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Volume No 1 Issue No.4   December 2012

www.iresearcher.org

THE INTERNATIONAL RESEARCH JOURNAL "INTERNATIONAL RESEACHERS"

www.iresearcher.org

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Threats to medicinal plant diversity in Soon Valley (Salt Range) of Punjab, Pakistan

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Abstract

It was an ethno botanical study in which threats to vegetation particularly medicinal plants and their uses in Soone Valley were identified by interviewing the residents and through personal observations. The survey showed that inhabitants of the valley are well aware of the fact that natural resources particularly medicinal plants of the valley are diminishing with alarming rate. Continuous cutting for various purposes particularly fuel and fodder, over grazing, less rain fall and lowering of water table are responsible for reduction in medicinal plants of the valley. Accidental fires by the herds' men and illegal honey hunters, agricultural activities and harvesting of medicinal plants by uprooting are the main reason of lowering of medicinal plants. Lack of knowledge and interest relating medicinal plants, local doctors (Hakeems) and over harvesting of medicinal plants without taking care of its survival in future due to less knowledge of conservation also reduces their production.

Almost all the respondents voted for gaining knowledge from the older and able peoples and transfer to next generations for protection of medicinal flora particularly endangered species by protecting them from grazing, fires and cutting. Respondents also suggested cultivation, research and analysis of medicinal plants as essential component for their improvement and development of confidence of common man.

Key words: Threats, Soone Valley, medicinal plants, diversity, conservation.

1. Introduction

The Earth's natural resources whether renewable or nonrenewable play a vital role in the human welfare. Since the early age, human have been engaged in exploring new resources but seem to use them in a sustainable way adopting some simple techniques like deferred gratification (Hunter, 1996). However, during the last fifty years, following industrialization and green revolution, the exploding human population has placed a cumbersome pressure on natural resources, particularly the plant diversity. The current era is facing considerable biological extinction due to a number of natural and anthropogenic activities including the clear-cutting of forests, conversion of grasslands into cultivated lands, industrialization, urbanization, overgrazing, soil erosion, desertification, *etc.* Similarly, overexploitation also poses a severe threat to biodiversity and has led to a number of species to extinction (Goel, 2002).

The term Ethno Botany was coined by Harshberger in 1896 for the plants used by primitive and aboriginal people for the cure of a number of diseases (Plotkin, 1991). Now this term has been expanded and Ethno botany is considered to be a part of Economic Botany, which emphasizes on the economic utilization of plants for human welfare (Heiser, 1993; Wickens, 2001).

In the subcontinent, Herbal Medicine System referred to as Unani medicine was introduced by the Greco-Arabic society. It is based on many theories and remedies introduced by Ayurveda, a practice that started the utilization of medicinal plants as early as 2500 BC (Mahmood *et al.*, 2004).

According to the World Health Organization (WHO), more than 80% of the world's population relies on traditional herbal medicine for their primary health care needs (Inglis, 1994). These traditional systems are culturally and psychologically more tolerable in most of the societies as compared to western allopathic medicines. In addition, being the natural plant products, they are considered to be the safest way of treating diseases with least side effects on human health as compared to allopathic or homeopathic medicines (Prescott-Allen and Prescott-Allen, 1982).

The Soon Valley, present in the center of the Salt Range is regarded the heart of Salt Range and covering an area of 300 km^2 with average elevation of 762 m and the highest point in the area is the Sakesar Top being 1522 m above sea level. It is 20 km in length and 5 km in breadth (Afzal *et al.*, 1999). In recent years, the climate of the valley is characterized by a relatively low annual rainfall (20 inches) and average minimum temperature of 1 ^{0}C during January, while average maximum temperature is 36 ^{0}C during June. Hot dry winds and long periods of drought are frequent where as winters are accompanied by frost (Hussain, 2002).

