

Woody Plant Diversity of Banaras Hindu University Main Campus, India

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ABSTRACT

A study was conducted to explore the woody species diversity of Banaras Hindu University main campus spreading over 1,350 acres of land area. A total of 330 species of woody plants were recorded from the university campus of which 312 woody species belonging to 184 genera and 55 families were represented by the Angiosperms while 18 woody species belonging to 8 genera and 5 families were represented by the Gymnosperms. The Fabaceae, Euphorbiaceae and Apocynaceae were the dominant families of the woody species composition of university campus. The exotic woody species were greater in number compared to native woody species on the Banaras Hindu University main campus.

Keywords: Banaras Hindu University, exotic woody species, native woody species, woody plants, Varanasi district

INTRODUCTION

The great seat of learning Banaras Hindu University was founded by great freedom fighter and social reformer Pandit Madan Mohan Malaviya (1861-1946) during the Indian freedom movement as a national university with donation from both rich and poor. The foundation stone of this great university was laid by Lord Hardinge on 4 February 1916, the then Governor General of British ruled India. This vast university presently has two campuses, 4 institutes, 16 faculties, 140 departments, 4 advanced centers and 4 interdisciplinary centers and a constituent college for women and 3 constituent schools. The newly established fourth institute of the university named Institute of Environment and Sustainable Development (IESD) has been founded by the internationally renowned Ecologist Professor J. S. Singh.

About a century old Banaras Hindu University main campus provides dense flora. Studies have been conducted to explore the natural vascular flora [1], exotic flora [2], vascular wall flora [3], ornamental flora [4], wild medicinal flora [5] and vascular flora [6] of the Banaras Hindu University main campus. However, the main objective of the present investigation was to assess the woody plant diversity of the university campus, India.

MATERIAL AND METHODS

Study site

Banaras Hindu University main campus (Fig. 1) is located about 5 km south of the Varanasi City (Varanasi district of Uttar Pradesh) on the western bank of sacred river Ganges (25°18' N latitude and 83°1' E longitude) on leveled topography at an elevation of 76 cm [7]. The Varanasi district belongs to Indo-Gangetic Plains physiographic division of India.

The university campus is covered with alluvial deposits of river Ganges. Soil is fertile and sandy loam in texture. The climate is tropical monsoonal type with three distinct seasons; the cold (November to February), the hot (March to mid-June), and the rainy (mid-June to September), while October is regarded as strictly transitional month. The diurnal range of temperature ranges as average between 13°C and 14.5°C in the cold and hot months. The highest monthly temperature is recorded in May varying between 32°C and 42°C. The annual rainfall is around 1000 mm [8].

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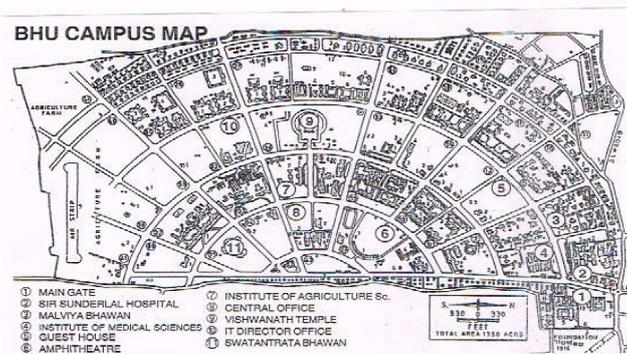


Figure1. Map of the Banaras Hindu University main campus



Figure2. Tree of *Bauhinia variegata* in front of Bharat Kala Bhavan on the Banaras Hindu University main campus

Field Observations

An extensive yearlong field observation was taken between July 2014 to June 2015 to observe and collect the various woody plant species growing on the Banaras Hindu University main campus. During observations, visits were made to every nook and corner of the university campus including the residential compounds in search of woody plant species. The collected specimens were identified through various sources [9-12]. The APG III (2009) [13] classification was followed for arranging the taxa to families.

The woody plant species were listed into two groups i.e. Angiosperms and Gymnosperms. The Angiospermic group was further categorized into dicotyledons and monocotyledons groups. Based on the habits, the woody plant species were categorized into trees, shrubs, woody climbers and woody grasses.

RESULTS AND DISCUSSION

The woody plants of Banaras Hindu University main campus along with their groups and families are presented in the Table 1.

Table1. List of woody plant species of Banaras Hindu University main campus, India

S.No.	Groups /Family / Plant species	Habit	Origin status
ANGIOSPERMS			
Dicotyledons			
Acanthaceae			
1.	<i>Adhatoda zeylanica</i> L.	Shrub	Native
2.	<i>Aphelandra squarrosa</i> Nees	Shrub	Exotic
3.	<i>Justicia adhatoda</i> L.	Shrub	Native
4.	<i>Justicia gendarussa</i> Burm.	Shrub	Exotic
5.	<i>Strobilanthes anisophyllus</i> T. Anders	Shrub	Exotic
6.	<i>Deeringia amaranthoides</i> (Lam.) Merri.	Woody climber	Native

