DOI : 10.33451/florafauna.v25i2pp121-136
FLORA AND FAUNA
ISSN 2456 - 9364 (Online)
2019 Vol. 25 No. 2 PP 121-136
ISSN 0971 - 6920 (Print)

Legume accessions diversity at ICAR-IGFRI herbarium with special reference to their utility

VC Tyagi*, AK Roy, N Dikshit and RV Kumar

ICAR-Indian Grassland and Fodder Research Institute,
JHANSI-284003, INDIA
*Corresponding Author
E-mail : tyagiv54@yahoo.in

Received **:** 18.10.2019; ***Accepted*** : 04.11.2019

ABSTRACT

Workers describe accepted name, common name, habit, habitat, and place of collection *etc.* of 210 herbarium specimens belonging to 83 taxa of leguminous family under 28 genera and 83 species available at ICAR-IGFRI, Jhansi and their interpretations. The collection includes herbs (52), shrubs (25), trees (5) and climber (1). Forage legumes form an important source of feed for livestock and have potential to provide a sustainable solution for food and protein security. Diversity observed at species level and utility levels in terms of food value, fodder and medicinal value are also described besides other economical uses. A comprehensive analysis based on the specimen available was undertaken to identify a total of 29 medicinally important plants species belonging to 12 genera for the treatment of different diseases in human being.

Figure : 00 References : 42 Tables : 05
KEY WORDS : Forage, Grassland, Herbarium, Leguminous crop, Medicinal uses

Introduction

According to Sushruta, no plant in this world is useless. Economically, Leguminosae is second in importance only after Poaceae.

Herbaria serve as basic step for an analytical study of the vegetation of a region which helps in evolving strategies for effective conservation and sustainable utilization. Countries rich in biodiversity strive to preserve the existing herbarium specimens and enhance the collections and also the related knowledge associated with them for their effective utilization. Herbarium specimens are recognized and valued as a reliable source for estimating phonological behavior for a diversity of plant species[40]. It also provides snapshots of plants' past and data for future. Museum collections, whether plant or animal, are important sources of information, as they may include extinct specimens, accessions that have been locally lost or samples collected in remote locations. In recent years, in the wake of technical innovations, a number of studies using DNA analysis from herbarium/ museum collections have been published. Such studies allow the opening of windows to the past to reveal new and hidden histories[38].They constitute remarkable sources of information about plants and the world they inhabited in the past and provide the comparative material essential for taxonomic studies, population ecology, conservation biology and molecular evolution[15] of rare or extinct species that can no longer be found in nature[11,39].

Collectively the world's approximately 3,990 recognized herbaria contain an estimated 350 million specimens that document the earth's vegetation for the past 400 years. India represents over 3.5 million herbarium specimens including over 23,000 type specimens (source: http://sciweb.nybg.org/science2/IndexHerbariorum.asp). The herbarium of cultivated plants at ICAR-National Bureau of Plant Genetic Resources, New Delhi, also known as National Herbarium of Cultivated Plants (code 'NHCP') occupies a place among 25 major Indian herbaria in India. It holds collections mainly of cultivated taxa and wild/ weedy relatives of crop taxa of both native and exotic origin; besides, seed and carpological samples of plant genetic resources (PGR) as complementary collections. NHCP is intended to serve as a reference collection for identification and taxonomic study of taxa of PGR relevance.

Research works on herbarium started as a repository of plants in the late 1960s at ICAR-IGFRI, Jhansi. It was realized that while physical specimens are a must in a herbarium, to increase its utility as well as to preserve the information pertaining to the specimens for a long time, its digitization was necessary. The herbarium houses number of rare, restricted and endangered plant taxa from different parts of India. As the collection is quite old and some of the sheets are more than 60 years, the heritage of the institute needs to be preserved for the benefit of the researchers as well as

122

TABLE-1: List of taxa maintained from different parts of the country

S.N	Botanical name	Common name	Location	State	Habit	Habitat
1	*Abrus precatorius*	Coral bead vine, rosary pea, ratti	Jhansi	UP	Cl	Forest land, plains
2	*Acacia catechu*	Cutch Tree, dant-dhavan, khair	Jhansi	UP	T	Along dry forests
3	*Aeschynomene indica*	Indian joint vetch, didhen, phulan	Jhansi	UP	H	Wet places, canal, paddy fields, ditches
4	*Albizia julibrissin* var. m*ollis*	Silktree mimosa, persian acacia, silk tree	Tehri-Garwal	UK	T	Roadsides, vacant plots, along rivers
5	*Alysicarpus bupleurifolius*	Sweet alyce clover	Hazaribagh, Udaipur, Jhansi	JH, RJ, UP	H	Grasslands, wet places
6	*Alysicarpus hamosus*	Round-leaf alyce clover	Jhansi, Jabalpur, Ajmer, Shivpuri	UP, MP, RJ	H	Grasslands, gravelly hill slopes, degraded forest
7	*Alysicarpus monilifer*	Necklace-pod alyce clover	Lucknow, Jhansi, Kottayam, Madras	UP, KL, TN	H	Grasslands, wet places
8	*Alysicarpus pubescens*	Bicoloralyce clover, durangi shevra	Mumbai	MH	H	Gravelly hill slopes,
9	*Alysicarpus rugosus*	Red moneywort, alyce clover, rough chainpea, shevra	Hosangabad, Ratnagiri, Jhansi	MP,MH, UP	H	Wet places, canal
10	*Alysicarpus tetragonolobus*	Red alyce clover, lalshevra	Vidharba, Saurastra, Nadia, Hosangabad	MH, GJ, WB, MP	H	Rocky soils, grasslands