Currently, the dominant vegetation of this valley comprises of *Adhatoda vasica, Achyranthus aspara, Acacia modesta, Acacia nilotica, Melilotus alba, Capparis decidua, Chenopodium album, Calotropis procera, Acacia farnesiana, Datura metel, Fumeria indica, Olea ferruginea, Peganum harmala and Zizyphus numularia* (Ahmad *et al.*, 2002; Hussain, 2002). These and many other such species are traditionally popular as curing agents and have been used by indigenous people.

During the last quarter century, environmental and cultural changes, market-based economics and over harvesting of medicinal plant species have resulted in resource degradation, loss of biodiversity and the loss of indigenous and traditional medicinal knowledge (Sheng-Ji, 2001).

Majority of the species are threatened by physical stresses and anthropogenic disturbances. The extensive uses are common threats to most of the plant species. They have narrow ecological amplitude and their unwise use has threatened their survival in the Salt Range (Ahmad *et al.*, 2002). At present, there is little understanding for conservation or collection plan, and so this natural resource faces significant risk of depletion. Keeping in view all these facts, this ethnobotanical survey was planed to detect major uses and threats to medicinal plant diversity in Soone valley.

2. Material and Methods

Valley was extensively surveyed and the available species were enlisted. Meetings were arranged with local herbalists (called hakims, who cure various diseases with plant extracts), older peoples having traditional plants knowledge, government officials from Department of Forestry and Agriculture and various non government organizations as SVDP (Soone Valley Development Project) to know about traditional uses of plants in the area. Meteorological data were recorded at Horticultural Research Station, Soon Valley for the entire study period.

2.1 Selection of sites

On the basis of a preliminary survey six ecologically diverse study sites namely Khabeki, Khoora, Dape Sharif, Anga, Knotti Garden and Jallar were selected. These sites were selected mainly on the basis of differences in their environmental attributes especially variations in elevation, slope, aspect, altitude, topography, soil composition, habitat, vegetation type and plant community.

Ecological data were recorded using quadrate sampling method. Fixed quadrates of 1 m^2 for herbs and 5 m^2 for shrubs and trees were used and all individual plants in the quadrates were counted. Randomly 15 quadrates were

taken at each site. Data recorded were used for the calculation of density and frequency of species (Ahmad et al., 2012).

$$Density~(\%) = \frac{Total~No.~of~individuals~of~a~species~in~a~quadrate}{Total~No.~of~individuals~of~all~species~in~a~quadrate}~x100$$

$$Frequency~(\%) = \frac{No.~of~quadrates~in~which~a~species~occurred}{Total~No.~of~quadrates~taken}~x100$$

Threats to biodiversity particularly medicinal plants were identified through following steps.

1. Through interviews of local residents particularly aged persons having traditional knowledge of plants. This was accomplished by developing questionnaire performa.
2. Discussion with government officials, public representatives, press reporters and NGO's representatives.
3. Through personnel observations.

For this purpose District Wild Life Officer and Agricultural Officer, Noushera**,** Research Officer, Noushera, Incharge Basic Health Unit, Nowshera, Executive Director, Soone Valley Development Project, Research officer, WWF, Noushera, Herbalists, Tehsil Nazims, Press Reporters and residents of selected study sites were interviewed.

3. **Results:**

For the identification of threats and develop a strong conservation plan for plant species, it is necessary to get the true picture of species, information about habitats, ecological factors and the disturbing factors prevailing there. Density and frequency of different plant species in an area are excellent ecological markers demonstrating the status of these species in the area.

