CPUH-Research Journal: **2018,** ***3(2),*** 124-131
ISSN (Online): 2455-6076
http://www.cpuh.in/academics/academic_journals.php

Diversity, Distribution and Prioritization of Fodder Species for Conservation in Hamirpur District, Himachal Pradesh

Hem Chander, Reena Kumari*, Shivani Sharma
Department of Bio-Sciences, Career Point University, Hamirpur (HP) INDIA
**E-mail: reenakumari7921@gmail.com*

ABSTRACT: The present study was conducted in rain fed district Hamirpur (Himachal Pradesh) to accumulate traditional knowledge regarding diversity and availability of fodder for livestock. Livestock is one of the main sources of livelihood and integral part of the economy to the local populace of the area. Livestock owners mostly rely on wild plants and cultivated crops for fodder. Livestock provides rural transport, manure, fuel, milk and meat. Most often, livestock is the only source of cash income for subsistence farming and also serves as insurance in the event of crop failure. Fodder is extracted from forests, grassland, agriculture and agroforestry. Fodder collected from the forest forms the largest component of biomass energy, which plays a significant role in improving the nutritional requirement of livestock. Unavailability of green forage during summer and winter has always remained a serious issuse resulting into nutritional deficiency in milch animals. During the rainy season, the availability of fodder is in plenty, but there is fodder crisis in other seasons of the year as people are not aware of scientific conservation of grasses for lean periods. The shortage of green fodder has been estimated to be 30-35% in lean period. The diversity, distribution, utilization pattern, seasonality of availability, nutritive value and pressure use index of livestock has not been studied in the study area. The diversity, distribution and utilization pattern of fodder species is important for prioritization of fodder species for conservation and management of fodder species. During the present study, a total of eighty six fodder species has been documented which include trees (26 species), shrubs (27 species) and herbs (33 species). There are 34 families including Meliaceae (1 species), Poaceae (18 species), Caesalpinaceae (1 species), Fabaceae (9 species), Mimosaceae(4 species), Papilionaceae (1 species), Brassicaceae (6 species), Rosaceae (3 species), Chenopodiaceae (4 species), Rhamnaceae (1 species), Apocyanaceae (2 species), Acanthaceae (1 species), Papaveraceae (3 species), Moraceae (5 species), Tiliaceae (1 species), Linaceae (1 species), Menispermaceae (3 species), Fagaceae(2 species), Cucurbitaceae (1 species), Saliaceae(1 species), Sapindaceae (1 species), Rutaceae (1 species), Aceraceae (1 species), Amaranthaceae (2 species), Anacardiaceae (1 species), Asteraceae (1 species), Berberidaceae (1 species), Bignoniaceae (4 species), Boraginaceae (1 species), Commelinaceae (1 species), Cayperceae (1 species), Myrtaceae (1 species), Ranunculaceae (2 species) and Ulmaceae (1 species). Majority of fodder species are used as multipurpose and contributed to the high economic values. Eight species *viz. Grewia oppositifolia, Acacia catechu, Broussonetia papyrifera, Setaria viridis, Pistacia integerrima, Dendrocalamus hamiltonii, Morus alba* and *Paspalum scrobiculatum* showed highest Pressure use index (PUI) indicating high preference and pressure. These eight species are being prioritized for conservation and management.

Keywords: Diversity; utilization; economic value; pressure use index; prioritization; conservation

