

FLORISTIC CHECKLIST OF DISTRICT KOTLI, AZAD JAMMU & KASHMIR

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Abstract

A comprehensive floristic survey was conducted to record the botanical diversity, ethnotaxonomy and the reproductive phenological response of the vascular flora of the district Kotli, Azad Jammu & Kashmir, Pakistan during 2011-13. A total of 463 plant species belonging to 306 genera and 93 families were recorded. The most dominant families in the study area were Poaceae (54 spp.), Leguminosae (39 spp.), Compositae (33 spp.), Lamiaceae (23 spp.) and Rosaceae (22 spp.), whereas the leading genera were *Ficus* (8 spp.), *Ipomoea*, *Cyperus*, *Euphorbia* and *Solanum* (6 spp. each). Use of online taxonomic literature and databases enabled us to document most of the species with their current accepted names, author citations and their placement in the higher taxa. Two different aspects, flowering duration and start of flowering event (or timing) were also recorded. Phenological studies revealed that most of the species found in flowering stage during the August (252 spp.), followed by July (245 spp.), May (239 spp.) and April (237 spp.); while with respect to flowering event, maximum number of species started their flowering in the month of March (111 spp.), followed by April (67 spp.) and July (62 spp.). With respect to floral growth forms, there was higher diversity of trees compared to the shrubs in the study area. This information pertaining to nomenclatural status, current placement of taxa and their phenological responses may provide baseline information to taxonomists, ecologists or phytogeographer, natural resource managers and conservationists for carrying out studies from this part of the western Himalaya.

Key words: Floristic checklist, Botanical diversity, Kotli, Taxonomic database, Nomenclatural status, Phenological response

Introduction

The inventory of native, agricultural, horticultural and weed flora of a region provides a baseline for further future taxonomic, ecological, ethnobotanical, phytochemical investigations, conservation and forest management projects. Being a major component of biotic components of an ecosystem, plants acknowledged their importance worldwide. Thus, they are grouped into floras on the basis of region, time period or climate, but the ecosystems are continually changing due to pollution, human population pressure affecting the deforestation rate and land conversions, invasive species, habitat destruction and fragmentation. Thus periodic updating of floral diversity in the form of checklists of a region are necessary to understand the various species to species and species to environment interactions (Ejtehadi *et al.*, 2005; Singh & Singh, 2010; Tastad *et al.*, 2010; Qureshi *et al.*, 2011a, 2011b, 2014; Shaheen *et al.*, 2014; Shinwari *et al.*, 2012, 2015).

A lot of fragmented work related to vegetation structure, types, composition and ethnobotany has been done in the different parts of the district Kotli (Malik & Malik, 2004a, 2004b; Malik & Ahmed, 2006; Ajaib *et al.*, 2010; Ahmad *et al.*, 2012; Amjad, 2012a, 2012b; Amjad *et al.*, 2013; Malik *et al.*, 2013), but a detailed floristic survey of the area is not conducted after Stewart, 1972. Another problem arose due to use of ambiguous or erroneous use of botanical scientific nomenclature in the aforementioned work in the area. Thus species names standardization and reclassifications were not kept in mind which causes confusions related to proper, correct identification and placement of the many taxa.

A change in botanical names of flowering plants is an issue emerged up from time to time. Sometimes there are valid scientific reasons for such changes, but it also creates some difficulties to the taxonomists in preparing floras. Furthermore, all the important floras of the world have included taxa with their old names, which are now

regarded as synonyms (Borah, 2014). In this study, we documented the current status of each species by using available online taxonomic databases and resources (JSTOR, EFLORAS, GRIN/NPGS, IPNI, THE PLANT LIST, WCSP, MMPND, ITIS, TROPICOS, GBIF, PFAF, Springer Reference, Plantsystematics.org, and Global Names Index) to minimize the impact of the issue.

Phenology refers to the seasonal and cyclic timing of various life events in plants which are related to periodic weather and edaphic changes (Rathcke & Lacey, 1985; Schwartz, 2003). Phenological studies are useful to conclude the pattern of climate and reproductive cyclic changes of the plant species (Lechowicz, 2001; Malik, 2005). Thus the present study also focused on how the flora of district Kotli responds particularly towards the flowering event with respect to the different months of the year.

The aim of this study was to provide floristic checklist of vascular flora to discover phytodiversity, updated species naming and placement, ethnotaxonomy or local names documentation as a means of awareness in local masses. Such findings will assist taxonomists, ethnobotanist, ecologists, conservationists, forest resource managers and monitoring persons and medicinal plant collectors in their future research projects.

Materials and Methods

Study area: Kotli district, Azad Jammu and Kashmir, Pakistan consist of five tehsils namely Kotli, Khairatta, Sehnsa, Fatehpur and Nikyal. It lies between 73° 6' to 74° 7' East longitudes and 33° 20' to 33° 40' North latitudes (Fig. 1) with an average elevation of 1000 above mean sea level (amsl). It is bounded by the Indian occupied Kashmir in the east, Rawalpindi, Pakistan in the west, Mirpur district

in the south and district Poonch in the north. The average annual rainfall is 1146.08mm in which July and August receive maximum precipitation (236.38 and 218.82mm respectively). The humidity was found higher in August, January, July and December, whereas the least one recorded in May and June. According to the 1999 census report, the total human population of the district is 0.558 million and the total land area is 1862 km² (Ajaib *et al.*, 2010; Malik *et al.*, 2013).

Floristic surveys, plants collection, Identification and Ethno-taxonomy: The floristic surveys were conducted during July 2011 to July 2013 for plant specimen collection, documentation of local names of the vascular flora and their phenological responses. The collected plant specimens were pressed, dried and mounted on standard herbarium sheets by using standard taxonomic method. The same were identified by using available taxonomic literature and online databases (Stewart, 1972; Nasir and Ali, 1971-1995; Ali and Qaiser, 1995-2009; EFLORAS, GRIN/NPGS, IPNI, THE PLANT LIST, WCSP, MMPND, TROPICOS). All the specimens were deposited in the herbarium of Pir Mehr Ali Shah, Arid Agriculture University Rawalpindi, Pakistan for future references and record.

Species naming and placement: Different available online taxonomic databases and resources (JSTOR, EFLORAS, GRIN/NPGS, IPNI, THE PLANT LIST, WCSP, MMPND, ITIS, TROPICOS, GBIF, PFAF,

Springer Reference, Plantsystematics.org, and Global Names Index) were employed to determine the current taxonomic naming status and placement of all the plants species.

Phenological studies: Maximum flowering, strobili development and sporogenesis starting month (timing) and duration of the event of each plant species of the angiosperms, gymnosperms and pteridophytes, respectively were recorded based on personal observations. The data were entered in Microsoft excel spreadsheet by placing them in rows against the months of a year (January to December) in columns. Each species was provided with a score or value of 1 (one) in its respective months, when it was found in its reproductive phase and 0 (zero), otherwise. Finally, the total number of species in reproductive stage within each month was determined by the summation of each of the 12 months column. Microsoft excel spreadsheet was then imported to PC-ORD version 5 (McCune & Mefford, 1999) for the generation of graph to establish clustering or grouping of months. The % age of the number of species found in their reproductive phase within each month was calculated according to the following formula:

$$\frac{\text{Species Number found in flowering in a month}}{\text{Total number of species in the area}} \times 100$$

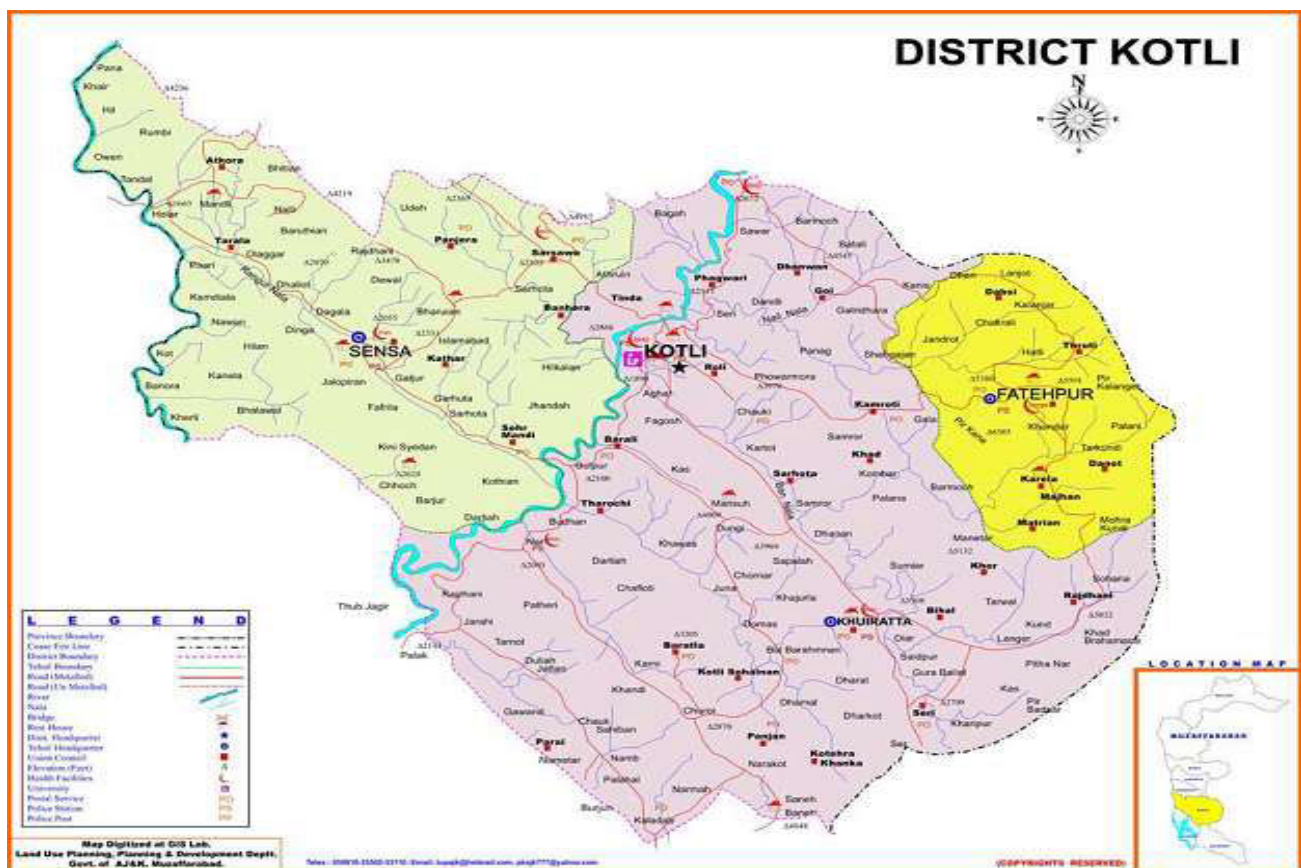


Fig. 1. Location map of the study area.

