Pakistan Journal of Applied Sciences 3 (6): 370-375, 2003
ISSN 1607-8926

Physiochemical Composition of Wild Medicinal Plant *Berberis lycium*

Hamidullah Shah, Anwar Ali Shad, [1]Sajida Perveen,
[2]Somia Khattak and [3]Khanzadi Fatima Khattak
Department of Agricultural Chemistry,
[1]Department of Soil and Environmental Sciences,
NWFP Agricultural University Peshawar, Pakistan
[2]Department of Chemistry, Peshawar University, Peshawar, Pakistan
[3]Nuclear Institute for Food and Agricultural, Tarnab, Peshawar, Pakistan

Abstract: The present research work was carried out to study the chemical and mineral constituents of possible pharmacological interest of the wild medicinal plant ***Berberis lycium***. Mean values of the data revealed that leaves have maximum moisture content (59.84±0.19%) followed by shoot and root (44.75±0.25%, 31.55±0.05%, respectively). The result of this study indicate that the content of moisture, ash and protein (31.55±0.05, 1.30±0.01, 2.40±0.04%, respectively) increased in different parts in descending order i.e. root < shoot < leaves whereas fat and fiber contents (0.46±0.01, 43.85±0.46%, respectively) decreased in ascending order i.e. root > shoot > leaves. Analysis of the data suggested that NFE for shoot (11.29±0.25%) lies between those for roots and leaves. When different elemental composition in the separate parts of the ***Berberis lycium*** was taken into an account, it was revealed that Zn, Cu and Na were maximum (56.15±0.01,95.67±0.12, 115.00±0.03 μg g^{-1}, respectively) in root and while Mn, P, Ca (136.12±0.01, 1315.00±0.01, 2389.00±0.04 μg g^{-1}, respectively) in leaves whereas K (5824.00±0.58 μg g^{-1}, respectively) in shoot. The mean weight percentage distribution of ***Berberis lycium*** revealed that shoot had maximum weight percentage in the range of 41.89 to 45.09% having mean value of 43.49% with standard deviation of 0.79.

Key words: Wild plant, medicinal, physiochemical, ***Berberis lycium***, atomic absorption spectrophotometer

Introduction

Since the time of early Neanderthal man, medicinal plants are the only source of health care management (Farnsworth ***et al.***, 1985). Even as modes of medicine changed throughout the centuries, plants continue to play a vital role in the health delivery system as methods and ideas on plant healing were passed down from family to family and within communities in general in the world and particularly in many African countries (Anokbonggo, 1992). Vigorous laboratory and clinical investigations have led to the confirmation that may of these herbal preparations are therapeutically effective even for disease in which conventional therapeutic are ineffective (Ampofo, 1977). There is hardly a food, beverage, pharmaceutical, or cosmetic preparations which does not contain essential oils, glycosides, enzymes, resins, mucilages, tannins, gums, fiber or other botanical ingredients (Said, 1996). The medicinal plants also have certain mineral elements that are known to be biologically important and occur as constituents of important cellular compounds (Simon ***et al.***, 1990).

Due to climatic diversity in Pakistan, a large number of medicinal plants are scattered abundantly over a large area particularly in the Kurram and Kaghan valleys, in Gilgit, Chitral, Waziristan, Quetta, Azad Kashmir, Himalayan and sub Himalayan tracts. Pakistan has around 6000 species of wild plants, out of which about 400 to 600 are considered to be medicinally important (Anwar ***et al.***, 1979).