INTRODUCTION

Fodder crops are the crops that are cultivated primarily for animal feed. Fodder crops are fed to animals either fresh or dried. Most of the cultivated fodder plants belong to the families Poaceae and Leguminaceae. Green fodder plays major role in feed of animals, their by providing required nutrients for milk production and health of livestock animals. Grasses contain fibers, proteins and some minerals. Wild fodder plants provide livestock feed and play critical role during lean period. The potential of fodder trees and shrubs to produce considerable amount of high protein biomass and their adaptation to natural vegetation make them suitable for further development as feed resources. Fodder, house building, making agricultural tools, religious and various other purposes (Samant and Dhar 1997). The inhabitants of the IHR are relatively poor and they rely for their sustenance on the biological resources in one way and other .About 279 species of fodder are known from the west Himalaya (Samant 1998). Livestock is one of the major sources of their livelihood and integral part of economy. To feed livestock, they mainly depend on the forest-based fodder, though some requirements of the fodder are met from the agricultural and agroforestry systems (Purohit and Samant 1995, Singh et al. 1998) . In general, in the IHR and neighbouring countries a few studies are available on the fodder resources (Balaraman 1981, Pandey 1982, Misri 1998, Samant 1998, Bisht et al. 1999, Samant et al. 2006 etc.)Himachal

Pradesh (30°22' ~ 32°29'N and 75°47' ~ 79°04'E, with a geographical area of55, 673km2) has a large altitudinal range supporting tropical, sub-tropical, temperate, sub-alpine and alpine vegetation. Major population of the State lives in the villages and villagers are dependent on the livestock for their sustenance .Like other parts of the IHR, they mainly depend on the forest-based fodder to feed their livestock. In the State, although studies were conducted on the floristic inventory (Collett 1902, Mohan and Puri 1955, Chowdhery and Wadhwa 1984, Aswal and Mehrotra 1994, Sharma and Singh 1996, Dhaliwal and Sharma 1999, Sharma and Dhaliwal 1997, Singh and Rawat 2000 etc.); ethnobotany (Koelz 1979, Aswal and Mehrotra 1987, Chauhan 1999, Samant and Dhar 1997, Badola and Aitken 2003 etc.) and rare endangered plants (Samant et al. 1998, Ved et al. 2003 etc.), such studies were not conducted on the diversity, distribution, utilization, prioritization and conservation of fodder species. The present study deals with diversity, distribution, and utilization pattern of fodder species.

STUDY AREA

Fodder crops are the crops that are cultivated primarily for animal feed. Fodder crops are fed to animals either fresh or dried. Most of the cultivated fodder plants belong to the families Poaceae and Leguminaceae. Green fodder plays major role in feed of animals, their by providing required nutrients for milk production and health of livestock animals. Grasses contain fibers, proteins and some minerals. Wild fodder plants provide livestock feed and play critical role during lean period. The potential of fodder trees and shrubs to produce considerable amount of high protein biomass and their adaptation to natural vegetation make them suitable for further development as feed resources. Fodder, house building, making agricultural tools, religious and various other purposes (Samant and Dhar 1997). The inhabitants of the IHR are relatively poor and they rely for their sustenance on the biological resources in one way and other .About 279 species of fodder are known from the west Himalaya (Samant 1998). Livestock is one of the major sources of their livelihood and integral part of economy. To feed livestock, they mainly depend on the forest-based fodder, though some requirements of the fodder are met from the agricultural and agroforestry systems (Purohit and Samant 1995, Singh et al. 1998) . In general, in the IHR and neighbouring countries a few studies are available on the fodder resources (Balaraman 1981, Pandey 1982, Misri 1998, Samant 1998, Bisht et al. 1999, Samant et al. 2006 etc.)Himachal Pradesh (30°22' ~ 32°29'N and 75°47' ~ 79°04'E, with a geographical area of55, 673km2) has a large altitudinal range supporting tropical, sub-tropical, temperate, sub-alpine and alpine vegetation. Major population of the State lives in the villages and villagers are dependent on the livestock for their sustenance .Like other parts of the IHR, they mainly depend on the forest-based fodder to feed their livestock. In the State, although studies were conducted on the floristic inventory (Collett 1902, Mohan and Puri 1955, Chowdhery and Wadhwa 1984, Aswal and Mehrotra 1994, Sharma and Singh 1996, Dhaliwal and Sharma 1999, Sharma and Dhaliwal 1997, Singh and Rawat 2000 etc.); ethnobotany (Koelz 1979, Aswal and Mehrotra 1987, Chauhan 1999, Samant and Dhar 1997, Badola and Aitken 2003 etc.) and rare endangered plants (Samant et al. 1998, Ved et al. 2003 etc.), such studies were not conducted on the diversity, distribution, utilization, prioritization and conservation of fodder species. The present study deals with diversity, distribution, and utilization pattern of fodder species.