S.N	Botanical name	Common name	Location	State	Habit	Habitat
11	*Alysicarpus vaginalis*	Alyce clover, chauli, sauri	Kota, Madras, Kottayam, Udaipur, Bhandara, Darjeeling, Jhansi, Hosangabad	RJ, TN, KL, MH, WB, UP, MP	H	Wastelands
12	*Argyrolobium flaccidum*	-	Dooga	JK	H	Wastelands
13	*Astragalus rhizanthus*	Candolle's milk-vetch	Uttarkashi	UK	H	Wastelands
14	*Bauhinia purpurea*	Butterfly tree, kaniar, rakta kanchan	Tripura	TR	T	Dry deciduous forests, often cultivated
15	*Bauhinia racemosa*	Bidi leaf tree, katmauli	Jhansi	UP	T	Dry evergreen to dry deciduous forests
16	*Butea monosperma* Taub.	Flame of the forest, palas tree, tesu	Jhansi	UP	T	Field border, Avenue, wet area
17	*Cajanus cajan*	Arhar, Congo, pigeon pea, red gram	Tripura	TR	S	Cultivated, plains
18	*Cajanus scarabaeoides*	Showy pigeonpea, kulatha, ban kurti	Betul	MP	S	Open areas, forest edges, plains
19	*Chamaecrista absus*	Tropical sensitive pea, banar, bankultthi, chaksi	Junagadh	GJ	H	Old farmland, along roadsides, open localities
20	*Chamaecrista pumila*	Dwarf Cassia, sarmal	Jhansi, Pali, Shivpuri	UP, MP, RJ	S	Wastelands, plains

S.N	Botanical name	Common name	Location	State	Habit	Habitat
21	*Crotalaria alata*	Winged-stem rattlepod, bandarlathi	Mumbai, Mysore	MH, KA	H	Sea coast, sandy soils
22	*Crotalaria albida*	Narrow leaf rattle pod, khurmana, ban-methi	Chittorgarh	RJ	H	Wild, open grassland, dry deciduous forests
23	*Crotalaria bifaria*	Fatakiya	Mysore, Saurastra	KA, GJ	H	Wild, open grassland, dry deciduous forests
24	*Crotalaria burhia*	Burhiarattlepod, saniya,	Mumbai	MH	S	Sand dunes in arid regions
25	*Crotalaria ferruginea*	-	Kota	RJ	H	Open forests, montane grasslands
26	*Crotalaria filipes*	Creeping hemp, phatphati	Udaipur, Jhansi	RJ, UP	H	Grasslands
27	*Crotalaria hebecarpa*	Godhadi, fuzzy fruited rattlepod	Kutch, Udaipur, Mumbai, Porbandar	GJ, RJ, MH	H	Grasslands, cultivated fields
28	*Crotalaria hirsuta*	Hairy rattlepod	Jhansi	UP	S	Grasslands
29	*Crotalaria medicaginea*	Medick rattlepod	Madras, Karnool	TN, AP	H	Seashore sandy areas, grassy slopes, along trails
30	*Crotalaria mysorensis*	Rattlebox, mysore rattlepod	Mysore, Madras	KA, TN	H	Scrub jungles, plains
31	*Crotalaria orixensis*	Mahadev korra	Kothajupudi	AP	H	Near cultivated fields
32	*Crotalaria prostrata*	Prostrate rattlepod, latangi	Madras, Mumbai, Kudi	TN, MH, HP	H	Montane grassy wetlands, grassy slopes;

124

S.N	Botanical name	Common name	Location	State	Habit	Habitat
33	*Crotalaria retusa*	Rattleweed, ghunghunia	Mumbai	MH	H	Montane grassy wetlands, grassy slopes
34	*Crotalaria spectabilis*	Cats bell, rattleweed	Mumbai	MH	H	Montane grasslands, along trails
35	*Crotalaria umbellata*	Tiny rattlepod	Godhra road	RJ	S	Rocky soils
36	*Crotalaria vestita*	Rattlepod	Vidharbha	MH	H	Hilly slopes
37	*Desmodium gangeticum*	Sal leaved desmodium, salpani,	Niharchir	HP	H	Moist places
38	*Desmodium heterocarpon* var. *strigosum*	Asian ticktrefoil	Darjeeling	WB	H	Wastelands, wetlands, irrigation channel
39	*Desmodium laxiflorum*	Loose flowered desmodium, jangli-ganja	Kothajupudi	AP	S	Moist deciduous forests, plains
40	*Desmodium multiflorum*	Many-flowered desmodium, bhatmasephool	Madras, Mysore	TN, KA	S	Mountain slopes, grasslands, forest margins
41	*Desmodium parviflorum*	Desmodium	Cochin	KL	H	Along stream banks, Wastelands
42	*Desmodium rotundifolium*	Round-leaved tick trefoil, dollar leaf	Suarastra	GJ	H	Dry, sandy soil, forests, rocky slopes
43	*Desmodium triflorum*	Creeping tick trefoil, kudaliya, motha	Mumbai, Kujung, Pachmari, Jhansi	MH, OD, MP, UP	H	Wastelands wetlands, moist places, irrigation channels, along streams

