Diversity, Utilization and Management of Medicinal Plants in Baitadi and Darchula Districts, Far West Nepal

Ripu M. Kunwar[1], Chotte L. Chowdhary[2] & Rainer W. Bussmann[3]

Abstract

As in other districts of Nepal, medicinal plants have played a significant role in the life of local people of Baitadi and Darchula districts by providing products for trade, subsistence and traditional therapies. Present study analyzed the pharmacological activities of the species which had the highest informant consensus factor. The use of Asparagus racemosus as galactogogue with consensus factor 0.97, Berberis asiatica for eye troubles with 1.0, Cordyceps sinensis as tonic and longevity with 0.97, Curculigo orchoides as tonic and aphrodisiac with 0.96, Nardostachya grandiflora for epilepsy with 0.97 and Phyllanthus emblica as diuretic with 0.97 possessed the highest consensus factors and greatest affinity to the Ayurveda and phytochemical findings. Phytochemical screening and validity assessments of the medicinal plant widely used in traditional therapies are worthwhile. The findings with the maximum affinity of informant consensus factors and phyto-chemical validations provide the potential to identify which plants are most likely to be useful in the treatment of diseases.

Key Words: Medicinal plants, Ethno-medicine, Informant consent factor (ICF), Phyto-chemical validation, West himalaya

Introduction

It has been estimated that the Himalayan region harbors about 12,000 species of medicinal and aromatic plants, supporting the livelihood of about 600 million people living in the area (Pie Shengji 2001). The flora of the Nepal Himalaya contains 10,167 plant species, of which over 7,000 are flowering plants and over 1,600 species are medicinal and aromatic herbs. The herbs, representing about 25% of the total country's vascular flora, are used under different traditional systems including the *Ayurveda*, Homeopathic, Home herbal (folklore) and *Amchi* (traditional Tibetan medicine) medicinal systems (Bhattarai 1997). Thirty percent medicinal plant species of the country occur in the western part of the country (Manandhar 1998) and about 50% of the plants used as ethno-medicine in Nepal Himalaya (Kunwar et al. 2008) have been documented. The management of medicinal and aromatic plants and knowledge of utilization of the resources therefore is of great importance and it can be promoted by considering and documenting the diversity of the medicinal plant resources and their indigenous knowledge of utilization (Kunwar et al. 2006).

[1] .*Centre for Biology Conservation, P.O. Box 19225, Kathmandu, Nepal, rkunwar@gmail.com*

[2] *Canadian Center for International Studies and Cooperation (CECI), kathmandu, Nepal*

[3] *William L. Brown Center, Missouri Botanical Garden, St. Louis, USA.*

Study Area

As there is varied topography, bioclimate and forest products (Devkota & Karmacharya 2003), both the Baitadi and Darchulsa districts possess a large variety of non-timber forest products and they have been collected since ancient past for domestic use, particularly for home herbal healing. Baitadi district ranges from 390 m to 2950 m altitude, 29° 22' – 29° 57' N latitude, and 80° 5' – 80° 57' E longitude, and Darchula district stretches from 357 m to 7132 m altitude, 29° 26' - 30° 15' N latitude and 80° 22' - 81° 90' E longitude. Community forests and their user groups, other government managed forests and NTFP collectors, traders and producers of Siddeswor VDC of Baitadi district and Khar and Dumling VDCs of Darchula districts were selected as study site and respondents for this study.

Because of the diversity and richness of the products in study area, some sites were community managed and some sites were government managed for better management. There is a belief of better management systems in community managed areas. Now, the forest lands lying at the vicinity of the settlement areas have been administered by local community and used the resources under indigenous management systems and customs and five years operational plans as community forests. Community forest user groups run under users' forest operational plan and constitution and National Forest Act (1961, 1993) and they are recognized as an independent institution.

Materials and Methods

Field visits were carried out in January-February 2007 and March-April 2008 and field observations were analyzed to evaluate the diversity, uses and management of medicinal plant resources. Group discussions, field observations, questionnaire surveys, cross checking, and key informant surveys were major tools as participatory appraisal. Group discussions were held as informal interactions, meetings, formal discussions, etc. and they were organized within community forest user groups.

Traders, collectors, traditional healers and producers were individually asked. A total of 174 respondents including 122 men and 52 women were asked for data collection. All the traditional healers and village/district NTFP traders of the study area were consulted. Collectors were selected randomly with keeping diversity in gender, ethnicity and well being. Checklists were made for crosschecking and key informant survey. In total, the respondents for surveys were carefully selected based on gender, caste, occupation, ethnicity and well being. The information was further validated by common response and considered as insignificant for single response.