Figure 1: Study area (Hamirpur, HP)

MATERIAL AND METHODS

Data concerning the use of cultivated and wild fodder plants was collected through personal interaction with villagers of Hamirpur district.

The pressure use index (PUI) of species was analyzed using 6 main attributes, i.e., preference, distribution range, other uses, availability, nativity & endemism and status/occurrence. The attributes used for the analysis of the PUI are described in Table 1. A total of 729 combinations of these attributes were made and the PUI for each species was calculated as follows:

1. Species with high preference was given full marks (5 marks), with moderate preference (3marks) and least preference (1 mark).
2. 2) Species with narrow range of distribution, i.e., distribution within <300 m range were given maximum value (5 marks), with moderate range, i.e., distribution within 300-500 m (3 marks) and with wide range, i.e., distribution above 500 m (1mark).
3. Species with multipurpose utility (3 or >3 uses) were given maximum value (5 marks), followed by species with two uses (3 marks) and with one use (1 mark).
4. Species used throughout year were given maximum value (5 marks), in two seasons (3 marks) and in one season (1 mark).
5. The species native and endemic/near endemic to the Himalayan Region were given maximum values (5 marks), native to the Himalayan Region (3 marks) and non-native (1 mark).
6. The Species rare in occurrence was given maximum value (5 marks), occasional (3 marks) and common, cultivated (1 mark).

The detailed observations are described in Table 2.

RESULTS AND DISCUSSION

A total of eighty six fodder species had been documented which included trees (26 species), shrubs (27 species) and herbs (33 species). There were 34 families including Meliaceae (1 species), Poaceae (18 species), Caesalpinaceae (1 species), Fabaceae (9 species), Mimosaceae(3 species), Papilionaceae (1 species), Brassicaceae (6 species), Rosaceae (3 species), Chenopodiaceae (4 species), Rhamnaceae (1 species), Apocyanaceae (2 species), Acanthaceae (1 species), Papaveraceae (3 species), Moraceae (5 species), Tiliaceae (1 species), Linaceae (1 species), Menispermaceae (3 species), Fagaceae(2 species), Cucurbitaceae (1 species), Saliaceae(1 species), Sapindaceae (1 species), Rutaceae (1 species), Aceraceae (1 species), Amaranthaceae (2 species), Anacardiaceae (1 species), Asteraceae (1 species), Berberidaceae (1 species), Bignoniaceae (4 species), Boraginaceae (1 species), Commelinaceae (1 species), Cayperceae (1 species), Myrtaceae (1 species), Ranunculaceae (2 species) and Ulmaceae (1 species).The eight species viz. *Acacia catechu, Broussonetia papyrifera, Dendrocalamus hamiltonii, Grewia oppositifolia, Morus alba, Paspalum scrobiculatum, Pistacia integerrima and Setaria viridis* showed highest pressure use index indicating high preference and pressure use**.**

Figure 2: Fodder species

CONCLUSIONS

The eight wild fodder plants are *Acacia catechu, Broussonetia papyrifera, Dendrocalamus hamiltonii, Grewia oppositifolia, Morus alba, Paspalum scrobiculatum, Pistacia integerrima and Setaria viridis* having high pressure use index indicating high preference and anthropogenic pressure, so these needed to be conserved and used sustainably.

ACKNOWLEDGEMNT

The data collected through personal interaction with the villagers of Hamirpur District, they provide this valuable knowledge and key informants on fodder plant species.

