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Ethnobotanical uses of Biofencing Plants in Himachal Pradesh, Northwest Himalaya

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Abstract: The aim of this study is to document the traditional knowledge on the utilization of Biofencing plants of Himachal Pradesh, Northwest Himalaya. The study was imperative because of dearth in the data pertaining to Biofencing plants in the study areas. The whole study area was stratified into three zones and a widespread field survey and random sampling method was adopted to assess the live fencing diversity of the region. The region occupies total 61 species. 10 (trees), 45 (shrubs), 4 (herbs) and 2 were climbers. These belong to the 25 families. Rosaceae, Fabaceae, Berberidaceae, Elaeagnaceae and Euphorbiaceae are dominant families. Among genera, *Berberis* and *Rosa* are dominant. Of the total, 55 species are medicinally important and among these 20% are used for stomach disorders; 17% (skin complaints), 14% (asthma), 11% (fever and joint pains), 3% (aphrodisiac and snake bite), 1% (anticancerous and nerve disorders). Ethnobotanical assessment showed that 33 of the recorded species are used as fuel, 20 (edible), 8 (fodder) and 4 (fiber and ornamental). This traditional knowledge of Biofencing plants contributes to the conservation of biodiversity and provides resource of economic and ecological interest and also decreasing the pressure on forests. So there is need to encourage the practice of using plant species for fencing in this region.

Key words: Biofencing plants, conservation, ethnobotanical, ethnomedicinal, fuel and fodder

INTRODUCTION

Indian Himalaya, identified as one of the mega biodiversity hotspots of the world (Zeeshan Hasan *et al*., 2009) includes 18,440 species of plants (Singh and Hajra, 1996; Samant *et al*., 1998). Its diverse habitats are rich repositories of plant diversity and are used for variety of purposes e.g., food, fiber, medicine, fodder, spices, etc. As the cultures developed, people started agriculture and with the passage of time the need of protecting the crops from cattle was felt. As reduction in community pasture lands along with the loss of forest cover is pushing domestic animals and wildlife to forage over agricultural farms (Mishra *et al*., 2011). For overcoming these problems the rural people developed unique fencing methods.

The natural means for protection were first to be opted for. People started making permanent or temporary boundaries around their field or courtyard using different plants called as 'Biofencing plants'.

It is the way of establishing a boundary by planting a line of trees, shrubs or herbs at relatively close spacing that provide protection against cattle and wildlife. The indigenous people have revealed various uses of natural resources around them, which is based on their necessities, observation and experience (Jain, 2004; Borkataki *et al*., 2008). So, a variety of species were checked to discover suitability of plants for use as fencing. Furthermore plant species having spines, thorns, unpalatable leaves or frequent branching are mostly preferred over others because they provide effective protection against cattle or wild animals (Bhattarai *et al*., 2007). The information of such plants is mainly collected by the populace in the form of traditions and experiences and is inherited over the centuries to the future generations. Hence it is tremendously imperative to save this conventional knowledge of biological heritage and explore new resources.

In Himachal Pradesh, suitable plant species are planted live or cut and used as dead fence around agricultural fields to protect the crops from livestock and wild animals. As the state is mostly rural in character (more than 90% people live in the villages) and major portion of the income comes from horticulture and agriculture sector, need for the protection of the farm and fields become imperative. Suitable live plant species are closely planted around the fields as hedgerows.

The literature studies showed that there are very few studies on these plants in general (Punjani, 1998; Choudhury *et al*., 2005; Chhetri, 2005; Otero and Onaindia, 2006; Bhattarai *et al*., 2007; Reddy, 2008; Subrahmanya and Raveendran, 2010; Mishra *et al*., 2011; Kumar *et al*., 2103) and no mention of any learning from this part of Himalaya so far. However many ethnobotanical works have been conducted in the field of medicinal plants (Samant *et al*., 1998, 2001; Kandari *et al*.,

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2012; Sharma, 2013) from this region. A profound awareness of the traditional knowledge of plants belonging to fencing categories, combined with initiatives for sustainable development, could form the means of better biodiversity conservation. The main aim of the study is to document the traditional knowledge on the utilization of BF resource of Himachal Pradesh.