Results and Discussion

The enumerating sequence of major plant groups starts with pteridophytes, followed by gymnosperms and angiosperms. Within each of these plant groups, families, genera and species are arranged alphabetically in tabular form (Appendix 1). During floristic surveys, a total of 463 plant species belonging to 306 genera and 93 families were recorded. Pteridophytes were represented by 3 families (3.19%) such as Aspleniaceae, Dryopteridaceae and Pteridaceae, 4 genera (1.31%) and 8 species (1.73%). Gymnosperms likewise were represented by 3 families (3.19%) that include Araucariaceae, Cupressaceae and Pinaceae, 4 genera (1.31%) such as Araucaria, Cupressus, Pinus and Platycladus and 5 species (1.08%) in the study area. The angiosperms contributed maximum species represented by 88 families (93.62%), 298 genera (97.38%) and 450 species (97.19%). Of them, 18 families (19.15%), 58 genera (18.95%) and 90 species (19.44%) belonged to monocots; whereas 70 families (74.47%) with 240 genera (78.43%) and 360 species (77.75%) were dicots (Table: 1; Fig. 2).

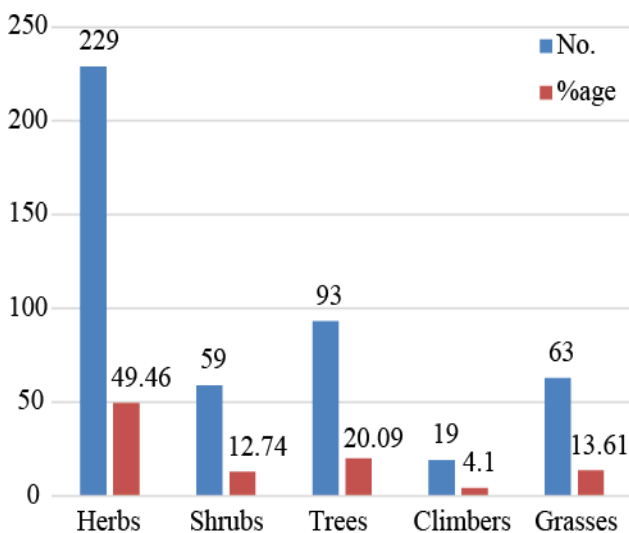


Fig. 2. Growth forms of the vascular flora of the study area.

The most dominant families in the study area were Poaceae (54 spp., 11.66%), Leguminosae (39 spp., 8.42%), Compositae (33 spp., 7.13%), Lamiaceae (23 spp., 4.97%) and Rosaceae (22 spp., 4.75%). The leading genera in the area were Ficus (8 spp.), Ipomoea, Cyperus, Euphorbia and Solanum (6 spp. each), Citrus (5 spp.), Adiantum, Allium, Lepidium, Mentha, Acacia, Grewia, Morus, Pyrus, Rosa and Rubus (4 spp. each).

There were 21 different genera which comprised of 3 species each, whereas the remaining 269 genera had two or fewer species.

On the basis of floral growth forms, herbs were dominated in the area with 229 species (49.46%), followed by 93 trees (20.09%), 63 grasses (13.61%), 59 shrubs (12.74%) and 19 climbers (4.10%) as shown in Fig. 2. With reference to woody species diversity, it is worth interesting to note that trees were higher than the shrubs in the area that clearly depicts smooth running of a forest ecosystem with less anthropogenic pressure. This trend is opposite to various studies undertaken from different areas of Pakistan and India (Gairola *et al.*: 2010; Qureshi *et al.*, 2011a; Chawla *et al.*, 2012; Qureshi *et al.*, 2014; Choudhary & Nama, 2014). The study area has both subtropical as well as a temperate climate with a variety of microhabitats, hence can support a variety of tree species to flourish. The highest diversity of indigenous trees urges to be declared as protected area which otherwise might deteriorate with increasing human population and resultant anthropogenic activities.

An utmost attempt has been taken into consideration to avoid the use of illegitimate, synonymous and unresolved status in the species naming and placement. Our results include 456 (98.49%) species with their accepted names and their placement in the higher ranks. Species names previously mentioned in botanical research papers from Pakistan or in Flora of Pakistan, now declared as synonyms or illegitimate, are avoided in this present inventory with few exceptions. This checklist includes only 3 synonyms (0.65%), belonged to genus *Brassica* due to its complex nature at subspecies or varieties level. Carolus Linnaeus recognized *B. rapa* and *B. campestris* as two different species in the 18th century; however, the current taxonomists viewed both as cross fertile and same species. Since the turnip (*Brassica rapa*) had been named first by the Linnaeus, so the same accepted (Thomas & Hartman, 2003). Similarly, the status of 4 species (0.86%) was unresolved and presently contained in this checklist due to their widespread use in various Pakistani botanical literatures. These are *Dryopteris stewartii* Fraser-Jenk., *Sarcococca pruniformis* Lindl., *Swertia chirayita* (Roxb.) Buch.-Ham. ex C.B.Clarke and *Cedrela serrata* Royle. We treated those as unresolved which are part of online taxonomic databases without any validation of either as accepted or synonym presently.

Table 1. Floristic composition of the vascular flora of Kotli, AJK.

Taxa	Pteridophytes	Gymnosperms	Angiosperms		Total
			Monocots	Dicots	
Families	3 (3.19%)	3 (3.19%)	18 (19.15%)	69 (74.47%)	93
Genera	4 (1.31%)	4 (1.31%)	58 (18.95%)	240 (78.43%)	306
Species	8 (1.73%)	5 (1.08%)	90 (19.44%)	360 (77.75%)	463

Appendix 1. Floristic checklist and phenological status of vascular flora of Kotli, Azad Jammu and Kashmir, Pakistan.

