

Full Length Research Paper

Vascular plant diversity with special reference to invasion of alien species on the Doon University Campus, Dehradun, India

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The present study was conducted to assess vascular plant diversity in a modified habitat in Shivalik region. Extensive surveys were conducted to document the species in each season and identification was done with the help of regional floras. A total of 191 species comprising 181 species of angiosperms (176 genera and 76 families), 2 species of pteridophytes (2 genera and 1 family), and 8 species of gymnosperms (7 genera and 5 families) were observed. The dominant Angiosperms families include Asteraceae (18 genera and 18 species), followed by Fabaceae (16 genera and 18 species), Lamiaceae (8 genera and 9 species), Solanaceae (5 genera and 9 species), Amaranthaceae (7 genera and 8 species), Euphorbiaceae (4 genera and 8 species) and Apocynaceae (6 genera and 7 species). In Gymnosperms, 5 families were recorded which include family Pinaceae, Cycadaceae, Zamiaceae, Araucariaceae and Cupressaceae. In pteridophytes, only two species of the family Pteridaceae were recorded. The categorizations on the basis of species habit, 96 species were recorded as herbs, 23 shrubs, 48 trees, 14 climbers, 8 grasses and 2 species of ferns. On the basis of species economic importance, 111 species had medicinal value, 43 ornamental, 8 medicinal-edible, 8 fodder, 7 edible, 2 medicinal-ornamental, 2 edible-fodder, 1 medicinal-timber, 1 fuel-fodder, 1 fuel-timber-edible-ornamental, 1 medicinal-fiber, 1 medicinal-fuel-fodder-religious, 1 ornamental-fuel, 1 ornamental-religious, 1 condiment uses while rests of the 2 species have other uses. In terms of occurrence, 36.64% species were native, while 63.35% species were non-native. The study provides baseline information on a modified habitat in an important eco-region and would be helpful in monitoring the changes in future.

Key words: Doon University, vascular plants, life form, nativity, exotic.

INTRODUCTION

India is one of the 19 megabiodiverse countries of the world and consists of 48,158 species of plants

(Anonymous, 2016) and 97,514 species of animals (Anonymous, 2016) in its ten biogeographic regions. The

Shivalik or sub-Himalayan region is the youngest and ecologically fragile mountains have been categorized under the Indo-Gangetic plains with unique significance which integrates ecosystem of Indo-Malayan and palaeartic regions (Shivkumar et al., 2010). Shivalik Himalaya ranges over a stretch of 1500 miles long and 20 to 30 miles wide from the Indus to Brahmaputra in Assam (Kohli, 2002). In Uttarakhand State, the Shivalik Himalaya covers Tarai-Bhabhar, Shivalik and lesser Himalayan zones which include the part of district Pauri, Tehri, Dehradun and Haridwar, etc (Sharma et al., 2011).

Information on floral diversity of any region is a fundamental requirement to understand ecosystem type, biodiversity pattern and other ecological qualities pertaining to natural resource management and conservation planning at local, regional and global levels (Rajendran et al., 2014). Several studies have been conducted to understand vegetation diversity and pattern of Shivalik and its adjacent areas such as Upper Gangetic plains (Raizada, 1976), Chakrata, Dehradun and Saharanpur (Kanjilal, 1979), Mussoorie (Raizada and Saxena, 1984), Shimla (Collet, 1980), Garhwal Himalaya (Gaur, 1999; Sharma, 2013), Rajaji National Park (Singh and Anand, 2002), Dehradun (Adhikari, 2008, 2010) and Binog Wildlife Sanctuary (Kumar et al., 2012). Outstanding work on economically important plant species was also done by various workers (Nadkarni, 1910; Jain, 1968; Chauhan, 1999; Prajapati et al., 2003; Rawat and Vashista, 2011).

Invasion of alien species has been considered a significant threat to an ecosystem which trigger the alteration of ecological characteristics of a habitat. Organisms immigrating to new habitats have been specified as alien, adventive, exotic, introduced and non-indigenous (Mack et al., 2000; McGeoch et al., 2010). Invasive species may occur through accidental, import for a limited purpose and subsequently escape or persistent introduction on a large scale (Ehrenfeld, 2003). These species affect natural ecosystem structure and function (Sekar et al., 2012), although have significant ecological benefits too. Alien species differ in their nutrient requirement, mode of resource utilization which cause changes in soil structure and profile (Negi and Hajra, 2007; Raizada et al., 2008). Invasion of exotic plant species might have significant adverse changes on the biodiversity and ecosystems functioning (Sharma and Raghubanshi, 2011) which further affect the environment as well as human health (Sekar, 2012). Over the years, invasion of various alien species of diverse origin has been increased in India and reported mainly from regions like Doon valley (Negi and Hajra, 2007), Kashmir Himalaya (Khuroo et al., 2007; Khuroo et al., 2010), Uttarakhand (Tewari et al., 2010), Uttar-Pradesh (Singh

et al., 2010), Himachal-Pradesh (Jaryan et al., 2013), Assam (Das and Duarah, 2013), Jammu (Kaur et al., 2014), North-Eastern Uttar Pradesh (Srivastava et al., 2014), Karnataka (Kambhar and Kotresha, 2011), Madhya-Pradesh (Wagh and Jain, 2015), Delhi (Mishra et al., 2015) and Haryana (Singh and Mohammed, 2015).

Over the years, as developmental activities are continuing to modify the natural ecosystem throughout the world, native floral and faunal species are continuously decreasing with their diminishing habitat. Therefore, it is important to document the current biodiversity status (diversity, life form, habitat, use values and phenological patterns) and monitor the changes in vegetation pattern over the time. Considering these facts, the present study has been conducted to assess plant diversity within the Doon University campus which would be important to monitor the change in near future and implementation of suitable management plan.

Study area

The present study was conducted in the Doon University campus, situated in the foot hills of Shivalik mountains, lying between 30°15'60"-30°16'10" latitudes and 78°2'36"-78°2'50" longitudes with an altitudinal range of 600 to 630 m asl and covering an area of approximately 0.199 km² (Patwal and Naithani, 2014) (Figure 1). It is situated in a mosaic of various habitat types which includes thick deciduous forest, riverine habitat, agricultural fields and human settlements. *Tectona grandis*, *Shorea robusta*, *Terminalia alata*, *Anogeissus latifolia*, *Mallotus philippensis* and *Melia azedarach* are major tree species in the forest. The riverine habitat is constituted by river Rispana which flows through eastern side of the campus and further join Song River, a tributary of the River Ganga. The average temperature remains moderate year round ranging from 35 to 40°C in the summers to 15 to 25°C in winter. The average annual rainfall recorded for the area is 2073 mm and most of the rainfall received during the month of June to September. Due to its unique location in the vicinity of different habitat types, the campus consist suitable environmental conditions to supports a variety of floral and faunal species.

MATERIALS AND METHODS

Intensive plant surveys were conducted from August 2014 to December 2015 in different seasons, floral specimens were collected from different locations and identified with the help of relevant floras, book chapters and published literature (Raizada, 1976; Kanjilal, 1979; Raizada and Saxena, 1984; Collet, 1980; Gaur, 1999; Singh and Anand, 2002; Adhikari et al., 2010; Sharma

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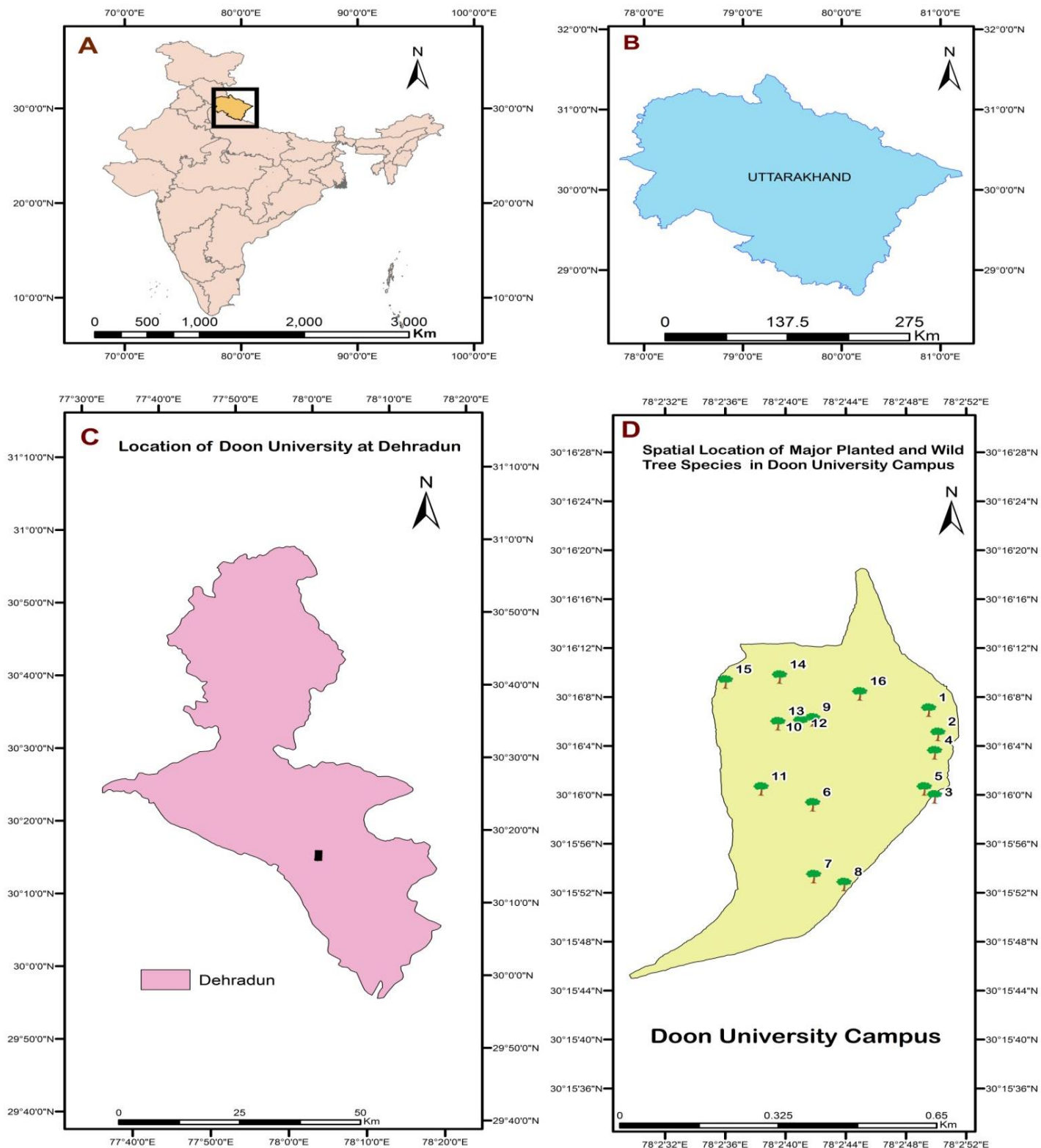