S.N	Botanical name	Common name	Location	State	Habit	Habitat
44	*Flemingia chappar*	Moghania, salpan	Bori village	MP	S	Open, moist places
45	*Flemingia strobilifera*	Wild hops, luck plant, kanphuta	-	A N	S	Forest, Grasslands, plains
46	*Geissaspis cristata* .	Eyelashes shell beans, barki	Mumbai, Kochi	MH, KL	H	Open grasslands, rocky areas, waterlogged areas, fallow fields
47	*Indigofera arrecta* .	Bengal indigo, java indigo, natal indigo	Mysore	KA	H	grassland; roadsides; flood plains
48	*Indigofera aspalathoides*	Manneli, wiry indigo	Ramaranpatnam	AP	H	Sandy wastelands
49	*Indigofera colutea*	Sticky Indigo	Madras	TN	H	Open grassy ground, fallow agricultural fields
50	*Indigofera cordifolia*	Heart-Leaf Indigo, gokhru, bekara	Jabalpur, Udaipur	MP, RJ	H	Open places, Plains, dry localities
51	*Indigofera dosua* var. *simlensis*	Chiringijhar	-	UK	S	Open hillsides and roadside banks
52	*Indigofera glandulosa*	Befri, three Leaf Indigo	Chittorgarh, Kothajupudi, Hosangabad	RJ, AP, MP	S	Open grassy ground, agricultural fields
53	*Indigofera hebepetala*	Fuzzy petal Indigo	Uttarkashi, Mumbai	UK, MH	S	Shady places
54	*Indigofera heterantha*	Indigo bush, saakhino	Tehri- Garwal, Srinagar, Kullu, Mumbai, Madras	UK, JK, HP, MH, TN	S	Dry sunny slopes, often forming dense scrub, and in forests

S.N	Botanical name	Common name	Location	State	Habit	Habitat
55	*Indigofera hirsuta*	Hairy indigo, rough hairy indigo	Jhansi	UP	S	Cultivated and waste areas, in grassland
56	*Indigofera linifolia*	Narrowleaf Indigo, ratnamala, lalgodhadi	Mysore, Mumbai, Udaipur, Pokran, Shivpuri, Jodhpur, Hosangabad, Jhansi	KA, UP, MP, MH, RJ	H	Dry grassland, bushland, cultivated grounds, sandy roadsides, beaches
57	*Indigofera linnaei*	Birdsville indigo	Palasa, Jhansi, Kota, Barabanki, Kujung, Udaigiri	AP, UP, RJ, OD	S	Near rivers, dry open places, sunny trail sides
58	*Indigofera oblongifolia*	Jhil, Jhiladi	Ramathirthum, Saurastra, Sirohi	RJ, AP, GJ	S	Stream sides, grassland, bush land, stony ground
59	*Indigofera remota*		Kulu	HP	S	
60	*Indigofera trifoliata*	Three-leaf Indigo, kathi	Cape comorin	KL	H	Grasslands, near rivers, cultivated fields
61	*Indigofera trigonelloides*	-	Madras	TN	H	Arid areas
62	*Indigofera trita*	Asian indigo,	Jhansi	UP	H	Wastelands and scrub forests
63	*Indigofera uniflora*	One-flowered indigo	Madras	TN	H	Sandy wastelands
64	*Lathyrus sativus*	Grass pea, chickling pea, indian vetch, khesari	Jhansi	UP	H	Moist places, roadsides, cultivable fields

S.N	Botanical name	Common name	Location	State	Habit	Habitat
65	*Medicago orthoceras*	-	Jhansi	UP	H	Dry, rocky slopes, sandy desert, pasture land
66	*Medicago polymorpha*	Toothed medik, chandausi, maina	Jhansi	UP	H	Moist places, roadsides, cultivable fields
67	*Melilotus indicus*	Yellow sweet clover	Jhansi	UP	H	Fields and waste places, roadsides
68	*Mimosa himalayana*	Himalayan mimosa, agla, aila	Jhansi	UP	S	Moist localities
69	*Phaseolus acutifolius*	Tepary bean	Jhansi	UP	H	Moist places, roadsides, cultivable fields
70	*Rhynchosia capitata*	-	Jhansi	UP	S	Disturbed area
71	*Senna italica*	Italian Cassia	Cape comorin	KL	S	Roadsides and waste places
72	*Senna occidentalis*	Coffee senna, coffeeweed, kasunda	Jhansi	UP	S	Waste places, forest, roadsides, river overflow areas
73	*Senna tora*	Stinking cassia, chakunda	Jhansi	UP	H	Common in grassy localities, roadsides and waste land
74	*Tadehagi pseudotriquetrum*	Treflegros	Mumbai	MH	S	Open areas
75	*Tephrosia purpurea*	Dhamasia, sarphanka, common tephrosia	Jhansi	UP	S	Dry grasses, roadsides, wastelands