3.1 Density

It was observed from pCCA of density data that large number of species were associated with Khoora, Jallar and Anga, however, *Melilotus indica*, *Salvia virgata* and *Solanum surraten*s were more associated with Anga and *Ziziphus nummularia, Adiantum capillus-veneris, Alternanthera sessilis, Fagonia indica, Peganum hermala*, *Withania coagulens*, *Cyprus niveus* and *Veronica arvensis were* more with Khoora. Some herbaceous species as *Malvastrum coromandelianum*, *Cida cordifolia, Parthenium historophorus*, *Cannabis Sativa*, *Mentha longifolia*, *Tenospora malabarica, Barleria cristata*, *Cynoglosum lanceolatum*, *Heliotropium strigosum* and a tree *Ziziphus mauritiana* were associated with Khabeki, Knotti Garden and Dape Sharif. Although some species like *Boerhavia procumbens, Tecomella undulate, Trebulus terristis* had more distribution in Khoora, Jallar and Anga sites. Species such as *Buxus papillosa*, *Dodonaea viscose*, *Oxalis corniculata*, *Solanum nigrum*, and *Tenospora malabarica* were equally distributed between Khoora, Jallar and Anga sites. Species of *Prosopis juliflora, Nerium oleander, Prosopis glandulosa, Adiantum capillus-veneris*, *Conyza ambigua*, *Datura metel* and *Desmostacya bipinnata* showed relatively less effect of sites on their distribution. However, these seem to be a little associated with Dape and Knotti Garden. *Diclyptera bupleuroides* was distributed equally in Khabeki and Knotti Garden sites (Fig. 1).

3.2 Frequency

The *pCCA* of frequency data showed that most of the species were associated with Khoora, Anga and Khabeki sites. Species of *Mentha longifolia* and *Tenospora malabarica* were frequent at Knotti Garden. However, at Dape Sharif species of *Ziziphus mauritiana*, *Barleria cristata*, *Prosopis juliflora, Narium oleander, Cynoglosum lanceolatum* and *Heliotropium strigosum* were frequently associated. Species of *Buxus papillosa, Oxalis corniculata, Withania somnifera* were equally associated with Anga, Khabeki and Knotti Garden sites. Species of *Withania coagulens*, *Fagonia indica* and *Cyprus niveus* were associated with Jallar. Species of *Prosopis glandulosa, Adiantum capillus-veneris, Cannabis sativa*, *Conyza ambigua*, *Datura metel*, *Desmostacya bipinnata* and *Diclyptera bupleuroides* had frequency associated with both Knotti Garden and Dape Sharif but more with Knotti Garden.

4. DISCUSSION

Spatial variations have been discussed on the basis of relationship between vegetation types, elevation, soil composition and soil mineral contents whereas the seasonal variations in plant diversity were related to rainfall, maximum and minimum temperature and availability of different nutrients during different seasons.

Among the environmental factors affecting the vegetation of an area, the moisture in the soil resulting from rainfall was the most important factor for plant growth (Skarpe, 1990; Michael *et al.*, 2002) and distribution of species which was also controlled by soil composition, soil type and mineral nutrients of soil. The results of present study are in accordance with Sharma *et al.*, 1983; Cole *et al.*, 1987, Dalsted, 1988; Smitheman and Perry, 1990 who supported the criteria mentioned above, investigated and described the plant communities of different areas of the world.

Spatial variation showed that most of the salt tolerant species such as *Fagonia indica* and *W. cogulans* were distributed around saline soils of Jallar. It also had high field capacity which helps to maintain more moisture even when it rained rarely. Most of the herbs and shrubs were distributed around Khoora which is fertile area around cultivated lands and grazing is the common threat and tree species are mostly very sensitive to grazing where as grasses and herbs are tolerant. Some species were associated with Khabeki as macronutrients and field capacity was more associated with this site.

Canabis sativa, M. longifolia and *Tinospora malabarica* were entirely associated with Knotti Garden around the water springs as these species are mostly found at high moisture containing sites (Dupont and Plummer, 1997) and dry spell is a threat for these species. Moreover enough macronutrients were also available at Knotti Garden (Ahmad *et al.,* 2011) which is essential for maximum growth of herbs (Nanette *et al.,* 2007).

Large number of species were associated around Dape Sharif, Knotti Garden and Khabeki sites due to their requirement for macronutrients (Skarpe, 1990; Nanette *et al.,* 2007).

Most of the species were more frequent around Khabeki and Khoora due to its association with macronutrients and high field capacity (Ahmad *et al.,* 2011). Salt and drought tolerant species were associated around Jallar. Moisture loving and moderately moisture requiring species were associated with and equally between the Knotti Garden and Dape Sharif.

