Diversity of Woody and Non Woody Forestry Species in Budaun District of Uttar Pradesh, India

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Abstract: A wide-ranging field assessment was carried out with aim to observe the diversity of plants species including tree, shrub and herb together with woody and non woody forestry species. The survey was conducted in Budaun District, Uttar Pradesh, India during 2005 to 2007 with special focused on forestry tree species. Geographically, the District is located at 28°2'23"N 79°7'12"E. It has an average elevation of 169 meters. The rainfall is normal and this place belongs to the tropical region of western Uttar Pradesh. Average temperature is approximately 30°C. In this study, total 58 plants species were recorded covering 32 families. Out of 58 species, 34 species were belonged from tree families while 19 shrub families whereas 3 from herb and 2 from grass families. The total number of species, genera and families were highest observed for trees followed by shrubs, herbs and grass species. In terms of species distribution, Moraceae and Caesalpinaceae were found to be the most dominant family in tree species; Solanaceae in shrub species; Poaceae in grass species whereas in case of herb species, Mimosaceae, Cannabinaceae and Amaranthaceae were found to be the leading family. The survey of this study concluded that the plant material including tree, shrub, herb and grass can be used for planking, paneling, carriages, furniture, and carpentry of all kinds and traditional medicinal purpose which will promote forest conservation and plant diversity research through extensive survey, aforestation, reforestation and forest rehabilitation. Apart from this, in future, study will be utilized as a reference of plant species distribution and availability in Budaun District of Uttar Pradesh India.

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1. Introduction

Species Diversity and variability of plant and animal species are the most striking feature of life, which reflects the complexity, uniqueness, and intactness of natural ecosystems (Mohammad *et. al.*, 2000). An appropriate biodiversity management strategy should take into account the distribution patterns of species (Perring and Lovett, 1999). Conservation of ecosystem and maintenance of biodiversity is matter of both national and international concern.

Plants provide food and other life supporting commodities and very important for survival of human beings and other organisms, besides they protect our environment and maintain nature. Tropical forests are major reservoir of plant diversity. Those forests inhabit a large number of trees, shrubs, herbs, climbers, faunal, wealth and a wealth of non-timber forest products including medicinal and wild edible plants. The increased demand of medicinal plants in drug and pharmaceutical industries have caused the over exploitation of many species. Many of these are close to extinction due to over harvesting or un-skilled harvesting. Some important forestry species that need immediate attention for conservation in India for human being (Kharkwal, 2009).

India is one of the 12th mega-biodiversity centres in the world and consists of 17,000 flowering plant species. It accounts for 8% of the global biodiversity with only 2.4% of the total land area in the world (Reddy, 2008; Hajra and Mudgal, 1997). Uttar Pradesh is one of the state of India, bounded by Nepal on the North, Uttarakhand on the north-east, Himachal Pradesh on the north-west, Haryana on the west, Rajasthan on the south-west, Madhya Pradesh on the south and south-west, and Bihar on the east. The state

is situated between 23°52'N and 31°28'N latitudes and 77°3' and 84°39'E longitudes (http://uponline.in/Profile/Geography/). Uttar Pradesh is India's fifth largest and the most populous state. The state is located in the north-western part of the country. It spreads over a large area, and the plains of the state are quite distinctly different to the high mountains in the north. Geographically, area of state is 240928 km^2 which constitutes 7.3% of the total area of the country (Indian State of Forest Report, 2009). In Uttar Pradesh, forests constitute about 12.8% of the total geographical area of the state. The Himalayan region and the terai and bhabhar area in the Gangetic plain have most of the forests (http://uponline.in/Profile/Geography/ resources.asp).

Budaun is the district of Uttar Pradesh which comes under Rohilkhand region. It was an ancient city where some Sufi saints lived in 11th century and is located on the bank of the holy river Ganga (http://www.uponline.in/profile/districts/Budaun.asp). There are three distinct seasons viz.- winter (October-February), summer (March-June), and rainy (June-September). It is well connected with other main cities of the country such as Delhi, Lucknow, Bareilly, Moradabad, Agra, Mathura and Jaipur by rail and road transport which facilitates industrial and commercial development in the area.