128

S.N	Botanical name	Common name	Location	State	Habit	Habitat
76	*Tephrosia subtriflora*	Tephrosia	Jhansi	UP	S	Dry grasses, roadsides, wastelands
77	*Tephrosia tenuis*	Bristly tephrosia	Jhansi	UP	H	Gravelly hill slopes
78	*Tephrosia villosa*	Hoary tephrosia, runchhalo-sarpankho	Jhansi	UP	H	Open fields and flood plains, often on sandy soils
79	*Vicia hirsuta*	Hairy tare, tiny vetch	Uttarkashi, Jhansi	UK, UP	H	Agricultural field, plain areas
80	*Vicia sativa*	Common vetch, spring vetch	Jhansi	UP	H	Cultivated, plain areas
81	*Vicia sativa* subsp. *nigra*	Black-pod vetch	Uttarkashi	UK	H	Wetlands, grasslands, roadsides, disturbed sites
82	*Vigna unguiculata*	Cowpea, black eyed pea, lobia	Jhansi	UP	H	Cultivated, plain areas
83	*Zornia diphylla*	Two-leaf zornia, murikkotti	Jhansi	UP	H	Grasslands, forest plantations, plains

* Cl-Climber, H-Herb, S-Shrub, T-Tree

**Abbreviations used: AP- Andhra Pradesh, UP- Uttar Pradesh, UK- Uttarakhand, MH- Maharashtra, KL- Kerala, TN- Tamil Nadu, RJ- Rajasthan, GJ- Gujrat, OD- Odisha, MP- Madhya Pradesh, KA- Karnataka, HP- Himachal Pradesh, JK- Jammu & Kashmir, WB- West Bengal, TR- Tripura, JH- Jharkhand

students of the Plant sciences.

With close to 770 genera and over 19,500 species[22-24], the Leguminosae is the third largest angiosperm family in terms of species numbers after Asteraceae and Orchidaceae. Economically, Leguminosae is second in importance only after Poaceae. The United Nations General Assembly designated 2016 as the International Year of Pulses to promote awareness of their nutritional benefits, importance in food security and sustainable agriculture, and in mitigating biodiversity loss and climate change.

The present work is essentially an attempt to bring together a list of legume taxa collected at ICAR-IGFRI, Jhansi, herbarium holdings and their interpretation of distribution, diversity and utility *etc.* A comprehensive analysis based on the specimen available is currently being undertaken.

Material and Methods

The present paper shows the present status of legume taxa collected from different parts of the country from time to time mainly during Grassland Survey Scheme of PL-480 (1960-70s) of ICAR. All the collection is composed of mounted sheets and housed within the Grassland and Silvipasture Management Division of ICAR-IGFRI, Jhansi. A complete plant specimen possessing all parts including root system, flowers and fruits were collected from different regions. After collection, the specimens were dried, poisoned and fixed in herbarium sheets[16]. The samples were identified in consultation with regional and modern flora. The samples were arranged alphabetically along with their family.

Result and Discussion

In the present study, all the species of Leguminosae recorded from the different parts of the country during the survey are enumerated below with names of genera and, again, species under each genus arranged alphabetically. Each species has been provided with common name, location, state, habit, and habitat in Table 1. The present analysis includes 210 specimens belonging to 83 taxa of leguminous family under 28 genera and 83 species. It includes herbs (52), shrubs (25)] trees (5) and climbers (1). The genus having both herb and shrub habit are *Crotalaria* herbs (13) and shrubs (3); *Desmodium* herbs (5) and shrubs (2); and *Indigofera* herbs (9), shrubs (8). The genus *Alysicarpus* is represented by herbs while *Bauhinia* was represented by trees. Remaining are mostly herbs and one climber *i.e Abrus precatorius* L. However, in case of *Bauhinia* three tree species are represented in our herbaria.

1. Diversity observed at species level

The numerical representation of genus and species under three subfami-lies Leguminosae *viz.* Caesalpinioideae, Cercidoideae and Papilionoideae along with the number of specimen collected is presented in Table 2. Papilionoideae has been found as the largest sub family representing 73 species under 22 genera.

TABLE-2 : Sub family, genus, species

Sub family	Genus	Species	No. of specimens
Caesalpinioideae	5	8	14
Cercidoideae	1	2	3
Papilionoideae	22	73	193
Total	**28**	**83**	**210**

The genus *Alysicarpus* is represented by 18 species in India of which seven species are maintained in our herbarium. The species are *A. bupleurifolius*, *A. hamosus*, *A. monilifer*, *A. pubescens*, *A. rugosus*, *A. tetragonolobus* and *A. vaginalis*. Constituents of genus *Medicago* forms one of the world's most important forage crops. Two herbs mainly *Medicago orthoceras* and *M. polymorpha* are maintained. The genus *Tephrosia* is a large pantropical genus and many of which have important traditional uses in agriculture. Two herbs viz. *Tephrosia tenuis, T. villosa* and shrubs *T. purpurea, T. subtriflora* are used as green manure. Out of a total 19 species of the genus *Vicia,* three species mainly *Vicia hirsuta*, *V. sativa* and *V. sativa* sub sp. Nigra are maintained at IGFRI. The species of the genus are cultivated all over the world mainly for forage, grain and as a green manure crops. *Cajanus cajan* is one of the important food crop and a source of proteins, carbohydrates, B group vitamins, and certain minerals whereas *Cajanus scarabaeoides* is a wild relative of pigeon pea belonging to the secondary gene pool and most widely distributed. The genus *Crotalaria* has both herbs and shrubs types of plants. The herbs are *C. alata*, *C. albida*, *C. bifaria*, *C. ferruginea*, *C. filipes*, *C. hebecarpa*, *C. medicaginea*, *C. mysorensis*, *C. orixensis*, *C. prostrata*, *C. retusa*, *C. spectabilis*, *C. vestita* and Shrubs are *C. burhia*, *C. hirsuta* and *C. umbellata*. *Demodium* belonging to Papilionoideae are largely used as fodder species. The herbs *D. gangeticu*, *D. heterocarpon* var. *Strigosum*, *D. parviflorum*, *D. rotundifolium*, *D. triflorum* and shrubs *D. laxiflorum*, *D. multiflorum*. In India, 15 species of *Flemingia* occur in different states. Herbarium of