Berberis lycium is amongst the widely used medicinal plants in Pakistan, known by common name "Zyarh larghai" or "Kashmal" whereas its English name is Barberry (Anwar ***et al.***, 1979). It is an erect small rigid shrub about 1.0-2.5 meter in height, with a thick woody shoot and covered with a thin brittle bark and belongs to the family Berberidaciae (Hooker, 1882). Al-Biruni describes the plant under the name of Ambarbris and also mentioned its Persian names as Zirkash (Said, 1996). ***Berberis lycium*** is a native of the whole range of Himalayas Mountains and is widely distributed in temperate and semi-temperate areas of India, Nepal, Afghanistan, Bangladesh and Pakistan. In Pakistan it grows in Baluchistan, NWFP, Punjab and Azad Kashmir at elevation of 900-2900 meters (Ali and Khan, 1978; Fluck, 1971). The roots of the plant known as "***Darhald***" are used as tonic, for astringent, diaphoretic and bleeding piles (Nadkarni, 1980). Its active constituents are alkaloids. The major alkaloids are umbellatine, berberine (Ali and Khan, 1978), oxyacanthine and chelidonic acid (Karnick, 1994). Beside these berbamine, starch grains and tannins are also present in small quantities (Ali and Khan, 1978). Berberine found to be effective in amoebiasis and cholera and dis-infective in diarrhea (Said, 1996). It is being used in China as antibacterial agent. Similarly Harsh and Nag (1988) reported the antimicrobial activities of ***Berberis lycium***. The flavonoids, quercetin and kaempferol, isolated from leaves were active against ***Staphylococcus aureus*** and ***Escherichia coli*** (Harsh and Nag, 1988).

Materials and Methods

The wild medicinal plant ***Berberis lycium*** was collected from district Abbotabad and its suburbs, in the month of May 2000. The specimens were deposited in Pakistan Council for Scientific and Industrial Research (PCSIR). The vouchers specimen has number 9738 (PES), which has been cataloged and preserved in the herbarium of PCSIR, Peshawar. The chemical and mineral analysis was carried out at NWFP Agricultural University, Peshawar and Nuclear Institute for Food and Agriculture (NIFA), Tarnab, Peshawar, Pakistan. The chemical analysis included crude protein, crude fat, crude fiber, ash, moisture content and vitamin C (ascorbic acid) were performed in accordance with AOAC (1990), vitamin C was determined tritrimetricaly whereas Na, K, Zn, Mn, Fe, Cu, Ca and P were determined by Flame Photometer, Atomic Absorption Spectrophotometer and Spectrophotometer, respectively.

Results and Discussion

Berberis lycium known to be beneficial in the treatment of a number of diseases have been investigated for chemical and mineral constituents of possible pharmacological interest.

Table 1: Proximate Composition of *Berberis Lycium* (%age)

Plant/Parts	Moisture	Ash	Fat	Fiber	Protein	NFE	Vit. C
Roots	31.55±0.05	1.30±0.01	0.46±0.01	43.85±0.46	2.40±0.04	20.43±0.40	-
Shoots	44.75±0.25	1.41±0.02	0.43±0.02	39.53±0.03	2.58±0.03	11.29±0.25	-
Leaves	59.84±0.19	1.48±0.04	0.36±0.01	15.44±0.05	3.26±0.03	19.61±0.24	-
Whole plant	43.85±0.26	1.23±0.02	0.41±0.01	33.17±0.06	2.17±0.03	19.18±0.35	9.70±0.01
Mean	45.00	1.36	0.42		33.00	2.60	17.63

Table 2: Elemental composition of various parts of *Berberis lycium* (μgg^{-1})

Plant parts	Zn	Mn	Fe	Cu	P	K	Na	Ca
Roots	56.15±0.01	27.86±0.02	325.23±0.02	95.67±0.12	451.00±0.02	2458.00±0.58	115.00±0.03	543.00±0.53
Shoots	38.74±0.03	73.54±0.01	492.33±0.01	15.8±0.07	563.00±0.03	5824.00±0.58	125.00±0.03	941.00±0.51
Leaves	37.71±0.02	136.12±0.01	528.47±0.02	53.41±0.09	1315.00±0.01	4077.00±0.58	79.00±0.01	2389.00±0.04
Mean	44.20	79.17	448.68	54.96	776.00	4120.00	106.00	1291.00

Table 3: Percent weight distribution of different plant parts of *Berberis lycium*