No.	Family	S/No.	Acc./No.	Species name	Habit	Local name	Phenology
Pteridophytes							
1.	Aspleniaceae	1.	2758	<i>Asplenium adiantum-nigrum</i> L.	H	Fern	Jun-Aug
2.	Dryopteridaceae	2.	3204	<i>Dryopteris ramosa</i> (C. Hope) C. Chr.	H	Longer	Jun-Sep
		3.	2854	<i>Dryopteris stewartii</i> Fraser-Jenk.	H	Daid, Dad	May-Sep
		4.	2774	<i>Adiantum capillus-veneris</i> L.	H	Sumbal, Persiansha	Jun-Aug
		5.	2799	<i>Adiantum concinnum</i> Humb. & Bonpl. ex Willd.	H	Fern	Jun-Aug
3.	Pteridaceae	6.	2802	<i>Adiantum incisum</i> Forssk.	H	Fern	Jun-Oct
		7.	3008	<i>Adiantum venustum</i> D. Don	H	Kakwa	Jun-Aug
		8.	2869	<i>Pteris cretica</i> L.	H	Fern	Jun-Aug
Gymnosperms							
1.	Araucariaceae	9.	3213	<i>Araucaria columnaris</i> (G. Forst.) Hook.	T	Araucaria	Feb-Jun
2.	Cupressaceae	10.	2780	<i>Cupressus sempervirens</i> L.	T	Surroo	Jan-Mar
		11.	2839	<i>Platycladus orientalis</i> (L.) Franco	T	Thuja, Morpunkh	Feb-Apr
3.	Pinaceae	12.	2960	<i>Pinus roxburghii</i> Sarg.	T	Cheer	Feb-Apr
		13.	2826	<i>Pinus wallichiana</i> A.B. Jackson	T	Biyaarr, Kail	Apr-Jun
Angiosperms							
1.	Acanthaceae	14.	2999	<i>Barleria cristata</i> L.	H	Chekal	Nov-Feb
		15.	3174	<i>Dicliptera bupleuroides</i> Nees	H	Kali Booti, Kirch, Somni	Jun-Oct
		16.	2759	<i>Dicliptera chinensis</i> (L.) Juss.	H	Kaloo	Aug-Nov
		17.	3060	<i>Eranthemum pulchellum</i> Andr.	S	Neeli Booti	Feb-Mar
2.	Adoxaceae	18.	2873	<i>Justicia adhatoda</i> L.	S	Baikarr	Jul-Oct
		19.	3080	<i>Viburnum grandiflorum</i> Wall. ex DC.	S	Guch	Mar-Jun
		20.	2882	<i>Achyranthes aspera</i> L.	H	Puth-Kanda	Jul-Oct
3.	Amaranthaceae	21.	3128	<i>Aerva sanguinolenta</i> (L.) Blume	H	Sufed Phulia	Aug-Oct
		22.	2821	<i>Alternanthera pungens</i> Kunth	H	Phakra	Aug-Oct
		23.	3033	<i>Amaranthus hybridus</i> L.	H	Bara Ghanyar	Jul-Oct
		24.	3198	<i>Amaranthus spinosus</i> L.	H	Surkh Ghanyar	May-Sep
		25.	3209	<i>Amaranthus viridis</i> L.	H	Ganhar, Ghanyar, Cholai	Mar-Oct
		26.	2883	<i>Celosia argentea</i> L.	H	Tandola, Kulgha	Jul-Aug
		27.	3104	<i>Chenopodium album</i> L.	H	Bathwa	Jun-Oct
		28.	2827	<i>Allium cepa</i> L.	H	Piyaz, Ganda	May-Sep
4.	Amaryllidaceae	29.	2841	<i>Allium humile</i> Kunth	H	Jangli Piyaz	Jun-Jul
		30.	3042	<i>Allium jacquemontii</i> Kunth	H	Jangli Piyaz	Mar-Apr
		31.	2829	<i>Allium sativum</i> L.	H	Thoom, Lehsan	Mar-Jun
		32.	2767	<i>Cotinus coggygria</i> Scop.	S	Bhan	Apr-May
5.	Anacardiaceae	33.	3190	<i>Lannea coromandelica</i> (Houtt.) Merr.	T	Kamlai	Mar-Apr
		34.	2825	<i>Mangifera indica</i> L.	T	Aam, Amb	Mar-Apr
		35.	2856	<i>Pistacia chinensis</i> subsp. <i>integerrima</i> (J. L. Stewart ex Brandis) Rech. f.	T	Kaker, Kanger	Mar-May
6.	Apiaceae	36.	2809	<i>Anethum graveolens</i> L.	H	Soya, Soe, Sowa	Jan-Mar
		37.	2840	<i>Bupleurum falcatum</i> L.	H	Unavailable	Jun-Oct
		38.	3140	<i>Coriandrum sativum</i> L.	H	Dhaniya	Feb-Jun
		39.	2848	<i>Daucus carota</i> L.	H	Gajar	Mar-Jun
		40.	3177	<i>Calotropis procera</i> (Aiton) Dryand.	S	Akk	Whole Year
7.	Apocynaceae	41.	2838	<i>Carissa spinarum</i> L.	S	Garanda	Apr-Jun
		42.	2929	<i>Nerium oleander</i> L.	S	Zangi Gul, Gandeera, Kaner	Apr-Sep
		43.	2791	<i>Periploca aphylla</i> Decne.	S	Burya, Batta	Mar-May
8.	Araceae	44.	2801	<i>Tylophora hirsuta</i> (Wall.) Wight	S	Panja Booti	May-Aug
		45.	3166	<i>Arisaema intermedium</i> Blume	H	Samp ki Much	Jun-Aug
		46.	3054	<i>Arisaema jacquemontii</i> Blume	H	Cobra Plant	Jun-Jul
		47.	2847	<i>Sauromatum venosum</i> (Dryand. ex Aiton) Kunth	H	Sanp Ki Makai, Sanp ki Booti	Apr-May
		48.	3175	<i>Hedera nepalensis</i> K. Koch	C	Kurie	Oct-Apr
10.	Arecaceae	49.	3108	<i>Phoenix loureiroi</i> Kunth	T	Khajoor	Mar-Jun
		50.	2804	<i>Phoenix sylvestris</i> (L.) Roxb.	T	Khajoor	Mar-Jun
		51.	3078	<i>Agave cantala</i> (Haw.) Roxb. ex Salm-Dyck	H	Sandal, Cantala	Jun-Aug
11.	Asparagaceae	52.	3187	<i>Agave sisalana</i> Perrine	H	Sisal	Jun-Sep
		53.	2808	<i>Asparagus adscendens</i> Roxb.	H	Sufaid Musli, Ari	Oct-Nov
		54.	2798	<i>Asparagus asiaticus</i> L.	H	Shah Gandal	Aug-Sep
12.	Balsaminaceae	55.	2865	<i>Impatiens edgeworthii</i> Hook. f.	H	Bantil	Jul-Sep
13.	Berberidaceae	56.	2924	<i>Berberis aristata</i> DC.	S	Sumbal, Sumbalu	Apr-May
		57.	2842	<i>Berberis lycium</i> Royle	S	Sumbal, Komal	Apr-Jun
		58.	3106	<i>Buglossoides arvensis</i> (L.) I.M. Johnston	H	Kalu	Mar-Apr
		59.	2816	<i>Cordia myxa</i> L.	T	Lasurra	Mar-May
14.	Boraginaceae	60.	2956	<i>Cynoglossum lanceolatum</i> Forssk.	H	Landi, Lunduri	Jun-Aug
		61.	2812	<i>Ehretia acuminata</i> R.Br.	T	Puna	Feb-Apr
		62.	2860	<i>Ehretia laevis</i> Roxb.	T	Sakkar, Chambal	Mar-Apr
		63.	3117	<i>Trichodesma indicum</i> (L.) Lehm.	H	Nil Karaj, Doosi, Gao-Zaban	Aug-Oct

Appendix 1. (Cont'd.).

No.	Family	S/No.	Acc./No.	Species name	Habit	Local name	Phenology
		64.	2823	<i>Brassica oleracea</i> var. <i>capitata</i> L.	H	Kale, Gobhi	Jun-Sep
		65.	2909	<i>Brassica rapa</i> subsp. <i>campestris</i> (L.) A.R.Clapham	H	Saryan, Sarsoon	Feb-Apr
		66.	3124	<i>Brassica rapa</i> subsp. <i>rapa</i> L.	H	Gonglu, Shaljam	Jun-Sep
		67.	2871	<i>Capsella bursa-pastoris</i> (L.) Medik.	H	Bun Paincha, Phuman	May-Jul
		68.	2830	<i>Eruca vesicaria</i> (L.) Cav.	H	Tara Mera	Feb-Apr
15.	Brassicaceae	69.	2928	<i>Lepidium capitatum</i> Hook.f. & Thoms.	H	Halian	May-Jun
		70.	2751	<i>Lepidium didymum</i> L.	H	Halian	Mar-Jun
		71.	2849	<i>Lepidium pinnatifidum</i> Ledeb.	H	Halian	Apr-Jun
		72.	2837	<i>Lepidium sativum</i> L.	H	Halian	Apr-Jun
		73.	3095	<i>Nasturtium officinale</i> R.Br.	H	Baburu, Nilofar	Apr-Jul
		74.	2805	<i>Raphanus raphanistrum</i> subsp. <i>sativus</i> (L.) Domin	H	Mooli	Mar-May
		75.	3105	<i>Sisymbrium irio</i> L.	H	Khub Kalan	Mar-May
16.	Buxaceae	76.	2904	<i>Sarcococca pruniformis</i> Lindl.	S	Ban-Sathra	Sep-Mar
17.	Cactaceae	77.	3038	<i>Opuntia dillenii</i> (Ker Gawl.) Haw.	S	Thor	May-Nov
18.	Campanulaceae	78.	3192	<i>Campanula pallida</i> Wall.	H	Beli Flower	Jul-Oct
19.	Cannabaceae	79.	2861	<i>Cannabis sativa</i> L.	H	Bhang	Jul-Sep
		80.	3141	<i>Celtis australis</i> L.	T	Kharrak	Mar-May
20.	Caprifoliaceae	81.	2863	<i>Lonicera quinquelocularis</i> Hardwicke	S	Phut	May-Sep
		82.	2916	<i>Valeriana jatamansi</i> Jones	H	Mushk Bala	Mar-May
		83.	2919	<i>Silene conoidea</i> L.	H	Dabbri	Mar-Apr
21.	Caryophyllaceae	84.	2900	<i>Stellaria media</i> (L.) Vill.	H	Neeli Buti, Gandel	Apr-Aug
22.	Celastraceae	85.	2857	<i>Gymnosporia royleana</i> Wall. ex M.A. Lawson	S	Patakhi	Sep-Jan
23.	Colchicaceae	86.	3109	<i>Colchicum luteum</i> Baker	H	Suranjan Talkh	Feb-Apr
		87.	3028	<i>Gloriosa superba</i> L.	H	Sanp booti	Nov-Mar
24.	Commelinaceae	88.	2875	<i>Commelina benghalensis</i> L.	H	Chura	Jul-Sep
		89.	3139	<i>Achillea millefolium</i> L.	H	Khati/Sultani booti	Jul-Sep
		90.	2957	<i>Anaphalis margaritacea</i> (L.) Benth. and Hook.f.	H	Unavailable	Aug-Nov
		91.	3202	<i>Artemisia absinthium</i> L.	H	Afsanthin	Jun-Sep
		92.	2828	<i>Artemisia roxburghiana</i> Wall. ex Besser	H	Jhau	Aug-Oct
		93.	3145	<i>Artemisia scoparia</i> Waldst. & Kit.	H	Jhau	Jul-Sep
		94.	2918	<i>Bidens biternata</i> (Lour.) Merr. and Sherff	H	Sumal	Jul-Sep
		95.	2833	<i>Calendula officinalis</i> L.	H	Marigold	May-Sep
		96.	2874	<i>Carduus edelbergii</i> Rech.f.	H	Kandiyari	Jul-Sep
		97.	2753	<i>Carthamus oxyacantha</i> M.Bieb.	H	Pohli	Mar-Jun
		98.	2862	<i>Carthamus tinctorius</i> L.	H	Pohli	Apr-Jun
		99.	2921	<i>Centaurea iberica</i> Trev. ex Spreng.	H	Kandiyara	May-Aug
		100.	3200	<i>Chrysanthemum indicum</i> L.	H	Chandramallika, Daudi	Gul-e- Aug-Nov
		101.	2962	<i>Cichorium intybus</i> L.	H	Kasni	Apr-Jul
		102.	2852	<i>Cirsium arvense</i> (L.) Scop.	H	Kandiyari, Leh	Aug-Oct
		103.	2922	<i>Erigeron bonariensis</i> L.	H	Paleet	Jun-Nov
		104.	2807	<i>Erigeron canadensis</i> L.	H	Kutahudy, Kali Booti	Jul-Sep
25.	Compositae	105.	2933	<i>Gerbera gossypina</i> (Royle) Beauverd	H	Ladrun	May-Jul
		106.	2903	<i>Helianthus annuus</i> L.	H	Gul-e-Aaftab, Surajmakhi	Feb-May
		107.	2878	<i>Helianthus tuberosus</i> L.	H	Arvi	Sep-Oct
		108.	2796	<i>Himalaiella heteromalla</i> (D. Don) Raab-Straube	H	Gurana	Jun-Aug
		109.	2911	<i>Launaea nudicaulis</i> (L.) Hook.f.	H	Methi Hand	Apr-Jun
		110.	3037	<i>Launaea procumbens</i> (Roxb.) Ram. & Rajagopal	H	Methi Hand	Mar-Aug
		111.	3169	<i>Launaea taraxacifolia</i> (Willd.) Amin ex C. Jeffrey	H	Unavailable	May-Aug
		112.	2902	<i>Parthenium hysterophorus</i> L.	H	Sitara Buti, Thandi Buti	Whole Year
		113.	3009	<i>Saussurea costus</i> (Falc.) Lipsch.	H	Kuth	Jul-Sep
		114.	2868	<i>Silybum marianum</i> (L.) Gaertn.	H	Kandiyara	Feb-Apr
		115.	2850	<i>Sonchus arvensis</i> L.	H	Dodal	Feb-May
		116.	2898	<i>Sonchus asper</i> (L.) Hill	H	Dodak, Dodal	Mar-Oct
		117.	2975	<i>Sonchus oleraceus</i> (L.) L.	H	Dodal	Mar-Jun
		118.	2853	<i>Taraxacum campyloides</i> G.E. Haglund	H	Hand	Mar-Sep
		119.	2820	<i>Tussilago farfara</i> L.	H	Watpan	Mar-May
		120.	2917	<i>Xanthium strumarium</i> L.	H	Cocklebar, Jojra	Aug-Oct
		121.	2899	<i>Zinnia elegans</i> L.	H	Zinnia	Feb-May
		122.	2814	<i>Convolvulus arvensis</i> L.	H	Naro, Lailee, Hiran Padi	May-Sep
		123.	3129	<i>Cuscuta reflexa</i> Roxb.	C	Dodder, Neel Dhari	Aug-Oct
		124.	2877	<i>Evolvulus alsinoides</i> (L.) L.	H	Sunkhpshpi	Feb-Oct
		125.	3210	<i>Ipomoea aristolochiifolia</i> G. Don	C	Unavailable	Jun-Oct
26.	Convolvulaceae	126.	2886	<i>Ipomoea cairica</i> (L.) Sweet	C	Aair	Sep-Jan
		127.	2771	<i>Ipomoea carnea</i> Jacq.	S	Jangli Baker, Vilayiti Ak	Jul-Sep
		128.	3212	<i>Ipomoea nil</i> (L.) Roth	C	Neeli Bail, Kaladana	Sep-Oct
		129.	3019	<i>Ipomoea pes-tigridis</i> L.	C	Unavailable	Jun-Sep
		130.	3137	<i>Ipomoea purpurea</i> (L.) Roth	C	Morning Glory	Jul-Sep