Flemingia chappar was collected from Madhya Pradesh and *F. strobilifera* from Andaman & Nicobar Islands. Species of *Indigofera* has both herbs and shrubs and are mostly dye yielding and also used as forage crop. Species maintained are *I. arrecta*, *I. aspalathoides*, *I. colutea*, *I. cordifolia*, *I. linifolia*, *I. trifoliata*, *I. trigonelloides*, *I. trita*, *I. uniflora*. Shrubs of Indigofera species are *I. linnaei*, *I. dosua* var. *simlensis, I. glandulosa*, *I. hebepetala*, *I. heterantha*, *I. hirsuta*, *I. oblongifolia*, *I. remota*. *Senna* has been used as a traditional medicine by ancient cultures all over the world for millennia. The dried, powdered leaves of *S. italica* are used as a hair conditioner to make the hair glossy. *S. occidentalis* a pantropical plant species and almost all parts viz. leaf, root, seeds of the plant are used as food and medicine by tribal populations in India.

2. Diversity observed at utility level

Fabaceae family features a number of economically significant plants, ranging from important food crops, forage and fodder crop, medicinal, ornamental to timber and wood products. Details of taxa and their utilities are presented here.

2.1 Food value species

Legumes are important food crops providing highly nutritious sources of protein and micronutrients that can greatly benefit health and livelihoods, particularly in developing countries[41]. Legumes have been domesticated alongside grasses in different areas of the world since the beginning of agriculture and have played a key role in its early development [12,14]. Legumes are also uniquely important as fodder and green manure in both temperate and tropical regions and are used for their wood, tannins, oils and resins, in the manufacture of varnishes, paints, dyes and medicines and in the horticultural trade. Some of the important species found useful are listed in Table 3 along with their food value.

2.2 Medicinal value

Medicinal uses of leguminous plants and plant parts used to cure various diseases have been recorded. Leaves, fruits, seeds, roots and even whole plants of 29 taxa are found to be medicinally useful (Table 4). Important plants used as active principle for leucorrhea, contraceptive (*Abrus precatorius*), anti-cancerous (*Crotalaria burhia*), Epilepsy (*Flemingia chappar*), Leprosy and cancerous affections (*Indigofera aspalathoides*).

2.3 Potential species suitable for fodder and grassland development

Legumes are not just food source for humans, but also for farm animals[13]. Some of the important species have been identified to be of feed resource for ruminants. They are used as both cultivated as well as important

TABLE-3 : Species and their utility

S. N	Species	Food value
1	*Bauhinia purpurea*	Leaves, Flower buds and flowers - cooked and eaten as a vegetable
2	*Cajanus cajan*	Food value, rich source of protein
3	*Crotalaria retusa*	Flowers and leaves have a sweet flavor and are edible as a vegetable
4	*Crotalaria spectabilis*	Flowers - cooked and eaten as a vegetable, or pickled after boiling
5	*Indigofera arrecta*	Young leaves - cooked and eaten as a vegetable;
6	*Indigofera hebepetala*	Immature seed pods are cooked as a vegetable or are pickled
7	*Indigofera heterantha*	Flowers are boiled and pickled
8	*Phaseolus acutifolius*	Food value
9	*Senna occidentalis*	Young leaves - steamed and eaten as a vegetable
10	*Vicia hirsuta*	Used as a vegetable

TABLE- 4 : Medicinally important species

S.N	Species	Uses	Plant parts used	References
1	*Abrus precatorius*	Leucorrhoea, baldness, mouth ulcer, stomach ache, knee pain, contraceptive	Seed, green leaves	05
2	*Alysicarpus monilifer*	Anti-inflammatory, stomach ache, fevers, jaundice	Whole plant, leaves	18
3	*Astragalus rhizanthus*	Blood purifier, coughs and skin diseases	Whole plant	29
4	*Bauhinia purpurea*	Carminative, laxative	Roots, flowers	36
5	*Butea monosperma*	Anthelmintic, antifungal, antibacterial, purgative	Seeds, flower	01
6	*Crotalaria alata*	Malarial fever	Roots	25
7	*Crotalaria burhia*	Rheumatism, anti-cancer activity	Roots, whole plant	32
8	*Crotalaria ferruginea*	Against fever	Roots	25
9	*Crotalaria prostrata*	Derangements of the stomach, infantile diarrhoea	Roots	08
10	*Crotalaria retusa*	cough, dyspepsia, fever, cardiac disorders, diarrhoea	Whole plant	42
11	*Crotalaria spectabilis*	Scabies and impetigo	Whole plant	17
12	*Desmodium gangeticum*	Febrifuge, digestive, anti-catarrhal, anti-emetic and anti-inflammatory	Leaves, whole plant	28
13	*Desmodium multiflorum*	Against fever	Flowers, stem	-
14	*Desmodium triflorum*	Antipyretic, antiseptic, expectorant	Whole plant	33
15	*Flemingia chappar*	Epilepsy, hysteria, insomnia and to relieve pain; acidity and stomach disorders	Roots	-
16	*Flemingia strobilifera*	Epilepsy, vermifuge	Roots, leaves	04
17	*Indigofera arrecta*	Diarrhoeas, dysentery, epilepsy and nervous disorders, heal sores and ulcers, ophthalmic	Leaves, fruits, seeds	-