The spatial variations might be due to the soil type, composition of soil, elevation of selected sites, moisture contents of soil, nature of disturbance like grazing pressure, human interference and distance of study site from population area etc. From the results it was found that *Justicia adhatoda* was the most abundant species in the Soon Valley. That might be due to its adaptations to the environmental and osmotic adjustment to various types of environments.

It is clear from the table 2 that inhabitants of the valley are well aware of the fact that natural resources particularly medicinal plants of the valley are diminishing with alarming rate but they do not have enough resources to save this loss. However, according to 90% respondents, continuous cutting for various purposes particularly fuel and

fodder, over grazing and less rain fall are responsible for reduction in medicinal plants of the valley. Lowering of water table is also considered (70% respondents) as one of the major causes of reduction in medicinal plants. According to 50% respondents accidental fires by the herds' men and illegal honey hunters are the main reason of lowering of medicinal plants. Agricultural activities and harvesting of medicinal plants by uprooting (40% respondents) from natural vegetation are also causing damage to medicinal plant diversity. Lack of knowledge and interest relating medicinal plants (35% respondents) also reduces their production. Local doctors (Hakeems) are also responsible for (30% respondents) over harvesting of medicinal plants without taking care of its survival in future due to less knowledge of conservation. Personal observation showed that continuous grazing and clear cutting for fuel and forage are the main causes of reduction in medicinal plants. Less water availability is not so severe problem for all medicinal plants as most of them are found at stressed conditions which are necessary for secondary compound synthesis.

Almost all the respondents voted for gaining knowledge from the older and able peoples and transfer to next generations for protection of medicinal flora particularly endangered species by protecting them from grazing, fires and cutting. Most of the respondents suggested cultivation, research and analysis of medicinal plants as essential component for their improvement and development of confidence of common man.

Human activities have changed landscape and native habitats of different species which have put many unique species at risk. One of the major threats posed by human activities in Soon Valley is the increased human population which has increased pressure on all natural resources particularly on species responsible for food, fuel, forage and medicine (Hussain, 2002). Due to limited resources of fuel people in the valley cut some rare plant species including some important medicinal plants for fuel. This high population growth and its demands for increased standards of living have put the available resources on risk. Economic development widens the gap and forces the poor to depend heavily on natural resources, which cannot be correlated with any project developed for the sustainable use of natural resources.

During last many years frequency of rain falls has been considerably decreased which caused lowering of water table and severly affected vegetation of the valley. Large scale deforestation in the adjoining areas of the valley has severely changed the environment due to which lush green slopes has been converted to barren. Like global warming, this has led to a progressive rise in temperature (Ahmad, 2002). Materiological data of the valley also supports the above statement. Last eight year data showed that there was a severe dry spell in the area posing severe impacts on the vegetation and environment. As forests play important role in raining and desertification caused shortage of raining. There are three wet lands in Soon Valley namely Khabeki, Ucchali and Jahlar containing brackish to saline water thus supporting very small marsh and aquatic vegetation and these are fed mostly fed by rain or very small quantity of spring water from the surrounding hills (WWF, 1994). Reduction in rainfall and rise in temperature lowered the water level of these lakes causing severe impacts on the vegetation of the area.

Aridity and salinity, due to deficiency of water, in Salt Range particularly in Soone Valley, are also severe threats to vegetation. Large number of species living in the lower parts particularly is vulnerable to salinization. In different parts of the world large number of the natural plant species is threatened with extinction because of arid land salinity (Keighery, 2000). In drought periods, different plant populations become as much as 95% smaller than in years with adequate rain fall and only a few plants produced flowers that contributed to the seed bank (Altman, 2003). Horrible results have been observed on the possible consequences of dry land salinity on the plants and animals which share our agricultural zones.