Appendix 1. (Cont'd.).

No.	Family	S/No.	Acc./No.	Species name	Habit	Local name	Phenology
27.	Crassulaceae	131.	2858	<i>Bryophyllum pinnatum</i> (Lam.) Oken.	H	Pather Chat	Nov-Mar
		132.	2795	<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai	H	Tarbuz	Jan-May
		133.	2813	<i>Cucurbita pepo</i> L.	C	Kaddu	Jun-Aug
		134.	3000	<i>Lagenaria siceraria</i> (Molina) Standl.	C	Dabri, Lauki, Al	Mar-May
28.	Cucurbitaceae	135.	2881	<i>Luffa acutangula</i> (L.) Roxb.	C	Kali Tori	May-Oct
		136.	2959	<i>Luffa cylindrica</i> (L.) M. Roem.	C	Ghia Tori	Apr-Oct
		137.	3206	<i>Momordica balsamina</i> L.	C	Jangli Karaila	Aug-Nov
		138.	2806	<i>Momordica charantia</i> L.	C	Karaila	Apr-Jul
		139.	2923	<i>Praecitrullus fistulosus</i> (Stocks) Pangalo	H	Teenda	Mar-Sep
		140.	3164	<i>Cyperus compressus</i> L.	G	Madani Gaas	Jul-Oct
		141.	2892	<i>Cyperus difformis</i> L.	G	Madani Gaas	Jul-Oct
		142.	2944	<i>Cyperus iria</i> L.	G	Bhoian	May-Oct
		143.	2800	<i>Cyperus niveus</i> Retz.	G	Madani Gaas	Apr-Jun
29.	Cyperaceae	144.	3143	<i>Cyperus rotundus</i> L.	G	Jabbay Gha, Muthri, Della	Apr-Oct
		145.	2935	<i>Cyperus stoloniferus</i> Retz.	G	Madani Gaas	Jul-Nov
		146.	2981	<i>Eriophorum comosum</i> (Wall.) Nees	G	Babya	Jul-Sep
		147.	2920	<i>Fimbristylis dichotoma</i> (L.) Vahl.	G	Chooti Bhoim	Aug-Oct
		148.	2766	<i>Fimbristylis quinqueangularis</i> (L.) Vahl.	G	Chooti Bhoim	Aug-Oct
30.	Dioscoreaceae	149.	2905	<i>Dioscorea deltoidea</i> Wall. ex Griseb.	C	Kanees	May-Jul
31.	Ebenaceae	150.	2822	<i>Diospyros kaki</i> L.f.	T	Amlook	May-Aug
		151.	3160	<i>Diospyros lotus</i> L.	T	Kala Amlook	May-Jun
32.	Elaeagnaceae	152.	2885	<i>Elaeagnus parvifolia</i> Wall. ex Royle	T	Ghowein	May-Jun
		153.	2958	<i>Elaeagnus umbellata</i> Thunb.	T	Autumn Olive	May-Jun
		154.	2889	<i>Euphorbia helioscopia</i> L.	H	Doodal	Jan-Jul
		155.	2966	<i>Euphorbia hirta</i> L.	H	Dudhli, Moti Dudal	Jul-Dec
		156.	3119	<i>Euphorbia indica</i> Lam.	H	Dhodhe	Jun-Dec
33.	Euphorbiaceae	157.	3020	<i>Euphorbia prostrata</i> Ait.	H	Dudhli, Hazar Dani	Whole Year
		158.	2910	<i>Euphorbia royleana</i> Boiss.	S	Danda Thor	May-Aug
		159.	3157	<i>Euphorbia wallichii</i> Hook.f.	H	Harwi	May-Aug
		160.	3207	<i>Mallotus philippensis</i> (Lam.) Muell. Arg.	T	Kameela	Feb-Apr
		161.	2983	<i>Ricinus communis</i> L.	S	Arind, Hernauli	Feb-Oct
34.	Fagaceae	162.	3132	<i>Quercus baloot</i> Griff.	T	Breh, Barungi, Mohru	Apr-May
		163.	2844	<i>Quercus incana</i> Bartram	T	Reen, Kathera, Irian	Apr-May
		164.	3134	<i>Gentiana pedicellata</i> (D.Don) Wall.	H	Pashanbhed	Apr-Aug
35.	Gentianaceae	165.	2783	<i>Swertia chirayita</i> (Roxb.) Buch.-Ham. ex C.B. Clarke	H	Surkhjan, Chirayita	Jul-Oct
		166.	2915	<i>Swertia speciosa</i> Wall.	H	Kori Jari	Jun-Nov
		167.	3027	<i>Erodium cicutarium</i> (L.) L'Her.	H	Moni jamain	Mar-Apr
36.	Geraniaceae	168.	2973	<i>Geranium mascatense</i> Boiss.	H	Jandorunu	Mar-Apr
		169.	3100	<i>Geranium rotundifolium</i> L.	H	Jandorunu	Mar-May
		170.	2949	<i>Geranium wallichianum</i> D.Don ex Sweet	H	Rattan jot	Jul-Sep
37.	Hypericaceae	171.	3055	<i>Hypericum oblongifolium</i> Choisy	H	Pinli	Mar-Aug
		172.	3010	<i>Hypericum perforatum</i> L.	H	Chamba, Sharan Gulab	Jun-Sep
38.	Iridaceae	173.	2880	<i>Iris aitchisonii</i> (Baker) Boiss.	H	Sanp Booti	Mar-Apr
39.	Juglandaceae	174.	2976	<i>Engelhardtia spicata</i> var. <i>integra</i> (Kurz) Man. ex Steenis	H	Samma	Mar-Apr
		175.	2773	<i>Juglans regia</i> L.	T	Khorri, Khor, Akhrot	Feb-Apr
40.	Juncaceae	176.	2811	<i>Juncus articulatus</i> L.	H	Rush	May-Sep
		177.	2835	<i>Ajuga integrifolia</i> Buch.-Ham.	H	Jan-e-Adam, Maneer, Kauri booti	Mar-Dec
		178.	2996	<i>Anisomeles indica</i> (L.) Kuntze	H	Sankhia	Apr-Sep
		179.	2834	<i>Colebrookea oppositifolia</i> Sm.	S	Chiela, Bansa Siah	Jan-Apr
		180.	2845	<i>Elsholtzia fruticosa</i> (D.Don) Rehder	S	Unavailable	Aug-Oct
		181.	3199	<i>Isodon rugosus</i> (Wall. ex Benth.) Codd	S	Chitta Manja, Khwangere, Peemar	Mar-Oct
		182.	2931	<i>Lamium amplexicaule</i> L.	H	Motcappra, Henbit	Dec-Apr
		183.	2990	<i>Leucas cephalotes</i> (Roth.) Spreng.	H	Chatra, Chara	Jul-Oct
		184.	3131	<i>Marrubium vulgare</i> L.	H	Horehound	Apr-Jun
		185.	2832	<i>Mentha arvensis</i> L.	H	Podina	Jul-Sep
		186.	3130	<i>Mentha longifolia</i> (L.) L.	H	Chitta Poodna, Breena	May-Oct
		187.	2901	<i>Mentha royleana</i> Wall. ex Benth.	H	Kala Poodna, Jangli Pudina	Jul-Oct
41.	Lamiaceae	188.	3025	<i>Mentha spicata</i> L.	H	Poodna	Jul-Sep
		189.	2859	<i>Micromeria biflora</i> (Buch.-Ham. ex D.Don) Benth.	H	Baburi, Boine	Mar-Nov
		190.	2992	<i>Nepeta erecta</i> (Royle ex Benth.) Benth.	H	Ladori, Mushkbal	Jun-Aug
		191.	2965	<i>Ocimum basilicum</i> L.	H	Niazboo, Sabajhi	Mar-Oct
		192.	3023	<i>Phlomis superba</i> (Royle ex Benth.) Kamelin and Makhm.	H	Gurganna, Gajar Mula	Mar-Apr
		193.	2872	<i>Prunella vulgaris</i> L.	H	Kalaveuth, Ustakhdus	Jun-Aug
		194.	3125	<i>Pseudocaryopteris bicolor</i> (Roxb. ex Hardw.) P.D. Cantino	H	Path Geri	May-Sep
		195.	3195	<i>Rydingia limbata</i> (Benth.) Scheen & Albert	S	Chitta Jand, Chitti Patakhi	Apr-May
		196.	2951	<i>Salvia canariensis</i> L.	H	Sage	Apr-Jul
		197.	2926	<i>Salvia officinalis</i> L.	H	Noorchari	Jun-Aug
		198.	2994	<i>Scutellaria linearis</i> Benth.	H	Mastiari	May-Jul
		199.	2876	<i>Vitex negundo</i> L.	S	Kala Banna, Nirgundi	Whole year

Appendix 1. (Cont'd.).