S.N	Species	Uses	Plant parts used	References
18	*Indigofera aspalathoides*	Leprosy and cancerous affections, toothache and mouth ulcers; antibacterial and antioxidant	Root, whole plant	08, 09
19	*Indigofera colutea*	healing medicine, Stomach aches	Roots, whole plant	06
20	*Indigofera glandulosa*	Nutritive tonic	Seeds	08
21	*Indigofera hirsuta*	Ophthalmic	Whole plant	06
22	*Indigofera oblongifolia*	Antidote of poisons, purgative	Roots	19
23	*Indigofera trifoliata*	Nutritive tonic and restorative, rheumatism and leucorrhoea	Seeds	08, 09, 20
24	*Indigofera trita*	Nutrient rich tonic, liver disorder, tumour	Whole plant	08, 31
25	*Phaseolus acutifolius*	Toothache	Leaves	27
26	*Senna occidentalis*	Diuretic, febrifuge, stomachic and tonic, hypertension, dropsy, diabetes, fevers, biliousness, rheumatism, ringworm	Whole plant	37
27	*Senna tora*	Diuretic and purgative, laxative and anthelmintic	Roots, seeds	10
28	*Tephrosia purpurea*	Tonic and laxative properties	Roots, whole plant	-
29	*Tephrosia villosa*	Dropsy and diabetes, antimicrobial and anticancer properties	Leaf	02, 07, 34,

constituents of grasslands and pasture lands. Most of the species available in herbarium are constituents of natural grasslands whereas some specimens such as *Lathyrus sativus, Vigna unguiculata* are important cultivated legumes. Other species found suitable during the study as fodder crop are *Alysicarpus rugosus*, *Bauhinia purpurea*, *Chamaecrista absus*, *Melilotus indicus* and *Tephrosia subtriflora.* Grassland ecosystems are vulnerable to anthropogenic pressure. Humans plough grasslands to plant rice, wheat and other crops, replace wildlife with domestic livestock and construct dams, bridges and houses for settlement.However,grasslands have been the backbone of the traditional pasture based livestock rearing activity which is the prime source of the economy of the rural people particularly of nomadic and semi-nomadic population. Most of the grasslands are in degraded condition due to various reasons *viz.* overgrazing, lack of grazing schedule, poor or no management practices. Overgrazing greatly affects the legume component population. Whatever population remains basically major component remains of grasses which are usually low in protein component and for nutritional balance, there is immense need to introduce suitable pasture legumes to make grassland nutritionally rich and sustainable on long term basis. Studies conducted at ICAR-IGFRI, Jhansi (India) have clearly indicated the nitrogen equivalence of legumes to the tune of 40-60 kg N/ha in natural grasslands[30]. Besides being a substitute and additional source of nitrogenous fertilizer, legumes also influence total dry matter production and crude protein yield of the biomass obtained from grassland. The pasture legume genera *viz. Indigofera*, *Rhynchosia* and

134

TABLE-5 : Miscellaneous uses

S. N	Name	Uses
1	*Acacia catechu*	Dye, timber and fuel value
2	*Bauhinia purpurea*	Ornamental value
3	*Albizia julibrissin var. mollis*	Furniture, industrial applications, firewood
4	*Butea monosperma*	Flowers are used for the preparation of a yellow dye
5	*Desmodium gangeticum*	Fibrous stems are reported to be useful for paper production
6	*Flemingia chappar*	Wood is used for toothbrushes
7	*Indigofera arrecta, I. colutea, I. hirsuta, I. trifoliata*	Leaves are a source of the Blue dye 'indigo
8	*Indigofera aspalathoides*	Twigs are used for making brooms
9	*Indigofera heterantha*	Used in making basket and twig bridges, firewood
10	*Senna tora*	Seeds are used as a mordant when dyeing cloth blue

Tephrosia exhibit rich diversity and are adopted to harsh climatic conditions of hot arid region. Species of *Indigofera* are of importance in the region as withstand adverse environmental conditions such as extremes of temperature and drought and also occurring in different habitats on a wide range of soils and rainfall[3,35]. In most of the existing grasslands, local grasses are dominating which are of course hardy, well adopted but have low protein content and are less palatable. During the study, some of the species found suitable for grassland development are *Alysicarpus bupleurifolius, A. hamosus , A. Monilifer, A. tetragonolobus, Crotalaria albida, C. bifaria, C. burhia , C. ferruginea, C. filipes, C. hirsuta, Desmodium heterocarpon var. Strigosum, D. multiflorum, D. rotundifolium, D. triflorum, Geissaspis cristata, Indigofera arrecta , Indigofera hirsuta, I. linifolia, I. oblongifolia,* I. *trifoliata*, *Medicago orthoceras, Tephrosia villosa* and *Vicia hirsuta* as they can be very much incorporated in degraded grassland suitably as per their suitability and adoptability.