Overgrazing is perhaps the most serious threat to large number of plant species in the valley, as the people in the valley are poor and mainly depend upon animals for their earning. They do not have enough land for growing fodder of their animals, therefore graze their sheep, goats, cows, camels and other animals on natural vegetation causing real damage to vegetation particularly rare medicinal plant species. Extensive grazing accompanied by aridity in the valley accelerated the erosion process. Many reports sport the above findings (Macias and Royes, 2002). According to Rajvanshi *et al.* (1985) stresses such as grazing, browsing and trampling are more important than edaphic factors in determining community composition and affecting biodiversity. Chhangani (2002) has placed overgrazing as one of the major causes of degradation of the floral diversity.

Over-harvesting of different plant species particularly medicinal plants has also become a severe threat to medicinal plant diversity. One of the major reasons of over-harvesting is lack of knowledge (IUCN, 2004) because most of the people are unaware of their importance and use large quantity of these valuable plants for fuel and fodder. Some times local doctors (Hakeems) collect a plant species on a large scale without taking care of its future existence, so that its existence becomes threatened such as resources of *Litsea* are depleted to an extent that 95% of its crude drug available in the market is imported from the neighboring countries (Ahmad and Amin, 2004).

Deforestation has also severely affected vegetation in general and medicinal flora in particular. Main causes of deforestation and degradation of natural habitats are mostly anthropogenic stresses, associated with rapid growth in human population and the prevailing poverty in the rural landscape of Pakistan. Poverty of people led them to cut important plants and sell in the market for their earning. According to Kaimowitz (2003) forest resources play important role to rural livelihood which become a threat and causes loss of important plant species. Low rain fall in recent years also played a role in less growth of forests. Therefore it can be concluded that forests were affected due to biotic and a biotic factors.

Forest fires were also frequently recoded in the valley which also caused reduction in some valuable plants in the forests. These fires are mostly deliberately ignited by local herdsmen and illegal honey hunters (WWF, 1994). Normally such fires are self extinguished after a day or two but destroyed some important rare plant species. Various such fires were recorded during the course of study.

Increase in population emphasizes the inhabitants to use some extra land for cultivation of crops to fulfill the needs of increasing families. So natural areas are converted to agricultural lands destroying the habitat of large number of species. Destruction of local habitat is the main cause of the present high rate of local extinction (IUCN, 1997). According to Rouget *et al. (*2003) there are three important factors that threaten the biodiversity, as cultivation of intensive agriculture, urbanization and stands of invasive self sown alien trees and shrubs.

Collection of plants, seeds and particularly uprooting of plants from natural population, threatens a large number of species, although the harvesting of seeds had minimal impact on population growth where as harvesting by uprooting, of adult plants led to rapid population decline. According to Raimondo and Donaldson, (2003) the conservation of adult plants was essential for all species.

Due to the location of most of the villages at higher altitude the requirement of fuel for cooking especially during winter also increased due to lower atmospheric pressure and frosting temperature which causes extra pressure on vegetation of the valley.

In Salt Range of Pakistan, biotic factors strongly interfere with the forests but its impacts are greater in the open-to-excess areas than the protected areas. The protected areas in most of the cases are badly invaded by the invasive introduced species e.g. *Prosopis* species introduced in the Sodi Game Reserve, is threatening the existence of important local vegetation particularly medicinal flora, in the protected area (Ahmad and Waseem, 2004).

From the above discussion it can be concluded that population pressure, low rain fall, soil aridity, over grazing, deforestation and natural and accidental fires are the main threats to biodiversity in Soon valley. If the local peoples were not provided alternate of these problems the prevailing disturbances will soon eliminate the remaining patches of vegetation particularly medicinal flora of the valley. Immediate and complete protection, efficient recovery system and effective community participation for long term conservation are essential for sustainable use of plant resources in the area. Similar suggestions were given by Hussain, 2002; Altman, 2003 and Ahmad and Waseem, 2004.

References

Afzal, S., M. Younas and K. Hussain. 1999. Physical and chemical characterization of the agricultural lands of the Soan.Sakesar Valley, Salt Range, Pakistan. Aust. J. Soil Res., 37: 1035-1046.

Ahmad, H. and M. Waseem. 2004. Conservation status of some medicinal plants of the Salt Range. Zonas Áridas. 8:1013-1044.