The wide geographical and climatic diversity provides a repository of valuable medicinal and wild edible plants of the region. The District cover 5,168 km^2 geographical area whereas total forest cover (42 km^2) in different canopy density classes such as moderate dense forest (12 km^2), open forest (30 km^2) and scrub (8 km^2). The area of the total forest cover in district contributes about 0.81% of the total geographical area (Indian State of Forest Report, 2009). These forests are consisting different plant species which are being used in curing veterinary and human disease. Still, there is no scientific study available on profiling of plant species diversity of Budaun district.

Hence, the present extensive survey will be providing a hand list on plant species distribution and diversity in Budaun District. In future, it can be used by Ayurvedic Medicine practitioners to preventing disease and also useful for ethno botanist as well as researcher from plant science. Therefore, the present study is an endeavor to identify important forestry tree and non timber forestry tree species including medicinal plants in Budaun district based on primary and secondary resources.

2. Materials and methods

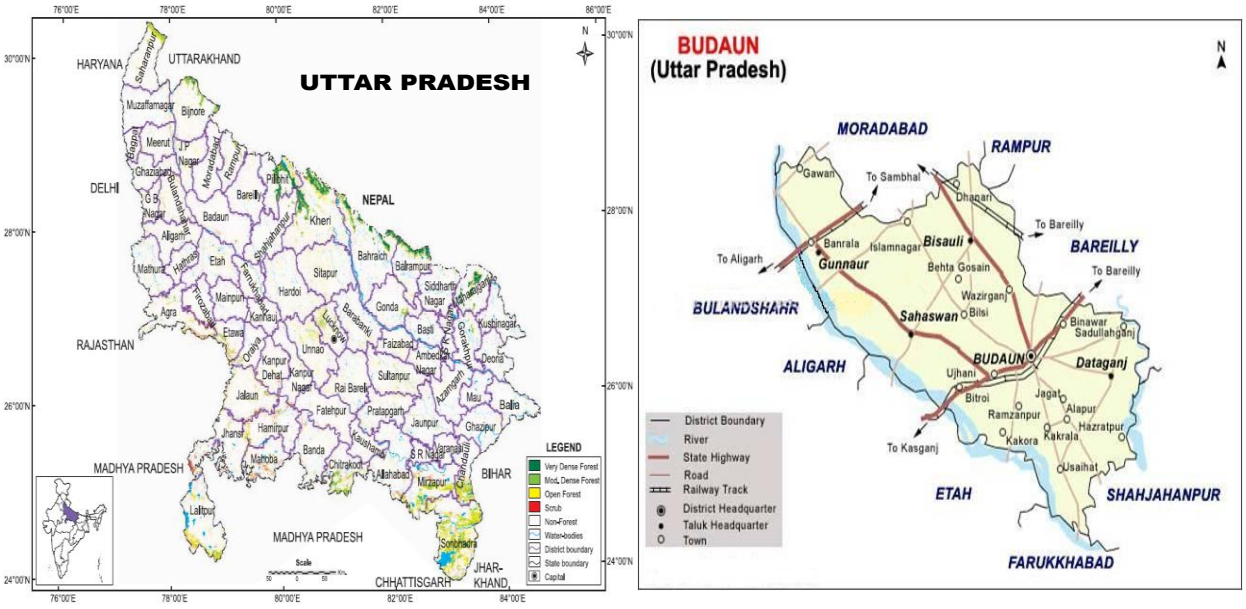
The field survey was carried out throughout the land of Budaun district across the year. The polythene bags, tags, field note book, pencil and blotting paper etc. were used during field survey. Geographically, the Budaun is located at 28°2'23"N 79°7'12"E. It has an average elevation of 169 meters (554 feet). The rainfall is normal and this place belongs to the tropical region. Average temperature is approximately 30°C. There is widespread greenery.