Table 1: Attributes used for the analysis of the PUI

Preference	Distribution range	Other uses	Availability	Nativity &endemism	Status/occurrence
High	<300	3 or >3	Throughout year	Native & endemic	rare
moderate	300-500	>2	Two season	native	occasional
Least	>500	<2	One season	Non native	Common and cultivated

Table 2: Observation of the analysis of the PUI

Sr. No.	Taxonomy	Local name	Family	Altitudinal range(m)	PUI	Life form	Status	Other uses
1	*Acer acuminatum* Wallich ex D.Don	Tilkunj	Aceraceae	150-250	10	T	R	M
2	*Adhatoda vasica* Nees.	Basuti	Acanthaceae	200-400	16	S	R	M
3	*Alternathera sessilis* L.	Jaljambua	Amaranthaceae	100-200	9	H	R	M
4	*Amaranthus viridis* L.	Chalaai	Amaranthaceae	150-200	9	H	Co	M
5	*Pistacia integerrima* Stewart.	Kakar singhi	Anacardiaceae	130-160	17	T	R	Hb, M, Fl
6	*Carissa carandas* Lour.	Bda garna	Apocynaceae	500-650	12	S	Co	E
7	*Carissa spinarum* L.	Chota garna	Apocynaceae	300-600	12	S	Co	E
8	*Eclipta prostrata* L.	Bhring raj	Asteraceae	140-170	10	H	R	M
9	*Berberis lycium* Hort.ex K. Koch	Rasaunt	Berberidaceae	150-190	11	H	Oc	M
10	*Stereospermum chelonoides* L.	Padal	Bignoniaceae	110-150	12	S	R	Misc, M
11	*Oroxylum indicum* (L.) Benth. Ex Kurz	Tat-palanga	Bignoniaceae	150-190	11	H	R	M, Fl
12	*Oroxylum indicum* Vent.	Arlu	Bignoniaceae	150-200	9	H	Co	M
13	*Cordia dichotoma* G. Forst.	Lasura	Boraginaceae	160-210	11	T	R	M, E, Fl
14	*Brassica napus* L.	Toria	Brassicaceae	200-350	11	H	Co	M, E
15	*Brassica nigra* (L.) Andrz.	Banarsi rai	Brassicaceae	150-300	11	H	Oc	M, E
16	*Raphanus sativus* L.	Mooli	Brassicaceae	200-350	9	S	C	E
17	*Brassica campestris* L.	Sarsoon	Brassicaceae	300-450	9	S	C	E
18	*Brassica juncea* (L.) Czern.	Rai	Brassicaceae	150-300	12	S	C	-
19	*Eruca sativa* Hill.	Taramira	Brassicaceae	300-400	14	S	C	-
20	*Bauhinia variegata* L.	Kachnar	Caesalpinaceae	300-500	10	T	Oc	M,Fl
21	*Chenopodium ambrosioides* Hance	Kah jawyan	Chenopodiaceae	170-280	11	H	Co	M