MATERIALS AND METHODS

Study area: The Himalaya, newest range of mountains and the greatest physical feature on earth is having landscapes of incomparable scenic grandeur and are perpetual source of wonder and veneration. Himachal Pradesh (abode of snow) very rich in phytodiversity is situated to the north of India and NW Himalaya. It lies between 30°22'44"to 33°12'40" N latitude and 75°45'55" to 79°04'20"E longitude. Its height from sea level ranges from 350-6975 m (Dhiman, 1976). There is J and K in its north, Uttarakhand in S-E, Haryana in south and Punjab in the west. In the east it is bordered by Tibet (Fig. 1).

Methodology: A widespread field survey of the region carried out during 2010-2012. Rapid random sampling method was done to assess the live fencing diversity of the region. On spot identifications were done with the help of regional floras (Collett, 1902; Polunin and Stainton, 1984; Jain 1991; Dhaliwal and Sharma, 1999; Singh and Rawat, 2000). Doubtful plant species are carried to the NBPGR, Regional Station, Phagli, Shimla, identified and stored. The whole region was stratified into three zones based on geographical and political realms. Zone 1 includes; Una, Hamirpur, Bilaspur and Sirmaur districts located in the foothills of Himalaya (Shivalik range) and are adjoining to the states of Punjab and Haryana. Zone 2 includes; Kangra, Mandi, Kullu, Chamba and Lahaul-Spiti districts. These are the regions comprising mostly of Dauladhar and Pir-Panjal range except Mandi district which is lying in Shivalik Himalaya whereas Lahaul-Spiti covers the cold desert biosphere region. Zone 3 comprising of Solan, Shimla and Kinnaur districts. This zone comprises of subtropical, temperate to alpine zones and dry temperate area of Kinnaur. Learned local informants were selected between the age group of 35-74 years. Only those people were selected for information generation who were residing in their locality for more than 25 years.

Fig. 1: Map of the study area

People (nearly 30), were interviewed from zone 1; 28 from zone 2 and 33 from zone 3. The primary and secondary information gathered in structured and semi-structured questionnaires. All the plant specimens were arranged alphabetically along with their local names; family, habit, altitudinal range, role, type of fencing (living or dry) and ethnobotanical uses (Table 1).

Table 1: Inventory of Biofencing plants with local names, family, habit, altitudinal range, role, type of fence and ethnobotanical uses