Figure 1. Location map of Doon University. A) India B) Uttarakhand C) Location of Doon University in Dehradun D) Spatial location of major planted and wild tree species in Doon University campus: 1: *Mimusops elengi* (P), 2: *Ficus benjamina* (P), 3: *Lagerstroemia indica* (P), 4: *Bambusa tuldoidea* (P), 5: *Chukrasia tabularis* (P), 6: *Nyctanthes arbor-tristis* (P), 7: *Ceiba speciosa* (P), 8: *Ficus semicordata* + *Bauhinia purpurea* (W), 9: *Acacia catechu* (W), 10: *Dalbergia sissoo* + *Acacia catechu* (W), 11: *Melaleuca bracteata* + *Grevillia robusta* + *Putranjiva roxburghii*+*Jacaranda mimosifolia* (P), 12: *Dalbergia sissoo*+*Mallotus philippensis* + *Broussonetia papyrifera* (W), 13: *Erythrina crista-galli* +*Pinus roxburghii* (P), 14: *Neolamarckia cadamba* (P), 15: *Ficus religiosa* + *Tecoma castanifolia* + *Grevillia robusta* + *Aurocaria columnaris* (P), 16: *Magnolia champaca* + *Agathis robusta* (P). W- Wild, P- planted.

Table 1. Floristic detail of Doon University Campus.

Groups		F	G	S	T	Sh	H	Cb	G	Fn
Angiosperms	Dicots	63	148	161	39	20	89	13	--	--
	Monocots	7	19	20	2	2	7	1	8	--
Gymnosperms		5	7	8	7	1	--	--	--	--
Pteridophytes		1	2	2	--	--	--	--	--	2
Total		76	176	191	48	23	96	14	8	2

F = family, G = genera, S = species, T = tree, Sh = shrub, H = herb, Cb = climber, G = grass, Fn = fern.

et al., 2011, 2013; Rajendran et al., 2014). For each species, information was collected on local name, altitudinal range, life form, flowering and fruiting periods. Information on economic importance and plant part used was collected through formal discussion with local people working as gardener and wage labour in the campus and from various earlier studies (Nadkarni, 1910; Prajapati et al., 2003; Kumar et al., 2012; Subramanion et al., 2013). In addition, information on ornamental flora was assembled from local plant nurseries and botanical gardens in Dehradun. Additional information such as updated nomenclature of native and exotic plant species was generated through related websites like international plant name index (IPNI, 2015), the plant list (2015), encyclopedia of life (EOL, 2015), tropicos (2016) and the global biodiversity information facility (GBIF, 2015). The nativity of the invasive plants has been recorded from published literatures (Champion and Seth, 1968; Negi and Hajra, 2007; Khuroo et al., 2007; Raizada et al., 2008; Reddy, 2008; Sharma and Raghubanshi, 2008; Weber et al., 2008; Khuroo et al., 2010; Singh et al., 2010; Tewari et al., 2010; Kambhar and Kotresha, 2011; Sekar et al., 2012; Sekar, 2012; Khuroo et al., 2012; Jaryan et al., 2013; Das and Duarah, 2013; Hiremath and Sundaram, 2013; Kaur et al., 2014; Srivastava et al., 2014; Wagh and Jain, 2015; Mishra et al., 2015; Singh and Mohammed, 2015) and further categorized according to their vernacular name, English name, altitudinal range, life forms (herb, shrub, trees, grass, climber and ferns), flowering fruiting periods, plant parts (leave, root, stems, rhizomes, bark, flowers, fruits, seeds and pods). Plants were further categorized according to their economic uses such as medicinal, ornamental, edible, timber, fuel, fodder, condiments and religious. Synonyms of plant species were not included to avoid the taxonomic inflation.

RESULTS AND DISCUSSION

A total of 191 species of vascular plants (Angiosperms, Gymnosperms and Pteridophytes) belonging to 176 genera and 76 families were recorded within the campus. Among these species, 181 species were angiosperms including 161 species of dicotyledons and 20 species of monocotyledons (63 families and 148 genera), 8 gymnosperms and 2 pteridophytes. In terms of habit types, 48 tree species, 96 herb, 23 shrubs, 14 climbers, 8 grasses and rest of 2 species are belonging to ferns were recorded (Table 1). Family Asteraceae (18 genera, 18 species), Fabaceae (16 genera and 18 species), Lamiaceae (8 genera and 9 species), Solonaceae (5 genera and 9 species) were among the dominant families and are followed by Amaranthaceae (7 genera and 8 species), Euphorbiaceae (4 genera and 8 species),

Apocynaceae (6 genera and 7 species), Araceae (5 genera and 5 species), Poaceae (5 genera and 5 species), Malvaceae (4 genera and 5 species) and Family Caesalpiniaceae, Verbenaceae, Moraceae, Asparagaceae (4 genera and 4 species in each families) are among the other (Figure 2). In gymnosperms, 8 species from 5 families (Pinaceae, Cycadaceae, Zamiaceae, Araucariaceae and Cupressaceae) were recorded, while 2 species of fern from family pteridaceae were recorded. Maximum flowering and fruiting period was observed in the plants throughout the year (20 species), followed by April to September (11 species), August to November (10 species), July to November (8 species), January to December (7 species), July to October (6 species), April to June (5 species), etc (Figure 3).

Economic importance of the species

Out of the recorded 191 species, all species were found to be used for various economic purpose which includes 111 (58%) medicinal, 43 (23%) ornamental, 8 (4%) medicinal-edible, 8 (4%) fodder, 7 (4%) edible, 2 (1%) medicinal-ornamental, 2 (1%) edible-fodder, 1 (1%) medicinal-timber, 1 (1%) fuel-fodder, 1 (1%) fuel-timber-edible-ornamental, 1 (1%) medicinal-fiber, 1 (1%) medicinal-fuel-fodder-religious, 1 (1%) ornamental-fuel, 1 (1%) ornamental-religious, 1 (1%) condiment uses, while rests of the 2 (1%) species have other uses (Figure 4). In terms of part used for economical and ethno-botanical value, a total of 49% species leaves are used which is followed by root 12%, fruits 12%, bark 7%, seeds 5%, stem 6%, flower 6%, tubers 2% and of 1% pods (Figure 5).

Species of medicinal value

Most of the plant species recorded from the study site are highly medicinal in nature. Some important herbaceous medicinal plants from the study site are *Acyranthus aspera* L., *Centella asiatica* (L.) Urb., *Calotropis procera* (Aiton) Dryand., *Dioscorea bulbifera* L., *Chamaesyce hirta* L., *Asperagus adscendens* Buch.-Ham.ex Roxb.,

