical and phytochemical studies on roots of Berberis umbellate Wall. ex G Don. Indian J Nat Prod Resour **3(1),** 55-60.

Sood P, Modgil R, Sood M. 2012. Berberis lycium, a medicinal plant with immense value. Ind J Pharmaceut Biol Res **1(1),** 1-8.

Tait Y, Harper J. 1999. Haemochromatosis. Australian Journal of Medical Herbalism **11(1),** 41.

Tang J, Feng Y, Tsao S, Wang N, Curtain R, Wang Y. 2009. Berberine and Coptidis rhizoma as novel antineoplastic agents: a review of traditional

use and biomedical investigations. Journal of ethnopharmacology **126(1),** 5-17.

Tewary DK, Bhardwaj A, Shanker A. 2005. Pesticidal activities in five medicinal plants collected from mid hills of western Himalayas. Indus. Crop. Prod **22,** 241-247.

Tiwari JK, Dangwal LR, Rana CS, Tiwari P, Ballabha R. 2010. Indigenous uses of plant species in Nanda Devi Biosphere Reserve, Uttarakhand, India. Repo. Opin **2(2),** 58-61.

Tripathi YB, Shukla SD. 1996. Berberis aristata inhibits PAF induced aggregation of rabbit platelets. Phytother Res **10(7),** 628–630.

Tuzlacı E, Erol MK. 1999. Turkish folk medicinal plants. Part II: Eğirdir (Isparta). Fitoterapia **70(6),** 593-610.

Uniyal SK, Singh KN, Jamwal P, Lal B. 2006. Traditional use of medicinal plants among the tribal communities of Chhota Bhangal, Western Himalaya. Journal of Ethnobiology and Ethnomedicine **2(1),** 14.

Upwar N, Patel R, Waseem N, Mahobia NK. 2011. Hypoglycemic effect of methanolic extract of Berberis aristata DC stem on normal and streptozotocin induced diabetic rats. Int J Pharm Pharm Sci **3(1),** 222–224.

Usmanghani K, Saeed A, Alam MT. 1997. Indusyunic medicine, (Karachi, Pakistan: University of Karachi press) p.120.

Vermani K, Garg S. 2002. Herbal medicines for sexually transmitted diseases and AIDS. Journal of Ethnopharmacology **80(1),** 49-66.

Villinski RJ, Dumas ER, Chai HB, Pezzuto JM, Angerhofer CK, Gafner S. 2003. Antibacterial activity and alkaloid content of Berberis thunbergii, Berberis vulgaris and Hydrastiscanadensis. Pharmaceutical Biology **41(8)**, 551-557.

Waseem M, Shah MA, Qureshi RA, Iqbal M, Afza R, Yousaf S. 2006. Ethnopharmacological Survey of Plants Used for the Treatment of Stomach, Diabetes, and Ophthalmic Diseases in Sudhan Gali, Kashmir, Pakistan. Acta. Bot. Yunn **28(5),** 535.

Xaio P. 1983. Recent developments on medicinal plants in China. Journal of ethnopharmacology **7(1),** 95-109.

Yarnell E, Abascal K. 2005. Natural Approaches to Treating Chronic Prostatitis and Chronic Pelvic Pain Syndromes. Alternative & Complementary Therapies **11**, 246 - 251.

Yeşilada E, Küpeli E. 2002. Berberis crataegina DC root exhibits potent anti-inflammatory, analgesic and febrifuge effects in mice and rats. J Ethnopharmacol **79(2),** 237–248.

Yogesh HS, Chandrashekhar VM, Katti HR, Ganapaty S, Raghavendra HL, Gowda GK, Goplakhrishna B. 2011. Anti-osteoporotic activity of aqueous-methanol extract of Berberis aristata in ovariectomized rats. Journal of ethnopharmacology **134(2),** 334-338.

Zabihullah Q, Rashid A, Akhtar N. 2006. Ethnobotanical survey in kot Manzaray Baba valley Malakand agency, Pakistan. Pak. J. Plant Sci **12(2),** 115-121.

Zaman MB, Khan S. 1970. Hundred Drug Plants of West Pakistan. (Peshawar, NWFP, Pakistan: Pakistan Forest Institute).

Zha W, Liang G, Xiao J, Studer EJ, Hylemon PB, Pandak JrWM, Zhou H. 2010. Berberine inhibits HIV protease inhibitor-induced inflammatory response by modulating ER stress signaling pathways in murine macrophages. PLoS One **5(2),** e9069.