Anacardiaceae			
1.	<i>Anacardium occidentale</i> L.	Tree	Exotic
2.	<i>Buchanania latifolia</i> Roxb.	Tree	Native
3.	<i>Mangifera indica</i> L.	Tree	Native
4.	<i>Spondias pinnata</i> (Koen.) Kurz	Tree	Native
Annonaceae			
1.	<i>Annona squamosa</i> L.	Tree	Exotic
2.	<i>Artabotrys odoratissimus</i> R. Br.	Woody climber	Native
3.	<i>Polyalthia longifolia</i> (Sonn.) Thw. var. pendula	Tree	Native
Apocynaceae			
1.	<i>Adenium obesum</i> (Forsk.) Roem. & Schult	Shrub	Exotic
2.	<i>Allamanda cathartica</i> L.	Woody climber	Exotic
3.	<i>Allamanda neriifolia</i> Hook.	Woody climber	Exotic
4.	<i>Allamanda violacea</i> Gardn. & Field.	Woody climber	Exotic
5.	<i>Alstonia scholaris</i> R. Br.	Tree	Native
6.	<i>Calotropis gigantea</i> (L.) R. Br. ex. Ait.	Shrub	Native
7.	<i>Carissa carandas</i> L.	Shrub	Exotic
8.	<i>Ervatamia coronaria</i> (Jacq.) Stapf	Shrub	Native
9.	<i>Hemidesmus indicus</i> (L.) R. Br.	Shrub	Native
10.	<i>Holarrhena pubescens</i> Benth.	Tree	Native
11.	<i>Nerium indicum</i> L.	Shrub	Native
12.	<i>Nerium oleander</i> L.	Shrub	Exotic
13.	<i>Plumeria acuminata</i> Ait.	Shrub	Exotic
14.	<i>Plumeria alba</i> L.	Shrub	Exotic
15.	<i>Rauvolfia serpentina</i> Benth.	Shrub	Native
16.	<i>Thevetia peruviana</i> Schum.	Shrub	Exotic
17.	<i>Trachelospermum jasminoides</i> (Lindl.) Lem.	Woody climber	Exotic
18.	<i>Vallis solanacea</i> (Roth.) Kuntze	Woody climber	Native
19.	<i>Wrightia antidysenterica</i> (L.) R. Br.	Tree	Native
Araliaceae			
1.	<i>Aralia digitata</i> Roxb.	Shrub	Native
2.	<i>Aralia elata</i> (Miq.) Seem	Shrub	Exotic
3.	<i>Polycias balfouriana</i> (Andre) L. H. Bailey	Shrub	Exotic
4.	<i>Schefflera actinophylla</i> (Endl.) Harms	Tree	Exotic
Bignoniaceae			
1.	<i>Campsis grandiflora</i> (Thunb.) K. Schum.	Woody climber	Exotic
2.	<i>Campsis radicans</i> Seem.	Woody climber	Exotic
3.	<i>Crescentia cujete</i> L.	Tree	Exotic
4.	<i>Dolichandra unguis-cati</i> (L.) Miers	Woody climber	Exotic
5.	<i>Jacaranda mimosaeifolia</i> D. Don	Tree	Exotic
6.	<i>Kigelia africana</i> (Lam.) Benth.	Tree	Exotic
7.	<i>Mansoa alliacea</i> Gentry.	Woody climber	Exotic
8.	<i>Millingtonia hortensis</i> L.	Tree	Exotic
9.	<i>Pyrostegia venusta</i> Miers	Shrub	Exotic
10.	<i>Tabebuia spectabilis</i> Nicholas	Tree	Exotic
11.	<i>Tecoma capensis</i> (Thunb.) Lindl.	Woody climber	Exotic
12.	<i>Tecoma stans</i> (L.) H. B. & K.	Shrub	Exotic
Boraginaceae			
1.	<i>Cordia dichotoma</i> G.Forst	Tree	Native
Cannabaceae			
1.	<i>Trema orientalis</i> Blume	Tree	Native
Capparaceae			
1.	<i>Capparis decidua</i> (Forsk.) Edgew.	Shrub	Native
2.	<i>Capparis spinosa</i> L.	Shrub	Native
3.	<i>Maerua arenaria</i> Hk. f & Th.	Woody climber	Native
Casuarinaceae			
1.	<i>Casuarina equisetifolia</i> L.	Tree	Exotic
Celastraceae			
1.	<i>Celastrus paniculatus</i> Willd.	Woody climber	Native