Ahmad, H., A. Ahmad and M. M. Jan. 2002. The medicinal plants of Salt Range. Online J. Biol. Sci. 2: 175-177.

Ahmad, I., M. S. A. Ahmad, M. Hameed, M. Hussain, M. Y. Ashraf, F. Ahmad and H. Malik. 2012. Status of plant diversity in the soone valley, salt range, Pakistan. *Pak. J. Bot.*, 44: 59-62, Special Issue May 2012.

Altman, A. 2003. Plant genetic engineering is a fact. It is an efficient and necessary breeding technique and it is both a chalenge and a solution that will be accepted by the public. Acta Hort., 625: 425- 437.

Chhangani, A. K. 2002. Major threats to floral diversity of kumbhal garh wild life sancturyin the Aravalli hills of Rajasthan. Flora and fauna (Jhansi), 8 (2): 104- 106.

Edeoga, H.O., D. E. Okwu and B.O Mbaebie.2005. Phytochemical constituents of some Nigerian medicinal plants. African J. of Biotechnol. 4 (7): 685-688.

Goel, A.K. 2002. Ex situ conservation studies on some rare , endangred and endemic plant species at NBRI botanical garden . Ind. J. Forestry , 25(1-2) 67-78.

Hunter,M.L. Jr. 1996. Fundamentals of conservation biology. Black well Science, Inc. USA, pp: 7.

Hussain, M. 2002. Exploration of legume diversity endemic to salt range, in the Punjab. Annual Technical report submitted to University of Agriculture Faisalabad, Pakistan

Inglis, J. 1994 : Introduction. Nature and Resources, 30: 3-4.

IUCN. 2004. Biodiversity Programme. http://asp.isb.sdnpk.org/biodiversity/index.htm

Kaimowitz, D. 2003. Not by bread alone forest and livelyhoods in sub Saharan Africa. EPI Proc., (47): 45 - 63.

Keighery, G. 2000. Salt: The creeping threat to biodiversity. Media Release - Ref 2000/240 - Sep 12, 2000. http://www.cpbr.gov.au/biodiversity2000

Macias, C.G.V. and M. N. de Los Royes. 2002. A new genus for the Cactaceae family for the state of Nuevo leon, Mexico, Cactaceae Y Suculentas Mexicans., 47(4):78- 86.

Mahmood, T., M. A. Khan, J. Ahmad and M. Ahmad. 2004. Ethnomedicinal Studies of Kala Chitta Hills of District Attock, Pakistan. Asian J. Plant Sci., 3 (3): 335-339.

Okwu, D.E. 2004. Phytochemicals and vitamin content of indigenous spices of South Eastern Nigeria. J. sustains Agric. Environ., 6: 30-34.

Plotkin, M.J. 1991. Traditional Knowledge of Medicinal Plants - The Search for New Jungle Medicines. In Akerele, O., V. Heywood, and H. Synge (eds.) The Conservation of Medicinal Plants, Proceedings of an International Consultation, 21-27 March 1988, Chiang Mai, Thailand. Cambridge: Cambridge University Press, pp 53-64.

Prescott-Allen, R., and C. Prescott-Allen. 1982. What's Wildlife Worth? Economic Contributions of Wild Animals and Plants to Developing Countries London: Earthscan.

Raimondo, S. C. and J. S Donaldson. 2003. Responses of cycads with different life histories to the impact of plant collection. Stimulation models to determine important life history stages and population recovery times. Biol. conservation, 111 (3): 345- 358.

Rajvanshi, R.,S.P.Jain and S. R. Gupta. 1985. Soil and vegetation analyses of some forest habitates at Kurukshetra. Ind. J. Forestry, 8 (2):118- 123.

Rouget, M., D.M. Richardson, R M. Cowling, Y.W. Lioyd and A.T. Lombard. 2003. Current pattern of habitat transformation and future threats to biodiversity in terrestrial ecosystem of the cape floristic region. South Africa Biol. Conserv., 112(1/2): 63-85.

