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Studies on assessment of *Berberis* role across high mountainous traditional landscapes of Western Karakorum Mountain Ranges

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Abstract

Berberis is a wonderful medicinal plant used for various reasons by different communities across traditional landscape of Western Karakoram Mountain Ranges. Since 1950s, its naturally attuned existence faces adverse pressures from bulging human and livestock populations. Out of two subspecies, *Berberis pseudumbellata* subsp. *gilgitica* has become critically endangered. Present study was an attempt to assess and explore its uses and their contribution towards its survival and future consequences. A total of 373 people interviewed differentially responded regarding its diverse uses i.e. medicine (92.2%), firewood (19.3%), commercial (2.41%), cultural (2.41%), fodder (16.08%), fencing (19.03%) and grazing (100%). Data was analyzed using Pearson correlational coefficient and student t-test. With the degeneration in ethnobotanical wisdom over generations, its population has also declined. Habitat loss and overgrazing are two major adverse physical factors affecting its population dynamics.

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Introduction

Berberis is the most pronounced genus among other 13 established genera of family Berberidaceae (Adhikari *et al.* 2012; Khan et. al. 2014; Perveen and Qaiser 2010; Bottini *et al.* 2007; Duke *et al.* 2002; Landrum 1999; Loconte 1993; Loconte 1984; Chamberlain and Hu 1975). The family includes about 715 species and genus Berberis contains almost 496 species (Adhikari *et al.* 2012). It shows a global distribution. Except very few species, almost all (>95%) members found across northern hemisphere (Tiwari *et. al.* 2012; Perveen and Qaiser 2010; Chamberlain and Hu 1975; Landrum 1999; Loconte 1993). Berberis has two important centres of diversity: Eurasia with c.300 species mainly in the Himalayas and in China, and South America with c.200 (Landrum 1999; Ahrendt, 1961).

In Pakistan, there are 29 Berberis species have been identified (eFlora 2014). However, 14 species have been reported from Gilgit-Baltistan by several researchers. *Berberis pseudumbellata* subsp. *gilgitica* is endemic to Gilgit-Baltistan and has become critically endangered (Khan *et al.* 2014; Alam and Ali 2010). Different ethno-lingual races in the study area use two local names commonly to call Berberis i.e. 'Ishkeen and Churkuye'. Almost 70-75% population calls it 'Ishkeen'. Shina language is widely spoken language in the area.

Berberis is one of the important medicinal plant used as a very common ingredient in herbal medication systems viz; Eastern, Ayurvedic, Unani and modern system of medicines (Sing *et al.*, 2008, Chopra *et al.*, 1981; Chandra and Purohit, 1980). It has been reported useful in treatment of cancer, diabetes, jaundice, enlargement of spleen, AIDS, osteoporosis, cardiovascular ailments, ocular trachoma, hypertension, infectious diseases, cholera, diarrhea, dysentery, eye troubles, leprosy and bone fractures etc. (Khan *et al.*, 2013; Sing *et al.*, 2008; Asif *et al.*, 2007; 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).

Detailed investigation of each plant species would reveal more important insights in relation to socio-cultural, ecological, religious and commercial aspects (Deil *et al.* 2005; Taylor *et al.* 2001). Such a detailed study of individual species may enable development and academic communities to exploit them wisely to impact poverty, market marginalization and potential advancement in creation of alternatives towards health care practices (Garrity 2004; Roe and Elliott 2004; Scherl 2004; Reynolds *et al.* 2005).

Traditional communities across Gilgit-Baltistan are mostly dependent on the natural resources for meeting their medicinal, food, shelter, economic and other livelihood purposes (Ali *et al.* 2008; Khan and Khatoon 2007; Pie and Manandhar 1987). Ethnobotanical investigations are important not only for health care but also critical to establish and continue an ecological balance between human and nature (Balée 1994; Gómez-Baggethun *et al.* 2010).