No.	Family	S/No.	Acc./No.	Species name	Habit	Local name	Phenology
		200.	2930	<i>Acacia catechu</i> (L.f.) Willd.	T	Khair, Katha	May-Aug
		201.	3208	<i>Acacia farnesiana</i> (L.) Willd.	T	Vilayati Kikar, Vilayati Babul	Nov-Mar
		202.	2789	<i>Acacia modesta</i> Wall.	T	Phulaie	Mar-May
		203.	3193	<i>Acacia nilotica</i> (L.) Delile	T	Kiker	Mar-Aug
		204.	2953	<i>Albizia lebbbeck</i> (L.) Benth.	T	Shreen	Apr-May
		205.	3127	<i>Albizia procera</i> (Roxb.) Benth.	T	Shreen	Jun-Aug
		206.	2794	<i>Argyrolobium roseum</i> (Camb.) Jaub. and Spach	H	Makhni Booti	Apr-Sep
		207.	2906	<i>Astragalus grahamianus</i> Benth.	S	Kala Kandyara	Apr-Aug
		208.	2884	<i>Astragalus leucocephalus</i> Bunge	H	Kainthi	Mar-Jun
		209.	3050	<i>Astragalus psilocentros</i> Fisch.	S	Tindni	Mar-May
		210.	2760	<i>Bauhinia variegata</i> L.	T	Kalyar, Kachnar	Feb-Apr
		211.	3015	<i>Butea monosperma</i> (Lam.) Taub.	T	Chhichra, Kamarkas, Palash	Mar-Apr
		212.	2855	<i>Cassia fistula</i> L.	T	Amaltas	Mar-Jun
		213.	2932	<i>Crotalaria medicaginea</i> Lam.	H	Trefal	Mar-Aug
		214.	2888	<i>Dalbergia sissoo</i> DC.	T	Tahli, Sheesham	Mar-May
		215.	3159	<i>Desmodium gangeticum</i> (L.) DC.	S	Salvan, Salparni	May-Sep
		216.	3178	<i>Indigofera heterantha</i> Brandis	S	Zand, Kanthi, Hiran Chari	May-Jul
		217.	2968	<i>Lathyrus aphaca</i> L.	H	Jangli Matar, Jangli Phali	Feb-Apr
		218.	2797	<i>Lathyrus odoratus</i> L.	H	Phool Matar	Mar-Aug
42.	Leguminosae	219.	3091	<i>Lespedeza juncea</i> (L.f.) Pers.	H	Unavailable	Jul-Sep
		220.	3184	<i>Lespedeza juncea</i> var. <i>sericea</i> (Thunb.) Lac. and Hau.	H	Unavailable	Jul-Oct
		221.	2817	<i>Leucaena leucocephala</i> (Lam.) de Wit	T	Vilayti Kikar, Kubabhal	Mar-May
		222.	3161	<i>Lotus corniculatus</i> L.	H	Makhan Booti	Apr-Aug
		223.	2979	<i>Medicago laciniata</i> (L.) Mill.	H	Maina	Mar-Apr
		224.	2785	<i>Medicago polymorpha</i> L.	H	Maina	Mar-May
		225.	3087	<i>Melilotus indicus</i> (L.) All.	H	Ran-Methi, Sinji	Mar-Aug
		226.	2938	<i>Melilotus officinalis</i> subsp. <i>alba</i> (Med.) H. Oha. & Tat.	H	Sinji	Mar-Sep
		227.	3082	<i>Pisum sativum</i> L.	H	Matar	Dec-Mar
		228.	2970	<i>Rhynchosia hirta</i> (And.) Meik. & Verdc.	H	Unavailable	Jul-Sep
		229.	3072	<i>Rhynchosia pseudo-cajan</i> Camb.	H	Lahr	May-Jun
		230.	2866	<i>Senna alexandrina</i> Mill.	S	Senna	Feb-Nov
		231.	2950	<i>Senna occidentalis</i> (L.) Link	S	Kaswandi, Talwar Phali	Aug-Mar
		232.	3135	<i>Trifolium dubium</i> Sibth.	H	Barseem	May-Oct
		233.	3182	<i>Trifolium repens</i> L.	H	Shatala	Apr-Jul
		234.	2997	<i>Trifolium resupinatum</i> L.	H	Shatala	Mar-Aug
		235.	2770	<i>Trigonella foenum-graecum</i> L.	H	Methi	Apr-May
		236.	2986	<i>Vicia faba</i> L.	H	Bakla, Rewari	Aug-Feb
		237.	3039	<i>Vicia sativa</i> L.	H	Mattri, Rewari	Jul-Aug
		238.	3188	<i>Vigna minima</i> (Roxb.) Ohwi & H. Ohashi	H	Jangli Moth	Mar-Aug
43.	Liliaceae	239.	3068	<i>Notholirion thomsonianum</i> (Royle) Stapf.	H	Domel Lily, Sanp Buti	Apr-May
44.	Linaceae	240.	2991	<i>Linum usitatissimum</i> L.	H	Alsi	Feb-May
45.	Loranthaceae	241.	2936	<i>Reinwardtia indica</i> Dumort.	H	Basant	Feb-May
46.	Lythraceae	242.	3077	<i>Loranthus pulverulentus</i> Wall.	S	Parwikh, Grunu	Dec-Jun
		243.	2971	<i>Punica granatum</i> L.	T	Darunna	Apr-Jun
		244.	2870	<i>Woodfordia fruticosa</i> (L.) Kurz	S	Tawi, Dhawi	Mar-Apr
		245.	3046	<i>Abelmoschus esculentus</i> (L.) Moench	H	Bhindi, Okra	Apr-Sep
		246.	2777	<i>Bombax ceiba</i> L.	T	Simmabal	Feb-Mar
		247.	2864	<i>Grewia asiatica</i> L.	T	Falsa	Mar-Sep
		248.	2993	<i>Grewia optiva</i> J.R. Drumm. ex Burret	T	Dhaman	Apr-Sep
		249.	3186	<i>Grewia tenax</i> (Forssk.) Fiori	S	Kango	Feb-Aug
47.	Malvaceae	250.	2985	<i>Grewia villosa</i> Willd.	S	Jalidhar	Mar-Sep
		251.	3059	<i>Malva parviflora</i> L.	H	Sonchal	Apr-Sep
		252.	3014	<i>Malva sylvestris</i> L.	H	Sonchal	May-Aug
		253.	3089	<i>Malvastrum coromandelianum</i> (L.) Garcke	H	Gogi Booti	Jun-Sep
		254.	2998	<i>Melochia corchorifolia</i> L.	H	Unavailable	Mar-Apr
		255.	2831	<i>Sida cordifolia</i> L.	H	Dil-Patri	Feb-Apr
48.	Martyniaceae	256.	3051	<i>Martynia annua</i> L.	H	Bichhu-butti, Hath Jori	Aug-Nov
		257.	2891	<i>Azadirachta indica</i> A. Juss.	T	Neem	Apr-May
49.	Meliaceae	258.	2894	<i>Cedrela serrata</i> Royle	T	Drawi, Dari	May-Jun
		259.	3017	<i>Melia azedarach</i> L.	T	Dhrek	Mar-Apr
		260.	2972	<i>Toona ciliata</i> M. Roem.	T	Toon	Mar-Apr
50.	Molluginaceae	261.	3098	<i>Mollugo pentaphylla</i> L.	H	Unavailable	Sep-Oct
		262.	3004	<i>Broussonetia papyrifera</i> (L.) L'Her. ex Vent.	T	Jangli Toot	Mar-Aug
		263.	2977	<i>Ficus auriculata</i> Lour.	T	Tussa, Dhushi	Aug-Nov
		264.	3084	<i>Ficus benghalensis</i> L.	T	Bhor, Bargad, Barota	Apr-Jul
		265.	2927	<i>Ficus carica</i> L.	T	Tosa, Injeer	Apr-Dec
		266.	2987	<i>Ficus elastica</i> Roxb. ex Homem.	T	Rubber Plant	Mar-Apr
		267.	2969	<i>Ficus palmata</i> Forssk.	T	Phagwarri	May-Sep
51.	Moraceae	268.	2763	<i>Ficus racemosa</i> L.	T	Gular, rumbal, umber	Mar-May
		269.	3074	<i>Ficus religiosa</i> L.	T	Pipal	Mar-Aug
		270.	3099	<i>Ficus semicordata</i> Buch.-Ham. ex Smith.	T	Joharphal, Kandrol	Mar-Jul
		271.	2995	<i>Morus alba</i> L.	T	Safaid toot	Mar-May
		272.	3081	<i>Morus macroura</i> Miq.	T	toot	Mar-Apr
		273.	2942	<i>Morus nigra</i> L.	T	Kala toot, Toot Siyah	Mar-May
		274.	2867	<i>Morus serrata</i> Roxb.	T	Kartoot	Mar-May

Appendix 1. (Cont'd.).

