



Observations on the Vascular Wall Flora of Banaras Hindu University Campus, India

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ABSTRACT

A study was conducted to analyze the seasonal vascular wall floristic composition of the Banaras Hindu University Campus, India spreading over 1,300 acres of land area. A total of 119 vascular wall flora was recorded, of which only one species was represented by pteridophyte. No any species of Gymnosperm was observed as wall flora in the University Campus. The Angiospermic wall flora was represented by 111 Genera belonging to 34 different families. The Asteraceae, Poaceae and Amaranthaceae were the dominant families of the wall flora of the Banaras Hindu Campus. Majority of the non-woody wall flora appear in rainy and winter seasons of the year. Among the woody perennials, *Ficus benghalensis*, *Ficus religiosa*, *Ficus glomerata* and *Ficus racemosa* were the most common wall flora of the Banaras Hindu University Campus.

Key words : Angiospermic flora, Banaras Hindu University, escape flora, vascular flora, wall flora.

INTRODUCTION

The great seat of learning, Banaras Hindu University was founded by Pandit Madan Mohan Malviya in 1916 as a National University during freedom struggle with donation from both rich and poor. The foundation stone of this largest teaching and residential University of the Asian continent was laid by Lord Hardinge on February 4, 1916, the then Viceroy and Governor General of British ruled India. This vast Central University of India presently has 4 institutes, 14 faculties and 124 departments. The newly established fourth institute of the University named Institute of Environment and Sustainable Development (I ESD) has emerged under the leadership of renowned Ecologist Prof. J. S. Singh. An eminent young Ecologist Prof. A. S. Raghubanshi has the honour to become the first Director of this newly established institute of the University in India. The University Campus spreading over 1,300 acres of land area has well maintained roads with extensive greenery all along and is encompassed by wall all around it. Nine and half decades old University Campus is rich in floral wealth [1-3].

Walls are man-made artificial habitats. Generally the walls having cracks and crevices often favour the growth and development of plant species. The wall plants are the result of spontaneous colonization unassisted by human actions. Several studies have been conducted to analyze the floristic composition of the wall habitats in India and abroad [4-15].

Walls may be generally categorized into 5 types (i) brick cement wall (ii) stone cement wall (iii) brick mud wall (iv) stone mud wall; and (v) mud wall. In the brick cement wall and stone cement wall, the cementing material used is cement, while in the brick mud wall and stone mud wall the cementing material used is mud. The mud wall is purely made of mud.

Since the Campus of Banaras Hindu University is highly urbanized hence only brick cement walls are available. The 95 years old Campus has several old constructions with walls developing cracks and crevices with passage of time. The cracks and crevices in the walls provide anchorage to the plant roots thus supporting the growth of plants. The objective of the study was to analyze the seasonal appearance of flora on the walls of the Banaras Hindu University Campus.

MATERIAL AND METHODS

Site description

Banaras Hindu University main Campus is located about 5 km South of Varanasi city on the Western bank of river Ganga (25°18' N latitude and 83° 1' E longitude), on leveled topography at an elevation of 76 m [16]. The Varanasi district belongs to Indo-Gangetic plains physiographic division of India.

The soil is alluvial type formed by the deposition of sediments of river Ganga. Soil is fertile and sandy loam in texture.

The climate is Tropical monsoonal type with three distinct season; 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 on average between 13 and 14.5°C in the cold and hot months. The highest monthly temperature is recorded in May, varying between 32 and 42°C. The annual rainfall is around 100 mm of which about 90% occurs in the rainy season [17].

Field observation

An extensive field study was conducted from July 2007 to June 2008 to record the vascular flora growing on the walls of the campus of Banaras Hindu University. One visit was made after every two months. Thus a total of six visits were made for the field observations in a year. During the process of observation, visits were made to every nook and corner of the University Campus in search of vascular plant species growing on the walls. The walls investigated for the flora included the main boundary wall surrounding the University campus, walls surrounding the University hostels, Central School, Sishu Bihar and new Vishwanath temple, and the walls of buildings represented by residences, hostels, S. S. hospital, health centres, canteens, motor garages, gymnasium, academic and administrative buildings. The identification of plant species was done using taxonomic literatures [18,19].

RESULTS AND DISCUSSION

The vascular wall flora of the Banaras Hindu University campus along with their habit and seasonal appearance is depicted in the Table 1.