A growing number of ethnobotanists and anthropologists have univocally reported fast erosion of ethnobotanical folk wisdom around the world (Khan *et al.* 2013a; Sheng-Ji 2001; Begossi *et al.* 2002; Case *et al.* 2005; Lozada *et al.* 2006; Monteiro *et al.* 2006; Ferguson and Messier 1997; Pieroni *et al.* 2004; Shanley and Rosa 2004; Anderson 2005; Zent 2001; Turner and Turner 2008; Khan *et al.* 2013; Hamayaun 2005). According to Hocking (1958) people among these traditional communities were 84% dependent on their indigenous folk medication practices. However, Khan *et al.* (2013) reported that in Hunza Valley people have lost ethnomedication practices and only a minor fragment (1.4%) use to practice.

Present study was aimed at assessment of Berberis role, its uses and its impact on the lives of rural mountainous communities living across traditional landscape of Western Karakorum Mountain Ranges.

In present scenario, these societies need special attention to explore them scientifically which has never been realized before (Qureshi *et al.*, 2006).

Material and methods

Geography of study area

Study was under taken across 27 villages distributed across three major valleys composing Western part of Karakoram Mountain Range falling in the extreme Western part of Central Karakoram National Park (CKNP). These valleys are Bagrot, Rahimabad-Naltar and Rakaposhi (Nagar). CKNP is unique for its geomorphological, biodiversity and socio-cultural spectra. Keeping in view its global importance, it was declared as National Park in 1993. It is the largest protected area (10,000 km²) in Pakistan having biggest glacial mass in the world outside poles. It extends over 35°N to 36.5°N Latitude and from 74°E to 77°E Longitude (Khan *et al.* 2014).

Fig. 1. Study area reflected within the geographical range of Gilgit-Baltistan and Karakoram Mountain Range.

Socio-cultural makeup

Area is inhabited by 16 major tribes speaking four different languages of distinct origins i.e. Shina, Brushaski, Gujari, Domaki. Settlements start from the river bed to sub-alpine zones (1300 m to 3500 m above sea level). Very recently, most of the area is accessible by jeep connected through link roads or pony tracts. More than 13 villages have become connected with Karakoram Highway constructed in seventies (1970s).

Sampling

***Sample frame*:** Sample frame was consisting upon three (3) major valleys stretched over 27 villages with 5480 households. A total of 52,048 souls are living in the study area. Population is living in small and medium sized settlements (villages) with dense or sparse distribution.

***Sample size*:** Using mathematical calculations and sample size (ss) calculator a total of 382 (male 197, 52.81%; female 176, 47.18%) sample size was calculated. However, during the course of study only 373 individuals were interviewed. This makes 97.6% of the total sample size drawn. Sample size (both male and female) was divided into three age groups each making a total of six (6) different groups i.e. below thirty (≤30 = 130, 34.85%), in-between 31 and 60 (≥31≤60 = 143, 38.33%) and above 61 (≥61 = 100, 26.80%).

***Sampling type*:** During the survey, stratified random sampling technique was employed across purposefully categorized geographic, gender and age strata.

Data collection: A detailed structured instrument was used to collect uniform data from different strata of sample. Personal observations were also recorded to supplement the questionnaire data collection (Kvist *et al.* 2001). Questionnaire was oriented to maximize quantification of responses (Fraser and Junqueira 2010).

Data processing and analysis

Data gathered using instrument was digitized into MS Excel 2010 and then transferred to SPSS v.16.1. Various descriptive and inferential techniques were applied to analyze data including frequencies, standard error of mean, Pearson correlational coefficient, student t-test and regression analysis were performed.

Results and discussion

Berberis uses

Berberis is used for various purposes. These needs can be categorized into at least six (6) broad classes

viz; medicinal, firewood, fencing, grazing, fodder, commercial and cultural. Cultural use is negligible and infrequent (n=9; 2.41%).