Results and Discussion

Diversity

The present study got an account of 76 plant species having medicinal values and properties. Among them 47 were indigenously used as ethno-medicine. Among the ethno-medicinal plants, 29 species were only from *Darchula* district, 19 were only from *Baitadi* district and 19 species were common to both districts. The high altitude medicinal herbs (*Cordyceps sinensis,*

Dactylorhiza hatagirea, Morchella conica, Nardostachys grandiflora, Neopicrorhiza scrophulariflora, etc.) were reported from Darchula district while the tropical and temperate medicinal plants (*Acorus calamus, Astilbe rivularis, Berberis asiatica, Centella asiatica, Moringa oleifera,* etc.) were reported from Baitadi district. The common medicinal plants were *Asparagus racemosus, Bergenia ciliata, Juglans regia, Paris polyphylla, Phyllanthus emblica, Swertia chirayita, Zanthoxylum armatum,* etc.

Utilization and management

Table 1 shows the number of medicinal plant species used for each of the usage categories with their informant consensus factor. To take the level of diseases category analysis, an informant consent factor (ICF) was calculated following Trotter & Logan (1986). Result showed the high level of consensus where the total 47 plant species revealed the data range 0.86-1.00 but the present study analyzed only the species possessed informant consensus factor 0.95 and more. There were only 13 species with their informant consensus factor 0.95 or more, therefore the discussion of the study confined only on those species.

All the informants were consent upon the usage of *Berberis asiatica* for eye troubles and *Cordyceps sinensis* for memory longevity. It was also supported by the use of *B. asiatica* for eye infection in *Tamang* ethnic groups with possessing ICF 0.92 from central Nepal Himalaya (Yadav 2008). All the species possessing the highest consensus factor (0.97 – 1.00) revealed the affinity to the *Ayurveda* and phytochemical findings. Use of *Asparagus racemosus* as galactogogue (0.97), *Berberis asiatica* for eye troubles (1.0), *Cordyceps sinensis* as tonic and longevity (0.97), *Curculigo orchoides* as tonic and aphrodisiac (0.96), *Nardostachya grandiflora* for epilepsy (0.97) and *Phyllanthus emblica* as diuretic (0.97) possessed the highest consensus factor and they were concurred with the phyto-chemical findings. High consensus factor means the usage of these species are well known in study area. It can be excerpted from the findings that the species with the highest consensus factor (more than 0.97 in this study) are in line with the phyto-chemical validations and the species with the least consensus factor are misused during course of social-cultural and economical transformation. The species with the highest consensus factor and strong resemblances with phytochemical findings are potential for the investigation of phyto-chemistry and pharmacology.

However, with increasing use of traditional therapies, a verification of efficacy by western scientific means would be interesting, because the traditional health system adopt customized and multi-pronged strategies in treatment involving drug, diet and therapy. Results of the present study suggest a fairly good correlation between traditional therapeutic use and the *in vitro* phyto-chemical activity because the findings showed only about 50% affinity. It shows that the home herbal remedy is an independent health care system of Nepal Himalaya which is indigenous and influenced by the *Ayurveda*. These results corroborate the importance of ethno-pharmacological surveys for screening plants as a potential source for bioactive compounds. Hence these could result in discovery of novel antimicrobial agents. The unlike uses of the species after thorough scrutinization under different health care systems and comparisons pose research scopes and such uses would better to be researched and or

alchemized. However, the changing life, perceptions, social transformation and acculturation result the indigenous knowledge gradual denudation.

Table 1: Medicinal plants, their usage and informant consensus factor (ICF) value