Taxa/ Local name	Family	Habit	Altitude range (m)	Role	Type of fence		Ethnobotanical Uses
					Living	Dry	
Acacia catechu Willd. (Khair)	Fabaceae	T	350-1250	MB, Th	+	-	M (Bk St; rheumatism, mouth sours)
Adhatoda zeylenica Medic. (Basuti)	Acanthaceae	S	450-1500	MB	+	-	M (Wp; fever, antispasmodic, pulmonary problems, swelling); edible
Agave americana L. (Kevda)	Agavaceae	S	500-1700	MB, UP	+	-	M (Lf,St; purgative, increases menstrual flow , diuretic, kidney problem), fiber
Agave cantala (Haw.) Roxb. ex Salm-Dyck (Ramban)	Agavaceae	S	400-1600	MB	+	-	M (Lf; wounds); ornamental, fiber
Astragalus candolleanus Royle ex Benth.(Rudanti)	Fabaceae	S	2400-4500	MB	-	+	M (Wp; skin diseases, coughs, blood purifier); fuel
Astragalus strobiliferus Royle ex Benth.(Garmezu)	Fabaceae	S	2400-3900	MB	-	+	Fuel
Bambusa bambos L. (Baans)	Poaceae	S	400-1350	MB	-	+	M (Rt; cuts, boil, wounds, cough, fever), fuel
Berberis aristata L. (Kasmale)	Berberidaceae	S	1600-3400	MB	+	+	M (St, Rt, Fr; skin disease, eye problem, jaundice); fuel, frnit edible
Berberis chtiria Lindl. (Kasmal)	Berberidaceae	S	1550-3300	Th, MB	+	+	M (St, Rt; eye problems), fuel
Berberis jaeschkeana Schneid.(Kashambal)	Berberidaceae	S	2700-3500	Th, MB	+	+	M (St, Rt; eye problems), fuel
Berberis lycium Royle (Kashmal)	Berberidaceae	S	800-3000	Th, MB	+	+	M (St, Rt, Fr; constipation and acidity), fuel
Berberis umbellata Lindl. (Kasmal)	Berberidaceae	S	2200-3200	Th, MB	+	+	M (St, Rt; fever, skin disease), fuel
Betula utilis D. Don. (Bojptra, Bhuj)	Betulaceae	T	3100-4000	MB	-	+	M (St, Rt; rheumatism, cuts, wounds, anaemia, cough), fuel
Bombex ceiba L. (Sembal)	Bombacaceae	T	450-1600	Th, MB	-	+	M (Fl, Bk, Rt; abdominal pain, acne, aphrodisiac, diarrhea, cough, dysentery)
Bougainvillea glabra L. (Bougainvilia)	Nyctaginaceae	S	400-2000	Th	+	+	M (Lf extract; anthelmentic, antibacterial); ornamental
Cannabis sativa L. (Bhang)	Caunabaceae	H	600-3500	UP	+	-	M (Sd; arthritis); fibers, seeds edible
Caragana brevifolia Komarov.	Fabaceae	S	3300-4100	Th, MB	-	+	Fuel
Caragana versicolor (Wall.) Benth (Bramswak, Zomoshing)	Fabaceae	S	2900-4800	Th, MB	-	+	M (St; dysmenorrheal); Fuel
Cotoneaster bacillaris Wall. ex Lindl.(Reun, Binde)	Rosaceae	S	2200-2900	MB	-	+	M (Lf, St, mixed with cow urine for scabies, rheumaticarthritis);walkingstick,agricultural tools, fuel
Cotoneaster microphylla Wall. ex Lindl. (Rhenus, Chhata)	Rosaceae	S	1000-4000	MB	-	+	M (St; astringent); Edible, fuel, walking sticks, fruit edible
Daphne papyracea Lour. ex Wall.(Nigi/Gandiri)	Thymelaceae	S	1800-2800	MB	+	+	M (Wp; intestinal complaints); Paper making
Desmodium elegans DC.(Kathi)	Fabaceae	S	2000-3000	MB	+	-	Fodder; Fuel
Duranta erecta L. (Duranta)	Verbenaceae	S	700-1600	MB, Th	+	-	M (Wp; skin itches, fever); insect repellent, ornamental
Elaeagnus conferta Wall ex. Royle (Ghiayeen)	Elaeagnaceae	S	800-1900	MB, Th	+	+	M (Fr, Fl; sores, ulcer); edible
Ephedra gerardiana Wall. ex Stapf (Chhedum, Khandphag)	Ephedraceae	S	2400-5000	MB, UP	-	+	M (Ap; joint pains, blood purification, asthma); fuel
Euonymus tingeus	Celastraceae	S	1300-3300	MB, UP	+	+	M (Rt, Bk; dyspepsia)
Euphorbia antiquorum L.	Euphorbiaceae	S		MB, Th	+	-	M (St latex; bodyache, veterinary use)
Euphorbia royleana Boiss.(Churro, Chhuee)	Euphorbiaceae	S	700-1800	MB, Th	+	-	M (St; asthma)
Ficus pumila L.	Moraceae	C	800-2000	W, UP	+	-	M (Fr latex; dysentery, indigestion, laxative)
Girardinia diversifolia (Forsk.) Gaud. (Bichhobuti)	Urticaceae	H	1500-2400	SH, UP	+	-	Fiber
Hippophae rhamnoides L. (Tarpu)	Elaeagnaceae	S	2100-4200	MB, Th	-	+	M (Wp; cough, cold, fever, blood purifier); fuel
Hippophae salicifolia D. Don (Chhe)	Elaeagnaceae	T	2000-3700	MB, Th	-	+	M (Fr,Bk; cuts, ulcer, wounds, cough, fever, dandruff, skin disease); edible, fuel, fodder, small timber, agricultural tools
Hippophae tibetana Schleecht. (Charma)	Elaeagnaceae	S	2900-4200	MB, Th	-	+	Fuel