2.4 Other uses

Besides food, medicinal and fodder values, some of the species are found to be economically useful.Taxa represented are *Acacia, Bauhinia,Albizia, Butea, Desmodium, Flemingia, Indigofera*and *Senna*. Uses ranged from dye, broommaking, mordant for dyeing clothes to paper production. In Table 5, all taxa along with their utility are enumerated.

Conclusion

Herbarium specimens permit precise chronological control, as the date of sample collection is normally recorded, allowing comparative studies of genetic diversity between past and present populations to determine possible continuties and pathways of process[2]. Out of the several methods of studying how climate change affects plant phenology (and therefore population and community dynamics) is the use of herbarium records[41,42]. The collections of specimens should also be accompanied with ample and accurate field data and additional information on various aspects including the knowledge associated with the genetic resource of the region. Since a herbarium is one of the major components which provides adequate information in order to conserve the biological diversity of any country, international agencies, well developed national organizations may help strengthening regional, infrastructure facilities, capacity building and dissemination of the knowledge. Herbarium specimens provide a window into the past that increases our temporal, geographic and taxonomic vision of how phenology – and

potentially plant success and ecosystem processes, have changed and will continue to be affected as the climate changes. With a thorough and growing understanding of the potential and limitations of this rich historical data source, combined with the modern tools of digitization, data sharing and integration, researchers will increasingly be able to address critical questions about plant biology, community and ecosystem ecology and how climate change impacts the rhythm of the natural world.

References

1. Allen O N, Allen E K. *The Leguminosae; A Source Book of Characteristics, Uses and Nodulation,* University of Wisconsin. 1981.
2. Bentley M D, Hassanali A L, Wande W, Njoroge P E W, Matagai Y. Insect antifeedants from *Tephrosia elata* Deflers, *Insect Sci. Appl.* 1987; **8** (1): 85-88.
3. Bhandari M M. *Flora of the Indian Desert*, Scientific Publishers. Jodhpur. 1978.
4. Bhatt S. Chalkones and some other constituents of *Flemingia strobilifera, Indian J. Chem.* 1975; **13:** 1105-1108.
5. Brown D. *Encyclopaedia of Herbs and their Uses.* Dorling Kindersley, London. 1995.
6. Burkil H M. *The Useful Plants of West Tropical Africa.* Royal Botanic Gardens; Kew. 2004.
7. Chen Yuh-Lin. New Piscicidal flavonoids from *Tephrosia obovata* Merr. *Asian, Journ. Pharm.* 1978; **3**(4): 18.
8. Chopra R N, Nayar S L, Chopra I C. *Glossary of Indian Medicinal Plants (Including the Supplement),* Council of Scientific and Industrial Research, New Delhi. 1986.
9. Dymock W, Warden C J H, Hooper D. *Pharmacographia Indica.* Education Society's Press, Byculla; Mumbai. 1890.
10. *Flora of China.* Missouri Botanical Garden Press; St. Louis. 1994.
11. Funk V. *100 uses for a herbarium (well at least 72),* US National Herbarium. 2007.
12. Gepts P, Beavis W D, Brummer E C, Shoemaker R C, Stalker H T, Weeden N F, Young N. Legumes as a model plant family: Genomics for food and feed report of the cross legume advances through genomics conference, *Pl. Physiol.* 2005; **137:** 1228–1235. https://doi.org/10.1104/pp.105.060871.
13. Graham P H, Vance C P. Legumes : Importance and constraints to greater use, *Plant Physiol.* 2003; **31:** 872–877.
14. Hancock J F. *Plant evolution and the origin of crop species,* ed. 3. Wallingford, U.K. & Cambridge, U.S.A, CAB International. 2012; https://doi.org/10.1079/9781845938017.0000.
15. Hartnup K, Huynen L, Tekanawa R, Shepherd L D, Millar C D, Lambert D M. Ancient DNA recovers the origins of Mâori feather cloaks. *Molecular Biology and Evolution*. 2011; **28:** 2741– 750.http://www.virtualherbarium.org/vh/100 UsesASPT.html.
16. Jain S K & R R Rao. *A handbook of field and herbarium methods, Todays and Tomorrows Printers and Publishers,* New Delhi. 1977.
17. Jain S K, Filipps R A De. *Medical plants of India*, Vol. 1, Reference Publications, Inc., Algonac, MI. 1991; 408.
18. Karthikeyan K, Dhanapal C K. GC-MS analysis of ethyl acetate extract of *Alysicarpus monilifer* -Whole plant, *Der Pharmacia Lettre.* 2016; **8**(13): 106-114.
19. Kirkitar K R, Basu B D. *Indian Medicinal Planta.* Sudhindra Nath Basu, Bahadur Ganj; India. 1918.
20. Kort I de, Thijsse G. A Revision of the Genus *Indigofera* (Leguminosae-Papilionoideae) in Southeast Asia, *Blumea.* 1984; **30:** 89-151.
21. Lavoie C, Lachance D. A new herbarium-based method for reconstructing the phenology of plant species across large areas, *American Journal of Botany.* 2006; **93**: 512–516.
22. Lewis G P, Forest F. *Cercideae, Legumes of the World. Richmond,* U. K.: Royal Botanic Gardens, Kew, In: Lewis, G., Schrire, B., Mackinder, B. & Lock, M. (eds.). 2005; 57–67.
23. Lewis G P, Schrire B D, Mackinder B A, Rico L, Clark R. A linear sequence of legume genera set in a phylogenetic context: A tool for collections management and taxon sampling, *S. African J. Bot.* 2013; **89:**76–84. https://doi.org/10.1016/j.sajb.2013.06.005.
24. LPWG. Legume Phylogeny Working Group, Legume phylogeny and classification in the 21st century: Progress,