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Combretaceae			
1.	<i>Combretum indicum</i> (L.) De Filippis	Shrub	Native
2.	<i>Terminalia arjuna</i> Wt. & Arn.	Tree	Native
3.	<i>Terminalia bellerica</i> (Gaertn.) Roxb.	Tree	Native
4.	<i>Terminalia catappa</i> L.	Tree	Exotic
5.	<i>Terminalia chebula</i> Retz.	Tree	Native
6.	<i>Terminalia tomentosa</i> Wt. & Arn.	Tree	Native
Convolvulaceae			
1.	<i>Ipomoea fistulosa</i> Mart.	Shrub	Exotic
Dilleniaceae			
1.	<i>Dillenia indica</i> L.	Tree	Native
Ebenaceae			
1.	<i>Diospyros embryopteris</i> Pers.	Tree	Native
Elaeocarpaceae			
1.	<i>Elaeocarpus ganitrus</i> Roxb.	Tree	Native
Euphorbiaceae			
1.	<i>Acalypha hispida</i> Burm. f.	Shrub	Exotic
2.	<i>Acalypha wilkesiana</i> Muell.- Arg.	Shrub	Exotic
3.	<i>Codiaeum variegatum</i> Blume	Shrub	Exotic
4.	<i>Euphorbia antiquorum</i> L.	Tree	Native
5.	<i>Euphorbia caducifolia</i> L.	Shrub	Native
6.	<i>Euphorbia cattimando</i> Elliott ex. Wight	Shrub	Native
7.	<i>Euphorbia lactea</i> Haw.	Shrub	Native
8.	<i>Euphorbia milii</i> Des Moul.	Shrub	Exotic
9.	<i>Euphorbia nerifolia</i> L.	Shrub	Native
10.	<i>Euphorbia nivulia</i> L.	Shrub	Native
11.	<i>Euphorbia pulcherrima</i> Willd. ex Klotzsch	Shrub	Exotic
12.	<i>Euphorbia royleana</i> Boiss. L.N.	Shrub	Native
13.	<i>Euphorbia santapau</i> Henry	Shrub	Native
14.	<i>Euphorbia susanholmesiae</i> Binojk & Gopalan	Shrub	Native
15.	<i>Euphorbia tirucalli</i> L.	Shrub	Native
16.	<i>Euphorbia tortilis</i> Rottler ex Ainslie	Shrub	Native
17.	<i>Euphorbia trigona</i> Mill.	Shrub	Native
18.	<i>Euphorbia vajravelui</i> Binjok & Balakr.	Shrub	Native
19.	<i>Excoecaria bicolor</i> L.	Shrub	Exotic
20.	<i>Jatropha curcus</i> L.	Shrub	Exotic
21.	<i>Jatropha podagrica</i> Hook.	Shrub	Exotic
22.	<i>Jatropha gossypifolia</i> L.	Shrub	Exotic
23.	<i>Jatropha integerrima</i> Jacq.	Shrub	Exotic
24.	<i>Jatropha multifida</i> L.	Shrub	Exotic
25.	<i>Mallotus philippensis</i> Muell.	Tree	Exotic
26.	<i>Pedilanthus tithymaloides</i> L.	Shrub	Exotic
27.	<i>Ricinus communis</i> L.	Shrub	Exotic
Fabaceae			
1.	<i>Acacia auriculiformis</i> A. Cunn. ex Benth.	Tree	Exotic
2.	<i>Acacia catechu</i> Willd.	Tree	Native
3.	<i>Acacia concinna</i> (Willd.) DC.	Tree	Native
4.	<i>Acacia leucophloea</i> Willd.	Tree	Native
5.	<i>Acacia mangium</i> Willd.	Tree	Exotic
6.	<i>Acacia nilotica</i> (L.) Delile	Tree	Exotic
7.	<i>Albizia lebbek</i> (L.) Willd.	Tree	Native
8.	<i>Albizia saman</i> F. Muell.	Tree	Exotic
9.	<i>Albizia procera</i> Benth.	Tree	Native
10.	<i>Bauhinia acuminata</i> L.	Tree	Native
11.	<i>Bauhinia purpurea</i> L.	Tree	Native
12.	<i>Bauhinia racemosa</i> Lam.	Tree	Native
13.	<i>Bauhinia variegata</i> L.	Tree	Native
14.	<i>Butea monosperma</i> (Lam.) Taub.	Tree	Native
15.	<i>Cajanus cajan</i> (L.) Mill.	Shrub	Exotic