Table 1: Continue

Taxa/ Local name	Family	Habit	Altitude range (m)	Role	Type of fence		Ethnobotanical Uses
					Living	Dry	
Ipomoea carnea Facq. (Ghodan)	Convolvulaceae	H	450-1800	MB, UP	+	-	M (Latex; skin problems)
Jatropha curcas L. (Jatropha)	Euphorbiaceae	S	350-900	UP, MB	+	-	M (Sd latex, St, Rt; anti-cancerous, skin diseases and rheumatism, cleaning teeth, piles, snake-bites, dye)
Juniperus communis L. (Shupa, Bithal)	Cuperaceae	S	2800-4500	MB, UP	-	+	M (Lf; leucorrhoea, skin ailments); fuel, incense
Juniperus recurva Buch.-Ham. ex D.Don (Shupa, Baithori)	Cuperaceae	S	3000-4500	MB, UP	-	+	M (Wp; Emetic); incense, fuel,
Lantana camara L. (Phulnu)	Verbenaceae	S	350-1900	MB, Th	+	+	M (Wp; cough, fever, boils)
Mucuna prurieus L. DC. (Dragle)	Fabaceae	S	350-1800	SH, UP	+	+	M (Sd; snakebite, aphrodisiac, nervous disorders and Seed hairs as pesticide)
Murraya koenigii Spreng. (Gandhela)	Rutaceae	S	350-1600	MB, UP	+	-	M (Lf,St; scouring teeth and for healthy gums); leaves flavoring agent for food
Opuntia stricta (Haw.) Haw. (Nag-phani)	Cactaceae	S	450-1400	MB, UP	+	+	M (Fr; antidiabetic), fruit edible
Populus ciliata Wall. ex Royle (Poplar)	Salicaceae	T	350-2600	MB	-	+	Fuel, fodder
Prinsepia utilis Royle (Bhekhal)	Rosaceae	S	400-1800	MB, Th	+	+	M (Wp; Skin Burns, cuts, rheumatic); edible
Prunus armeniaca L. (Chuli)	Rosaceae	T	1500-3500	MB	-	+	M (Lf, Sd; Massage oil, cooking oil, fever); edible; fuel
Punica granatum L. (Anar)	Rosaceae	T	700-2200	MB, Th	-	+	M (Rt, St, Fr, Lf; antihelminthic, checks bleeding of child birth and miscarriage, cholera, cooling, dysentery, eye problems, pimples, stomachache); edible, fuel
Pyrus pashia Buch.-Ham. ex Don (Shegal, Kainth)	Rosaceae	T	1200-1900	MB, Th	-	+	Edible, fodder, fuel
Ricinus communis L. (Airand)	Euphorbiaceae	S	600-1650	MB, UP	+	-	M (Sd, Rt, Lf, Fr; snake bite, burns, constipation, contraceptive, dysentery, gum troubles, headache, heat stroke, injury, intestinal worms, joint pain, laxative, muscular pain, purgative, sciatica, skin diseases, sores); edible
Robinia pseudo-acacia L. (Rasinia)	Fabaceae	T	1000-2300	MB	-	+	Fuel, agriculture implements, sports goods, animal feed
Rosa macrophylla Lindl. (Sia , Bangulab)	Rosaceae	S	1200-3200	Th, MB	+	+	Fuel
Rosa moschata Lindl. (Kuja)	Rosaceae	S	800-3200	Th, MB	+	+	M (Lf, Fr; diarrhoea, eye disorders, wounds); edible, fodder, fuel
Rosa sericea Lindl. (Jangli Gulab)	Rosaceae	S	1700-3100	Th, MB	+	+	M (Rt, Fl, Fr; uterine diseases); edible
Rosa webbiana Wall. ex Royle. (Chua, Siamendo)	Rosaceae	S	1500-4100	Th, MB	+	+	M (Fr, Rt, Fr; jaundice, stomachache); edible, fuel
Rubia cordifolia L. (Manjith)	Rosaceae	C	800-2900	W	+	-	M (Rt, St; tonic, astringent, snake bite, dysentery)
Rubus ellipticus Don (Akhe)	Rosaceae	S	600-1800	MB, Th	+	+	M (Fr, Rt; dysentery, malaria, stomachache)
Rubus foliolosus D.Don (Akhe)	Rosaceae	S	2300-3050	MB, Th	+	+	M (Fr, Rt; dysentery); edible
Saccharum spoutaneum L. (Nahl)	Poaceae	S	750-2500	MB	-	+	Fodder
Salix babylonica L. (Biuns)	Salicaceae	S	1500-3500	MB	+	+	M (Bk paste; cuts, wounds); Fuel and fodder
Sorbaria tomentosa (Lindl.) Rehder	Rosaceae	S	1900-3100	MB	-	+	M (Fr, St; asthma); fuel, oruamental
Urtica dioica L. (Bichhubuti, Aahn)	Urticaceae	H	600-3500	SH, UP	+	-	M (Lf; blood purifier, jaundice, skin eruption); edible
Vitex negundo L. (Bana)	Verbenaceae	T	600-1600	MB, UP	+	+	M (Lf, Fr, Rt; rheumatism, arthritis, sprains, anthelmentic, analgesic); fuel; religious
Zanthoxylum armatum DC (Tirmir)	Rutaceae	S	750-2600	MB, Th, UP	+	+	M (Fr, Sd, St; cough, cholera, fever, eczema, itching, piles, tonic, toothache); edible, fuel