Plants (10)	Root	Shoot	Leaves
1	30.56	4.02	27.42
2	30.83	41.89	27.28
3	31.18	42.09	26.63
Mean	30.86	42.00	27.14
Standard Dev.	0.31	0.10	0.37
C. V.	1.00	0.24	1.36

The analysis of the data (Table 1) revealed that leaves have maximum amount of moisture (59.84±0.19%) followed by shoot (44.75±0.25) and root (31.55±0.05), respectively. The possible reason for high moisture content could be that, this plant is usually grows in alpine regions, at high elevation of 6000-10,000 feet and due to low temperature and more rainfall, as result the moisture content of the plant is slightly high. Mean values of the data indicated that leaves contain maximum ash content (1.48±0.04%) followed by shoot (1.41±0.02%) and root (1.30±0.01%). This could be probably due to more photosynthetic activities. Maximum amount of fat was observed in root (0.46±0.01%) while minimum amount in leaves (0.36±0.01%). Maximum fiber content was obtained in root (43.85±0.46%) while shoot and leaves contain the lesser one. The possible reason could be that the main function of root is to anchor the plant in the soil firmly, for which it needs more fiber for strength. Thus it can be concluded from these results that root contained more fiber contents compared to other plant parts. The analysis also showed that minimum amount of crude proteins (2.40±0.04%) was found in root and highest amount in leaves (3.20±0.03%). In case of NFE, maximum amount was obtained for root (20.43±0.04%) followed by that of leaves (9.61±0.24%) and shoot (11.29±0.25%). The possible reason for high contents of protein and NFE in the leaves could be due to more photosynthetic activities of the leaves, which might have resulted in maximum protein and NFE synthesis. Analysis of the data (Table 1) revealed that vitamin C (ascorbic acid) was 9.70±0.01 mg 100 g^{-1}. The observation that L-ascorbic acid increases beyond expectation the absorption of iron from intestines and improves iron nutrition proved in raising the recommended daily allowance (RDA) for vitamin from 45 to 60 mg (Hallberg, 1981; Recommended Dietary Allowances, 1980). Vitamin C requirements for wound, repair, normal healing processes and trauma are 500 to 1000 mg day^{-1} and are based upon collagen synthesis and its fiber cross linking to form new tissue of high tensile strength (Stone and Meister, 1962). It also plays an important role in drug metabolism and maintaining adequate tissue levels are recommended (Peterson ***et al.***, 1982).

The macrocosmic and microcosmic elements in relation to their philosophical and scientifically defined role in health and diseases and being catalysts in nature they activate certain enzymes and are essential components of vitamins and hormones and thus play a vital role in the medicinal value of plant therapy in health and diseases (Simon ***et al.***, 1990). Therefore, intake of trace elements should be such that their lake does not lead to any disease/disturbance (Bukhari ***et al.***, 1987). Analysis of the data (Table 2) indicate that ***Berberis lycium*** contained Cu, Zn, Fe, Mn, Ca, Na, K, P in fair amounts. In the present study, the Zn content in root (56.15±0.01 $\mu g\ g^{-1}$) was maximum followed by that of shoot (38.74±0.03 $\mu g\ g^{-1}$)and leaves (37.71±0.02 $\mu g\ g^{-1}$), respectively. A comparative decrease was observed in Zn content from root to leaves. The role of zinc in glucose metabolism is very important. Heber and Gershoff (1973), Kirchgessner ***et al.*** (1976) and Walman (1979) have reported that zinc depletion leads to abnormalities in glucose utilization. Bray and Betteger (1990) reported that Zn play as antioxidant role in animals and as well as in plant membrane (Cakmak and Marschner, 1988) in controlling the level of oxygen radicals. The antiarthritic activity of zinc sulphate against rheumatoid is established. It shows significant improvements in joint swelling, tenderness, morning stiffness and other symptoms (Das, 1990). These results are in agreement with those reported by Schroeder (1971) who reported that various species contained on the average, 23 ug g^{-1} of zinc and 6.8 ug g^{-1} of copper. Whereas Mn was found maximum in leaves (136.12±0.01 $\mu g\ g^{-1}$) followed by that of shoot (73.54±0.01 $\mu g\ g^{-1}$) and root (27.86±0.02 $\mu g\ g^{-1}$). Manganese plays a useful role is glucose metabolism. Donsbach and Ayne (1982) have reported the correlation of glucose tolerance curve with manganese adequate diet. Analysis of the data (Table 2) revealed that Zn, Cu and Na were maximum (56.15±0.01,95.67±0.12, 115.00±0.03 $\mu g\ g^{-1}$, respectively) in root and while Mn, P, Ca and Fe (136.12±0.01, 1315.00±0.01, 2389.00±0.04, 528.47±0.02 $\mu g\ g^{-1}$, respectively) in leaves whereas K (5824.00±0.58 $\mu g\ g^{-1}$, respectively) in shoot. These results are contrary to those were reported by Sondhi and Agarwal (1995) because the range of concentration of a particular element varies widely between different plants and is also affected by the conditions under which the plants are grown and also because the individual plant species and verities differ markedly in their mineral contents even when they are grown under the same conditions (Sutcliffe, 1980).