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16.	<i>Caesalpinia crista</i> Lam.	Woody climber	Native
17.	<i>Caesalpinia sappan</i> L.	Tree	Native
18.	<i>Calliandra haematocephala</i> Hassk.	Shrub	Exotic
19.	<i>Calliandra surinamensis</i> Benth.	Shrub	Exotic
20.	<i>Cassia fistula</i> L.	Tree	Native
21.	<i>Cassia marginata</i> Roxb,	Tree	Native
22.	<i>Cassia javanica</i> L.	Tree	Exotic
23.	<i>Dalbergia sissoo</i> Roxb.	Tree	Native
24.	<i>Delonix regia</i> (Boj) Raf.	Tree	Exotic
25.	<i>Derris scandens</i> Benth.	Woody climber	Native
26.	<i>Dichrostachys cinerea</i> (L.) Wt. & Arn.	Tree	Native
27.	<i>Erythrina indica</i> Lam.	Tree	Native
28.	<i>Erythrina variegata</i> L.	Tree	Native
29.	<i>Millettia pinnata</i> (L.) Panigrahi	Tree	Native
30.	<i>Mimosa pigra</i> L.	Shrub	Exotic
31.	<i>Peltophorum pterocarpum</i> (DC.) K. Heyne	Tree	Exotic
32.	<i>Pithecellobium dulce</i> (Roxb.) Benth.	Tree	Exotic
33.	<i>Prosopis cineraria</i> Druce	Tree	Native
34.	<i>Prosopis juliflora</i> (Sw.) DC.	Shrub	Exotic
35.	<i>Saraca indica</i> Roxb.	Tree	Native
36.	<i>Senegalia polycantha</i> (Willd.) Seigler & Ebinger	Tree	Native
37.	<i>Senna alata</i> (L.) Roxb.	Shrub	Exotic
38.	<i>Senna auriculata</i> (L.) Roxb.	Shrub	Native
39.	<i>Senna occidentalis</i> (L.) Link.	Shrub	Exotic
40.	<i>Senna siamea</i> (Lam.) Irwin et Barneby	Tree	Exotic
41.	<i>Senna spectabilis</i> (DC.) Irwin & Barneby	Tree	Exotic
42.	<i>Senna surattensis</i> (Burm. f.) Irwin & Barneby	Tree	Exotic
43.	<i>Sesbania aculeata</i> (Willd.) Poir.	Shrub	Exotic
44.	<i>Sesbania grandiflora</i> (L.) Poir.	Tree	Exotic
45.	<i>Sesbania sesban</i> (L.) Merr.	Shrub	Exotic
46.	<i>Tamarindus indicus</i> L.	Tree	Exotic
47.	<i>Uraria lagopodioides</i> DC.	Shrub	Native
Lamiaceae			
1.	<i>Caryopteris incana</i> Miq.	Shrub	Exotic
2.	<i>Clerodendrum infortunatum</i> Gaertn.	Shrub	Native
3.	<i>Clerodendrum serratum</i> (L.) Moon	Shrub	Native
4.	<i>Ocimum sanctum</i> L.	Shrub	Native
5.	<i>Tectona grandis</i> L. f.	Tree	Native
Lauraceae			
1.	<i>Cinnamomum verum</i> J. Presl	Tree	Exotic
2.	<i>Cinnamomum camphora</i> (L.) J. Presl	Tree	Exotic
3.	<i>Cinnamomum tamala</i> Buch.-Ham.	Tree	Native
Longaniaceae			
1.	<i>Strychnos nux-vomica</i> L.	Tree	Native
Loranthaceae			
1.	<i>Dendrophthoe falcata</i> (L. f.) Ettingsh	Shrub	Native
Lythraceae			
1.	<i>Lagerstroemia indica</i> Blanco	Shrub	Native
2.	<i>Lagerstroemia speciosa</i> (L.) Pers.	Tree	Native
3.	<i>Lawsonia inermis</i> L.	Shrub	Exotic
4.	<i>Punica granatum</i> L.	Tree	Exotic
5.	<i>Woodfordia fruticosa</i> (L.) Kurz.	Shrub	Native
Magnoliaceae			
1.	<i>Magnolia grandiflora</i> L.	Shrub	Native
2.	<i>Michelia champaca</i> L.	Shrub	Native
3.	<i>Schisandra grandiflora</i> Hook.	Woody climber	Native
Malvaceae			
1.	<i>Abutilon indicum</i> (L.) Sweet	Shrub	Native
2.	<i>Bombax ceiba</i> L.	Tree	Native

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3.	<i>Grewia asiatica</i> L.	Shrub	Native
4.	<i>Grewia serrulata</i> DC.	Tree	Native
5.	<i>Grewia tiliaefolia</i> Vahl	Tree	Native
6.	<i>Guazuma ulmifolia</i> Lam.	Tree	Exotic
7.	<i>Hibiscus rosa-sinensis</i> L.	Shrub	Exotic
8.	<i>Hibiscus schizopetalus</i> Hook f.	Shrub	Exotic
9.	<i>Hibiscus sabdariffa</i> L.	Shrub	Exotic
10.	<i>Hibiscus mutabilis</i> L.	Shrub	Exotic
11.	<i>Hibiscus syriacus</i> L.	Shrub	Exotic
12.	<i>Pterospermum acerifolium</i> (L.) Willd.	Tree	Native
13.	<i>Sterculia foetida</i> L.	Tree	Exotic
14.	<i>Sterculia alata</i> Roxb.	Tree	Native
15.	<i>Sterculia villosa</i> Roxb.	Tree	Native
16.	<i>Tespesia populnea</i> Solind.	Tree	Exotic
Meliaceae			
1.	<i>Azadirachta indica</i> A. Juss.	Tree	Native
2.	<i>Melia azedarach</i> L.	Tree	Native
3.	<i>Swietenia humilis</i> Zuccarini	Tree	Exotic
4.	<i>Toona ciliata</i> Roem.	Tree	Native
Menispermaceae			
1.	<i>Cissampelos pareira</i> L.	Woody climber	Native
2.	<i>Tinospora cordifolia</i> (Willd.) Miers	Woody climber	Native
Moraceae			
1.	<i>Artocarpus heterophyllus</i> Lam.	Tree	Native
2.	<i>Artocarpus lacucha</i> Roxb.	Tree	Native
3.	<i>Ficus benghalensis</i> L.	Tree	Native
4.	<i>Ficus benjamina</i> L.	Tree	Exotic
5.	<i>Ficus carica</i> L.	Tree	Exotic
6.	<i>Ficus elastica</i> Roxb.	Tree	Native
7.	<i>Ficus glomerata</i> Roxb.	Tree	Exotic
8.	<i>Ficus infectoria</i> Roxb.	Tree	Native
9.	<i>Ficus religiosa</i> L.	Tree	Native
10.	<i>Ficus retusa</i> L.	Tree	Exotic
11.	<i>Ficus rumphii</i> Blume	Tree	Native
12.	<i>Morus alba</i> L.	Tree	Exotic
13.	<i>Morus nigra</i> L.	Tree	Exotic
14.	<i>Streblus asper</i> Lour.	Tree	Native
Moringaceae			
1.	<i>Moringa oleifera</i> Lam.	Tree	Exotic
Myrtaceae			
1.	<i>Callistemon lanceolatus</i> Sweet	Tree	Exotic
2.	<i>Eucalyptus globulus</i> Labill.	Tree	Exotic
3.	<i>Eucalyptus hybrid</i>	Tree	Exotic
4.	<i>Eucalyptus rostrata</i> Schlecht	Tree	Exotic
5.	<i>Eucalyptus tereticornis</i> Sm.	Tree	Exotic
6.	<i>Myrtus communis</i> L.	Shrub	Exotic
7.	<i>Psidium guajava</i> L.	Tree	Exotic
8.	<i>Syzygium cuminii</i> (L.) Skeels	Tree	Native
Nyctaginaceae			
1.	<i>Bougainvillea buttiana</i> Holtum & Standl.	Shrub	Exotic
2.	<i>Bougainvillea glabra</i> Choisy	Shrub	Exotic
3.	<i>Bougainvillea peruviana</i> Humb. & Bonpl.	Shrub	Exotic
4.	<i>Bougainvillea spectabilis</i> Willd.	Shrub	Exotic
Oleaceae			
1.	<i>Jasminum auriculatum</i> Vahl	Shrub	Native
2.	<i>Jasminum flexile</i> Vahl	Shrub	Native
3.	<i>Jasminum officinale</i> L.	Shrub	Native
4.	<i>Jasminum sambac</i> (L.) Ait.	Shrub	Exotic
5.	<i>Nyctanthes arbor-tristis</i> L.	Tree	Native