Table 1 : Vascular wall flora of the Banaras Hindu University Campus, India

S. No.	Family / Plant species	Habit	Seasonal appearance
ANGIOSPERMS			
Acanthaceae			
1.	<i>Blepharis boerhaviaefolia</i> Pers.	Herb	Winter
2.	<i>Justicia diffusa</i> Willd.	Herb	Winter
3.	<i>Justicia simplex</i> D. Don	Herb	Winter
4.	<i>Peristrophe bicalyculata</i> Nees	Herb	Winter
5.	<i>Rungia parviflora</i> Nees	Herb	Winter
Aizoaceae			
1.	<i>Trianthema portulacastrum</i> L.	Herb	Rainy
Amaranthaceae			
1.	<i>Achyranthes aspera</i> L.	Herb	Whole year
2.	<i>Aerva lanata</i> (L.) Juss. Ex Schult	Herb	Summer
3.	<i>Alternanthera sessilis</i> R. Br.	Herb	Rainy & Winter
4.	<i>Amaranthus polygamosus</i> L.	Herb	Summer
5.	<i>Amaranthus spinosus</i> L.	Herb	Rainy & Summer
6.	<i>Amaranthus tenuifolius</i> Willd.	Herb	Summer
7.	<i>Amaranthus viridis</i> L.	Herb	Summer
8.	<i>Celosia argentea</i> L.	Herb	Winter
9.	<i>Digera arvensis</i> Forsk.	Herb	Rainy & Summer
Apiaceae			
1.	<i>Centella asiatica</i> (L.) Urban	Herb	Winter
Asclepiadaceae			
1.	<i>Calotropis gigantea</i> (L.) R. Br.	Shrub	Whole year
2.	<i>Calotropis procera</i> (Ait.) R. Br.	Shrub	Whole year
Asteraceae			
1.	<i>Ageratum conyzoides</i> L.	Herb	Summer
2.	<i>Blumea aromatica</i> DC.	Herb	Rainy
3.	<i>Blumea eriantha</i> DC.	Herb	Summer
4.	<i>Blumea indica</i> Linn.	Herb	Summer

5.	<i>Blumea oxyodonta</i> DC.	Herb	Rainy
6.	<i>Eclipta alba</i> Hassk	Herb	Rainy
7.	<i>Gnaphalium indicum</i> L.	Herb	Winter
8.	<i>Gnaphalium purpureum</i> L.	Herb	Winter
9.	<i>Launaea nudicaulis</i> Hook.	Herb	Winter
10.	<i>Parthenium hysterophorus</i> L.	Herb	Rainy
11.	<i>Sonchus arvensis</i> L.	Herb	Winter
12.	<i>Sonchus oleraceus</i> L.	Herb	Winter
13.	<i>Spilanthes acmella</i> (L.) Murr.	Herb	Winter
14.	<i>Taraxacum officinale</i> Webber	Herb	Winter
15.	<i>Tridax procumbens</i> L.	Herb	Summer
16.	<i>Vernonia cinerea</i> (L.) Less.	Herb	Winter
17.	<i>Xanthium strumarium</i> L.	Herb	Rainy
Boraginaceae			
1.	<i>Heliotropium indicum</i> L.	Herb	Winter
2.	<i>Heliotropium strigosum</i> Willd.	Herb	Winter
Cappardaceae			
1.	<i>Cleome viscosa</i> L.	Herb	Rainy
Chenopodiaceae			
1.	<i>Chenopodium album</i> L.	Herb	Winter
Commelinaceae			
1.	<i>Aneilema nudiflorum</i> R. Br.	Herb	Rainy
2.	<i>Commelina benghalensis</i> L.	Herb	Rainy
3.	<i>Commelina diffusa</i> Burm.	Herb	Rainy
4.	<i>Cyanotis axillaris</i> Schult.	Herb	Rainy
Convolvulaceae			
1.	<i>Convolvulus pluricaulis</i> L.	Herb	Summer
2.	<i>Evolvulus nummularius</i> L.	Herb	Rainy
Cucurbitaceae			
1.	<i>Coccinia grandis</i> (L.) Voigt.	Herb	Winter
Cyperaceae			
1.	<i>Cyperus compressus</i> L.	Herb	Rainy
2.	<i>Cyperus difformis</i> L.	Herb	Rainy
3.	<i>Cyperus iria</i> L.	Herb	Rainy
4.	<i>Kyllinga triceps</i> Rottb.	Herb	Rainy
Euphorbiaceae			
1.	<i>Acalypha indica</i> L.	Herb	Rainy
2.	<i>Euphorbia hirta</i> L.	Herb	Rainy & Winter
3.	<i>Euphorbia thymifolia</i> L.	Herb	Rainy & Winter
4.	<i>Phyllanthus niruri</i> L.	Herb	Rainy & Winter
Fabaceae			
1.	<i>Cassia tora</i> L.	Herb	Rainy
2.	<i>Lathyrus aphaca</i> L.	Herb	Winter
3.	<i>Melilotus alba</i> Desr.	Herb	Winter
4.	<i>Melilotus indica</i> All.	Herb	Winter
5.	<i>Mimosa pudica</i> L.	Undershrub	Winter
Lamiaceae			
1.	<i>Hyptis suaveolens</i> (L.) Poir.	Herb	Rainy
2.	<i>Nepeta ruderalis</i> Buch. - Ham.	Herb	Winter
3.	<i>Ocimum canum</i> Sims.	Herb	Winter
4.	<i>Salvia plebeian</i> R. Br.	Herb	Winter