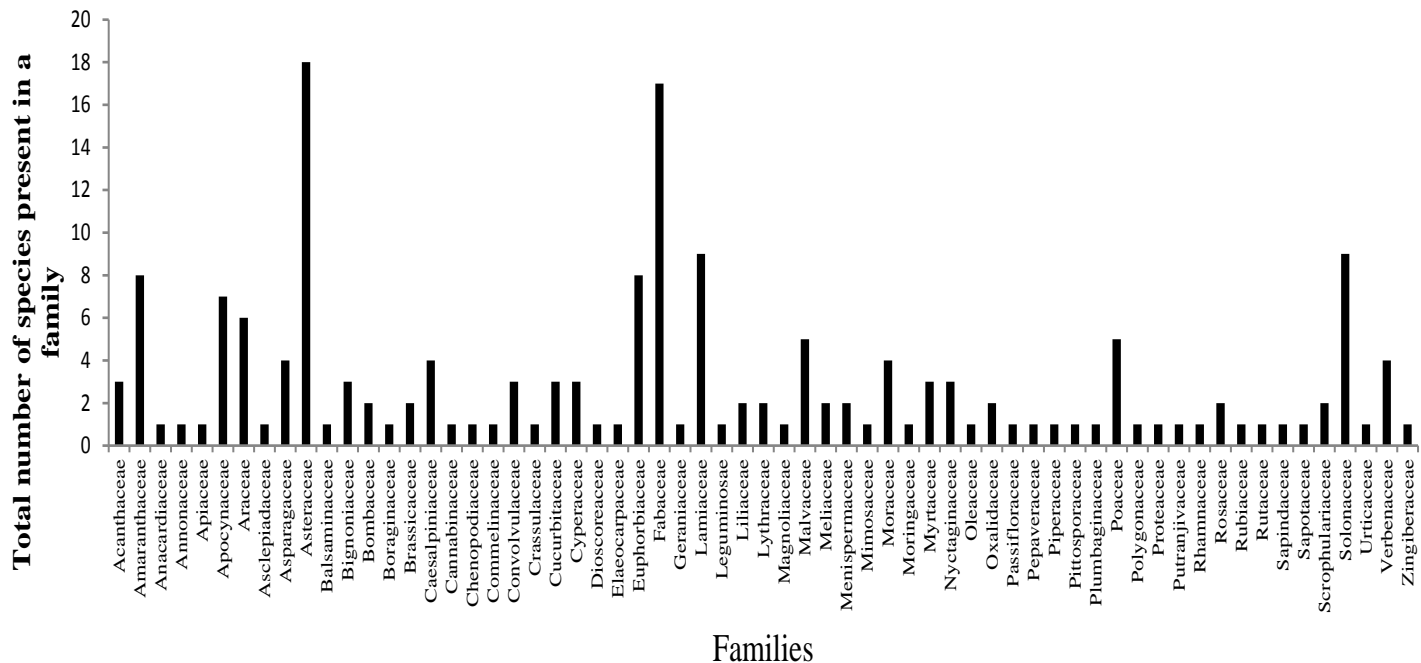


Figure 2. Distribution of vascular plants families in Doon University Campus.

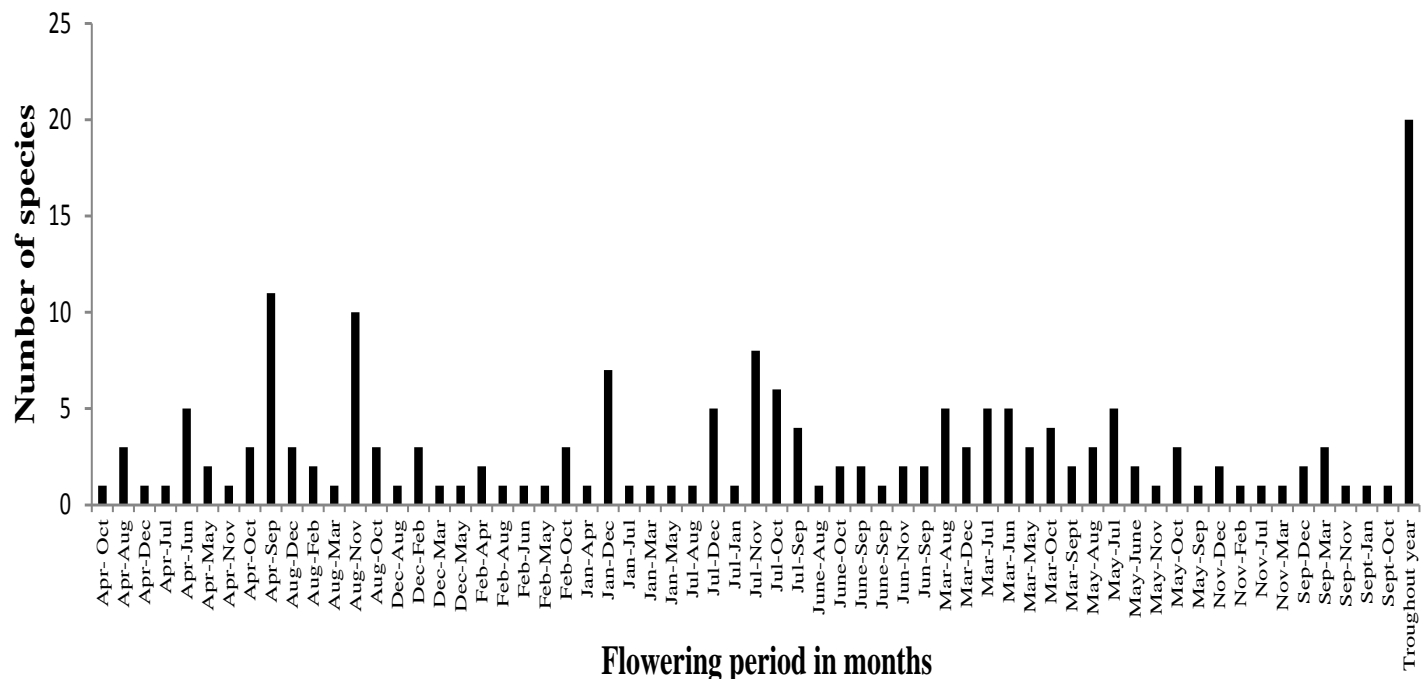


Figure 3. Phenological data on vascular plants in Doon University Campus.

Artemisia nilagrica (C.B.Clarke) Pamp., *Acmella ciliata* (Kunth) cass., *Malvestrum coromendelianum* (L.) Garcke, *Cissampelos pereira* L., *Tinospora cordifolia* (Thunb.) Miers, *Boerhavia diffusa* L., *Plumbago zeylanica* L.,

Oxalis latifolia Kunth, *Murraya koenigii* L. Sprengel, *Cymbopogon citratus* (DC.) Stapf. and *Hellenia speciosa* (J. Koenig) Govaerts. Among the woody plant species *Ficus religiosa* L., *Dalbergia sissoo* Roxb. ex DC.,

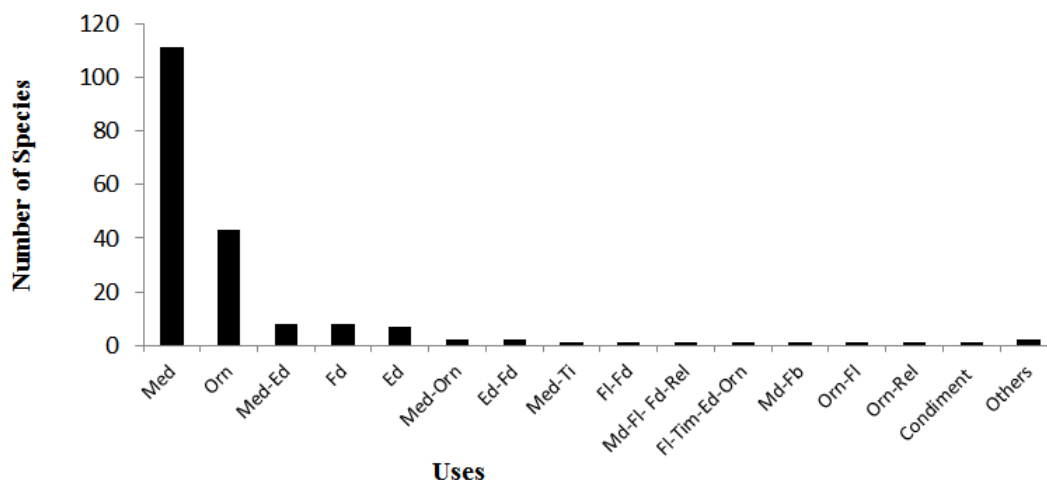


Figure 4. Distribution of different life from the aspect of use value.

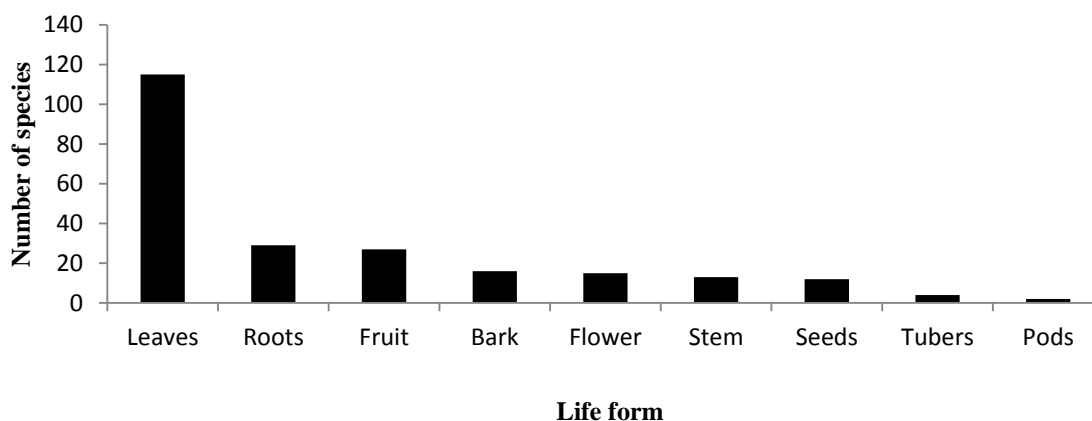


Figure 5. Number of plants species on the basis of use of plant parts.

Erythrina suberosa Roxb., *Ficus palmata* Forssk., *Moringa oleifera* Lam., *Mimusops elengi* L., *Nyctanthes arbor-tristis* L., *Chukrasia tabularis* A. Juss., *Mangifera indica* L., *Cassia fistula* L., *Phyllanthus emblica* L., *Elaeocarpus ganitrus* (Roxb.) and *Bauhinia purpurea* (L.) Benth. are important medicinal plants.

Nativity

Among the 191 recorded species, 70 (36.64%) are native, while 121 (63.35%) are non-natives or exotic species. Thus, the study reveals that the floristic diversity is dominated with exotic species and most of them are planted for ornamental purposes in the campus.