Medicinal use

Most frequent annually used quantities are; 1.4 kg (n=119, 33.9 %), 1.0 kg (n=54, 15.5%), 0.25 kg (n=47, 13.4%) and 0.5 kg (n=25, 7.1%). On an average each household in the area uses 1.17 kg annually (fig. 2).

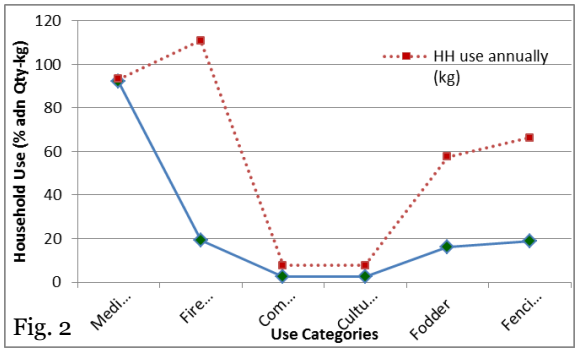

Fig. 2

Firewood

Among 11 quantitative categories mentioned, 36 kg (n=24, 6.4% and valid % = 33.3) is the most frequent quantity used. However, people most commonly use quantities fall in-between 10 kg and 36 kg (Fig. 2). In the valley of Bagrot a total of 2.244 MT (34.02%), in Rahimabad-Naltar 4.311 MT (65.34%) and in Rakaposhi it is only 42 kg (0.63%).

Sale

A total sale during 2012-13 was only 48 kg (Fig. 2). Among valleys, Bagrot 16 kg (33.33%) and Rahimabad-Naltar 32 kg (66.67%). This study did not record any sale in Nagar Valley.

Fodder

Amongst different quantities used, 150 kg (n=21, 35.0%), 180 kgs (n=6, 10%) and 300 kgs (n=6, 10%) per annum. Remaining categories were less common used by only 5% (n=3) each. A total of 8724 kg (8.724 MT) Berberis is collected every year for fodder purpose. Every year in Bagrot, 2908 kg (2.908 MT, 33.33%) and Rahimabad-Naltar 5486 kg (5.486 MT; 62.88%) is being collected. Nagar (Rakaposhi) valley as compared to others shows a least trend of using Berberis as fodder i.e. 330 kg (3.78%) annually. Statistical presentation shows a positive but very weak correlation between fodder quantitative ranks and their use frequency. Communities more frequently use quantities ranging between 150-300 kg per annum (Fig. 2).

Fencing

Berberis use for fencing purpose is one of the major consumption sites. Quantities used fall between 12 kg and 300 kg. Among all 20 kg (n= 26, 7.0%; Valid percent 36.6%) is the most frequent consumption quantity followed by 72 kg (n= 15, 4.0%; Valid percent 21.1%), 25 kg (n=9, 2.4%; Valid percent 12.7%) and 15 kg (n=5, 1.3%; Valid percent 11.3%). Remaining six (6) categories showed lesser frequency (< n= 3, < 1.0%; Valid percent < 4.2%) of use. A total of 3.352 MT is used annually in the area.

Population change

For the last fifty (50) years, there is no change in Berberis population (n=200, 53.6%). However, 30.3% (n=113) still believe that population has changed. Furthermore, 16.1% (n=60) people told that they do not know whether it has changed or not.

Change direction: Out of change believers 12.9% (n=48) told that population has decreased significantly (Fig. 7). However, 14.5% (n=54) favor a slight decreased. Whereas, 2.1% (n=8) interviewee told that the population has increased significantly, for 1,6% (n=6) there is a slight increase in the population.

Population change factors

Only 27.9% (n=104) respondents said that plantation (n=6:1.6%) has healthy contribution towards population growth. However, commercialization (n=21: 5.6%), over grazing (n=23: 6.2%), development activities (n=32: 8.6%), medicinal exploitation (n=6: 1.6%) and other (n=16: 4.3%) factors have negative impact. Population change factor analysis shows that developmental activities are the most ruinous factor followed by over grazing

and commercialization, to name top three ones. This change has occurred across all varieties (general) and not to a specific variety. Moreover, this change is 94.23% unhealthy and only 5.76% healthy (Fig. 3).