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Phyllanthaceae			
1.	<i>Phyllanthus emblica</i> L.	Tree	Native
Plumbaginaceae			
1.	<i>Plumbago rosea</i> L.	Shrub	Native
Proteaceae			
1.	<i>Grevillea pteridifolia</i> Knight	Tree	Exotic
2.	<i>Grevillea robusta</i> A. Cunn ex R. Br.	Tree	Exotic
Putranjivaceae			
1.	<i>Putranjiva roxburghii</i> Wall.	Shrub	Native
Rhamnaceae			
1.	<i>Ziziphus mauritiana</i> Lam.	Tree	Exotic
2.	<i>Ziziphus nummularia</i> (Burm. f.) Wt. & Arn.	Shrub	Native
3.	<i>Ziziphus oenoplia</i> Mill.	Shrub	Native
4.	<i>Ziziphus xylopyrus</i> Willd.	Shrub	Native
Rosaceae			
1.	<i>Eriobotrya japonica</i> Lindl	Tree	Exotic
2.	<i>Prunus amygdalus</i> Batsch.	Tree	Exotic
3.	<i>Prunus persica</i> (L.) Stokes	Tree	Exotic
4.	<i>Rosa banksiae</i> R. Br.	Shrub	Exotic
5.	<i>Rosa centifolia</i> L.	Shrub	Exotic
6.	<i>Rosa damascena</i> Mill.	Shrub	Exotic
7.	<i>Rosa indica</i> L.	Shrub	Native
8.	<i>Rosa chinensis</i> Jacq.	Shrub	Exotic
9.	<i>Rosa gigantea</i> Mill.	Shrub	Native
10.	<i>Rosa moschata</i> Herrm.	Shrub	Native
11.	<i>Rosa multiflora</i> Thunb.	Shrub	Exotic
Rubiaceae			
1.	<i>Anthocephalus cadamba</i> Miq.	Tree	Native
2.	<i>Gardenia gummifera</i> L. f.	Shrub	Native
3.	<i>Gardenia jasminoides</i> Ellis	Shrub	Native
4.	<i>Haldina cordifolia</i> Roxb.	Tree	Native
5.	<i>Hamelia patens</i> Jacq.	Shrub	Exotic
6.	<i>Ixora chinensis</i> L.	Shrub	Exotic
7.	<i>Ixora coccinea</i> L.	Shrub	Native
8.	<i>Ixora parviflora</i> Vahl	Shrub	Native
9.	<i>Ixora undulata</i> Roxb.	Shrub	Exotic
10.	<i>Mussaenda frondosa</i> L.	Shrub	Native
11.	<i>Mussaenda</i> hybrid	Shrub	Exotic
12.	<i>Mussaenda incana</i> Wall. ex Roxb.	Shrub	Exotic
13.	<i>Mussaenda luteola</i> Delile	Shrub	Exotic
Rutaceae			
1.	<i>Aegle marmelos</i> (L.) Corr.	Tree	Native
2.	<i>Citrus aurantifolia</i> Swingle	Tree	Exotic
3.	<i>Citrus aurantium</i> L.	Tree	Native
4.	<i>Citrus limon</i> (L.) Burm. f.	Tree	Exotic
5.	<i>Citrus limettioides</i> Tanaka	Tree	Exotic
6.	<i>Citrus maxima</i> (Burm.) Merr.	Tree	Exotic
7.	<i>Citrus medica</i> L.	Tree	Native
8.	<i>Citrus paradisi</i> Macf.	Tree	Exotic
9.	<i>Citrus reticulata</i> Blanco	Tree	Exotic
10.	<i>Citrus sinensis</i> (L.) Osbeck	Tree	Exotic
11.	<i>Feronia limoni</i> (L.) Swingle	Tree	Exotic
12.	<i>Murraya koenigii</i> (L.) Spreng	Tree	Native
13.	<i>Murraya paniculata</i> (L.) Jacq.	Shrub	Native
Salicaceae			
1.	<i>Populus deltoides</i> L.	Tree	Exotic
Santalaceae			
1.	<i>Santalum album</i> L.	Tree	Native
Sapindaceae			