Native plant species

The native species diversity within the University campus

are comparatively low. Among these species, *Barleria cristata* L., *Cryptolepis dubia* (Burm.f.) M.R. Almeida, *Cynoglossum glochidiatum* Wall. ex Benth., *Bauhinia purpurea* (L.) Benth., *Cassia fistula* L., *Cycas rumphii* Miq, *Cyperus rotundus* L., *Phyllanthus emblica* L., *Dalbergia sissoo* Roxb. ex DC., *Desmodium concinnum* DC., *Erythrina suberosa* Roxb., *Crotalaria spectabilis* Roth., *Alysicarpus pubescens* Y.W Law, *Elaeocarpus serratus* L., *Leucas cephalotes* (Roth) Spreng., *Anisomeles indica* (Linnaeus) Kuntze, *Ajuga bracteosa* Wall ex Benth., *Perilla frutescens* (L.), *Asparagus adscendens* Buch.-Ham.ex Roxb., *Chukrasia tabularis* A.Juss., *Ficus palmata* Forssk., *Ficus religiosa* L., *Ficus sarmentosa* Buch.-Ham. ex Sm., *Moringa oleifera* Lam., *Nyctanthes arbor-tristis* L., *Cynodon dactylon* (L.) Pers., *Cymbopogon citratus* (DC.) Stapf., *Putranjiva roxburghii* Wall., *Murraya Koenigii* L. Sprengel, *Mimusops elengi* L., *Clerodendrum infortunatum* L. and *Hellenia speciosa* (J. Koenig) Govaerts are major native plants.

Invasive plants

Major exotic invasive species include *Lantana camara* L., *Parthenium hysterophorus* L., *Ageratum conyzoides* L., and *Ricinus communis* L. and are dominant throughout the campus. Species like *Chenopodium album* L., *Bidens pilosa* L., *Amaranthus spinosus* L., *Synedrella nodiflora* (L.) Gaertn., *Galinsoga parviflora* Cav., *Sigesbeckia orientalis* L., *Tridax procumbens* L., *Xanthium strumarium* L., *Sonchus asper* (L.) Hill., *Argemone maxicana* L., *Impatiens balsamina* L., *Senna tora* (L.) Roxb., *Ipomoea quamoclit* L., *Cyperus iria* L., *Euphorbia heterophylla* L., *Chamaesyce hirta* L., *Mimosa pudica* L., *Mucuna pruriens* (L.) DC., *Sesbania bispinosa* (Jacq.) W. Wight., *Hyptis suaveolens* (L.) Poit., *Saccharum spontaneum* L., *Solanum nigrum* L., *Solanum viarum* Dunal., *Solanum torvum* Sw., *Vitex negundo* L. were among the other naturally grown exotic species.

Exotic ornamental species

Among the recorded species, 63.35% species are non-natives or exotic. Some of these species are critical to native biodiversity and its ecological and socio-economic framework. Despite the fact, non-native or exotic species generally considered as noxious. However, they also play a significant role in ecological restoration, soil conservation and generating new socio-economic prospects. The field investigation revealed that exotic plants like *Grevillea robusta* A.Cunn. ex R.Br is used for its fuel wood and aesthetic value. Some other species like *Vachellia nilotica* (L.) P.J.H. Hurter & Mabb., *Sesbania bispinosa* (Jacq.) W. Wight, *Pennisetum setaceum* (Forssk.) Chiov and *Trifolium resupinatum* L. are used as fodder species. Tree species like *Polyalthia longifolia* (Sonn.) Thwaites, *Plumeria obtusa* L., *Plumeria alba* L., *Hyophorbe lagenicaulis* (L. H. Bailey) H. E. Moore., *Agathis robusta* (C. Moore ex F. Muell.) F. M. Bailey., *Araucaria columnaris* (G. Forst.) Hook., *Jacaranda mimosifolia* D. Don., *Tecoma castanifolia* (D. Don) Melch., *Delonix regia* (Bojer ex Hook.) Raf., *Platyclusus orientalis* (L.) Franco., *Pongamia pinnata* (L.) Pierre., *Magnolia grandiflora* L., *Chukrasia tabularis* A. Juss., *Ficus benjamina* L., *Melaleuca bracteata* F. Muell. and *Zamia furfuracea* L. F. in Aiton contributed to the aesthetic artistry of the university campus.

Origin of invasive species

A total of 11 geographic provinces were recorded in terms of species origin or nativity for the present study. The Tropical America contributed to the maximum percentage of species 61 (31.94%) followed by Asia (excluding Indian sub-continent) 20 (10.47%), Tropical Africa 12 (6.28%), Europe 10 (5.24%), Australia 7 (3.66%), Madagascar 5 (2.62), Eurasia 4 (2.09%),

Mediterranean 2 (1.05%), Mascarene Islands 1 (0.52%), New Caledonia 1 (0.52%) and the West Indies 1 (0.52%). American continents have also contributed to majority of invasive species in other parts of India like Doon Valley and Uttarakhand (Negi and Hajra, 2007; Sekar et al., 2012), Indian Himalayan region (Sekar, 2012), Uttar Pradesh (Singh et al., 2010; Srivastava et al., 2014), Himachal Pradesh (Jaryan et al., 2013), Karnataka (Kambhar and Kotresha, 2011), Madhya Pradesh (Wagh and Jain, 2015), South Western Ghats (Aravindhan and Rajendran, 2014), Darjiling Himalaya (Moktan and Das, 2013), Tamil Nadu (Narasimhan and Arisdason, 2009).

The findings from literature and discussions with local inhabitants indicate that several invasive species are also used for various other purposes. For example, leaves of *A. spinosus* are edible and used as fodder while leaves and stem of *G. parviflora* are used for medicinal (anti-itch) as well as fodder purposes while *Tagetes erecta* is considered and used as religious plant species. A total of 67 species were reported to use for medicinal purposes by the local inhabitants and 42 exotic species planted for ornamental purposes within the campus. The economic uses of 3 species namely *Barbarea vulgaris* R.Br., *Ipomoea triloba* L. and *Pteris vittata* L. are not known (Table 2).

The vegetation pattern is crucial for the existence of various faunal species in any habitat. The unique floral diversity within the University campus provides suitable habitat to a number of wild faunal species including mammals (7), avifauna (138), reptiles (8), lepidopteron (41) and other insects (Balodi et al., unpublished). With the modification on the riverine habitat, nesting of species like Red-wattled lapwing *Vanellus indicus* has been affected and cutting of natural stand of *Acacia catechue* (L. f.) Willd. has affected nesting of Baya weaver *Ploceus philippinus*. However, one single *A. catechue* (L. f.) Willd tree holds one of the largest nesting colony (more than 150 nests from last two years) within the Doon Valley (Balodi et al., unpublished). The ornamental plant species like *Hyophorbe lagenicaulis*, *Jacaranda mimosifolia* D.Don., *Bauhinia purpurea* (L.) Benth., *Delonix regia* (Bojer ex Hook.) Raf., *Vachellia nilotica* (L.) P.J.H. Hurter & Mabb. *Lagerstroemia indica* (L.) Pers., *Bombax ceiba* L. *Ceiba speciosa* (A.St.-Hil.) Ravenna., *Magnolia grandiflora* L., *Grevillea robusta* A. Cunn. ex R.Br., *Putranjiva roxburghii* Wall., *Neolamarckia cadamba* (Roxb.) Bosser., *Mimusops elengi* L. and *Zamia furfuracea* L.F. in Aiton provide suitable nesting sites to various avifaunal species like crows, Asian-pied sterling, kites and some other birds. Ornamental plant like *P. orientalis* (L.) Franco., is observed to be preferred by scaly-breasted munia *Lonchura punctulata* for its nesting. Various frugivorous birds' species can be observed on many ornamental plant species during the fruiting season (Balodi et al., unpublished).

Bird community structure play vital roles in seed dispersal in human-altered landscapes

Table 2. List of vascular plants in Doon University campus.

Family/Taxa	Vern./Eng. names	Altitudinal range (m)	LF	Blooming period	N/NN	Nativity	Part used	Major uses/effects
Acanthaceae								
<i>Barleria cristata</i> L.	Bajradanti	300-2600	H	Nov-Feb	N	S.Asia	Rt, Sd	Md (Bronchitis, pneumonia, antidote to snake bite)
<i>Justicia procumbens</i> L.	Karambal	700-2500	H	Dec-Mar	NN	Trop. Amer.	Lv, Rt, Sd	Md (Asthama, Cough, Backache, skin)
<i>Dicliptera paniculata</i> (Forssk.) I.Darbysh.	Atrilal	500-2000	H	Jul-Sep	NN	Trop. Afr.	Lv	Md (Hemorrhage)
Amaranthaceae								
<i>Achyranthes aspera</i> L.	Chirchira	300-2200	H	Mar-Dec	N	S.Asia	Rt, Lv	Md (Antimalarial, Dropsy, Bronchitis)
<i>Alternanthera sessilis</i> (L.) R.br ex DC.	Ghandugli	250-1300	H	Feb-Oct	NN	Trop. Amer.	Lv, St	Md (Eye complaints, Diarrhea Vegetables)
<i>Bassia scoparia</i> (L.) A.J.Scot	Burning bush	100-2600	H	June-Oct	NN	Europe	--	Orn
<i>Celosia argentea</i> L.	Lal-murga	200-1500	H	Nov-Dec	NN	Trop. Amer.	--	Orn
<i>Amaranthus viridis</i> L.	Jungli chaulai	450-1200	H	Jan-Dec	NN	S.Amer	St, Lv	Md (Gastro intestinal disorders, Dermatological and topical diseases)
<i>Amaranthus spinosus</i> L.	Kantili chaulai	400-1200	H	July- Oct	NN	Trop. Amer.	Lv	Ed, Fd
<i>Gomphrena globosa</i> L.	Gul-e-makhmal	900-1500	H	June-Sep	NN	Trop. Amer.	--	Orn
<i>Aerva sanguinolenta</i> (L.) Blume	Safed fulia	400-1500	H	Apr- Oct	NN	Trop. Afr.	Rt , Lv	Md (dysentery)
Anacardiaceae								
<i>Mangifera indica</i> L.	Aam	300-1000	T	Mar-Jul	N	S.Asia	Fr, Lv, Bk	Md, Ed
Annonaceae								
<i>Polyalthia longifolia</i> (Sonn.) Thwaites	Aashupal	500-1500	T	Mar-May	N	S.Asia	--	Orn
Apiaceae								
<i>Centella asiatica</i> (L.) Urb.	Brahmibooti	500-2500	H	Apr-Nov	N	S.Asia	Lv	Md (Brain tonic, Sedative, antibacterial , diuretic and galactogogic activities)
Apocynaceae								
<i>Carissa spinarum</i> L.	Karaunda	300-1600	Sh	Apr-Jun	N	S.Asia	Fr, Rt, Lv	Ed, Fd
<i>Cryptolepis dubia</i> (Burm.f.) M.R.Almeida	Medasinghi	250-1500	Cb	Mar-July	N	S.Asia	Lv, Stem, Rt	Md, Fb

Table 2. Contd.