Sheng-Ji, P. 2001. Ethnobotanical Approaches of Traditional Medicine Studies: Some Experiences From Asia. Pharma. Biol. 39: 74-79.

Wickens. G.E. 2001. Economic Botany: Principles and practices. Kluwer Academic publishers. Pp: 4-5.

WWF, 1994. Ucchali complex (Khushab): A report on the planning the conservation of the water bodies based on the indigenous population

Table 1: Summary of the partial CCA of the vegetation data for density and environmental data for seasons and sites.

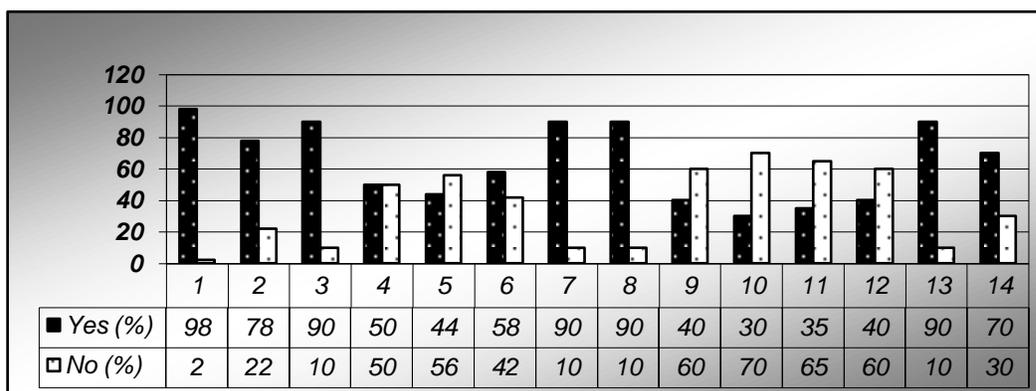| Parameters and data		Axes		Total inertia	F-ratio	*P* value
		1	2			
Density (Seasons | Sites)	Eigenvalues	0.047	0.036	0.784	2.835	0.0080 ***
	Sum of all canonical Eigenvalues	0.097				
Density (Sites | Seasons)	Eigenvalues	0.302	0.071	0.784	12.114	0.0020 ***
Frequency (Seasons | Sites)	Eigenvalues	0.071	0.050	1.032	3.053	0.0020 ***
	Sum of all canonical Eigenvalues	0.138				
Frequency (Sites | Seasons)	Eigenvalues	0.248	0.111	1.032	5.816	0.0020 ***
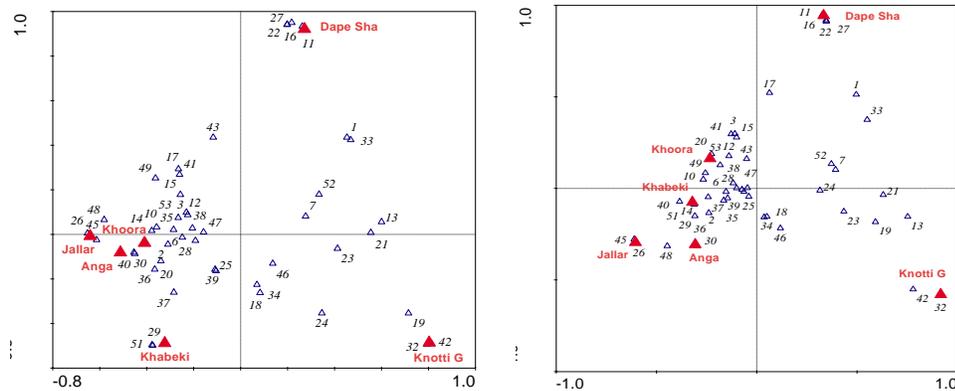
Figure 1: Partial CCA ordination biplot showing the effects of seasons and sites on species composition and frequency in Soone Valley of Salt Range.