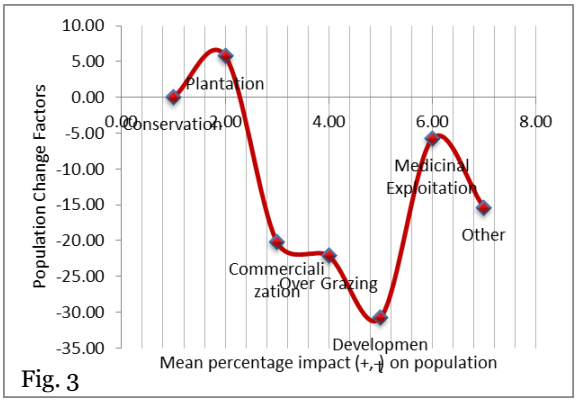

Fig. 3

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References

Adhikari B, Pendry CA, Pennington RT, Milne RI. 2012. A REVISION OF BERBERIS SS (BERBERIDACEAE) IN NEPAL. Edinburgh Journal of Botany, **69(3),** 447.

Alam J, Ali SI. 2010. Contribution to the red list of the Plants of Pakistan. Pakistan Journal of Botany **42(5)**, 2967-2971

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

Ali SI, Qaiser M. 1986. A phytogeographical analysis of the phanerogams of Pakistan and Kashmir. Proc. Royal. Soc. Edinburgh., **89**: 89-101.

Anderson TR. 2005. Plankton functional type modeling: running before we can walk? Journal of Plankton Research **27**, 1073-1081

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.

Balée W. 1994. Footprints of the forest: Ka'apor ethnobotany. The historical ecology of plant utilization by an Amazonian people.

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

Begossi A, Hanazaki N, Tamashiro JY. 2002. Medicinal plants and the Atlantic Forest (Brazil): knowledge, use and conservation. Human Ecology **30**, 281-299.

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.

Case RJ, Pauli GF, Soejarto DD. 2005. Factors in Maintaining Indigenous Knowledge among Ethnic Communities of Manus Island. Economic Botany **59**, 356–365.

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.

Deil U, Culmsee H, Berriane M. 2005. Sacred Groves in Morocco: A Society's Conservation of nature for spiritual reasons'. Silva Carelica, **49**, 185-201.

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

El-Hilaly J, Hmammouchi M, Lyoussi B. 2003. Ethnobotanical studies and economic evaluation of medicinal plants in Taounate province (Northern Morocco). Journal of Ethnopharmacology, **86(2)**, 149-158.

eFlora. 2014. eFlora of Pakistan. Flora of Pakista. Retrieved from http://www.efloras.org/browse.aspx?flora_id=5&name_str=berberis&btnSearch=Search on November 1, 2014.

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.

Fraser JA, Junqueira AB. 2010. How important is a use? Critical reflection on the conceptualization of use and importance in quantitative ethnomedicine In: UP Albuquerque, N Hanazaki (Eds.): Recent Development and Case Studies in Ethno medicine. Brazilian Society of Ethno-biology and Ethno-ecology: Publication Group of Ecology and Applied Ethno-medicine NUPEEA, pp. 113-126.

Ferguson M, Messier F. 1997. Collection and analysis of traditional ecological knowledge about a population of Arctic tundra caribou. Arctic; **50**,17–28.

Garrity DP. 2004. Agroforestry and the achievement of the Millennium Development Goals. Agroforestry Systems, **61(1-3)**, 5-17.

Gómez-Baggethun ERIK, Mingorría S, Reyes-García VICTORIA, Calvet L, Montes C. 2010. Traditional ecological knowledge trends in the transition to a market economy: empirical study in the Donana natural areas. Conservation Biology, **24(3)**, 721-729.

Hamayaun M. 2005. Ethnobotanical Studies of some Useful Shrubs and Trees of District Buner, NWFP, Pakistan. Ethnobotany leaflets.