SN	No. of taxa and name	Indigenous uses	ICF	Use in the Ayurveda and Phytochemical validations
1	*Adiantum capillilus-veneris* L. **Adiantaceae** Maidenhair fern (E), Gophale (N)	Root juice is taken in migraine, snake bite and scorpion sting.	0.97	Plant is useful in diarrhoea, spleen disorders. It is demulcent, expectorant and tonic (CSIR 1994).
2	*Asparagus racemosus* Willd. **Liliaceae** Asparagus (E), Jhirjhirine (L), Kurilo, Satawari (N), Abhiru, Satmuli (S)	Roots are used for milking cattle, fermenting and local brewing. They are also useful in urinary and liver troubles. Acidity is also reduced.	0.97	Plant is galactogogue, aphrodisiac, diuretic, antispasmodic, and nerve tonic in the Ayurveda. Extract of *Asparagus racemosus* root increases mammary gland in post partum period (Sabnis *et al.* 1968) and acts as lactogogue (Sharma *et al.* 1996a). Root extract possesses cardioprotective (Khanna *et al.* 1991), antitumor (Kamat *et al.* 2000), antifungal, anti-ulcer,, immuno stimulatory (Dhuley 1997), and diuretic (Balans and & Rayband 1987).
3	*Astilbe rivularis* Buch.-Ham. ex D.Don **Saxifragaceae** Astilbe (E), Sutkeribelo (L), Thulo okhati , Budhookhato (N)	Root juice is used for easy delivery during child birth. It is valued for fever, diarrhea, dysentery and hemorrhage.	0.96	Extracts from *Astilbe* had antineoplastic and immunopotentiating activities (Chen et al 1996) and beneficial in regulating various inflammatory process (Moon et al 2005).
4	*Bauhinia vahlii* Wight & Arn **Fabaceae** Camel's foot climber (E), Malu (L), Bhorla (N), Murva (S)	Bark is used in sprain and fracture. Root is tonic.	0.96	Leaf and bark extract is taken for skin diseases. Root is useful in pulmonary tuberculosis (Bajracharya 1979). Methanolic extract of the plant possesses activity against herpes simplex virus (Taylor et al 1996).
5	*Berberis asiatica* Roxb. ex DC. **Berberidaceae** Barberry (E), Kimmada (L), Chutro, Rasanjan (N), Daruharidra, Darwi (S)	Root and stem bark paste is used to control worms.	0.95	Plant is astringent, antipyretic, antidiarrhoic and stomachic in properties. Berberine is effective to the genital infections (Vermani & Garg 2002). Berberine has been shown to bind to DNA and inhibit its cleavage (Krey & Hahn 1969).
		Root and stem bark paste is used to cure eye diseases	1.00	Root, stem and fruits are used in conjunctivitis, inflammation, diabetes, dysentery, jaundice, skin diseases and fever in the Ayurveda. Its use, as extract for eye drops in conjunctivitis, is widespread. It is effective as antipyretic, antihypertensive and pigment inducing (Sabir & Bhide 1971).
6	*Cordyceps sinensis* **Clavicipitaceae** Caterpillar fungus (E), Jara (L), Yarsagumba (N), Sanjivani (S)	Whole plant is tonic and aphrodisiac and useful in increase memory.	0.97	Plant is highly valued as aphrodisiac and tonic. It regulates body functions, strengthens immune system and promotes vitality and longetivity (Kunwar 2006). Cordyceps has been used as an anti-tumor herb (Wu et al 2007). It is also used as hemostatic, mycolytic, antiasthmatic, expectorant and tonic (Wang et al 2000). Cordycepin is antibiotic, antitumor, anti-oxidant, and potentiating the immune system (Liu et al 1992).
7	*Curculigo orchoides* Gaertn. **Hypoxidaceae** Black musale (E), Kalmusali (N), Talmule (S)	Root is used as tonic and effective on paralysis.	0.96	Root is diuretic, tonic, aphrodisiac, antidiarrhoic, and it is used in liver problems, piles, asthma and gonorrhea in the Ayurveda. Curculigo extracts are known to have vasculo protective activities (Valls *et al.* 2006).