The soil is very fertile due to Tarai, because the holy river Ganga flows by the district, which is located at 28º 02’ 30” North latitude and 79º 01’ 20” East longitude. In this study, the field survey was conducted in different forest sites of Budaun district, and the plant species including herbs, shrubs and trees were recorded. The site for the study is sown in figure 1. Throughout field visits, plant samples were collected from natural habitats, wastelands, road sides, parks, lawns, orchards, and other relevant localities. Identification was done mostly with live specimens in the field itself but when it was not found possible then plant samples were identified in the lab.

The collected plants species were identified using of various floras such as Hooker (1872-1897), Duthies’ (1893), Kumar (2001) Mishra and Verma (1992). Identification of plant specimens was followed by, the arrangement of plants according to Bentham and Hooker’s system of classification. Additional information of plants about their habit was also recorded and incorporated in the study.

3. Results and discussions

An extensive survey of the locality of Budaun area was made for the proposed study. A total of 58 species belonging to 32 families were recorded across the study sites, of which 34 were trees, 19 were shrubs, 3 were herbs and 2 grasses (Table 1 and 2). Among these families, Fabaceae actually include three sub families viz. Caesalpinieae (4), Mimosae (6) Papilionaceae (2) with maximum number of species. In this study, the survey was mainly focused on important forestry tree species.



Sources: Indian State of Forest Report, 2009

Figure 1. Forest cover map of Uttar Pradesh State (Left) and map of district Budaun (Right)

4. Results and discussions

Table 1. A list of forestry as well as non wood forestry plants species encountered in the study sites.

S. No.	Botanical name	Family	Hindi name	Habit
1.	*Delonix regia*	Caesalpinaceae	Gulmohar	T
2.	*Cassia fistula*	,,	Amaltas	T
3.	*Saraca asoca*	,,	Ashok	T
4.	*Tamarindus indica*	,,	Imli	T
5.	*Acacia nilotica*	Mimosaceae	Babul	T
6.	*Mimosa pudica*	,,	Chui-mui	H
7.	*Prosopis juliflora*	,,	Junglee kikar	S
8.	*Mangifera indica*	Anacardiaceae	Aam	T
9.	*Carica papaya*	Caricaceae	Papita	T
10.	*Syzgium cumini*	Myrtaceae	Jamun	T
11.	*Eucalyptus sp.*	,,	Sugandh patra	T
12.	*Anthocephalus sp.*	Rubiaceae	Kadam	T
13.	*Dalbergia sissoo*	Papilionaceae	Shisham	T
14.	*Butea monosperma*	,,	Dhak	T
15.	*Shorea robusta*	Dipterocarpaceae	Sal	T
16.	*Ficus religiosa*	Moraceae	Pipal	T
17.	*Ficus virens*	,,	Pakar	T
18.	*Ficus racemosa*	,,	Gular	T
19.	*Ficus bengalensis*	,,	Bargad	T
20.	*Morus alba*	,,	Mulberry	T
21.	*Atrocarpus heterophyllus*	,,	Kathal	T
22.	*Aegle marmelos*	Rutaceae	Bel	T
23.	*Citrus reticulata*	,,	Santara	T
24.	*Azadirachta indica*	Meliaceae	Neem	T