Ap: Aerial parts, Bk: Bark, C: Climber, Fr: Fruits, Lf: Leaves, M: Medicinal, MB: Mechanical barrier, Rt: Roots, Sd: Seeds, SH: Stinging hairs, St: Stem, Th: Thorny, UP: Unpalatable, W: On walls, Wp: Whole plant

RESULTS AND DISCUSSION

Phytosociology of Biofencing plants: There are 61 species which the inhabitants of the area use for BF either live or in dried state. Among these; 10 were trees, 45 (shrubs), 4 (herbs) and 2 were climbers. These belong to the 25 families. All species belong to the angiosperms and none was found to be of other taxonomic group. Among the angiosperm families, Rosaceae (14 spp.); Fabaceae (8 spp.); Berberidaceae; (5 spp.); Elaeagnaceae and

Euphorbiaceae (4 spp. each); Verbenaceae (3 spp.); Agavaceae, Cuperaceae, Poaceae, Rutaceae, Salicaceae and Thymelaceae (2 spp. each) were dominant. Thirteen families were found to be monotypic. Among genera, *Berberis* (5 spp.); *Rosa* (4 spp.); *Hippophae* (3 spp.); *Agave*, *Astragalus*, *Caragana*, *Cotoneaster*, *Euphorbia*, *Juniperus* and *Rubus* (2 spp., each) were dominant genera.

There are 27 species like; *Berberis lycium*, *Bombex ceiba*, *Bougainvillea glabra*, *Caragana versicolor*, *Duranta erecta*, *Elaeagnus conferta*, *Euphorbia royleana*, *Hippophae rhamnoides*, *Princepia utilis*, *Rosa moschata*, *Rubus ellipticus* and *Zanthoxylum armatum* which are thorny or spinous. Among the total species, 17 are preferred due to their unpalatability to cattle. The notable among these are; *Agave Americana*, *Cannabis sativa*, *Ipomoea carnea*, *Murraya koenigii*, *Opuntia stricta*, *Ricinus communis* and *Zanthoxylum armatum* etc. Few species possess stinging hairs e.g., *Girardinia diversifolia*, *Mucuna pruriens* and *Urtica dioica* and help to prevent cattle or wildlife entry into fields.