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1.	<i>Litchi chinensis</i> (Gaertn.) Sonn.	Tree	Exotic
2.	<i>Sapindus mukorossi</i> Gaertn.	Tree	Native
3.	<i>Schleichera oleosa</i> (Lour.) Oken.	Tree	Native
Sapotaceae			
1.	<i>Madhuca longifolia</i> (J. Konig) J. F. Macbr.	Tree	Native
2.	<i>Manilkara zapota</i> Roxb.	Tree	Exotic
3.	<i>Mimusops elengi</i> L.	Tree	Exotic
Solanaceae			
1.	<i>Cestrum diurnum</i> L.	Shrub	Exotic
2.	<i>Cestrum nocturnum</i> L.	Shrub	Exotic
3.	<i>Solanum torvum</i> Sweet	Shrub	Exotic
4.	<i>Withania somnifera</i> Dunal	Shrub	Exotic
Symplocaceae			
1.	<i>Symplocos racemosa</i> Roxb.	Tree	Native
Tamaricaceae			
1.	<i>Tamarix aphylla</i> (L.) Karst.	Tree	Exotic
2.	<i>Tamarix dioica</i> Roxb.	Tree	Exotic
Ulmaceae			
1.	<i>Holoptelea integrifolia</i> (Roxb.) Planch	Tree	Native
Verbenaceae			
1.	<i>Duranta erecta</i> L.	Shrub	Native
2.	<i>Lantana camara</i> L.	Shrub	Exotic
3.	<i>Petrea volubilis</i> L.	Woody climber	Exotic
Vitaceae			
1.	<i>Vitis vinifera</i> L.	Woody climber	Exotic
Monocotyledons			
Arecaceae			
1.	<i>Archotophoenix alexandrae</i> (F. Muell.) H. Wendl. & Drude	Tree	Exotic
2.	<i>Areca catechu</i> L.	Tree	Exotic
3.	<i>Areca triandra</i> Roxb. ex Buch.Ham.	Tree	Native
4.	<i>Bactris major</i> Jacq.	Tree	Exotic
5.	<i>Borassus flabellifer</i> L.	Tree	Exotic
6.	<i>Caryota mitis</i> L.	Tree	Exotic
7.	<i>Caryota urens</i> L.	Tree	Exotic
8.	<i>Chamaerops humilis</i> L.	Shrub	Exotic
9.	<i>Cocos nucifera</i> L.	Tree	Native
10.	<i>Dyopsis lutescens</i> (H. Wendl.) Beentje & J. Dransf.	Shrub	Exotic
11.	<i>Livistona chinensis</i> R. Br.	Tree	Exotic
12.	<i>Heterospatha elata</i> Scheff.	Tree	Exotic
13.	<i>Phoenix dactylifera</i> L.	Tree	Exotic
14.	<i>Phoenix rupicola</i> T. Anders.	Tree	Native
15.	<i>Phoenix sylvestris</i> (L.) Roxb.	Tree	Native
16.	<i>Raphis excelsa</i> (Thunb.) A. Henry	Shrub	Exotic
17.	<i>Roystonea regia</i> (Kunth.) f. Cook	Tree	Exotic
Asparagaceae			
1.	<i>Agave americana</i> L.	Shrub	Exotic
2.	<i>Agave desmettiana</i> Jacobi	Shrub	Exotic
3.	<i>Agave vera-cruz</i> Miller	Shrub	Exotic
4.	<i>Agave wightii</i> Drumm. & Prain	Shrub	Exotic
5.	<i>Beaucarnea recurvata</i> Lem.	Shrub	Exotic
6.	<i>Dracaena braunii</i> Engl.	Shrub	Exotic
7.	<i>Dracaena fragrans</i> (L.) Ker Gawl.	Shrub	Exotic
8.	<i>Dracaena reflexa</i> Lam.	Shrub	Exotic
9.	<i>Nolina brittoniana</i> Nash	Shrub	Exotic
10.	<i>Ruscus aculeatus</i> L.	Shrub	Native
11.	<i>Yucca gloriosa</i> L.	Shrub	Exotic
12.	<i>Yucca aloifolia</i> L.	Shrub	Exotic
Pandanaceae			