25.	*Melia azedarach*	,,	Bakain	T
26.	*Emblica officinalis*	Euphorbiaceae	Amla	T
27.	*Jatropha curcas*	,,	Jamal gota	S
28.	*Zizyphus mauritiana*	Rhamnaceae	Ber	T
29.	*Ziziphus nummularia*	,,	Jharber	S
30.	*Calotropis procera*	Asclepiadaceae	Chhota madar	S
31.	*Calotropis gigentea*	,,	Madar	S
32.	*Nyctanthes arbor-tristis*	Oleaceae	Harsinghar	T
33.	*Phoenix dactylifera*	Palmae	Khajur	T
34.	*Carissa carandas*	Apocynaceae	Karaunda	S
35.	*Rauwolfia serpentina*	,,	Sarapgandha	S
36.	*Averrhoa carambola*	Oxalidaceae	Kamrakh	S
37.	*Madhuca indica*	Sapotaceae	Mahua	T
38.	*Withania somnifera*	Solanaceae	Ashwagandha	S
39.	*Atropa belladonna*	,,	Sag angur	S
40.	*Solanum xanthocarpum*	,,	Kateli	S
41.	*Solanum nigrum*	,,	Makoi	S
42.	*Terminalia arjuna*	Combretaceae	Arjun	T
43.	*Terminalia billirica*	,,	Bahera	T
44.	*Terminalia chebula*	,,	Harad	T
45.	*Adhatoda vasica*	Acanthaceae	Vasaka	S
46.	*Tamarix troupli*	Tamaricaceae	Jhau	S
47.	*Lawsonia inermis*	Lythraceae	Mehndi	S
48.	*Hibiscus-rora-sinensis*	Malvaceae	Gurhal	S
49.	*Bombax ceiba*	,,	Semul	T
50.	*Rosa sp.*	Rosaceae	Gulab	S
51.	*Abutilon indicum*	,,	Kanghi	S
52.	*Cannabis sativa*	Cannabinaceae	Ganja	H
53.	*Pendalium murex*	Pedaliaceae	Bada gokhru	S
54.	*Achyranthes aspera*	Amaranthaceae	Chirchita or Latzira	H
55.	*Moringa oleifera*	Moringaceae	Sahjan	T
56.	*Bambusa vulgaris*	Poaceae	Baansa	G
57.	*Erianthus munja*	,,	Sarkanda or Munja	G
58.	*Populus ciliate*	Saliceae	Poplar	T
59.	*Simaruba glauca*	,,	Laxmitru	T

Family Fabaceae with sub family Caesalpinaceae, Mimosaceae and Papilionaceae; and family Moraceae and Solanaceae were the most dominant family (with 17 species) followed by Combretaceae (with 3 species), Myrtaceae, Rutaceae, Meliaceae, Euphorbiaceae, Rhamnaceae, Asclepiadaceae, Apocynaceae, Combretaceae, Malvaceae, Rosaceae, and Poaceae (with 22 species) whereas the remaining 16 families were represented by one species each (Table 2 and Figure 2).

Most of the species were recorded as tree species (Table 1) viz. *Acacia nilotica* (Mimosaceae), *Anthocephalus sp.* (Rubiaceae), *Atrocarpus heterophyllus* (Moraceae), *Aegle marmelos* (Rutaceae), *Azadirachta indica* (Meliaceae), *Butea monosperma* (Dipterocarpaceae), *Bombax ceiba* (Malvaceae), *Cassia fistula* (Caesalpinaceae), *Carica papaya* (Caricaceae), *Citrus reticulate* (Rutaceae), *Delonix regia* (Caesalpinaceae), *Dalbergia sissoo* (Papilionaceae), *Emblica officinalis* (Euphorbiaceae), *Eucalyptus sp.* (Myrtaceae), *Ficus religiosa* (Moraceae), *Ficus infectoria* (Moraceae), *Ficus glomerata* (Moraceae), *Ficus bengalensis* (Moraceae), *Morus alba* (Moraceae), *Mangifera indica* (Anacardiaceae), *Melia azedarach* (Meliaceae), *Madhuca indica* (Sapotaceae), *Moringa sp.* (Moringaceae), *Nyctanthes arbor-tristis* (Oleaceae), *Populus sp.* (Saliceae), *Phoenix dactylifera* (Palmae), *Shorea robusta* (Dipterocarpaceae), *Saraca asoca* (Caesalpinaceae), *Syzgium cumini* (Myrtaceae), *Tamarindus indica* (Caesalpinaceae), *Terminalia arjuna* (Combretaceae),

Terminalia billirica (Combretaceae), *Terminalia chebula* (Combretaceae) and *Zizyphus mauritiana* (Rhamnaceae).