No.	Family	S/No.	Acc./No.	Species name	Habit	Local name	Phenology
52.	Musaceae	275.	2752	<i>Musa paradisiaca</i> L.	H	Kela	Mar-Aug
		276.	3203	<i>Callistemon citrinus</i> (Curtis) Skeels	T	Bottle Brush	Feb-Apr
		277.	3185	<i>Callistemon lanceolatus</i> (Sm.) Sweet	T	Bottle Brush	Feb-Apr
53.	Myrtaceae	278.	2907	<i>Corymbia citriodora</i> (Hook.) Hill & John.	T	Safaída	Jun-Nov
		279.	2954	<i>Eucalyptus camaldulensis</i> Dehnh.	T	Goand	May-Jan
		280.	3024	<i>Psidium guajava</i> L.	T	Amrood	Jun-Sep
		281.	2755	<i>Syzygium cumini</i> (L.) Skeels	T	Jamun	Apr-May
		282.	3040	<i>Boerhavia diffusa</i> L.	H	Sanati	Apr-Aug
54.	Nyctaginaceae	283.	3067	<i>Boerhavia procumbens</i> Banks ex Roxb.	H	Sanati, Itsit	Mar-Sep
		284.	3196	<i>Boerhavia repens</i> L.	H	Chanati	Whole year
		285.	2963	<i>Bougainvillea spectabilis</i> Willd.	S	Bougainvillea	May-Sep
		286.	2776	<i>Jasminum humile</i> L.	S	Peeli Chumbaili	Apr-Jun
		287.	3090	<i>Jasminum officinale</i> L.	S	Chumbaili	May-Jul
55.	Oleaceae	288.	3138	<i>Jasminum sambac</i> (L.) Aiton	S	Motiya	May-Sep
		289.	3061	<i>Ligustrum lucidum</i> W.T. Aiton	S	Dumdum	May-Jun
		290.	2967	<i>Olea ferruginea</i> Wall. ex Aitch.	T	Rons Pattar, Kahu	Apr-May
		291.	2897	<i>Oenothera rosea</i> L'Her. ex Aiton	H	Sufaid Mohri, Seh Davi	Apr-Sep
56.	Onagraceae	292.	2946	<i>Habenaria digitata</i> Lindl.	H	Mohri	Jul-Aug
57.	Orchidaceae	293.	3047	<i>Oxalis corniculata</i> L.	H	Khatmit, Jandoro, Khatti	Mar-Oct
58.	Oxalidaceae	294.	3168	<i>Oxalis latifolia</i> Kunth	H	Khatmit, Khatti	Jun-Aug
		295.	2955	<i>Fumaria indica</i> (Hauskn.) Pugsley	H	Pitpapra	Mar-Jun
		296.	3045	<i>Fumaria parviflora</i> Lam.	H	Papra	Mar-Jun
		297.	2896	<i>Papaver dubium</i> L.	H	Koko-kanga	Mar-Jun
59.	Papaveraceae	298.	2978	<i>Papaver hybridum</i> L.	H	Koko-kanga	Apr-Jun
		299.	3048	<i>Papaver somniferum</i> L.	H	Post, Afeem	Apr-Jun
		300.	3173	<i>Sesamum indicum</i> L.	H	Til	Jun-Oct
60.	Pedaliaceae	301.	2846	<i>Flueggea virosa</i> (Roxb. ex Willd.) Royle	S	Path Geri	Apr-Jul
		302.	3148	<i>Glochidion heyneanum</i> (Wight & Arn.) Wight	T	Kaira, Kayara	May-Jul
		303.	3171	<i>Leptopus cordifolius</i> Decne.	S	Unavailable	Jul-Oct
61.	Phyllanthaceae	304.	3056	<i>Phyllanthus emblica</i> L.	T	Amla	Mar-May
		305.	2757	<i>Phyllanthus niruri</i> L.	H	Bahupatra, Bhuiamla	Aug-Sep
		306.	3066	<i>Digitalis purpurea</i> L.	H	Gandoora	Mar-May
		307.	3003	<i>Plantago lanceolata</i> L.	H	Chamchi patra, Gola, Isabgool	Jul-Sep
		308.	3011	<i>Plantago major</i> L.	H	Isabgool	Aug-Sep
62.	Plantaginaceae	309.	2895	<i>Plantago ovata</i> Forssk.	H	Isabgool	Aug-Sep
		310.	2948	<i>Veronica polita</i> Fries	H	Sriiri	Feb-May
		311.	2786	<i>Platanus orientalis</i> L.	T	Chinar	Apr-May
63.	Platanaceae	312.	3044	<i>Agrostis canina</i> L.	G	Gaas	Jul-Aug
		313.	2984	<i>Agrostis stolonifera</i> L.	G	Gaas	Jul-Aug
		314.	3002	<i>Andropogon munroi</i> C.B. Clarke	G	Unavailable	Aug-Sep
		315.	3043	<i>Aristida adscensionis</i> L.	G	Lappa, Lamba gha	Mar-Dec
		316.	2778	<i>Arundo donax</i> L.	G	Narr, Narra	Jun-Nov
		317.	3150	<i>Avena fatua</i> L.	G	Jai	May-Aug
		318.	3158	<i>Avena sativa</i> L.	G	Jai	May-Aug
		319.	3069	<i>Brachiaria eruciformis</i> (Sm.) Griseb.	G	Sair	Jul-Sep
		320.	3153	<i>Brachiaria reptans</i> (L.) Gar. & Hub.	G	Sair, Kandeeri	Jun-Oct
		321.	3071	<i>Catabrosa aquatica</i> (L.) P. Beauv.	G	Unavailable	Jun-Aug
		322.	3181	<i>Cenchrus ciliaris</i> L.	G	Leendra, Damun	Feb-Mar
		323.	3136	<i>Chloris barbata</i> Sw.	G	Ganni, Jargi	Apr-May
		324.	2939	<i>Chrysopogon aucheri</i> (Boiss.) Stapf.	G	Bari Gaas	Mar-May
		325.	3126	<i>Chrysopogon serrulatus</i> Trin.	G	Bari Gaas	Aug-Sep
		326.	3075	<i>Cymbopogon distans</i> (Nees ex Steud.) W. Watson	G	Sunni	Aug-Oct
		327.	3103	<i>Cymbopogon jwarancusa</i> (Jones) Schult.	G	Khawi	Mar-May
		64.	Poaceae	328.	3041	<i>Cynodon dactylon</i> (L.) Pers.	G
329.	3006			<i>Dactyloctenium aegyptium</i> (L.) Willd.	G	Madhana Gaas	Jul-Oct
330.	3031			<i>Dactyloctenium scindicum</i> Boiss.	G	Madhana Gaas	Sep-Apr
331.	3156			<i>Desmostachya bipinnata</i> (L.) Stapf.	G	Dabh	Jul-Oct
332.	3092			<i>Dichanthium annulatum</i> (Forsk.) Stapf.	G	Palwan Gaas	Mar-Nov
333.	3032			<i>Digitaria ciliaris</i> (Retz.) Koeler	G	Pachar Gaas	Jul-Oct
334.	3018			<i>Digitaria sanguinalis</i> (L.) Scop.	G	Moti khabbal	Jul-Sep
335.	3016			<i>Digitaria setigera</i> Roth	G	Pachar Gaas	Jul-Sep
336.	3176			<i>Eleusine indica</i> (L.) Gaertn.	G	Mandhano	Jun-Aug
337.	3036			<i>Elymus repens</i> (L.) Gould	G	Mandhano	Jul-Aug
338.	3086			<i>Eragrostis amabilis</i> (L.) Wight and Arn.	G	Bharbhuri	Mar-Jul
339.	2836			<i>Eragrostis japonica</i> (Thunb.) Trin.	G	Bharbhuri	Aug-Oct
340.	3094			<i>Heteropogon contortus</i> (L.) P.Beauv. ex Roem. & Schult.	G	Sariyala Gaas	Jun-Oct
341.	3022			<i>Imperata cylindrica</i> (L.) Raeusch.	G	Kulfi gass, Siru	Apr-Jun
342.	3034			<i>Oplismenus compositus</i> (L.) P. Beauv.	G	Unavailable	Aug-Sep

Appendix 1. (Cont'd.).