The altitudinal distribution of the floristic diversity has been presented. Maximum number of species (50 spp.) was recorded in wide distribution range i.e., 1000 m followed by (11 spp.) in moderate range i.e., <1000 m. The representative species of altitudinal zone, <1000 m were; *Berberis jaeschkeana*, *Betula utilis*, *Caragana brevifolia*, *Cotoneaster bacillaris* and *Girardinia diversifolia* etc. People of the region use 39 species of plants as living hedges as compared to 44 as dried and 22 in both (living and dried also). The plants with thick foliage cause obstruction to sight of cattle, thereby prevent grazing and act as mechanical barrier e.g., *Adhatoda zeylenica*, *Astragalus candolleanus*, *Astragalus strobiliferus*, *Bambusa bambos*, *Cotoneaster microphylla* and *Desmodium elegans* etc.

Ethnomedicinal uses: Present study showed that 55 species of BF are medicinally important and used to care various ailments (Table 1). Different medicinally important plant part used are; whole plant (8 spp.), stem (38 spp.), bark (5 spp.), leaves (12 spp.), roots (23 spp.), seeds (6 spp.) and latex (4 spp.) (Table 1). Stem of *Berberis umbellate*, *Betula utilis*, *Caragana versicolor*, *Cotoneaster bacillaris*, *Euphorbia antiquorum*, *Jatropha curcas*, *Rubia cordifolia*, *Sorbaria tomentosa*, *Zanthoxylum armatum*; Leaves of *Agave Americana*, *Cotoneaster bacillaris*, *Juniperus communis*, *Murraya koenigii*, *Prunus armeniaca*, *Ricinus communis*; Bark of *Acacia catechu*, *Bombex ceiba*, *Euonymus tingens*, *Hippophae salicifolia*, *Salix babylonica* and latex of *Euphorbia antiquorum*, *Ficus pumila*, *Ipomoea carnea* and *Jatropha curcas* is used. For stomach disorders 20% of BF plants are used, like wise for others; skin complaints (17%), asthma (14%), fever and joint pains (11% each), eye disorder (6%), blood purifier (5%), jaundice and tooth problems (4% each), aphrodisiac and snake bite (3%), anticancerous and nerve disorders (1% each) (Fig. 2).

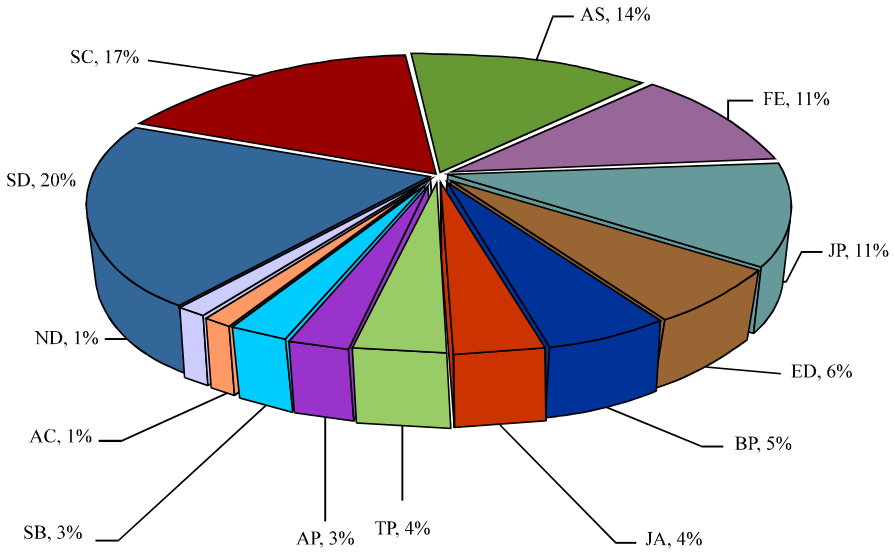

Fig. 2: Pie diagram showing percentage of BF plants used to cure various ailments, AC: Anticancerous, AP: Aphridisiac, AS: Asthma, BP: Blood purifier, ED: Eye disorder, FE: Fever, JA: Jaundice, JP: Joint pians, ND: Nervous disorders, SBL Snake bite, SE: Skin complaints, SD: Stomach disorders, TP: Tooth problems