136

prospects and lessons for other species-rich clades, *Taxon*. 2013a; **62:** 217–248. https://doi.org/10.12705/622.8.

25. Manandhar N P. *Plants and People of Nepal*. Timber Press. Oregon. 2002.
26. Miller-Rushing A J, Primack R B, Primack D, Mukunda S. Photographs and herbarium specimens as tools to document phenological changes in response to global warming, *American Journal of Botany.* 2006; **93:** 1667–1674.
27. Moerman D. *Native American Ethnobotany,* Timber Press, Oregon. 1988.
28. Obulesa M, Dowlathabad Muralidhar Rao. Effect of plant extracts on Alzheimers disease: An insight into therapeutic avenues, *J Neurosci Rural Pract.* 2011; Jan-Jun; **2**(1): 56-61.
29. Pankaj Sharma, Usha Devi. Ethnobotanical Uses of Biofencing Plants in Himachel Pradesh, Northwest Himalaya, *Pakistan Journal of Biological Sciences.* 2013; **16**(24): 1957-1963.
30. Rai P, Kanodia K C, Patil B D, Velayudhan K C, Agrawal R. Nitrogen equivalence of range legumes introduced in natural grasslands, *Indian Journal of Range Management.* 1980; **1** : 97-101.
31. Raju Sentil Kumar, Manivannan R, Balasubramaniam A, Rajkapoor B. Antioxidant and Hepatoprotective Activity of Ethanolic Extract of *Indigofera trita* Linn. on CCl4 Induced Hepatotoxic, *J. Pharmacol. Toxicol.* 2008; **3**(5): 344-350.
32. Saboon, Yamin Bibi, Muhammad Arshad, Nabeela Ahmad, Iqra Ria. An insight into medicinal and ethnopharmacological potential of *Crotalaria burhia, Asian Pac J Trop Dis.* 2015; **5**(7): 511-514.
33. Samvatsar S. Plants used for the treatment of different types of fever by Bhils and subtribes in India, *Indian Journal Traditional Knowledge.* 2004; **3**(1): 96-100.
34. Sarin J P S, Singh S, Garg H, Khanna N M, Dhar M. A flavonol glycoside with anticancer activity from *Tephrosia candida*, *Phytochemistry.* 1976; **15** (1): 232-234.
35. Singh J P, R K Beniwal. Wild arid legume diversity, A hope for rehabilitation of grazing land resources in the desert, *J. Arid legumes.* 2005 ; **2**: 258-161.
36. Sornay P De, Flattely FW. *Green Manures and Manuring in the Tropics.* John Bale, Sons and Danielsson Ltd, London. 1916.
37. Uphof J C T. *Dictionary of Economic Plants,* Weinheim. 1959.
38. Wandeler P, Hoeck P E, Keller L F. Back to the future: museum specimens in population genetics. *Trends in Ecology and Evolution.* 2007; **22 :** 634–642.
39. Weising K, Nybom H, Pfenninger M, Wolff K, Kahl G. *DNA fingerprinting in plants: principles, methods, and applications,* Boca Raton, FL: CRC Press. 2005.
40. Willis C G, Ellwood E R, Primack R B, Davis C C, Pearson K.D, Gallinato A S, Yost J M, Nelson G, Mazer S J, Rossington N L et al. Old plants, new tricks: phenological research using herbarium specimens, *Trends in Ecology & Evolution.* 2017; **32:** 531–546.
41. Yahara T, Javadi F, Onoda Y, Queiroz L P, D de, Faith, Prado D E, Akasaka M, Kadoya T, Ishihama F, Davies S, Slik J W F, Yi T, Ma K, Bin C, Darnaedi D, Pennington R T, Tuda M, Shimada M, Ito M, Egan A N, Buerki S, Raes N, Kajita T, Vatanparast M, Mimura M, Tachida H, Iwasa Y, Smith G F, Victor J E, Nkonki T. Global legume diversity assessment: Concepts, key indicators and strategies, *Taxon*. 2013; **62:** 249–266. https://doi.org/10.12705/622.12.
42. Zerbo P, Compaore M, Meda R N T, Kiendrebeogo M. Potential medicinal plants used by traditional healers in western areas of Burkina Faso, *World J Pharm Pharm Sci.* 2013; **2**(6): 6706-6719.