Table 2. Habit wise contribution of family to genera and species

S. No.	Family	Tree		Shrub		Herb		Grass	
		Genus	Species	Genus	Species	Genus	Species	Genus	Species
1.	Caesalpinaceae	4	4	-	-	-	-	-	-
2.	Mimosaceae	1	1	1	1	1	1	-	-
3.	Anacardiaceae	1	1	-	-	-	-	-	-
4.	Caricaceae	1	1	-	-	-	-	-	-
5.	Myrtaceae	2	2	-	-	-	-	-	-
6.	Rubiaceae	1	1	-	-	-	-	-	-
7.	Papilionaceae	2	2	-	-	-	-	-	-
8.	Dipterocarpaceae	1	1	-	-	-	-	-	-
9.	Moraceae	3	6	-	-	-	-	-	-
10.	Rutaceae	2	2	-	-	-	-	-	-
11.	Meliaceae	2	2	-	-	-	-	-	-
12.	Euphorbiaceae	1	1	1	1	-	-	-	-
13.	Rhamnaceae	1	1	1	1	-	-	-	-
14.	Asclepiadaceae	-	-	1	2	-	-	-	-
15.	Oleaceae	1	1	-	-	-	-	-	-
16.	Palmae	1	1	-	-	-	-	-	-
17.	Apocynaceae	-	-	2	2	-	-	-	-
18.	Oxalidaceae	-	-	1	1	-	-	-	-
19.	Sapotaceae	1	1	-	-	-	-	-	-
20.	Solanaceae	-	-	3	4	-	-	-	-
21.	Combretaceae	1	3	-	-	-	-	-	-
22.	Acanthaceae	-	-	1	1	-	-	-	-
23.	Tamaricaceae	-	-	1	1	-	-	-	-
24.	Lythraceae	-	-	1	1	-	-	-	-
25.	Malvaceae	1	1	1	1	-	-	-	-
26.	Rosaceae	-	-	2	2	-	-	-	-
27.	Cannabinaceae	-	-	-		1	1	-	-
28.	Pedaliaceae	-	-	1	1	-	-	-	-
29.	Amaranthaceae	-	-	-	-	1	1	-	-
30.	Moringaceae	1	1	-	-	-	-	-	-
31.	Poaceae	-	-		-	-	-	2	2
32.	Saliceae	1	1	-	-	-	-	-	-
33.	Simarubiaceae	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**
	Total	**30**	**35**	**17**	**19**	**3**	**3**	**2**	**2**

Kumar *et al.*, 2008 reported total 74 species belonging to 55 genera of 31 families from the campus of Bareilly College, Bareilly (Uttar Pradesh) India. In addition to this, Information about medicinal uses of various parts of tree species was gathered from local herbal medicine pactitioners and senior citizens. The dominant trees from the families *Caesalpiniaceae, Mimosaceae, Moraceae, Euphorbiaceae, Magnoliaceae, Myrtaceae, Rutaceae, Anacardiaceae, Lythraceae, Fabaceae, Meliaceae, Rubiaceae, Bignoniaceae, Apocynaceae, Bombacaeae, Lauraceae, Sapotaceae, Oleaceae, Arecaceae, Annonaceae, Punicaceae, Verbenaceae, Combretaceae, Proteaceae, Pinaceae*, and *Diileniaceae* were recorded (Kumar, 2011).