Ethnobotanical uses: Of the recorded species, 33 are used as fuel. Among these notable are; *Berberis aristata*, *Berberis lycium*, *Betula utilis*, *Astragalus strobiliferus*, *Caragana brevifolia*, *Desmodium elegans*, *Ephedra gerardiana*, *Hippophae tibetana* and *Populus ciliata* etc. Nearly 20 species are edible, e.g., *Elaeagnus conferta*, *Hippophae salicifolia*, *Prunus armeniaca*, *Punica granatum*, *Pyrus pashia*, *Rosa moschata*, *Rubus foliolosus* etc. Among others include fodder (8 spp.), fiber and ornamental (4 spp. each), incense and agriculture tools (2 spp. each) (Table 1).

A live fence plant acts as soil filter preventing soil erosion and with time makes the terraced fields more stable. Fast growing species are effective and some of them can be used as fodder or fuel. They also help in storing some moisture (Samra *et al*., 1999) and have strong soil binding capacity and are efficient enough to strengthen the mud boundaries of crop fields and houses (Eyzaquirre and Linares, 2001; Ramakrishnan *et al*., 1996).

Documentation of BF plants to the control of human diseases has been gaining importance in recent times (Reddy, 2008). The BF plants reported from Himachal Pradesh in the present study are used by the inhabitants for their routine treatment practices. Biofencing and afforestation practices of some potential medicinal species like; *Rubia cordifolia*, *Rubus ellipticus*, *Vitex negundo*, *Ricinus communis*, *Hippophae salicifolia*, *Prunus* sp., *Rosa sericea*, *Rosa macrophylla* and *Zanthoxylum armatum* etc. should be made prevalent so that they would also provide nutrition to the local communities and help to conservation of these plant resources.

CONCLUSION

This traditional knowledge contributes to the conservation of biodiversity and provides resource of economic and ecological interest and decreasing the pressure on forests. It can also be a desirable substitute to wall fences in the region. In addition to this, many potential medicinal benefits and the number of locally developed systems of fencing are currently not well documented in the area. Further research on these may help in developing effective drugs for health care. Moreover knowledge can be gained from farmers and local folks who have been already using Biofencing in their farming systems and can help expanding this knowledge. In conclusion, there is need to encourage the practice of using plant species as Biofencing in this region of the world.

REFERENCES

Bhattarai, S., R.P. Chaudhary and R.S.L Taylor, 2007. Plants used as fence and fuelwood in Manang district, Central Nepal. Scient. World, 5: 107-111.

Borkataki, S., M. Chutia and S.K. Borthakur, 2008. Ethnobotany of biofencing among teagarden and ex-teagarden communities of Nagaon district of Assam Indian J. Trad. Knowl., 7: 666-668.

Chhetri, R.B., 2005. Ethnobotany of bio-fencing in Dhulikhel region in Nepal. Ethnobotany, 17: 176-178.

Choudhury, P.R., P. Rai, U.S. Patnaik and R. Sitaram, 2005. Live fencing practices in the tribal dominated Eastern Ghats of India. Agroforestry Syst., 63: 111-123.

Collett, H., 1902. Flora Simlensis. Thacker Spink and Co., Calcutta and Simla.

Dhaliwal, D.S. and M. Sharma, 1999. Flora of Kullu District (Himachal Pradesh). Bishen Singh Mahendra Pal Singh, Dehra Dun, Pages: 744.

Dhiman, D.R., 1976. Himachal Pradesh Ki Vanoshdhi Sampada. Imperial Printing Press, K.B. Dharmshala, (H.P.).