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1.	<i>Pandanus tectorius</i> Soland. ex Parkinson	Shrub	Native
Poaceae			
1.	<i>Bambusa bambos</i> Voss.	Woody grass	Native
2.	<i>Bambusa tulda</i> Roxb.	Woody grass	Native
3.	<i>Bambusa vulgaris</i> Schrad.	Woody grass	Native
4.	<i>Dendrocalamus strictus</i> Nees	Woody grass	Native
Smilacaceae			
1.	<i>Smilax zeylanica</i> L.	Woody climber	Native
GYMNOSPERMS			
Araucariaceae			
1.	<i>Araucaria bidwilli</i> Hook.	Tree	Exotic
2.	<i>Araucaria columnaris</i> J. R. Forst. Hook.	Tree	Exotic
3.	<i>Araucaria cunninghamii</i> Ait. ex D. Don	Tree	Exotic
4.	<i>Araucaria heterophylla</i> (Salisb.) Franko	Tree	Exotic
Cupressaceae			
1.	<i>Cupressus sempervirens</i> D. Don	Tree	Exotic
2.	<i>Juniperus chinensis</i> L.	Shrub	Exotic
3.	<i>Juniperus communis</i> L.	Shrub	Exotic
4.	<i>Juniperus indica</i> Bertol.	Shrub	Native
5.	<i>Juniperus virginiana</i> L.	Tree	Exotic
6.	<i>Platycladus orientalis</i> (L.) Franco	Shrub	Exotic
7.	<i>Thuja occidentalis</i> L.	Tree	Exotic
Cycadaceae			
1.	<i>Cycas circinalis</i> L.	Tree	Native
2.	<i>Cycas pectinata</i> Griff.	Tree	Native
3.	<i>Cycas revoluta</i> Thunb.	Tree	Exotic
4.	<i>Cycas rumphii</i> Miq.	Tree	Native
Pinaceae			
1.	<i>Pinus roxburghii</i> Sarg.	Tree	Native
2.	<i>Pinus wallichiana</i> A. B. Jads	Tree	Native
Zamiaceae			
1.	<i>Zamia pygmaea</i> Sims	Shrub	Exotic

A total of 330 woody plant species were recorded from the Banaras Hindu University main campus of which 312 species belonging to 184 genera and 55 families were represented by the Angiosperms while 18 species belonging to 8 genera and 5 families were represented by the Gymnosperms (Table2).

Table2. Analysis of genera, species, families and origin status of the woody plants of the Banaras Hindu University main campus, India

Plant Groups	Genera	Species	Families	Origin status	
				Native	Exotic
Angiosperms	184	312	55	148	164
Gymnosperms	8	18	5	6	12

Thus it is evident from the study that the woody plant species of Banaras Hindu University main campus is dominated by the Angiospermic group of plant species. Among Angiosperms, 277 woody plant species belonging to 161 genera and 50 families were represented by the dicotyledons while 35 woody species belonging to 23 genera and 5 families were represented by the monocotyledons (Table3).

Table3. Analysis of genera, species, families and origin status of the Angiospermic woody plants of the Banaras Hindu University main campus, India

Angiospermic Groups	Genera	Species	Families	Origin status	
				Native	Exotic
Dicotyledons	161	277	50	137	140
Monocotyledons	23	35	5	11	24
Total	184	312	55	148	164

Therefore the woody dicotyledonous plants dominate over the woody monocotyledonous plants on the university campus.

The most dominant genus of the woody species of Banaras Hindu University main campus was *Euphorbia* with 15 species followed by *Citrus* and *Ficus* each with 9 species. The other dominant genera includes *Rosa* (8 species), *Acacia* (6 species), *Senna* (6 species), *Terminalia* (5 species) and *Hibiscus* (5 species).

The maximum number of woody plant species on Banaras Hindu University main campus are represented by family Fabaceae (47 species) followed by the families Euphorbiaceae (27 species) and Apocynaceae (19 species). Therefore, the study indicates that Fabaceae, Euphorbiaceae and Apocynaceae are the dominant families of the woody plants of Banaras Hindu University main campus. These three families together constitute more than one-fourth of the woody plant species of university campus. Other studies on the flora of Banaras Hindu University main campus reports the dominance of Asteraceae, Fabaceae and Poaceae families [1, 6].

The analysis on origin status of the woody plants of the Banaras Hindu University main campus reveals that of the total recorded woody species, 154 woody plants were represented by the native species whereas 176 woody plants were represented by the exotic species. Furthermore, among the angiospermic group of plants, 148 woody plants were represented by native species while 164 woody plants were represented by the exotic species (Table 2). Thus the exotic woody plants dominate over the native woody plants on the university campus. Study on the vascular flora of Banaras Hindu University main campus also suggests the dominance of exotic species over the native species [6]. A previous study on exotic flora suggests that Banaras Hindu University main campus is rich in exotic flora and the flora of American origin dominate the exotic floristic composition of the university campus [2].

The analysis on habits of the woody plants of the university campus reveals that of the total recorded woody plant species, 165 were represented by trees, 139 by the shrubs, 22 by the woody climbers and only 4 species were represented by the woody grasses. Hence the study indicates that the woody plant species of Banaras Hindu University main campus are dominated by the trees.