22	*Chenopodium botrys* L.	Kah sag	Chenopodi-aceae	180-260	10	H	Co	M
23	*Chenopodium album* Bosc.ex.Moq.	Bathu	Chenopodi-aceae	200-500	10	H	Oc	E
24	*Spinacia oleracea* L.	Palak	Chenopodi-aceae	300-400	8	H	C	E
25	*Commelina bengha-lensis* L.	Rannipata	Comme-linaceae	150-200	10	H	Oc	M
26	*Trichosanthes tri-cuspidata* Lour.f.siberutensis Rugayah.	Bish khapar	Cucurbita-ceae	180-250	10	H	Oc	M
27	*Cyperus rotundus* Hook. F.	moth	Cyperaceae	130-190	9	H	Oc	M
28	*Pisum sativum* L.	Mattar	Fabaceae	120-300	10	S	Oc	M, E
29	*Butea monosperma* Taub.	Dhak/Palah	Fabaceae	150-350	10	T	Oc	M, Misc, Fl
30	*Cajanus cajan* (L.) Huth	Arhar	Fabaceae	180-260	9	S	Oc	M, E
31	*Macrotyloma uniflo-rum* (Lam.) Verdc.	Kolth	Fabaceae	150-200	9	S	Oc	M, E
32	*Robinia pseudoaca-cia* L.var.monophylla Koehne	Kikar	Fabaceae	100-300	10	T	Co	Fl
33	*Albizia stipulata* (DC.) Boivin	Oyee	Fabaceae	100-300	8	S	Co	-
34	*Leucaena leuco-cephala* (Lam.) de Wit.	Alseenia	Fabaceae	250-300	12	S	R	Fl
35	*Trifolium alexan-drinum* L.	Berseem	Fabaceae	300-600	10	H	C	-
36	*Cicer arietinum* L.	Cholle	Fabaceae	200-500	13	H	C	E
37	*Quercus glauca* Thund.	Bani	Fagaceae	150-200	14	T	Oc	Fl
38	*Quercus leucotri-chophora* A.Camus	Ban	Fagaceae	100-180	14	T	Co	Fl,Ag tools
39	*Linum usitatissimum* Griseb.	Alsi	Linaceae	250-450	12	H	Oc	M,E
40	*Tinospora cordifolia* Miers.	Giloy	Menisper-maceae	400-600	8	H	Co	-
41	*Cissamplos pareira* L.	Patindoo	Menisper-maceae	160-250	10	H	Co	M, E
42	*Cocculus hirsutus* (L.) Diels	Tardya/Jal-Jamni	Menisper-maceae	140-260	11	S	R	M
43	*Melia azedarach* L.	Draek	Meliaceae	200-350	10	T	Co	M
44	*Acacia fistula* Herbb. Ex Oliv.	Amaltash	Mimosaeae	250-450	13	T	Oc	M, R, Fl
45	*Acacia nilotica* H. Karst.	Kikar	Mimosaeae	200-500	12	T	R	M, Hb, Fl
46	*Acacia catechu* (L.f.) Willd.	Khair	Mimosaeae	400-900	19	T	Oc	Ag tools, Fl,Hb
47	*Albizia lebbeck* (L.)	Sirin	Mimosaceae	100-300	11	T	R	-