Leagends

1. *Acacia farnesiana*; 2. *Acacia modesta*; 3. *Acacia nilotica*; 4 . *Albizia lebbeck*;5. *Dalbergia sissoo*; 6. *Olea ferruginea*; 7. *Prosopis glandulosa*;8. *Salvadora oleoides*; 9. *Tamarix aphylla*; 10. *Ziziphus nummularia*; 11. *Ziziphus*

mauritiana; 12. *Achyranthes aspera*;13. *Adiantum capillus-veneris*; 14. *Alternanthera sessilis*; 15. *Sophora tementosa*; 1. *Barleria cristata*; 17. *Boerhavia procumbens*; 18. *Buxus papillosa* ; 19. *Cannabis sativa*; 20.*Capparis decidua*; 21.*Conyza ambigua*; 22. *Cynoglosum lanceolatum*; 23. *Datura metel*; 24. *Diclyptera bupleuroide*; 25.*Dodonea vasica*; 26.*Fagonia indica*; 27. *Heliotropium strigosum*; 28. *Justisia adhatoda*; 29. *Malvastrum coromandelianum*; 30. *Melilotus indica*; 31. *Medicago denticulate*; 32. *Mentha longifolia*; 33. *Nerium oleander*; 34. *Oxalis stricta*; 35. *Peganum hermala*; 36. *Salvia vergata*; 37. *Sida cordifolia*; 38. *Solanum incanum*; 39. *Solanum nigrum*; 40. *Solanum surretens*; *41. Tecomela undulate; 42. Tenospora malabarica; 43. Trebulus terrustis;* 44 *Vicia sativa*; 45. *Withania coagulens*; 46. *Withania somnifera*; 47. *Cynodon dactylon*; 48. *Cyprus niveus*; 49. *Saccharrum munja*; 50.*Saccharrum spontaneum;* 51. *Parthenium procumbens*; 52.*Desmostacya bipinnata;* 53. *Veronica arvensis* L.

Figure 2. Results of the Questionnaire Performa for identification of threats to medicinal plants

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
■ Yes (%)	98	78	90	50	44	58	90	90	40	30	35	40	90	70
□ No (%)	2	22	10	50	56	42	10	10	60	70	65	60	10	30

Legends: 2. Are medicinal plants important? 2. Are medicinal plants decreasing in your locality? 3. Clear cutting or deforestation? 4. Forest fires? 5. Agricultural activities? 6. Uncontrolled harvesting of local plants? 7. Dry spell or reduction in rain falls? 8. Uncontrolled grazing of cattle (as sheep, goat, cows and camels etc.)? 9. Lack of knowledge? 10. Soil erosion? 11. Lack of interest of local people for conservation? 12. Access of salts? 13. Lowered water table of the valley? 14. Using medicinal plants as fuel and fodder instead of their real use?

Table 2. USES OF MEDICINAL PLANTS IN SOONE VALLEY

Sr. No.	Plant Species	Uses in Soone Valley (as given by the respondents)
1.	*Justicia adhatoda*	For coughs, bronchitis, asthma and rheumatism. Leaf buds are also used in diabetes and for joints and as antiseptic. Roots are used as tonic.
2.	*Adiantum capillus-veneris*	For headaches, chest pains, laxative, stimulant, emetic, dandruff, cough, lactation.
3.	*Fagonia indica*	As blood purifier
4.	*Diclyptera bupleuroides*	Shoots are used as tonic.
5.	*Buxus papillosa*	As purgative and antirheumatic.
6.	*Mentha longifolia*	For various digestive problems, antiemetic.

7.	*Peganum harmala*	Whole plant is used as an analgesic, antinflamatory and antispasmodic.
8.	*Salvia virgata*	Leaves are applied to tumors and ulcers.
9.	*Solanum incanum*	Roots, leaves and fruits are used as expectorant, and carminative analgesic.
10.	*Solanum surraten*se	Whole plant is used as vasodilater, astringent and expectorant
11.	*Sophora tomentosa*	Seeds are used as anthelmintic
12.	*Withania somnifera*	Used for reproductive and nervous systems problems as to improve vitality. The leaves and the root bark are used as antibiotic, diuretic, narcotic, strongly sedative and tonic. Also used for post-partum difficulties. It is also applied to boils and swellings.