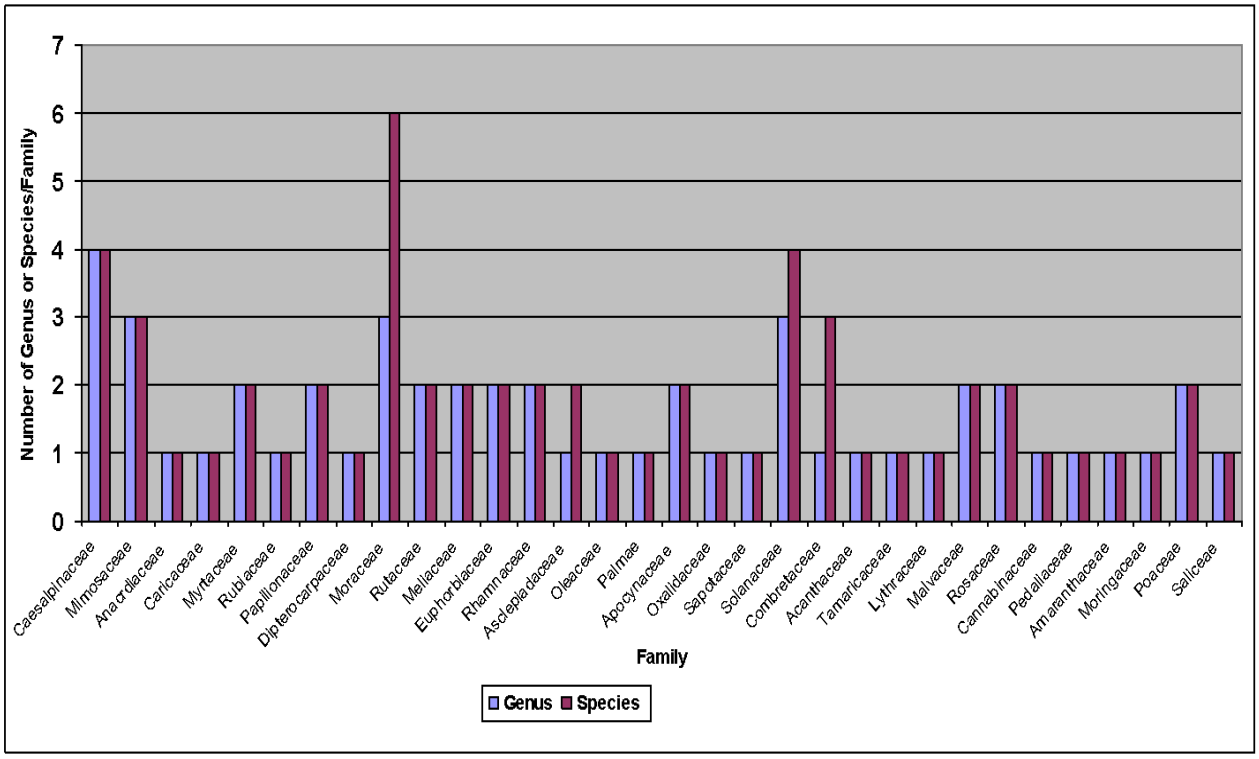


Figure 2. Family-wise contribution to genera and species

The family wise contribution of genera and species is given in figure 2. The maximum numbers of plant species were identified for family Moraceae followed by Solanaceae, Caesalpinaceae and Solanaceae while minimum for most of the remaining family. Plants together with trees, shrubs and herbs on the earth represent one of the vital elements of biodiversity; therefore the understanding of plant species occur in the different areas of the world is a pre-requirement to preserve and maintain the natural biodiversity. It helps us to appreciate the overall structure and function of an ecosystem (Sumeet *et. al.*, 2010). For this reason accurate information of the known plant species from a given area is essential. The information is significant as it allows us to prevent or avoid the potential chances of biodiversity loss and to plan future policy for the protection of our environment. For instance, invasive alien species which are second greatest threat to biodiversity (Wilcove *et. al.*, 1998); can be better managed only if proper and accurate information is available for them. The different forestry species provides forest genetic resources for human welfare and provide timber, drugs, fiber, food, and other value added products. Genetic diversity provides the fundamental basis for the evolution of forest tree species and for their adaptation to change. Conserving forest genetic resources is therefore vital, as they are a unique and irreplaceable resource for the future. Forest genetic resources management can be effective only if treated as an integral element of overall sustainable forest management. Conservation concerns should be integrated into broader national and local development programmes, such as national forest programmes, rural development plans and poverty reduction strategies, which promote cooperation among sectors (http://www.fao.org/forestry/fgr/64582/en/). To maintain the ecosystem equilibrium, awareness of the sustainable utilization of these species is important and their conservation in sustainable environment is urgently needed, keeping in view the demand among the communities and their drugs in the global market.