<i>Tabernaemontana divaricata</i> R.Br. ex Roem. & Schult.	Tagar	300-800	Sh	May-Oct	N	S.Asia	Flw, Rt	Md (Tooth ache)
<i>Plumeria obtusa</i> L.	Gulchin	400-1400	T	May-Aug	NN	Trop. Amer.	--	Orn
<i>Plumeria alba</i> L.	Gulchin	400-1400	T	Mar-Jul	NN	Trop. Amer.	--	Orn
<i>Catharanthus roseus</i> (L.) G.Don	Sadabahar	150-1500	H	Throughout year	NN	Madagascar	Lv, Flw	Md (Leukemia , Cancer, muscle pain, dipression)
<i>Allamanda cathartica</i> L.	Peeli ghanti	0-1000	Cb	May-Aug	NN	Trop. Amer.	--	Orn
Araceae								
<i>Arisaema tortuosum</i> (Wall.) Schott	Bagh-mungri	500-1500	H	Jun-Oct	N	S.Asia	Tb	Md (inflammation)
<i>Colocasia esculenta</i> (L.) Schott	Arbi	200-2200	H	May-Oct	N	S.Asia	Tb, Lv	Ed
<i>Xanthosoma violaceum</i> Schott	Mankand	100-6000	H	May-Nov	NN	Trop. Amer.	Tb, Lv	Ed
<i>Monstera deliciosa</i> Liebm.	Split leaf	50-1500	H	--	NN	Trop. Amer.	--	Orn
<i>Hyophorbe lagenicaulis</i> (L.H Bailey) H.E. Moore	Bottel palm	50-800	T	Mar-Aug	NN	Mascarene Islands	--	Orn
<i>Rhapis excelsa</i> (Thunb.) Henry	Lady palm	500-2500	Sh	Apr-Sep	NN	N.E.Asia	--	Orn
Araucariaceae								
<i>Agathis robusta</i> (C.Moore ex F.Muell.) F.M.Bailey	Kauri pine	400-1900	T	--	NN	Austr.	--	Orn
<i>Araucaria columnaris</i> (G.Forst.) Hook.	Cook's pine	100-1500	T	--	NN	New Caledonia	--	Orn
Asclepiadaceae								
<i>Calotropis procera</i> (Aiton) Dryand.	Aak	300-1400	Sh	Dec-May	NN	Trop. Afr.	Bk, Rt, Lv	Md (Cold, Cough and Asthama)
Asparagaceae								
<i>Ophiopogon jaburan</i> (Siebold) Lodd.	White lily turf	100-1800	H	May-Jul	NN	N.E. Asia	--	Orn
<i>Sansevieria trifasciata</i> Prain	Naagdaman	100-1200	H	Apr-Sep	NN	Trop. Afr.	--	Orn
<i>Agave vivipara</i> L.	Rambans	200-1000	Sh	Jul-Dec	NN	N.Amer.	--	Orn
<i>Dracaena reflexa</i> Lam.	Song of India	100-1500	T	June-Aug	NN	Madagascar	--	Orn

Table 2. Contd.

Asteraceae									
<i>Cosmos sulphureus</i> Cav.	Yello cosmos	300-1350	H	Jul-Oct	NN	N.Amer.	--	Orn	
<i>Synedrella nodiflora</i> (L.) Gaertn.	Pig grass	500-2000	H	Apr-Sep	NN	West Indies	Lv	Md (Crushed Leaves used in rheumatism)	
<i>Cirsium wallichii</i> DC.	Kandara	500-3000	H	Jul-Nov	N	S.Asia	Lv, Rt, Flw	Md (Dysentery, thrist. Flower extract- Spasmolytic and antiviral)	
<i>Acmella ciliata</i> (Kunth) cass.	Beeri	500-1500	H	Aug-Dec	NN	Amer.	Lv , Flw	Md (Toothache and Oral Infections)	
<i>Ageratum conyzoides</i> L.	Pudina ghass	900-2500	H	Jan-Dec	NN	Trop. Amer.	Lv	Md (Cancer, Nematicide, Insecticide)	
<i>Artemisia nilagirica</i> (C.B.Clarke) Pamp.	Kujja	1500-2400	H	Jul-Dec	N	S.Asia	Lv	Md (Antimicrobial, Antifungal, Asthama, Larvicidal)	
<i>Bidens pilosa</i> L. .	Kumar	400-1900	H	Mar-Aug	NN	Trop. Amer.	Lv	Md (Cough, Bronchitis)	
<i>Parthenium hysterophorus</i> L.	Gajarghass	300-2000	H	Throughout year	NN	Trop. N. Amer.	Lv	Md (Cause skin allergies)	
<i>Galinsoga parviflora</i> Cav.	Maalya	600-1900	H	Apr-Oct	NN	Trop. Amer.	Lv, St	Md (Anti-itch), Fd	
<i>Inula cappa</i> (Buch.-Ham. ex D.Don.) DC.	Atthu	100-2500	H	Aug-Feb	N	S.Asia	Rt	Md (supperessed Urination)	
<i>Sigesbeckia orientalis</i> L.	Lichkurra	400-2700	H	Jul-Nov	NN	S.E As.	Lv, Flw	Md (Anti-inflammatory, anti cancerous, rheumatic arthritis)	
<i>Tagetes erecta</i> L.	Genda	800-2000	H	Throughout year	NN	S. Amer.	Flw, Lv	Md (Antiseptic , Ear pain), Orn	
<i>Tridax procumbens</i> L.	Khalmurya	250-1500	H	Jan-Dec	NN	Trop. Amer.	Lv, St	Md (Wound healing, Antiseptic, Hemorrhage from cuts, Bruises and Wound), Ed	
<i>Xanthium strumarium</i> L.	Golkurra	250-1600	H	Jul-Dec	NN	Europe	Lv	Md (Headache caused by wind cold ,Arthritis, Sinusitis)	
<i>Taraxacum officinale</i> F.H. Wigg.	Dhudhi	650-2000	H	Feb-Oct	NN	Eurasia	Rt, Lv	Md (Migrane , Salads, Lv used as a vegetable, Liver detoxicant)	
<i>Sonchus asper</i> (L.) Hill	Peeli dhudhi	300-3000	H	Mar-Sept	NN	Mediterranean	Lv, St	Md (Blood purifier, Wound and cut healing)	
<i>Sphagneticola trilobata</i> (L.) Pruski	Cripend daisy	200-1000	H	Throughout year	NN	Trop. Amer.	--	Orn	
<i>Silybum marianum</i> (L.) Gaertn.	Dudhpatra	300-1600	H	Mar-Aug	NN	Europe	Rt, Lv	Md (Liver complaints)	
Balsaminaceae									
<i>Impatiens balsamina</i> L.	Gulmehandi	300-1100	H	Jul-Oct	NN	Trop. Amer.	Lv, Sd	Condiment	
Brassicaceae									
<i>Barbarea vulgaris</i> R.Br.	Bitter cress	100-1600	H	Apr-June	NN	Europe	--	--	

Table 2. Contd.