Hocking GM. 1958. Pakistan Medicinal Plants I, Qualitas Plantarum Et. Material Vegetabiles., **5**, 145-153.

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.

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. 1996. Study on the anti-inflammatory action of Berberis vulgaris root extracts, alkaloid fractions and pure alkaloid. International Journal of Immunopharmacology **18(10)**, 553–561.

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

Kvist LP, Gram S, Cácares A, Ore I. 2001. 'Socio-economy of Flood Plain Households in the Peruvian Amazon', Forest Ecology and Management, **150**, 175–86

Khan SW, Khatoon S. 2007. Ethnobotanical Studies on useful trees and shrubs of Haramosh and Bagrot valleys, in Gilgit Northern Areas of Pakistan. Pakistan Journal of Botany **39(3)**, 699-710.

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.

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.

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.

Lozada M, Ladio A, Weigandt M. 2006. Cultural transmission of ethnobotanical knowledge in a rural community of northwestern Patagonia, Argentina. Econ. Bot., **60**, 374-385.

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.

Monteiro JM, Albuquerque AP, Lins-Neto EMF, Araújo EL, Amorim ELC. 2006. Use patterns and knowledge of medicinal species among two rural communities in Brazil's semi-arid northeastern region. J Ethnopharmacol **105**, 173-186.

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

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

Phillips O, Gentry AH. 1993. The useful plants of Tambopata, Peru: I. Statistical hypotheses tests with a new quantitative technique. Economic Botany, **47(1)**, 15-32.

Pie SJ, Manandhar NP. 1987. Sources of some local medicine in the Himalayan region. Himalayan Ecosys. p. 97-112.

Pieroni A, Quave C, Santoro R. 2004. Folk pharmaceutical knowledge in the territory of the Dolomiti Lucane, inland southern Italy. Journal of Ethnopharmacology **95**, 373–384.

Qureshi RA, Ahmah I, Ishtiaq M. 2006. Ethnobotany and phytosociological studies of Tehsil Gugar Khan district Rawalpindi, Pakistan. Asian J. Plant Sci., **5(5)**, 890-893.

Reynolds SG, Batello C, Baas S, Mack S. 2005. Grassland and forage to improve livelihoods and reduce poverty. Grassland: A global resource. Wageningen Academic Publishers, Wageningen, the Netherlands, 323-338.

Roe D, Elliott J. 2004. Poverty reduction and biodiversity conservation: rebuilding the bridges. Oryx, **38(02)**, 137-139.

Scherl LM. (Ed.). 2004. Can protected areas contribute to poverty reduction?: opportunities and limitations. IUCN.

Shanley P, Rosa NA. 2004. Eroding knowledge: An ethnobotanical inventory in eastern Amazonia's logging frontier. Economic Botany **58(2)**, 135–160.

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

Sher H, Hussain F. 2009. Ethnobotanical evaluation of some plant resources in Northern part of Pakistan. African journal of Biotechnology, **8(17).**

Taylor JLS, Rabe T, McGaw LJ, Jäger AK, Van Staden J. 2001. Towards the scientific validation of traditional medicinal plants. Plant Growth Regulation, **34(1)**, 23-37.

Tiwari UL, Adhikari BS, Rawat GS. 2012. A checklist of Berberidaceae in Uttarakhand, Western Himalaya, India. Check List, **8(4)**, 610-616.

Turner NJ, Turner K. 2008. "Where our women used to get the food": cumulative effects and loss of ethnobotanical knowledge and practice; case study from coastal British Columbia. Botany **86**,103–115.

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.

Zent S. 2001. Acculturation and ethnobotanical knowledge loss among the Piaroa of Venezuela: Demonstration of a quantitative method for the empirical study of traditional ecological knowledge change. In On biocultural diversity: Linking language, knowledge, and the environment. Maffi, L., editor. 190–211.Washington, D.C Smithsonian Institution Press.