Lythraceae			
1.	<i>Punica granatum</i> L.	Tree	Whole year
Malvaceae			
1.	<i>Abutilon indicum</i> (L.) Sweet	Shrub	Rainy & Winter
2.	<i>Corchorus acutangulus</i> Lamk.	Herb	Rainy
3.	<i>Malvastrum tricuspidatum</i> L.	Undershrub	Rainy
4.	<i>Sida acuta</i> Burm. f.	Undershrub	Rainy
5.	<i>Sida rhombifolia</i> L.	Undershrub	Rainy
6.	<i>Urena lobata</i> L.	Undershrub	Rainy
Meliaceae			
1.	<i>Azadirachta indica</i> A. Juss.	Tree	Whole year
Moraceae			
1.	<i>Ficus benghalensis</i> L.	Tree	Whole year
2.	<i>Ficus glomerata</i> Roxb.	Tree	Whole year
3.	<i>Ficus hispida</i> L. f.	Tree	Whole year
4.	<i>Ficus racemosa</i> L.	Tree	Whole year
5.	<i>Ficus religiosa</i> L.	Tree	Whole year
Nyctaginaceae			
1.	<i>Boerhavia diffusa</i> L.	Herb	Rainy & Winter
Oxalidaceae			
1.	<i>Biophytum sensitivum</i> DC.	Herb	Winter
2.	<i>Oxalis corniculata</i> L.	Herb	Rainy & Winter
Papavaraceae			
1.	<i>Argemone mexicana</i> L.	Herb	Winter
Piperaceae			
1.	<i>Peperomia pellucida</i> (L.) Kunth.	Herb	Rainy
Polygonaceae			
1.	<i>Rumex nigricans</i> Hook	Herb	Rainy
Poaceae			
1.	<i>Brachiaria ramosa</i> (L.) Stapf	Herb	Rainy
2.	<i>Chloris virgata</i> Swartz	Herb	Rainy
3.	<i>Cynodon dactylon</i> (L.) Pers.	Herb	Whole year
4.	<i>Dactyloctenium aegyptium</i> Beauv.	Herb	Rainy
5.	<i>Dichanthium annulatum</i> (L.) Stapf	Herb	Rainy
6.	<i>Digitaria marginata</i> Beauv.	Herb	Rainy
7.	<i>Digitaria sanguinalis</i> (L.) Scop.	Herb	Rainy
8.	<i>Echinochloa colonum</i> (L.) Link	Herb	Rainy
9.	<i>Eleusine indica</i> (L.) Gaertn.	Herb	Summer
10.	<i>Eragrostis tenella</i> (L.) P. Beauv.	Herb	Rainy
11.	<i>Eragrostis iscosa</i> Trin.	Herb	Rainy
12.	<i>Eulaliopsis binata</i> (Retz.) C. E. Hubbard	Herb	Winter
13.	<i>Oplismenus burmanii</i> Beauv.	Herb	Rainy
14.	<i>Panicum psilopodium</i> Trin.	Herb	Rainy
15.	<i>Setaria glauca</i> (L.) Beauv.	Herb	Winter
16.	<i>Sporobolus diander</i> Beauv.	Herb	Rainy
Portulacaceae			
1.	<i>Portulaca oleracea</i> L.	Herb	Winter
2.	<i>Portulaca quadrifida</i> L.	Herb	Winter