<i>Capsella bursa-pastoris</i> (L.)Medik.	Botlya	600-3500	H	Feb-Oct	NN	Europe	Lv	Md (Anti-haemorrhagic , anti-urtic)
Bignoniaceae								
<i>Tabebuia rosea</i> (Bertol.) Bertero ex DC.	Rosy trumpet tree	100-1200	T	Mar-Oct	NN	N.Amer.	--	Orn
<i>Jacaranda mimosifolia</i> D.Don	Neeli gulmohar	400-1200	T	Apr-May	NN	S. Amer.	--	Orn
<i>Tecoma castanifolia</i> (D.Don) Melch.	Tecoma	100-2200	T	Throughout year	NN	S.Amer.	--	Orn
Boraginaceae								
<i>Cynoglossum glochidiatum</i> Wall. ex Benth.	Lichkurra	700-2000	H	Jul-Nov	NN	E. As.	Rt, Lv, Flw	Md (Dyspepsia , digestive disorders)
Caesalpinaceae								
<i>Bauhinia purpurea</i> (L.) Benth.	Griwal, Kaniyar	400-1200	T	Sep-Mar	N	S.Asia, N.E.Asia	Bk, Lv, Flw	Md (Wounds, stomach, flower buds used for making vegetables and Pickels)
<i>Cassia fistula</i> L.	Amartas	600-1400	T	Feb-Apr	N	S.Asia	Lv , Fr	Md (Blood purifier, cough, epilepsy, dysuria, toothache)
<i>Delonix regia</i> (Bojer ex Hook.) Raf.	Gulmohar	450-1400	T	Apr-Dec	NN	Madagascar	--	Orn
<i>Senna tora</i> (L.) Roxb.	Panwar	500-1500	H	Apr-Sep	NN	Trop. Amer.	S. Lv, Sd	Md (Jaundice, skin disease, bone fracture, wounds, eczema)
Cannabaceae								
<i>Cannabis sativa</i> L.	Bhaang	600-3000	H	May-Oct	NN	C. As.	Lv, Bk	Md (Astringent, tonic, aphrodisiac, intoxicating, stomachic, analgesic, inflammation, haemorrhoides and abortifacient)
Chenopodiaceae								
<i>Chenopodium album</i> L.	Bathua	300-4200	H	Jan-Dec	NN	Europe	Lv	Md (Oleaginous, digestive, carminative, laxative, anthelmintic, diuretic, aphrodisiac, tonic and seminal weakness)
Commelinaceae								
<i>Commelina benghalensis</i> L.	Kansura	300-2000	H	Jul-Nov	N	S.Asia	Lv, Rt	Md (Liver complaints, Wounds, dysentary, Swellings)
Convolvulaceae								
<i>Ipomoea quamoclit</i> L.	Kaamlata	300-1200	Cb	Jul-Nov	NN	Trop. Amer.	Lv, Flw	Md (Bleeding piles, Ulcers)

Table 2. Contd.

<i>Ipomoea carnae</i> Jacq.	Besharam	250-1000	Sh	Throughout year	NN	N. Amer.	Lv	Md (Cut and Wounds)
<i>Ipomoea triloba</i> L.	Little-bell	100-750	Cb	July- Oct	NN	Trop. Amer.	Lv	--
Crassulaceae								
<i>Bryophyllum pinnatum</i> (Lam.) Oken.	Dardmar	250-1000	H	Nov-Mar	NN	Madagascar	Lv	Md (Swelling, Cuts, Wounds)
Cucurbitaceae								
<i>Bryonia laciniosa</i> L.	Shivlingi	200-1500	Cb	Aug-Oct	N	S.Asia	Fr	Md (Tonic)
<i>Cucumis melo</i> L.	Kachri	250-1000	Cb	Jun-Nov	NN	As.	Fr	Ed
<i>Trichosanthes cucurmarina</i> L.	Jungli chachinda	500-1000	Cb	Jul- Oct	NN	Trop. Austr.	Rt, Fr	Md (Malaria, Fever, Jaundice, Stomach problem)
Cupressaceae								
<i>Platycladus orientalis</i> (L.) Franco	Morpankhi	300-3000	T	Mar-Oct	NN	E. As.	--	Orn, Rel
<i>Juniperus communis</i> L.	Jhora	2500-3100	Sh	Sept-Oct	NN	S.E. Europe	--	Orn
Cycadaceae								
<i>Cycas revoluta</i> Thunb.	Kanghi palm	200-1000	T	--	NN	S. Japan	--	Orn
<i>Cycas rumphii</i> Miq	Sago-palm		T	--	N	S.Asia	--	Orn
Cyperaceae								
<i>Kyllinga brevifolia</i> Rottb.	Nirvishi	300-1500	G	Aug-Nov	NN	Afr., Madagascar	Rt	Md (Cold, bronchitis, malaria, intestinal problems)
<i>Cyperus iria</i> L.	Agarmotha	250-1500	G	Sep-Dec	NN	Trop. Amer.	Rt	Md (Rheumatism)
<i>Cyperus rotundus</i> L.	Motha	300-2400	G	July-Dec	N	S.Asia	Lv, Rt	Md (Diaphoretic, astringent)
Dioscoreaceae								
<i>Dioscorea bulbifera</i> L.	Genthi	300-2200	Cb	Jul-Nov	N	S.Asia	Tb	Md (Rheumatism, Asthama, Stomach pain, Body muscle mass, Cough)
Euphorbiaceae								
<i>Phyllanthus emblica</i> L.	Amla	150-1400	T	Mar-May	N	S.Asia	Fr	Md (Anti aging, cold, diabetes, anti-inflammatory, blood-purifier)
<i>Euphorbia prostrata</i> Aiton	Dhudhi	400-1300	H	Jan-Dec	NN	Trop. Amer.	Lv	Md (Constipation, dysentery)
<i>Euphorbia heterophylla</i> L.	Dhudhi	750-1200	H	Feb-Aug	NN	Trop. Amer.	Lv	Md (Constipation, body pain, fish poison)
<i>Chamaesyce hirta</i> L.	Dhudhi	300-2000	H	Jan-Dec	NN	Trop. Amer.	Lv	Md (Asthama, Lactification, Warts)

Table 2. Contd.

<i>Euphorbia milii</i> Des Moul.	Crown of thorns	200-1800	Sh	Throughout year	NN	Madagascar	--	Orn
<i>Ricinus communis</i> L.	Arandi	300-2500	Sh	Mar-Dec	NN	Trop. Afr.	Sd, Lv and Rt	Md (Skin disease, Constipation, Headache, Burns, Purgative)
<i>Mallotus philippensis</i> (Lam.) Müll.Arg.	Kamala, Raini	300-1800	T	Sep-Nov	N	S.Asia	Fr, Sd, Rt	Md (Rhumatism, Boils , dysentery, Vermifuge, Constipation)
<i>Phyllanthus ninuri</i> L.	Bhoomi amlaki	250-800	H	July-Sep	NN	E. As.	Lv	Md (Hypoglycemi, hypotensive, diuretic, antioxidative, and anti-inflammatory, Jaundice, Kidney ailments)
Fabaceae								
<i>Crotalaria medicaginea</i> Lam.	Van methi	500-1000	H	Apr-Aug	NN	As.	Lv	Md (Scabies, urticaria)
<i>Dalbergia sissoo</i> Roxb. ex DC.	Shisham	400-1500	T	Mar-Jun	N	S.Asia	Lv, St	Md (Leprosy and skin diseases),Fd
<i>Desmodium concinnum</i> DC.	Saakina	900-2200	H	Aug-Nov	N	S.Asia	Lv, St	Fl, Fd
<i>Mimosa pudica</i> L.	Laajwanti	400-1200	H	Jul-Jan	NN	S.Amer.	Lv	Md (Fever, headache, epilepsy, kidney diseases)
<i>Pongamia pinnata</i> (L.) Pierre	Karanj	Upto 1000	T	Apr-May	NN	As.	--	Orn
<i>Vachellia nilotica</i> (L.) P.J.H. Hurter & Mabb.	Kikar	100-2000	T	Jun-Sep	NN	Austr.	Lv	Fd
<i>Acacia catechu</i> (L. f.) Willd.	Khair	200-1400	T	May-Aug	N	S.Asia	Lv, Wd, Bk	Md, Fl, Fd, Rel
<i>Erythrina suberosa</i> Roxb.	Madaru	300-1500	T	Mar-Sept	N	S.Asia	Bk, Lv, St	Md (Gonorrhoea)
<i>Desmodium triflorum</i> (L.) DC.	Motha, Kudaliya	600-2300	H	Jul-Sep	NN	Trop. Amer.	Lv	Md (Body pain, Breast pain, toothache)
<i>Crotalaria spectabilis</i> Roth.	San	200-1200	H	Sep-Mar	N	S.Asia	Lv	Fd
<i>Alysicarpus pubescens</i> Y.W Law	Durangi	20-1200	H	Mar-Aug	N	S.Asia	Lv	Fd
<i>Indigofera astragalina</i> DC.	Ran-methi	800-1500	H	Aug-Nov	NN	Trop. Amer.	Lv , Rt	Md (Skin diseases, insect repellent)
<i>Vigna unguiculata</i> (L.) Walp.	Lobhia	300-1500	Cb	Apr-Aug	NN	Europe	Pods, Sd	Ed
<i>Canavalia ensiformis</i> (L.) DC.	Badi sem	400-1200	Cb	Apr-Oct	NN	S.E. As.	Pods, Sd	Ed
<i>Cicer arietinum</i> L.	Chana	150-1300	H	Feb-Apr	N	S.Asia	Fr, Lv	Md (Use in constipation and nervous disorders)
<i>Mucuna pruriens</i> (L.) DC.	Gauchii	150-1200	Cb	Jul-Nov	N	S.Asia	Lv	Fd
<i>Trifolium resupinatum</i> L.	--	500-2500	H	Mar-May	NN	Eur., As.	Lv	Fd
<i>Melilotus indicus</i> (L.) All.	Banmethi	500-2000	H	Jan-May	NN	Eurasia	Sd , Lv	Md (Bowl complaints and Infentile diarrhoea, also use as insect repellent)
Elaeocarpaceae								
<i>Elaeocarpus ganitrus</i> (Roxb.)	Rudraksha	400-1300	T	Aug-Nov	N	S.Asia	Bk , Lv, Sd	Md (Antihypertensive, antidiabetic, antifungal, antihypertensive, antioxidant, anxiolytic, analgesic and anti-inflammatory)

Table 2. Contd.