	Benth							
48	*Broussonetia papyrifera* (L.) Vent	Japani toot	Moraceae	200-500	18	T	Oc	Fl
49	*Ficus palmata* Forssk.	Khasara	Moraceae	150-450	9	T	Co	Hb, M, E, R, Fl
50	*Morus alba* Sudw.	Toot	Moraceae	350-650	20	T	Co	Fl, Ed
51	*Ficus roxburghii* Wall.	Triamble	Moraceae	400-600	12	T	Co	Fl
52	*Syzygium cumini* (L.) Skeels	Jamun	Myrtaceae	150-500	13	T	Co	Hb, Misc, M, E
53	*Dalbergia sissoo* Roxb.	Shisham	Papilionaceae	300-400	16	T	R	Fl
54	*Argemone mexicana* L.	Lea	Papaveraceae	150-300	12	H	Co	-
55	*Ficus carica*	Anjir	Papaveraceae	300-400	10	T	Oc	E ,Fl
56	*Fumaria indica* (Hausskn.) Pugsley.	Pitpapara	Papaveraceae	100-200	14	H	Oc	-
57	*Pennisetum purpureum* Schumach	Bajra	Poaceae	500-600	8	S	C	-
58	*Pennisetum americanum* K.Schum.	Chari	Poaceae	250-650	8	S	C	-
59	*Paspalum scrobiculatum* L.	Kodri grass	Poaceae	350-700	14	H		-
60	*Oryza sativa* L.	Dhan	Poaceae	400-600	11	S	C	E
61	*Cynodon dactylon* (L.) Pers.	Dhruv	Poaceae	500-600	8	H		-
62	*Dendrocalamus hamiltonii* Nees & Arn.ex.Munro	Bainjh	Poaceae	400-800	12	T	C	Hb, Fl, Ag tools
63	*Triticum aestivum* L.	Gehun	Poaceae	500-700	12	S	C	E
64	*Zea mays* L.	Makki	Poaceae	300-600	12	S	C	E
65	*Avena sativa* L.	Joe	Poaceae	200-500	10	S	C	-
66	*Setaria viridis* (L.) D.Beavu.	Hathi grass	Poaceae	200-300	14	H	Co	-
67	*Bambusa arundinacea* Bonpl.	Magar	Poaceae	200-700	12	T	Oc	Fl, Ag tools
68	*Bothriochloa pertusa* (L.) A. Camus	Khatiambi	Poaceae	160-260	10	S	R	M, Misc
69	*Brachiaria ramosa* (L.) Stapf	Butrri	Poaceae	150-270	11	S	R	M
70	*Neyraudia arundinacea* (L.) Henrad	Sarkanda	Poaceae	130-210	11	H	Co	M, E
71	*Chrysopogon fulvus* L.	Puthpatr	Poaceae	110-250	11	H	Oc	M
72	*Chrysopogon gryllus* L.	Gajannkah	Poaceae	100-170	10	H	Oc	M
73	*Hordeum vulgare* L.	Jau	Poaceae	120-200	11	H	Oc	M, E
74	*Arundinaria falcata* Nees	Bainzhi	Poaceae	150-250	10	S	Co	M, Hb
75	*Anagallis arvensis* L.	Jonkmri	Primulaceae	110-170	10	H	R	M

76	*Anemone vitifolia* Buch-Ham. Ex DC.	Makorri	Ranuncula-ceae	100-160	7	H	Co	M
77	*Adonis aestivalis* M. Bieb.	Ban-saunf	Ranuncula-ceae	150-190	11	H	Oc	M
78	*Zizyphus* Adans	Ber	Rhamnaceae	600-700	12	S	Co	E
79	*Prunus cerasoides* D.Don.	Pajja	Rosaceae	160-250	12	S	Oc	M
80	*Pyrus pashia* Buch,-Ham.ex D.Don	Kainth	Rosaceae	200-500	10	T	Oc	M,Fl
81	*Rubus ellipticus* Sm.	Akhe	Rosaceae	500-700	12	S	Co	M
82	*Murraya* J.Koenig.	Gandilla	Rutaceae	200-550	11	S	Co	M,E
83	*Salix acutifolia* Willd.	Biunsh	Salicaceae	150-200	10	T	Co	Fl
84	*Sapindus montanus* Blume.	Doda	Sapindaceae	150-300	12	H	Co	-
85	*Grewia oppositifolia* Roxb. & Dc	Beul	Tiliaceae	250-700	18	T	Co	M,Fl
86	*Celtis australis* L.	Khirk	Ulmaceae	140-200	9	T	Co	M, Hb, Fl

Abbreviations used: T=Tree, S=Shrub, H=Herb, R=Rare, Co=Common, Oc=Occasional, C=Cultivated, M=Medicinal, Hb=House building, Fl=Fuel, Misc=Miscellaneous, E=Edible, Ag tools=Agricultural tools and R=Religious

REFERENCES

1. Anonymous. 1883-1970. *Index Kewensis Plantarum Phanerogamarum* Vol.*1 - 2* (1883 - 1885*) and 15 Suppl.*(1886 - 1970) (Oxford: Clarendron Press).

2. Anonymous. 1970-1997**.** *Wealth of India*. A dictionary of Indian raw materials and industrial product. Vol. A-Z. Council of Scientific Industrial Research, New Delhi.

3. Aswal, B.S. and Mehrotra, B.N. 1987. Ethnobotanical studies on the flora of Lahaul valley (North-West Himalaya). In: Sharma, M.R. and Gupta, B.K. (eds.), *Recent advances in plant sciences.* Bishen Singh and Mahendra Pal Singh, Dehradun. pp. 116 - 130.