Primulaceae		
1.	<i>Anagallis arvensis</i> L.	Herb Winter
Rubiaceae		
1.	<i>Borreria articularis</i> L.	Herb Rainy
2.	<i>Oldenlandia corymbosa</i> L.	Herb Winter
3.	<i>Oldenlandia dichotoma</i> Hook.	Herb Winter
4.	<i>Oldenlandia diffusa</i> Roxb.	Herb Winter
Scrophulariaceae		
1.	<i>Lindenbergia indica</i> (L.) Kuntz	Herb Rainy
2.	<i>Lindernia ciliata</i> (Colsm.) Pennell	Herb Rainy
3.	<i>Lindernia crustacea</i> (L.) F. Muell	Herb Rainy
4.	<i>Scoparia dulcis</i> L.	Herb Summer
Solanaceae		
1.	<i>Datura metel</i> Sims.	Undershrub Rainy
2.	<i>Nicotiana plumbaginifolia</i> Viv.	Herb Winter
3.	<i>Physalis minima</i> L.	Herb Rainy
4.	<i>Solanum nigrum</i> L.	Herb Winter
5.	<i>Solanum xanthocarpum</i> Schrad. & Wendl.	Herb Rainy
Ulmaceae		
1.	<i>Holoptelea integrifolia</i> (Roxb.) Planch	Tree Whole year
Urticaceae		
1.	<i>Urtica dioica</i> Roxb.	Herb Rainy
Verbenaceae		
1.	<i>Lantana camara</i> L.	Shrub Whole year
2.	<i>Lippia nodiflora</i> Rich	Herb Whole year
PTERIDOPHYTE		
Dryopteridaceae		
1.	<i>Dryopteris filix-mas</i> (L.) Schott	Herb Winter

A total of 119 vascular plant species were observed, of which only one species was represented by pteridophyte while the remaining 118 plant species were represented by the Angiosperms. No any species of Gymnosperm was reported from the walls of Banaras Hindu University Campus. The Angiosperms were represented by 111 Genera belonging to 34 families, of which 31 were represented by dicotyledonous families while only 3 were represented by monocotyledonous families. Of the total Angiospermic flora recorded, the maximum number of species, that is 17 (14.40%) belongs to Asteraceae family, 16 (13.55%) to Poaceae family whereas 9 (7.62%) species were represented by Amaranthaceae family. Thus the study reveals that Asteraceae, Poaceae and Amaranthaceae are the dominant families of the wall flora of the Banaras Hindu University Campus. Several studies on wall flora suggest the dominance of Asteraceae and Poaceae families [12-15]. It was observed that mostly the Asteraceae members colonize the walls in winter season while the Poaceae members colonize the same in rainy season. Contrary to these, Amaranthaceae members generally colonize the walls in summer season. Of the total plant species observed, based on the habit, 101 (84.87%) were represented by herbs, 8 (6.72%) by trees, 6 (5.04%) by under shrubs and only 4 (3.36%) by shrubs. Therefore, the

herbs dominate the wall flora of the Banaras Hindu University Campus. Plants of herbaceous habits are the chief representatives of wall flora [12,14,15].

In the study 46 (38.65%), 39 (32.77%) and 11 (9.24%) plant species were recorded in rainy, winter and summer seasons, respectively on the walls of the University Campus. However, 14(11.76%) plant species were recorded throughout the year on the walls. Furthermore, 7(5.88%) plant species were observed during both rainy and winter seasons. Similarly 2(1.68%) plant species were observed during both rainy and summer seasons on the walls of Banaras Hindu University Campus. Thus it is evident from the study that most of the flora colonizes the walls during rainy and winter season. The representative wall flora belonging to Commelinaceae and Cyperaceae families exclusively appear on walls in rainy season while the representative flora of Acanthaceae, Boraginaceae and Portulacaceae families exclusively appears on walls in winter season.