Leguminosae									
<i>Sesbania bispinosa</i> (Jacq.) W.Wight	Dencha	300-1000	H	Sept-Jan	NN	Trop. Amer.	Lv		Fd
Geraniaceae									
<i>Geranium rotundifolium</i> L.	Ratan jot	900-1400	H	Feb-Jun	NN	Europ, As. bor.	Lv		Fd
<i>Leucas cephalotes</i> (Roth) Spreng.	Bishkapru	250-1700	H	Throughout year	N	S.Asia	Lv		Md (Diarrhoea, wounds, skin problems, malaria, cold, cough, infections)
<i>Hyptis suaveolens</i> (L.) Poit.	Jungli tulas	500-2000	H	Aug-Feb	NN	Trop. Amer.	Lv		Md (Anthelmintic)
<i>Anisomeles indica</i> (Linnaeus) Kuntze	Kala-branga	300-2200	H	Aug-Nov	N	S.Asia, S.E. Asia	Lv		Md (Blood purifier, Muscular pain, fever, cuts and wounds)
<i>Mentha arvensis</i> L.	Vilayati pudina	700-2000	H	Apr-June	NN	Europ, As. bor.	Lv		Md (Treating vomiting and digestion)
<i>Ocimum basilicum</i> L.	Marua	250-1500	H	Jul-Dec	N	S.Asia	Lv, St		Md (Cold, Fever, headache, insecticidal, Kidney stones)
<i>Ajuga bracteosa</i> Wall ex Benth.	Neelkanthi	700-1200	H	Apr-Sep	N	S.Asia	Lv		Md (Tonic, astringent, febrifuge, Leaf extract used in malaria)
<i>Ocimum americanum</i> L.	Tulsi	300-2000	H	Throughout year	NN	Trop. Afr.	Lv		Md (Insecticidal properties)
<i>Perilla frutescens</i> (L.)	Bhangjeer	300-3000	H	Jul-Oct	N	S.Asia	Lv, Sd		Md (Flavoring agents, rheumatic arthritis, cough, asthma)
<i>Salvia splendens</i> Sellow ex Schult.	Morokli	300-1800	H	Apr-Sep	NN	S. Amer.	--		Orn
Liliaceae									
<i>Aloe vera</i> (L.)	Ghritkumari	700-1400	H	Sep-Mar	NN	Mediterranean	Lv		Md (Fresh Leaves is use for Wounds and Sores, Plant extract is use for stomachic, purgative, anthelmintic)
<i>Asparagus adscendens</i> Buch.-Ham.ex Roxb.	Shatawar	300-2000	H	Aug-Nov	N	S.Asia	Rt		Md (Aphrodisiac, galactogauge, Dysentery, laxative, diarrhoea, laprosy)
Lythraceae									
<i>Cuphea hissisifolia</i> Kunth	Maxican heather	300-2000	Sh	Apr-Sep	NN	Trop. Amer.	--		Orn
<i>Lagerstroemia indica</i> (L.) Pers.	Saawni	1000-1500	T	May-Aug	N	N.E.Asia	Sd, Bk Fr Rt,		Md (Febrifuge, Narcotic, Stimulant and purgative)
Bombaceae									
<i>Bombax ceiba</i> L.	Semal	400-1600	T	Jan-Mar	N	S.Asia	Flw		Md (Chicken pox, leprosy, anaemia, asthma, digestive disorders)

Table 2. Contd.

<i>Ceiba speciosa</i> (A.St.-Hil.) Ravenna	Resham rui	400-1600	T	Feb-May	NN	N.Amer.	--	Orn
Magnoliaceae								
<i>Magnolia gradiflora</i> L.	Him-champa	60-700	T	May-July	NN	N.Amer.	--	Orn
Malvaceae								
<i>Hibiscus rosa-sinensis</i> L.	Mandar, Gurhal	400-700	H	Throughout year	NN	N.E.Asia	Bk, Flw	Md (Emolient, antifertility, kidney problems, menstrual, fever)
<i>Malvastrum coromandelianum</i> (L.) Garcke	Kharenti	300-1500	H	Throughout year	NN	Trop. Amer.	St, Lv	Md (Dysentery , wounds)
<i>Urena lobata</i> L.	Unga	400-1600	H	Aug-Nov	NN	Trop. Afr.	Lv, Flw, Rt, Bk	Md (Rheumatism, Diarrhoea)
<i>Hibiscus mutabilis</i> L.	Gul-e-ajaib	200-1200	Sh	Aug-Oct	NN	N.E.Asia	--	Orn
<i>Abelmoschus esculentus</i> (L.) Moench	Bhindi	200-1900	H	Jun-Nov	NN	Trop. Afr.	Fr, Sd	Md (Dysentery, fever), Ed
Menispermaceae								
<i>Cissampelos pereira</i> L.	Gindaru	600-3000	Cb	Apr-Sep	N	S. Amer.	Rt, Lv	Md (Cough, dysentery, piles)
<i>Tinospora cardifolia</i> (Thunb.) Miers	Giiloe	600-1600	Cb	Mar-June	N	S.Asia, N.E.Asia	St, Lv	Md (Urinary problems, fever, blood purifier, anti malarial)
Meliaceae								
<i>Toona ciliata</i> M.Roem.	Toon	300-1000	T	Mar-Jul	NN	Austr.	Flw,Bk, Wd	Md (Astringent, tonic,antiperiodic), Tim
<i>Chukrasia tabularis</i> A.Juss.	Chikrasi	400-900	T		N	S.Asia	--	Orn
Mimosaceae								
<i>Calliandra haematocephala</i> Hassk.	Red powder puff	250-1100	T	Apr-Jul	NN	Trop. Amer.	--	Orn
Urticaceae								
<i>Broussonetia papyrifera</i> (L.) L'Hér. ex Vent.	Jungli toot	250-1000	T	Mar-Jun	NN	N.E.Asia	Lv	Md (Liver kidney tonic,blood purifier, impotency, eczema, gonorrhoea)
Moraceae								
<i>Ficus benjamina</i> L.	Pukar ped	250-1400	T	Apr-Aug	NN	N.E.Asia	--	Orn
<i>Ficus palmata</i> Forssk.	Bedu	600-2300	T	May-Jun	N	S.Asia	St, Fr	Md (Stomach complaints, sores, constipation)

Table 2. Contd.

<i>Ficus religiosa</i> L.	Peepal	500-1800	T	Apr-Sep	N	S.Asia	Fr, St , Bk	Md (Mouth wash , curing tootache, weak gums, blood purifier, cough, urine problems)
<i>Ficus sarmentosa</i> Buch.-Ham. ex Sm.	Beduli	400-1400	Sh	Feb-May	N	S.Asia, N.E.Asia	Fr,Lv	Md (Fracture of bones , Lactation)
Moringaceae								
<i>Moringa oleifera</i> Lam.	Senjna	150-1100	T	Jan-Apr	N	S.Asia	Lv, Flw, Fr	Md (Rheumatism and circulatory disorders), Ed
Myrtaceae								
<i>Melaleuca bracteata</i> F.Muell.	Golden bottle brush	300-750	T	Apr-Sep	NN	Austr.	--	Orn
<i>Syzygium cumini</i> (L.) Skeels	Jaamun	400-1000	T	Mar-Jul	N	S.Asia	Lv, Fr, Lv, Bk	Md (Digestive problems, cough, dysentery, blood purifier, asthma)
<i>Psidium guajava</i> L.	Amrud	400-1200	T	Apr-June	NN	Trop. Amer.	Fr, Lv	Md (Heart and brain tonic, illusions, abdominal pain, fatigue)
Oleaceae								
<i>Nyctanthes arbor-tristis</i> L.	Harchringar	300-1500	T	Aug-Mar	N	S.Asia	Lv, Bk, Fr	Md (Skin disease, sores, cough, wounds, blood purifier, ulcers)
Nyctaginaceae								
<i>Boerhavia diffusa</i> L.	Punarnarva	600-2000	H	Aug-Dec	N	S.Asia	Rt, Lv	Md (Asthma, high blood pressure, eye ailments, snake bite, Jaundice, urinary disorders), Ed
<i>Mirabilis jalapa</i> L.	Gulabans	460-1800	H	Aug-Dec	NN	S.Amer.	Rt , Lv	Md (Diuretic, purgative, anti-inflammatory)
<i>Bougainvillea spectabilis</i> Willd.	Bauganvillia	150-2500	Sh	Throughout year	NN	S. Amer.	--	Orn
Oxalidaceae								
<i>Oxalis latifolia</i> Kunth	Khattmeethi	600-2000	H	May-Jul	NN	N.Amer.	Lv	Md (Urinary tract infection, kidney problems, cuts, skin infection , and digestive disorders)
<i>Oxalis corniculata</i> L.	Khattibooti	300-2900	H	Throughout year	NN	Europe	Lv	Md (Insect bites, appetite, diarrhea, piles, fever, skin diseases, stomachache), Ed
Passifloraceae								
<i>Passiflora foetida</i> L.	Gharibel	100-1200	H	Mar-June	NN	S.Amer.	Lv, Sd	Md (cold, cough)
Pepaveraceae								
<i>Argemone maxicana</i> L.	Satyanaashi	300-1700	H	Apr-Oct	NN	S. Amer.	Sd	Md (Malaria)

Table 2. Contd.