8	*Curcuma zeodoria* Rosc. **Zingiberaceae** Zeodory, Turmeric (E), Sathi, Kachur (L), Haldi (N)	Rhizome is used in paralysis.	0.96	Hydroalcoholic extract, fractions, specially dichloromethane, and a pure compound of *Curcuma* rhizomes denoted as curcumenol, exhibited potent and dose-related analgesic activity (Navarro et al 2002).
9	*Jatropha curcas* L. **Euphorbiaceae** Anim, Physic nut (E), Inna (L), Sajiwan (N), Vyaghra eranda (S)	Seed oil is applied on arthritis and boils.	0.96	Seed and latex are astringent and purgative in properties and are employed in scabies, eczema, inflammations and wounds. Root extract is antidiarrhoel. Root paste can be used as anti-inflammatory (Mujumdar & Misar 2004).
10	*Nardostachys grandiflora* DC. **Valerianaceae** Spikenard, Musk root (E), Bhulte (L), Jatamansi (N), Jatamasi, Gandhamasi (S)	Root and rhizome is useful in epilepsy and mental weakness. Oil is useful in headache.	0.97	Plant is useful in epilepsy, hysteria, ulcer, insomnia, blood disorders, digestion, respiratory problems, measles, syncope, mental disorders and skin diseases. Extract of rhizome contain hepatoprotective compounds and it moderates epilepsy with low neurotoxic effects (Rao *et al.* 2005). Rhizome extract shows antibacterial activity (Kumar *et al.* 2006).
11	*Phyllanthus emblica* L. **Euphorbiaceae**. Gooseberry (E), Aunla (L), Amala, Rikhiya (N), Dhatri, Aadiphala (S)	Fresh fruits are used as diuretic and laxative.	0.97	In the *Ayurveda* fruits are aphrodisiac, diuretic and haemostatic in properties and they are useful in anemia, diarrhoea, dysentery and Jaundice. Fresh fruits are used in diuretics. Plant juice shows liver protective property (Subramonium and Pushpangadan 1999). Fruit butanol extract relieves gastric ulcer (Bandyopadhyay *et al.* 2000). Methanolic extract of fruits inhibits leukotriene, which causes pain, inflammation and broncho-muscular constriction (Kumar & Muller 1999).
12	*Sophora mollis* (Grah. ex Royle) **Fabaceae** Himalayan laburnum (E), Chumjado (N)	Root paste is considered in cold and rheumatism.	0.96	Flowers are diuretics, and useful in lumbago and kidney problems. Seed is good in eye troubles (Kirtikar and Basu 1981). Root extract promotes hair growth (CSIR 1994). It is antiinflammatory, and antotumorous and inhibits liver fibrosis (Zhang et al 2001).
13	*Urtica doica* L. **Urticaceae** Stinging neetle (E), Sisnu (N), Agnidamani (S)	Wood is used for fracture and sprains. Leaf is used as vegetable.	0.96	Plant juice is valued in hemostatic, uterine hemorrhage and blood vomiting (CSIR 1994). The aqueous extract has antihyperglycemic effect (Farzami et al 2003), and it is also a good anticoxidant, hepatoprotective (Lebedev et al 2001), analgesic, antiviral (Manganelli et al 2005), diuretic and hypotensive in properties (Testai et al 2002).

E = English, L = Local, N = Nepali and S = Sanskrit

Medicinal plants were assumed to be a free commodity in Nepal and were mainly collected from wild since ancient past, which can make a significant contribution to the livelihoods, health care and income for those people who residing forest and pasture fringes and in rural areas (Kunwar 2002). Medicinal plants were collected as food, vegetable, and medicine for both domestic and commercial purposes. Some medicinal plants are used for home herbal remedy whilst the traditional healers (*Baidhyas*) used the species as major ingredients for their medicinal preparations (CECI 2006). However, the commercial collections of the species, started about a decade ago in the study area (CIRRUS 2008), are already threatening the populations of many species.

As a result of human population growth, habitat destruction and increasing commercial exploitation, pressure upon the existing plant resources is ever increasing. The number of individuals involved in collection, production and marketing of medicinal plants has noticeably increased in the study area (16.16% in comparison with 2007 data) due to a high growth

global market of phytomedicines (Kunwar 2007). The global market of medicinal products (herbal products including medicinal, health supplements, and herbal beauty and toiletry) is over USD 60 billion and grows at the rate of 7% increment per annum (Nagpal & Karki 2004).

The harvesting knowledge level varied in each collectors group and depended on a species and its phenology. Most of the high value medicinal herbs such as *Cordyceps* (*Yarchagunbu*), *Morchella* (*Guchhi*), *Zanthoxylum* (*Timur*), etc. were collected with paying greater attention. Irrational (in terms of time, productivity and quality) collections have made the species namely *Nardostachys grandiflora, Neopicrorhiza scrophulariflora, Astilbe rivularis, Dactylorhiza hatagirea* and *Juglans regia* threatened.

Conclusion

As in other indigenous communities of the world, the communities of the *Baitadi* and *Darchula* districts are experiencing great changes in their way of life. However, medicinal plants still have played significant role in their life. The pharmacological studies indicate the immense potential of medicinal plants in the treatment of various chronic and lethal diseases. Use of *Asparagus racemosus* as galactogogue, *Berberis asiatica* for eye troubles, *Cordyceps sinensis* as tonic and longetivity, *Curculigo orchoides* as tonic and aphrodisiac, *Nardostachya grandiflora* for epilepsy and *Phyllanthus emblica* as diuretic possessed the highest consensus factor and greater affinity to the *Ayurveda* and phytochemical findings. One of the factors constraining conservation, efficient use and sustainable management of medicinal plants and indigenous knowledge of utilization is the inability of users to recognize or commensurately value the functions and services of the products. Therefore similar research efforts on documentation and conservation of local plant resources and traditional knowledge are worthwhile.

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