Eyzaquirre, P.B. and O.F. Linares, 2001. A New Approach to the Study and Promotion of Home Gardens. In: People and Plants Handbooks, Issue 7, Growing Diversity, Martin, G.J., S. Barrow and P.B. Eyzaguirre (Eds). WWF-UNESCO-RBG, Kew, pp: 30-33.

Jain, S.K., 1991. Dictionary of Indian Folkmedicine and Ethnobotany. Deep Publications, New Delhi.

Jain, S.K., 2004. Credibility of traditional knowledge- the criterion of multinational and multi ethnic use. Ind. J. Trad. Knowledge, 3: 137-153.

Kandari, L.S., P.C. Phondani, K.C. Payal, K.S. Rao and R.K. Maikhuri, 2012. Ethnobotanical study towards conservation of medicinal and aromatic plants in upper catchments of Dhauli Ganga in the Central Himalaya. J. Mountain Sci., 9: 286-296.

Kumar, S., M.N. Naugraiya and G. Patil, 2013. Review: Environmental benefits of live fence and their role in biodiversity conservation. Life Sci. Leaflets, 3: 6-16.

Mishra, S., P. Vasudevan and S. Prasad, 2011. Biofencing: An ecofriendly boundary wall. J. Scient. Ind. Res., 70: 727-731.

Otero, J. and M. Onaindia, 2006. Landscape structure and live fences in Andes Colombian agrosystems: Upper basin of the Cane-Iguaque. Rev. Biol. Trop., 57: 1183-1192.

Polunin, O. and A. Stainton, 1984. Flowers of the Himalaya. Oxford University Press, UK.

Punjani, B.L., 1998. Role of plants in field fencing in tribal areas of district sabarkantha (North Gujarat). Ethnobotany, 10: 56-60.

Ramakrishnan, P.S., A.K. Das and K.G. Sexena, 1996. Conserving Biodiversity for Sustainable Development. Indian National Science Academy, New Delhi.

Reddy, A.V.B., 2008. Use of various bio-fencing plants in the control of human diseases by the Lambada Tribe inhabiting Nalgonda District, Andhra Pradesh, India. Ethnobotanical Leaflets, 12: 520-523.

Samant, S.S., U. Dhar and L.M.S. Palni, 1998. Medicinal Plants of Indian Himalaya: Diversity, Distribution and Potential Values. G.B. Pant Institute of Himalayan, India, pp: 163.

Samant, S.S., U. Dhar and L.M.S. Palni, 2001. Himalayan Medicinal Plants: Potential and Prospects. Gynanodya Publications, Nainital, India Pages: 435.

Samra, J.S., S.K. Dhyanai and A.R. Sharma, 1999. Soil and water conservation strategies for sustainable agriculture in North-Eastern Hill region. Proceedings of the National Seminar on Strategies for Agricultural Research in the North East, November 10-12, 1999, NAAS.

Sharma, P., 2013. Study on medicinal resources of protected Areas of Mandi District, North West Himalaya. J. Ethnobiol. Trad. Med., 118: 389-401.

Singh, D.K. and P.K. Hajra, 1996. Floristic Diversity. In: Changing perspectives of Biodiversity Status in the Himalaya. Gujral, G.S. and V. Sharma (Eds.). British Council, New Delhi, pp: 23-38.

Singh, S.K. and G.S. Rawat, 2000. Flora of Great Himalayan National Park, Himachal Pradesh. Bishen Singh Mahendra Pal Singh, Dehradun, India, Pages: 304.

Subrahmanya, P.K. and K. Raveendran, 2010. Traditional plant fencing and its conservatory nature in Kasaragod District, Kerala, India. Ethnobotanical Leaflets, 14: 681-686.

Zeeshan Hasan, S., V. Misra, S. Singh, G. Arora, S. Sharma and S. Sharma, 2009. Current status of herbal drugs and their future perspectives. Biol. Forum Int. J., 1: 12-17.