4. Aswal B.S. and Mehrotra B.N. 1994. *Flora of Lahaul-Spiti. (A Cold Desert in North-West Himalayas).* Bishen Singh Mahendra Pal Singh, Dehradun.

5. Badola H. K. and Aitken S. 2003. The Himalayas of India: A treasure of medicinal plants under siege. *Biod.* **4** (3): 3 - 13.

6. Balaraman N. 1981. Feeds and fodder resources for livestock in Sikkim. Research Bill No.13 ICAR Research complex for NEH Region, Sikkim centre, Gangtok.

7. Chauhan N.S. 1999. Medicinal and Aromatic Plants of Himachal Pradesh. Indus Publishing Company, New Delhi.

8. Chowdhery H.J. and Wadhwa B.M. 1984. *Flora of Himachal Pradesh, Vols. 1 - 3.* Botanical Survey of India, Culcutta.

9. Collett H. 1902. *Flora Simlensis*. Thacker Spink. & Co Calcutta and Shimla, Reprinted 1971. Bishen Singh Mahendra Pal Singh, Dehradun.

10. Dhaliwal D.S. and Sharma M. 1999. *Flora of Kullu District* (Himachal Pradesh). Bishen Singh Mahendra Pal Singh, Dehradun.

11. Dhar U. and Samant, S.S. 1993. Endemic diversity of Indian Himalaya. I Ranunculaceae and II. Paeoniaceae. *Journal of Biogeography* **20:** 659 - 668.

12. Gutteridge R.C., 1995. The potential of nitrogen fixing trees in livestock production systems. Paper presented in International Workshop on Nitrogen Fixing Trees for Fodder held in Pune, India, March 20 - 25, 1995.

13. Kumar G. and Chander H. (2017)Study on the Potential of *Azolla pinnata* as livestock Feed Supplement for climate Change adaptation and Mitigation , *Asian J. Adv. Basic Sci, 5(2),65-68*

14. Kumar G. and Chander H. (2018) Ethno-Veterinary and Fodder Plants of Awah Devi Region of Hamirpur District , Himachal Pradesh, *J. Biol. Chem. Chron,4(1),08-15*

15. Misri B. 1998. Proceeding of Third Temperate Asia Pasture and Fodder Network (TAPAFON). FAO, Rome.

16. Mohan N.P. and Puri, G.S. 1955. *The Himalayan conifers. Vol. III.* The succession of forest communities in oak conifer forest of the Bashahr Himalaya. *Indian Forester* **81** (8): 711p

17. Purohit K. and Samant S.S. 1995. *Fodder trees and shrubs of Central Himalaya*. Gyanodaya Prakashan, Nainital.

18. Pandey K. K. 1982. *Fodder trees and Tree fodder in Nepal* Swiss Development and Corporation, Berne, Switerzerland.

19. Samant S.S. 1998. Diversity, distribution and conservation of fodder resource of west Himalaya, India. In: B. Misri (ed.), *Proceedings of the Third Temperate Pasture and Fodder Network (TAPAFON)*, Pokhra, Nepal, 9 - 13 March, 1998, sponsored by F.A.O., Rome. pp. 109 - 128.

20. Samant S.S. and Dhar U. 1997. Diversity, endemism and economic potential of wild edible plants of Indian Himalaya. *International Journal of Sustainable Development and World Ecology* **4:** 179 - 191.

21. Samant S.S., Dhar U. and Palni L.M.S. 1998. *Medicinal Plants of Indian Himalaya: Diversity Distribution Potential Values.* Gyanodaya Prakashan, Nainital.

22. Samant S.S. 2006. Diversity, extraction, and status of fodder species in Askot Wildlife Sanctuary, West Himalaya, India. International Journal of Biodiversity Science and Management (2): 29-42.