The study reveals that several woody species growing on the Banaras Hindu University main campus are represented by the valuable medicinal plants. These includes *Adhatoda zeylanica*, *Bauhinia variegata*, *Celastrus paniculatus*, *Cinnamomum verum*, *Derris scandens*, *Hemidesmus indicus*, *Phyllanthus emblica*, *Plumbago rosea*, *Pterospermum acerifolium*, *Rauvolfia serpentina*, *Saraca indica*, *Solanum torvum*, *Strychnos nux-vomica*, *Terminalia arjuna*, *Terminalia bellerica*, *Terminalia chebula*, *Tinospora cordifolia*, *Withania somnifera* and *Wrightia antidysenterica*.

Dalbergia sissoo and *Tectona grandis* were the two most important timber yielding woody species recorded from the Banaras Hindu University main campus.

The study also reveals that 22 woody plant species on the university campus belongs to the threatened category. Among Angiosperms these are represented by *Celastrus paniculatus*, *Euphorbia antiquorum*, *Euphorbia caducifolia*, *Euphorbia cattimandoo*, *Euphorbia lactea*, *Euphorbia milii*, *Euphorbia neriifolia*, *Euphorbia nivulia*, *Euphorbia royleana*, *Euphorbia santapau*, *Euphorbia trigona*, *Euphorbia vajravelui*, *Phoenix rupicola*, *Rauvolfia serpentina*, *Saraca indica*, *Smilax zeylanica* and *Swietenia humilis* while among Gymnosperms these are represented by *Araucaria heterophylla*, *Cupressus sempervirens*, *Cycas circinalis*, *Cycas rumphii* and *Zamia pygmaea*.

Several woody plants recorded from the Banaras Hindu University main campus like; *Butea monosperma*, *Dendrocalamus strictus*, *Holarrhena pubescens*, *Holoptelea integrifolia*, *Madhuca longifolia*, *Melia azedarach*, *Nyctanthes arbor-tristis*, *Phyllanthus emblica*, *Terminalia arjuna*, *Terminalia bellerica*, *Woodfordia fruticosa* and *Ziziphus nummularia* are the chief component species of the dry deciduous forests of the locality [14].

CONCLUSION

It can be concluded from the study that Banaras Hindu University main campus hosts a large variety of woody plant species dominated by the Angiospermic group of plants. The Fabaceae, Euphorbiaceae and Apocynaceae are the dominant families of the woody plant species of the university campus. The number of exotic woody plant species exceeds over the native woody plant species, and the woody plants of tree habit dominate over the other habit forms on the university campus.

REFERENCES

- [1] A. Singh (2011a). Natural vascular floristic composition of Banaras Hindu University, India: An overview. *Int. J. Peace Develop. Stud.* **2** (1):13-25.
- [2] A. Singh (2011b). Exotic flora of the Banaras Hindu University main campus, India. *J. Ecol. Nat. Environ.* **3**(10): 337-343.
- [3] A. Singh (2011c). Observations on the vascular wall flora of Banaras Hindu University campus, India. *Bull. Environ. Pharmacol. Life Sci.* **1**(1): 33-39.
- [4] A. Singh (2014). Observations on the ornamental flora of Banaras Hindu University main campus, India. *Int. J. Mod. Bio. Medi.* **5**(3): 131-153.
- [5] A. Singh (2015a). Observations on the wild medicinal flora of Banaras Hindu University main campus, India. *Int. J. Mod. Bio. Medi.* **6**(1): 1-21.
- [6] A. Singh (2015b). Observations on the vascular flora of Banaras Hindu University main campus, India. *Int. J. Mod. Bio. Medi.* **6**(1): 48-87.
- [7] R. L. Singh, S. L. Kayastha and K. N. Singh (1971). *India: A Regional Geography*. The National Geographic Society, Varanasi, India, pp. 1-45.
- [8] R. P. B. Singh and P. S. Rana (2006). *The Holy City of Varanasi*. NATCON-IASO-WFSOS Department of Surgical Oncology Institute of Medical Sciences, Banaras Hindu University, Varanasi, India, pp. 49-61.
- [9] J. D. Hooker (1875-1897). *Flora of British India*. 7 Vols. L. Reeves and Co., London U. K.
- [10] J. F. Duthie (1903-1922). *Flora of the Upper Gangetic Plain and of the Adjacent Siwalik and Sub-Himalayan Tracts*. 3 Vols. Govt. of India, Central Publication Branch, Calcutta, India.
- [11] N. L. Bor (1960). *The Grasses of Burma, Ceylon, India and Pakistan*, Pergamon Press, Oxford, U. K.
- [12] K. R. Kirtikar and B. D. Basu (1975). *Indian Medicinal Plants* 4Vols. Bishan Singh, Mahendra Pal Singh, Dehra Dun, India.
- [13] APG III (2009). An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. *Bot. J. Linn. Soci.* **161**: 105-121.
- [14] A. K. Jha and J. S. Singh (1992). Influence of micro sites on redevelopment of vegetation on coalmine spoils in a dry tropical environment. *J. Environ. Manage.* **36**: 95-116.

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