Unlike other nutrients, living organisms cannot synthesis minerals. Only small fraction of the Ca, Mg and P and most of the Na, K and Cl are present as electrolytes in the body fluids and soft tissues. Electrolytes present in blood or cerebrospinal fluid maintain acid-base and water balance and osmotic pressure, they regulate membrane permeability and exert characteristic effects on the excitability of muscles and nerves. Though ***Berberis lycium*** can not be considered as a sole of source of macro or micro elements, but can be considered as potential source for providing a reasonable amount of the elements in diet or otherwise.

As different parts of medicinal plants have different physiochemical constituents (El-Habibi ***et al.***, 1990) and are used in traditional medicine for different purposes. Hence an experiment was conducted to analyze the weight percentage distribution of ***Berberis lycium***. Statistical analysis of the data (Table 3) revealed that more than 42% weight of ***Berberis lycium*** is contained in shoot. The plant roots and leaves have nearly the same weight percentage (30.86±0.31, 27.14±0.37%, respectively). The relative percentage of different parts of the plant provides an ample idea about their medicinal uses. The roots are widely used for medicinal purposes differently for a number of remedies in world. Since this plant belongs to the family Berberidaceae and found mostly in alpine areas due to which an extensive network of root is well developed. A number of alkaloids are present in the roots of this plant (Nadkarni, 1980; Ali and Khan, 1978), used for the elimination of certain internal and external diseases. The Rasaut of the plant mainly obtained from the extraction and is used in our traditional medicine. Beside its medicinal use, a yellow dye is prepared from roots and shoots when boiled in an alkaline lay likewise which is used in Poland for coloring leather (Brently and Trimen, 1983).

References

Ali, M.N. and A.A. Khan, 1978. Pharmacognostic studies of ***Berberis lycium*** Royle and its importance as a source of raw material for the manufacture of berberine in Pakistan, Pak. J. Fore., pp: 26.

Ampofo, O., 1977. Plants that heal. World helth., 26: 28-30.

Anokbonggo, W.W., 1992. The role of African traditional medicine in health care delivery alongside modern medicine. In: Botany 2000: East and Central African. Eds. S. Edwards, Z. Asfaw. NAPRECA Monograph Series No. 5, Addis Ababa, pp: 25-35.

Anwar, A.K., M. Ashfaq and M.A. Nasveen, 1979. Pharmacognostic studies of selected indigenous plants of Pakistan. Pakistan Forest Institute, Peshawar, NWFP, Pakistan.

A.O.A.C. (Association of official Analytical Chemist), 1990. Official methods of Analysis, 15th Ed. (Ed. K. Helrich) Arlington, Virginia, USA.

Bray, T.M. and W.J. Betteger, 1990. The physiological role of zinc as an antioxidant. Free Radical Biol. Med., 8: 281-291.