No.	Family	S/No.	Acc./No.	Species name	Habit	Local name	Phenology
		343.	3007	<i>Oplismenus undulatifolius</i> (Ard.) Roem. & Schult.	G	Unavailable	Aug-Sep
		344.	3149	<i>Paspalum distichum</i> L.	G	Naru Gaas	Apr-Sep
		345.	2947	<i>Pennisetum glaucum</i> (L.) R. Br.	G	Bajra	Jun-Aug
		346.	3165	<i>Pennisetum orientale</i> Rich.	G	Haati Gaas	Apr-Oct
		347.	2756	<i>Phalaris arundinacea</i> L.	G	Dumbi Sitti	May-Jul
		348.	3107	<i>Phalaris minor</i> Retz.	G	Dumbi Sitti	Mar-May
		349.	3029	<i>Phragmites karka</i> (Retz.) Trin. ex Steud.	G	Drumbi, Nar, Nalu	Apr-Nov
		350.	3030	<i>Poa annua</i> L.	G	Gaas	Apr-Sep
		351.	3062	<i>Poa infirma</i> Kunth.	G	Gaas	Mar-Apr
		352.	3101	<i>Poa sinaica</i> Steud.	G	Gaas	Apr-May
		353.	2765	<i>Polygogon viridis</i> (Gouan) Breistr.	G	Pochar	May-Aug
		354.	3194	<i>Saccharum bengalense</i> Retz.	G	Sirkee, Kana, Sarkanda	Oct-Jan
		355.	3172	<i>Saccharum officinarum</i> L.	G	Ganna	Dec-May
		356.	3191	<i>Saccharum spontaneum</i> L.	G	Kai	Jul-Sep
		357.	2803	<i>Setaria palmifolia</i> (Koen.) Stapf.	G	Unavailable	Aug-Oct
		358.	3005	<i>Setaria verticillata</i> (L.) P. Beauv.	G	Chirchira, Barchitta	Whole year
		359.	2782	<i>Setaria viridis</i> (L.) P. Beauv.	G	Kangni, Loomar Gaas	Jun-Sep
		360.	2988	<i>Sorghum bicolor</i> (L.) Moench	G	Jwar	Jun-Sep
		361.	3064	<i>Sorghum halepense</i> (L.) Pers.	G	Baru, Barwa	May-Sep
		362.	2810	<i>Themeda anathera</i> (Nees ex Steud.) Hack.	G	Bhari ghas, Loondar	Jun-Oct
		363.	3076	<i>Triticum aestivum</i> L.	G	Kanak, Gundam	Dec-Apr
		364.	3113	<i>Vetiveria zizanioides</i> (L.) Nash	G	Khas Khas	Jul-Sep
		365.	3197	<i>Zea mays</i> L.	G	Mak, Makaie	Jul-Sep
		366.	2775	<i>Persicaria nepalensis</i> (Meisn.) Miyabe	H	Choor, Masloon	Jun-Sep
		367.	2941	<i>Polygonum aviculare</i> L.	H	Karsu, Banali	Mar-Sep
65.	Polygonaceae	368.	3079	<i>Polygonum mollifforme</i> Boiss.	H	Masloon	Jun-Aug
		369.	3112	<i>Rumex dentatus</i> L.	H	Herfli, Jangli Palak	May-Aug
		370.	3035	<i>Rumex hastatus</i> D. Don	H	Khatimal	Jul-Sep
		371.	2989	<i>Rumex nepalensis</i> Spreng.	H	Hola, Aliphiri	Jun-Sep
66.	Potamogetonaceae	372.	3122	<i>Potamogeton nodosus</i> Poir.	H	Jujuli	Apr-Aug
		373.	2792	<i>Anagallis arvensis</i> L.	H	Billi Buti	Feb-May
67.	Primulaceae	374.	3205	<i>Androsace rotundifolia</i> Hardw.	H	Marchola	Apr-Aug
		375.	2787	<i>Myrsine africana</i> L.	S	Googal, Chapra	Mar-May
		376.	3121	<i>Clematis gouriana</i> Roxb. ex DC.	C	Bel Kanga	Aug-Sep
		377.	2913	<i>Ranunculus arvensis</i> L.	H	Gur-sochal	Mar-Apr
68.	Ranunculaceae	378.	2824	<i>Ranunculus muricatus</i> L.	H	Kor kandoli	Mar-Apr
		379.	3012	<i>Thalictrum aquilegifolium</i> L.	H	Beni	May-Aug
		380.	3147	<i>Thalictrum foetidum</i> L.	H	Beni	May-Aug
		381.	2788	<i>Thalictrum foliolosum</i> DC.	H	Beni	May-Aug
		382.	3057	<i>Rhamnus purpurea</i> Edgew.	T	Rangrek, Sinjal, Tandra	Apr-Jun
		383.	3001	<i>Rhamnus triquetra</i> (Wall.) Brandis	T	Clader	Jul-Aug
69.	Rhamnaceae	384.	3013	<i>Sageretia thea</i> (Osbeck) M.C. Johnst.	S	Meva	Jul-Sep
		385.	2761	<i>Ziziphus jujuba</i> Mill.	T	Bair, Unab	Apr-Jul
		386.	3097	<i>Ziziphus nummularia</i> (Burm.f.) Wight & Arn.	S	Jand Beri	Mar-Jun
		387.	2982	<i>Ziziphus oxyphylla</i> Edgew.	T	Mamyanu	Jun-Sep
		388.	3073	<i>Agrimonia pilosa</i> Ledeb.	H	Jalebi Buti	Jun-Sep
		389.	2980	<i>Cotoneaster acuminatus</i> Wall. ex Lindl.	S	Luni	May-Jul
		390.	3183	<i>Duchesnea indica</i> (Jacks.) Focke	H	Surkh Akhra	Mar-Oct
		391.	2769	<i>Eriobotrya japonica</i> (Thunb.) Lindl.	T	Lokaat	Feb-May
		392.	3118	<i>Fragaria nubicola</i> (Lindl. ex Hook.f.) Lacaita	H	Budmeva	May-Aug
		393.	3123	<i>Malus sylvestris</i> (L.) Mill.	T	Seb	Feb-May
		394.	2974	<i>Potentilla eriocarpa</i> Wall. ex Lehm.	H	Malli Chaw	Jul-Sep
		395.	3162	<i>Prunus armeniaca</i> L.	T	Khubani, Aari	Feb-Apr
		396.	3093	<i>Prunus domestica</i> L.	T	Alucha	Feb-Apr
		397.	3142	<i>Prunus persica</i> (L.) Batsch.	T	Arro, Rawara	Feb-Apr
70.	Rosaceae	398.	2952	<i>Pyrus calleryana</i> Decne.	T	Batangi	Mar-May
		399.	2815	<i>Pyrus pashia</i> Buch.-Ham. ex D. Don	T	Batangi, Kather	Apr-Jun
		400.	3115	<i>Pyrus pyrifolia</i> (Burm.f.) Nakai	T	Batangi	Mar-May
		401.	3049	<i>Pyrus ussuriensis</i> Maxim. ex Rupr.	T	Batangi	Mar-May
		402.	3083	<i>Rosa chinensis</i> Jacq.	S	Chini Ghulab	Jul-Aug
		403.	3151	<i>Rosa damascena</i> Herrm.	S	Ghulab	Jun-Aug
		404.	2793	<i>Rosa indica</i> L.	S	Ghulab	Jul-Aug
		405.	2790	<i>Rosa moschata</i> Herrm.	S	Tamari	Jul-Sep
		406.	3116	<i>Rubus ellipticus</i> Sm.	S	Peela Akhra	Apr-Jun
		407.	2943	<i>Rubus niveus</i> Thunb.	S	Akhra	Apr-Jun
		408.	3026	<i>Rubus sanctus</i> Schreb.	S	Akhra	Mar-May
		409.	3110	<i>Rubus vestitus</i> Weihe	S	Akhra	May-Jun

Appendix 1. (Cont'd.).

No.	Family	S/No.	Acc./No.	Species name	Habit	Local name	Phenology
		410.	2893	<i>Galium aparine</i> L.	H	Lahndra	Mar-Jul
		411.	2818	<i>Galium elegans</i> Wall. ex Roxb.	H	Lahndra	Jul-Oct
71.	Rubiaceae	412.	3114	<i>Rubia manjith</i> Roxb. ex Fleming	C	Manjith, Madder	Jun-Nov
		413.	2764	<i>Rubia tinctorum</i> L.	C	Madder	Jul-Aug
		414.	3211	<i>Wendlandia heynei</i> (Schult.) San. & Mer.	T	Ukan, Pansara	Mar-Apr
		415.	2784	<i>Citrus aurantiifolia</i> (Christm.) Swingle	T	Kaghzi Nimbo	Apr-Sep
		416.	2890	<i>Citrus aurantium</i> L.	T	Khatti	Mar-Apr
72.	Rutaceae	417.	3052	<i>Citrus limon</i> (L.) Osbeck	T	Khatta, Gulgul	Aug-Nov
		418.	2843	<i>Citrus reticulata</i> Blanco	T	Santra	Feb-May
		419.	3144	<i>Citrus sinensis</i> (L.) Osbeck	T	Malta	Mar-May
		420.	3088	<i>Zanthoxylum armatum</i> DC.	S	Timber	Mar-Apr
		421.	2772	<i>Casearia tomentosa</i> Roxb.	T	Chella	Mar-May
		422.	3096	<i>Flacourtia indica</i> (Burm.f.) Merr.	T	Bhutankas, Kanju, Kokoh	Mar-Apr
73.	Salicaceae	423.	3102	<i>Populus ciliata</i> Wall. ex Royle	T	Popular	Mar-Apr
		424.	3120	<i>Populus deltoides</i> Marshall	T	Popular	Apr-Jun
		425.	2925	<i>Salix acmophylla</i> Boiss.	T	Bains	Feb-Apr
		426.	3065	<i>Salix alba</i> L.	T	Beesa	Apr-May
74.	Sapindaceae	427.	2945	<i>Dodonaea viscosa</i> (L.) Jacq.	S	Sanatha	Jan-Mar
		428.	3180	<i>Sapindus mukorossi</i> Gaertn.	T	Ritha	May-Jun
		429.	3070	<i>Bergenia ciliata</i> (Haw.) Sternb.	H	Butbhyva, Zakhm-i-Hayat	Mar-May
75.	Saxifragaceae	430.	2768	<i>Bergenia pacumbis</i> (Buch.-Ham. ex D. Don) Wu & Pan	H	Zakhm-i-Hayat	Mar-Jul
		431.	3170	<i>Saxifraga hirculus</i> L.	H	Unavailable	Jul-Sep
		432.	2940	<i>Buddleja asiatica</i> Lour.	S	Banna, Batti	Jul-Oct
76.	Scrophulariaceae	433.	3133	<i>Verbascum thapsus</i> L.	H	Gadhi Kan, Tamakoo	Gidhar Jun-Aug
77.	Simaroubaceae	434.	2961	<i>Ailanthus altissima</i> (Mill.) Swingle	T	Jangli Toon	May-Jun
		435.	2912	<i>Capsicum annum</i> L.	H	Surkh Mirch	Apr-Jun
		436.	3167	<i>Cestrum aurantiacum</i> Lindl.	S	Peeli Chumbaili	Sep-Oct
		437.	3053	<i>Cestrum nocturnum</i> L.	S	Raat ki rani	Mar-Oct
		438.	3021	<i>Datura innoxia</i> Mill.	S	Datura	Jun-Sep
		439.	3189	<i>Lycopersicon esculentum</i> Mill.	H	Tamater	Jul-Oct
		440.	2937	<i>Nicotiana tabacum</i> L.	H	Tambaku	Apr-May
78.	Solanaceae	441.	3058	<i>Physalis divaricata</i> D. Don	H	Jangli Tamater	Aug-Sep
		442.	2851	<i>Solanum americanum</i> Mill.	H	Mako, Kachmach	Whole year
		443.	3155	<i>Solanum incanum</i> L.	H	Jangli Watao	Whole year
		444.	2914	<i>Solanum melongena</i> L.	H	Bangun, Wataoo	Jul-Sep
		445.	3063	<i>Solanum surattense</i> Burm. f.	H	Kundiyyara, Mokri	Whole year
		446.	2762	<i>Solanum tuberosum</i> L.	H	Alu	May-Aug
		447.	3085	<i>Solanum virginianum</i> L.	H	Bari Mokri	Mar-Sep
		448.	2879	<i>Withania somnifera</i> (L.) Dunal.	H	Aksun, Koori Chinothi	Whole year
79.	Typhaceae	449.	3146	<i>Typha domingensis</i> Pers.	H	Barya, Koondhar	May-Aug
80.	Ulmaceae	450.	2934	<i>Ulmus villosa</i> Brandis ex Gamble	T	Mannu	Feb-Apr
		451.	3154	<i>Ulmus wallichiana</i> Planch.	T	Kain, Mareen	Mar-Apr
81.	Urticaceae	452.	2908	<i>Debregeasia saeneb</i> (Forssk.) Hepper & J.R.I. Wood	S	Sindhari, Puruni	Mar-Jun
		453.	2781	<i>Urtica dioica</i> L.	H	Bichhu Buti	May-Sep
82.	Verbenaceae	454.	3179	<i>Verbena officinalis</i> L.	H	Karenta, Pamukh	Jun-Sep
		455.	2887	<i>Viola canescens</i> Wall.	H	Banafsha	Mar-Jun
83.	Violaceae	456.	2964	<i>Viola odorata</i> L.	H	Banafsha	Mar-Jul
		457.	2819	<i>Viola pilosa</i> Blume	H	Banafsha, Bamira	Apr-Aug
84.	Vitaceae	458.	3163	<i>Cissus trifoliata</i> (L.) L.	C	Dakh	Jul-Sep
		459.	3152	<i>Vitis vinifera</i> L.	C	Angur	May-Jul
85.	Xanthorrhoeaceae	460.	3111	<i>Aloe vera</i> (L.) Burm.f.	H	Kanwar gandal	Jan-Apr
		461.	2779	<i>Asphodelus tenuifolius</i> Cav.	H	Piyazi, Patak	Nov-Apr
86.	Zingiberaceae	462.	3201	<i>Curcuma longa</i> L.	H	Haldi	Jul-Sep
87.	Zygophyllaceae	463.	2754	<i>Tribulus terrestris</i> L.	H	Bhurt, Bhakrra	Whole year