Piperaceae									
<i>Peperomia pellucida</i> (L.) Kunth	Toyakand	200-2000	H	Sep-Dec	NN	Trop. S.Amer.	Lv	Md (Headache, fever, eczema, abdominal pain and convulsions)	
Pinaceae									
<i>Pinus roxburghii</i> Sarg.	Cheer	1100-2500	T	Mar-Jun	N	S.Asia	Lv,Wd	Fl, Tim, Ed, Orn	
Pittosporaceae									
<i>Pittosporum tobira</i> (Thunb.) W.T. Aiton	Piittosporum	-	Sh	Apr-June	NN	N.E.Asia	--	Orn	
Plumbaginaceae									
<i>Plumbago zeylanica</i> L.	Chitrak	500-2500	H	Mar-Dec	N	S.Asia	Rt	Md (Skin diseases, wounds, anti fertility, eczema)	
Poaceae									
<i>Bambusa tuldoidea</i> Munro	Buddha's-belly	Upto 1400	G	--	NN	N.E.Asia	--	Orn	
<i>Cynodon dactylon</i> (L.) Pers.	Drub	200 - 2600	G	Jan-Dec	N	S.Asia	Lv	Md (Plant believes as religious, Root juice is taken in fever and internal injury)	
<i>Saccharum spontaneum</i> L.	Kaans	200-1700	G	Aug-Nov	N	W. As	Lv, Rt	Md (Astringent, emollient, diuretic, purgative, dyspepsia, burning sensations, respiratory, Tropubles)	
<i>Pennisetum setaceum</i> (Forssk.) Chiov.	Fountain-grass	300-2700	G	Aug-Nov	NN	E. Afr.	--	Fd	
<i>Cymbopogon citratus</i> (DC.) Stapf.	Lemon-grass	550-2100	G	Jul-Sep	N	S.Asia, N.E.Asia	Lv	Md (carminative, depressant, antibacterial, antifungal, analgesic, stimulant)	
Polygonaceae									
<i>Persicaria capitata</i> (Buch.-Ham. ex D.Don.)	Kaafia	600-2500	H	Jan-Jul	NN	As.	Rt	Md (Boils , Dysentery)	
Proteaceae									
<i>Grevillea robusta</i> A.Cunn. ex R.Br.	Silver-Oak	760-2000	T	Nov-Dec	NN	Austr.	--	Orn, Fl	
Pteridaceae									
<i>Adiantum caudatum</i> L.	Mayur shikha	400-2000	Fn	--	N	S. As.	Lv	Md (Skin ailments, asthma, fever, bronchitis)	
<i>Pteris vittata</i> L.	--	500-2600	Fn	--	N	S. As.	Lv	--	

Table 2. Contd.

Putranjivaceae								
<i>Putranjiva roxburghii</i> Wall.	Putrjeev	400-1500	T	Mar-Aug	N	S.Asia	Bk, Lv, Fr	Md (Rheumatism)
Rosaceae								
<i>Prunus persica</i> (L.)	Aaru	500-2100	T	May-Jul	NN	N.E.Asia	Fr, Bk, Lv	Ed , Md (urinary troubles, cough and cold)
<i>Rosa indica</i> (Linn.)	Gulab	500-3000	Sh	Apr-Sep	N	N.E.Asia	Flw	Orn, Md (Blood purifier, antimicrobial)
Rhamnaceae								
<i>Ziziphus mauritiana</i> Lam.	Ber	300-1300	Sh	Dec-Feb	N	S.Asia	Fr, Bk, Lv	Md (Fever, Abdominal pain and pulmonary ailments)
Rubiaceae								
<i>Neolamarckia cadamba</i> (Roxb.) Bosser	Kadamb	500-1100	T	May-June	N	S.Asia	--	Orn
Rutaceae								
<i>Murraya Koenigii</i> L. Sprengel	Karipatta	300-1600	Sh	Mar-Oct	N	S.Asia	Lv , Rt	Md (Malarial fever, stomach pain, Insecticide), Ed
Sapindaceae								
<i>Cardiospermum halicacabum</i> L.	Kanfudi	400-1500	Cb	Jul-Nov	N	S.Afr.	Rt, Lv, Sd	Md (Antimicrobial, antifungal, anti-inflammatory, anxiolytic, antipyretic, respiratory disorders ,urinogential problems)
Sapotaceae								
<i>Mimusops elengi</i> L. Scrophulariaceae	Maulserri	Upto 1200	T	Dec-Aug	N	S.Asia	--	Orn
<i>Mazus pumilus</i> Burm.f.	Mastyar	250-2000	H	Aug-Nov	N	S.Asia	Lv	Md (Burn and Stomach Pains aperients, Emmenagouge, febrifuge and tonic for jaundice)
<i>Verbascum chinensis</i> (Linneaus). Santapau	Gaderi tambaku	100-1300	H	Throughout year	NN	N.E.Asia	Lv	Md (Cuts , wounds, diarrhoea)
Solanaceae								
<i>Solanum nigrum</i> L.	Mokoe	400-1800	H	Throughout year	NN	Trop. Afr.	Lv	Md (Diarrhoea, fever, piles)
<i>Solanum viarum</i> Dunal	Egg-plant	500-2800	H	Throughout year	NN	Trop. Amer.	Lv, Fr, Sd	Md (Mensural disorders, Contraseptive)
<i>Solanum torvum</i> Sw.	Bankatia	300-1600	Sh	Nov-Jul	NN	C. Amer, S.Amer	Lv, Fr	Md (Antifungal, Antibacterial, antiulcer, antidiabetic, analgesic)

Table 2. Contd.

<i>Solanum surattense</i> Burm.	Kateli, Kandara	400-1600	H	Throughout year	N	S. As.	Fr, Lv	Md (Cough, cold, asthma, eye ailments, fish poison)
<i>Datura metel</i> L.	Dhatura	300-2000	Sh	Jul-Dec	N	S.Asia	Lv	Md (Asthma, cough, tuberculosis)
<i>Datura stramonium</i> L.	Dhatura	200-2200	H	May-Sep	NN	C. Amer.	Sd, Lv	Md (Insecticidal properties , hair loss)
<i>Lycopersicon esculentum</i> Mill.	Tamatar	250-2000	H	Throughout year	NN	S. Amer.	Fr	Ed
<i>Physalis angulata</i> Linn.	Popati	300-1700	H	May-Jul	NN	Trop. Amer.	Lv, Rt	Md (Anticancer, antibacterial, diabetes, malaria, anemia)
<i>Solanum melongena</i> L.	Baingan	400-1800	H	Jul-Sep	N	S.E. As.	Fr	Ed
Verbenaceae								
<i>Clerodendrum infortunatum</i> L.	Bhaant	Upto 1500	Sh	Dec-Feb	N	S.Asia	Lv, Rt	Md (Headache, nausea, skin diseases)
<i>Vitex negundo</i> L.	Nirgundi/Simalu	100-3200	Sh	Mar-Oct	N	S.Asia	St, Lv, Rt, Fr	Md (Antibacterial, anti-feedant, anti-filarial, anti-viral, anti-larval, insecticidal, anti-malarial)
<i>Duranta erecta</i> L.	Pegion berry	200-1600	Sh	Throughout year	NN	N.Amer.	--	Orn
<i>Lantana camara</i> L.	Laaltain ghass	250-2000	Sh	Throughout year	NN	Trop. Amer.	Lv	Md (Skin diseases, Yellow fever, dysentery, malaria, rheumatism, bilious fever, eczema)
Zingiberaceae								
<i>Hellenia speciosa</i> (J. Koenig) Govaerts	Keon	300-1500	H	Aug-Oct	N	S.Asia, S.E. Asia	Lv, Rt	Md (Purgative, astringent bronchitis, cough, constipation, cholera, headache, jaundice. Stimulant)
Zamiaceae								
<i>Zamia furfuracea</i> L.F. in Aiton	Cardboard palm	Upto 1500	T	--	NN	N.Amer.	--	Orn

Nativity = Afr: Africa, Amer: America, Amphig: Amphigaea, As: Asia, Austr: Australia, Geront: Gerontia, Reg Himal: Himalayan region, Ind: Indian, Madag: Madagascar, Cosmop: Cosmopolitan, Or/Orient: Oriental, Sub Trop: Sub Tropical, Trop: Tropical, Eur: Europe, Ind: Indian, Mex: Mexico, S: South, SE: South East, Eur: Europe, Arct: Arctic, NW: North West, Bor: boreal, Temp: temperate, N: native NN: Non-natives, et: and, -- = unknown. Uses= Orn: ornamental, Md: medicinal, Fl: fuel, Fd: fodder, Ed: edible. Plant parts = Bk: bark, Lt: latex, Flw: flower, St: stem, Rt: roots, Lv: leaves, Flw: flowers Fr: Fruits, Sd: seeds, St: stems, Tb: tubers, Wd: wood. Life forms = H: herb, Sh: shrub, T: tree, G: grass, Fn: fern, Cb: climber.

(Pejchar et al., 2008) as birds are considered best dispersal agents. At a time when natural regeneration of native plant species experience challenges from climate change, land-use change, introduction of invasive species, birds play a vital role in dispersing seeds to suitable sites for

regeneration (Gosper et al., 2005; Ruxton and Schaefer, 2012). However, seed dispersal of invasive species through avian communities in the important eco-regions like Shivalik could have adverse ecological consequences on the native flora.

Conclusions

The study provides baseline information on floristic diversity of a modified habitat from riverine and agricultural to concrete jungle and plantation in Shivalik landscape. These finding would be

important in monitoring the changes in vegetation pattern in the near future. At present, the exotic floras dominate the native flora and are important in terms of influencing local environmental condition of the habitat. The flowering period of plants species of different origin would help in prediction of climate change over the years and role of interaction between local environmental conditions as well as their native behavior. Regular monitoring of vegetation and scientific inputs are crucial to promote native species and proper management of floristic diversity is crucial as they provide unique habitat to more than 138 bird species (used for perching, foraging, nesting, breeding, etc) and about 41 lepidopteron species. Further studies on their beneficial uses through phyto-chemical investigation would be important to conserve the important gene flow in a managed landscape to validate and sustain their ethno-medicinal importance.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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