The various parts of plant species are used for different purposes i.e. food for humans medicine, fuel, timber and multipurpose. Plant species provide excellent fuel and timber and are source of income generation in the different area (Samant *et al.*, 1997). The results of the present study open new prospect of plant materials used in traditional medicine which will promote forest conservation and ecological research through surveys, development and implementation of land use plans by proper planting, afforestation,

reforestation and forest rehabilitation. Medicinal plants could also be incorporated into primary health care, as people generally feel safer with indigenous cures and also the costs of medicine would be much lesser than modern drugs (Kharkwal, 2009).

5. Conclusions

The taxonomic understanding is critical to convene the challenges of biodiversity conservation in the 21st century (Bhaskaran and Rajan, 2010). It is of fundamental importance for understanding biodiversity and ecosystem functioning, as it provides us with the data to explore and describe biodiversity through scientific analysis. The study provides the basic information about the woody and non woody plant species, which are currently found in the district. Such a list could play an important role for the local and regional authorities interested in future to conserve and sustainable use the phyto-diversity for the sustainable development of the area. Forest managers can also use such information on important forestry plant species and common tree species alike to help manage habitat as well as provide cultural resource values of these trees.

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References

[1] Bhaskaran A and Rajan P S. Advancing the science of taxonomy in India. Current Science 2010; 99: 157-158.
[2] Duthie J. F. Flora of the Upper Gangetic Plain and of the Adjacent Siwalik and Sub-Himalayan Tracts, Calcutta, 3 vols 1893.
[3] Hajra P K and Mudgal V. Plant diversity hotspots in India – An Overview, BSI India 1997.
[4] Hooker J. D. The flora of British India, London, 7 Vols 1872-1897.
[5] Kharkwal G. Diversity and Distribution of Medicinal Plant Species in the Central Himalaya, India. Researcher 2009; 1: 61-73.
[6] Kumar R, Khare A K and Awasthi P B Phytosociological Studies in tree Flora of Bareilly College Campus, Bareilly, U. P. India. Vegetos 2008; 21: 45- 53.
[7] Kumar R. Taxonomic and ecological studies in Angiospermic Diversity of District Bareilly. U. P. Bareilly. Thesis M.J.P.R.University Bareilly, 2011.
[8] Kumar S. Flora of Haryana, BSMPS,Dehradun, 2001.
[9] Mishra B K and Verma B K. The flora of Allahabad District, U.P. India, BSMPS, Dehradun, 1992.
[10] Mohamed A A, Amal M, Fakhry and Abdel-Raouf A. Moustafa, Plant biodiversity in the Saint Catherine area of the Sinai Peninsula, Egypt. Biodiversity and Conservation 2009; 9:265-281.
[11] Perring C and Lovett J C. Policies for biodiversity conservation: The case of Sub-Saharan Africa. International Affairs 1999; 75:281-305.
[12] Reddy C S. Catalogue of invasive alien flora of India. Life science Journal, 2008; 5: 84-89.
[13] Samant S S, Dhar U and Palni L M S. Medicinal plants of Indian Himalaya: diversity distribution and potential Value. Nainital: Gyanodaya Prakashan, 1998.
[14] Sumeet, G, Sharma C M, Rana C S, Ghildiyal S K and Suyal S. Phytodiversity (Angiosperms and Gymnosperms) in Mandal-Chopta Forest of Garhwal Himalaya, Uttarakhand, India. Nature and Science 2010; 8: 1-17.
[15] Wilcove D S, Rothstein D, Dubow J, Phillips A and Losos E. Quantifying Threats to imperilled Species in the United States. Bioscience 1998; 48:607-615.

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