Legends: H= Herb; S= Shrub; T= Tree; C= Climber; G= Grass

Table 2. Average monthly phenological findings of the flora of Kotli, AJK.

Months	Species found in flowering / %age	Species started flowering/ %age
January	039 (08.42)	019 (04.10)
February	073 (15.76)	038 (08.21)
March	182 (39.31)	111 (23.97)
April	237 (51.18)	067 (14.47)
May	239 (51.62)	058 (12.53)
June	234 (50.54)	054 (11.66)
July	245 (52.91)	062 (13.39)
August	252 (54.42)	032 (06.91)
October	103 (22.24)	003 (00.65)
November	049 (10.58)	005 (01.08)
December	036 (07.77)	006 (01.30)

Phenological study of the vascular flora is shown in Table 2 under column 2. It revealed that majority of species (252 spp., 54.42%) were recorded in reproductive stage (i.e. flowering in angiosperms, strobili development in gymnosperms and sporogenesis in ferns) during the month of August, followed by July (245 spp., 52.91%), May (239 spp. 51.62%) and April (237 spp., 51.17%). Least number of species were found in their reproductive phase in the months of December (36 spp., 7.77%) and January (39 spp., 8.42%). As far as the timing of the flowering event is concerned, majority of species (111 spp., 23.97%) started flowering in the month of March, followed by April (67 spp., 14.47%) and July (62 spp., 13.39%), while the minimum number of species (3, 5 and 6 only) started flowering event in the months of October, November and December respectively (Table: 2, Column: 3).

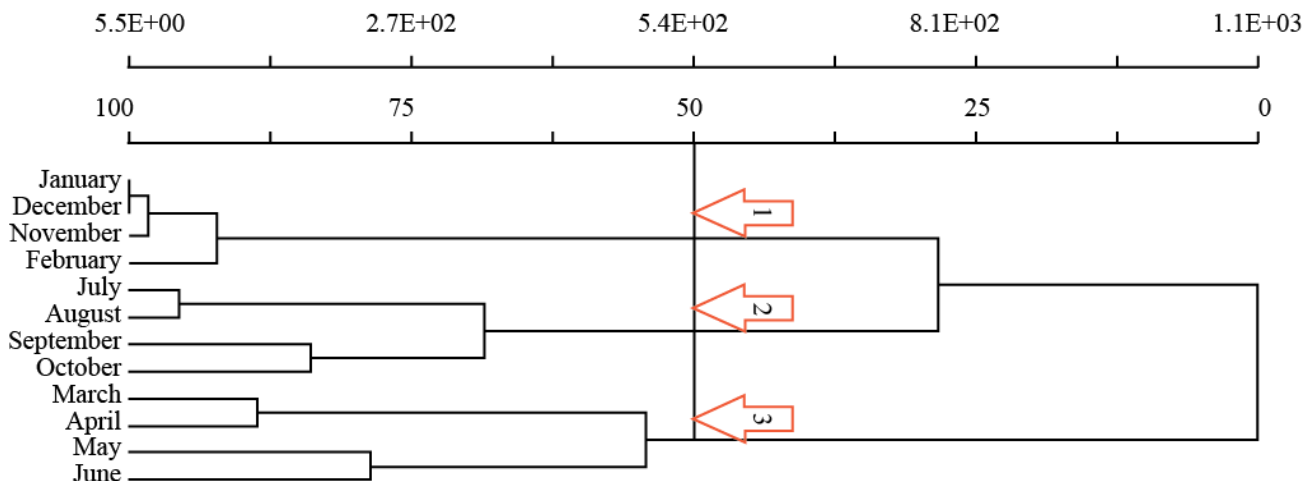


Fig. 3. Months clustering dendrogram based on phenological response.

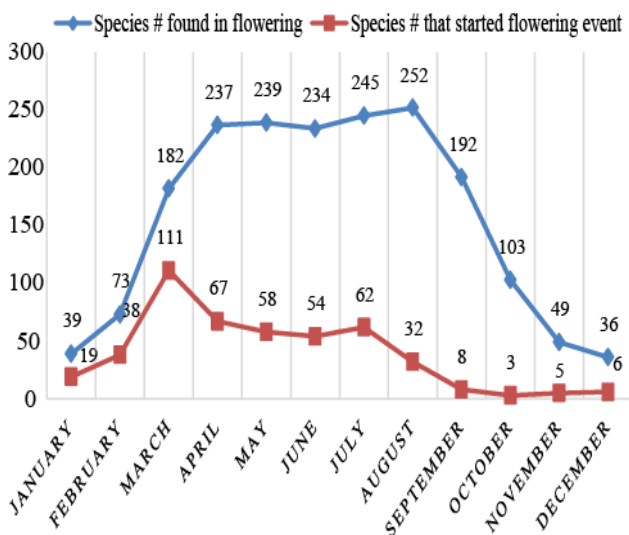


Fig. 4. Phenological responses of the vascular flora in the study area.

By using PC-ORD version 5 (McCune and Mefford, 1999), clustering dendrogram of all months of a year was generated to seek month-wise classificatory correlation with the number of species at flowering stage from the study area. This clustering dendrogram (Fig. 3) produced three (3) groups of months based on the degree of intensity of the reproductive stage of the vascular flora.

First group includes January, December, November and February. January and December are more closely related to each other and showed almost 100% similarity having a very weak relationship with the flowering event. The 2nd major group comprised of July, August, September and October during which flora showed maximum reproductive response with respect to total number of species in flowering stage; whereas, the 3rd group consists of March, April, May and June with intermediate response of species in flowering stage. However, during these months, maximum number of species started their flowering event (Table 2, Fig. 3). When the number of species found in flowering and number of species that started flowering event (y-axis) were plotted against the months (x-axis), we got a bimodal distribution graph. In case of number of species that started flowering event, the first peak appeared in the month of March and the second one in July (Fig. 4). These results can be tested for their correlation with the induction of suitable photoperiodic cycles, moderate temperature and the amount of soil moisture in March and July, respectively.

The flowering response clearly demonstrated the importance of seven months viz. March to September, during which, most of the flora of the study area go through the sexual reproductive cycle. Similarly, five months (from October to February) had a weak positive relationship with

the flowering event. So only a few specific species exhibited flowering response in December and January. The highest response from July to September can be correlated with maximum amount of monsoon rainfall in these months, whereas in the case of March and April, increased light duration, increased population of pollinators and moderate atmospheric temperature may play their vital role. Similar types of findings were also reported by Struck (1994), Kikim & Yaadava (2001) and Yadav & Yadav (2008).

Conclusions and Recommendations

Online taxonomic literature and databases can serve a useful tool for generating uniformity and standardization in botanical literature globally. We utilize these tools while documenting species names, author citations and their placement. For example, *Cedrela toona* Roxb. ex Rottler, *Conyza bonariensis* (L.) Cronquist and *Conyza canadensis* (L.) Cronquist commonly used in botanical literature but now treated as synonyms (i.e. *Toona ciliata* M. Roem., *Erigeron bonariensis* L. and *Erigeron canadensis* L., respectively). Thus, the current status of different taxa and use of accepted names in botanical literature will reduce the intensity of confusion amongst the workers. There is a need of a single uniform database that can be followed by the scientific community.

Overall, the area is rich in the floristic diversity, yet due to increased population pressure, clearing land for agriculture & developmental work as well as habitat destruction and fragmentation led to the decline in plant diversity. Thus, there is need to save this phytodiversity hotspot for future generations through the involvement of local communities.

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