Brently, R. and H. Trimen, 1983. Medicinal plants. Vol. 1. J and A. Churchill, New Burlington Street London, UK.

Bukhari, A.Q., S. Ahmad and M. Mirza, 1987. The role of trace elements in health and disease. In: Elements in health and disease. 2nd international conference held in Karachi-Pakistan.

Cakmak, I. and H. Marschner, 1988. Increase in Membrane Permeability and exudation in roots of zinc deficient plants. J. Pl. Physiol., 132: 356-361.

Das, A.K., 1990. Metallotherapy. In: A textbook on medicinal aspects of bioinorganic chemistry. CBS Publishers and Distributors, Delhi, India.

Donsbach, K. and A. Ayne, 1982. The physiological function of minerals in man. In: chelated Mineral nutrition in plants, animals and man. (Ed. A. De wayne). Spring field: Charles, Thomas publishers, pp: 247-257.

El-Habibi, A.M., N.A.E. Bosellah and H.B. Ibrahim, 1990. Phytochemical studies on some Fagonia species growing under desert conditions. Bulletin Fac. Agric., Univ. Cairo, Egypt, 41: 867-884

Farnsworth, N.R., O. Akerele, A.S. Bingel, D.D. Soejarto and Z. Guo, 1985. Medicinal plants in therapy. Bul. World Helth. Organ., 63: 965-981.

Fluck, H., 1971. Medicinal Plants. 4th Ed., W. Foul Sham and Co. Ltd. New York, USA, pp: 149-165.

Hallberg, L., 1981. Vitamin C (Ascorbic acid). J.N. Counsell and D.H. Honrnig (Eds.), Applied Science Publishers, London, UK.

Harsh, M.L. and T.N. Nag, 1988. Flavonoids with antimicrobial activities of arid zone plants, Geobios, India, 15: 32-35.

Heber, A.M. and S.N. Gershoff, 1973. Effect of zinc deficiency in rates on insulin release from the pancreas. J. Nutr., 103: 1739-1744.

Hooker, J.D., 1882. Flora of British India. Reeve and Co. London, 3: 640.

Karnick, C.R., 1994. Pharmacopoeial standards of herbal plants. Vol. 1, 1st Ed., Satguru Publication, Dehli, India, pp: 51.

Kirchgessner, M., H.T. Roth and E. Weinged, 1976. Biochemical changes in zinc deficiency. In: Trace elements in Human Health and Disease (Ed. Prasad). New York Acad. Press, pp: 189-225.

Nadkarni, K. M., 1980. Indian Material Mediea. 3rd Ed. (Ed. A.K. Nadkarni), Popular Parakashan Depot, Bombay, India, pp: 180-190.

Peterson, F.J., J.G. Babish and I.M. Rivers, 1982. Nutr. Rep. Int., 26:1037.

Recommended Dietary Allowances, 1980. 9th Ed., National Academy of Sciences, Washington DC, USA.

Said, H.M., 1996. Medicinal herbal-a textbook for medical students and doctors. Volume 1. Hamdard Foundation, Nazimabad, Karachi-74600, Sindh, Pakistan.

Schroeder, H.A., 1971. Loss of vitamins and trace minerals resulting from processing and preservation of foods. Amer. J. Clin. Nutri., 24:562-573.

Simon, E.W., K.J. Dormer and J.N. Hartshore, 1990. Lowson's Text Book of Botany. University Book Hall, New Delhi, India.

Sondhi, S.M. and N. Agrawal, 1995. Determination of mineral elements in medicinal plants used for cure of Bronchitis, Kidney, Bladder disorder, Skin diseases and Gonorrhoea ets. Hamdard Medicus, 38: 24-29.

Stone, N. and A. Meister, 1962. Nature, London, pp: 194: 555.

Sutcliffe, J.F., 1980. Plants and mineral salts. The Camelot Press Ltd., Southampton, Great Britain.

Walman, S.L., 1979. Zinc in total parenteral Nutrition requirements and metabolic effects. Gastroenterology, 76: 458-467.