Several of the vascular flora inhabiting the walls of Banaras Hindu University Campus in the present study like; *Lindenbergia indica*, *Achyranthes aspera*, *Boerhavia diffusa*, *Alternanthera sessilis*, *Amaranthus spinosus*, *A. viridis*, *Eragrostis tenella*, *Euphorbia hirta*, *Trianthema portulacastrum*, *Tridax procumbens*, *Sonchus arvensis*, *S. oleraceus*, *Melilotus alba*, *Centella asiatica*, *Oxalis corniculata*, *Digitaria sanguinalis*, *Eleusine indica*, *Anagallis arvensis*, *Ageratum conyzoides*, *Spilanthes acmella*, *Chenopodium album*, *Sida rhombifolia*, *Solanum nigrum*, *Commelina benghalensis*, *Cyperus iria*, *Kyllinga triceps*, *Cynodon dactylon*, *Oplismenus burmanii*, *Ficus benghalensis*, *Ficus hispida*, *Ficus racemosa*, *Ficus religiosa* and *Dryopteris filix-mas* have also been observed as wall flora in other studies conducted on wall habitats [6,7,14,15,20].

The most commonly visible flora on the walls of the Banaras Hindu University Campus in rainy season include *Lindenbergia indica*, *Achyranthes aspera*, *Amaranthus spinosus*, *Trianthema portulacastrum*, *Parthenium hysterophorus*, *Eclipta alba*, *Spilanthes acmella*, *Aneilema nudiflorum*, *Commelina benghalensis*, *C. diffusa*, *Cyanotis axillaris*, *Evolvulus nummularius*, *Cyperus compressus*, *C. difformis*, *C. iria*, *Kyllinga triceps*, *Acalypha indica*, *Euphorbia hirta*, *E. thymifolia*, *Phyllanthus niruri*, *Oxalis corniculata*, *Rumex nigricans*, *Abutilon indicum*, *Brachiaria ramosa*, *Chloris virgata*, *Cynodon dactylon*, *Dactyloctenium aegyptium*, *Dichanthium annulatum*, *Digitaria marginata*, *D. sanguinalis*, *Echinochloa colonum*, *Eragrostis tenella*, *E. viscosa*, *Lindernia ciliata*, *L. crustacea*, *Solanum nigrum* and *Urtica dioica*.

The commonly occurring vascular wall flora of the University Campus in winter season is represented by *Blepharis boerhaviaefolia*, *Justicia diffusa*, *J. simplex*, *Peristrophe bicalyculata*, *Rungia parviflora*, *Achyranthes aspera*, *Centella asiatica*, *Argemone mexicana*, *Gnaphalium indicum*, *G. purpureum*, *Launaea nudicaulis*, *Sonchus arvensis*, *S. oleraceus*, *Vernonia cinerea*, *Coccinia grandis*, *Euphorbia hirta*, *Melilotus alba*, *M. indica*, *Biophytum sensitivum*, *Oxalis corniculata*, *Cynodon dactylon*, *Eulaliopsis binata*, *Setaria glauca*, *Portulaca oleracea*, *P. quadrifida*, *Anagallis arvensis*, *Oldenlandia corymbosa*, *O. diffusa*, *O. dichotoma*, *Solanum nigrum* and *Nicotiana plumbaginifolia*.

The common summer season wall flora for the University Campus is represented by *Aerva lanata*, *Achyranthes aspera*, *Lippia nodiflora*, *Amaranthus spinosus*, *A. viridis*, *Blumea eriantha*, *Tridax procumbens*, *Convolvulus pluricaulis*, *Eleusine indica* and *Cynodon dactylon*.

Calotropis procera and *C. gigantea* are the two common shrubs visible on the older walls of Banaras Hindu University Campus.

Among the perennial woody species, stunted forms of *Ficus religiosa*, *F. benghalensis*, *F. glomerata* and *F. racemosa* are frequently visible on the walls of the Banaras Hindu University Campus.

Punica granatum, *Dryopteris filix-mas* and *Lantana camara* were the three escape flora appearing on the walls of University Campus. *P. granatum* and *D. filix-mas* are grown as fruit tree and ornamental plant, respectively in the gardens and residential compounds of the University Campus whereas the *L. camara* is grown as hedge plant.

Several of the wall flora observed in Banaras Hindu University Campus in the present study is represented by alien species. These include *Ageratum conyzoides*, *Alternanthera sessilis*, *Amaranthus spinosus*, *Anagallis arvensis*, *Argemone mexicana*, *Cassia tora*, *Chenopodium album*, *Corchorus acutangulus*, *Cynodon dactylon*, *Datura metel*, *Eclipta alba*, *Eragrostis tenella*, *Heliotropium indicum*, *Holoptelea integrifolia*, *Euphorbia hirta*, *E. thymifolia*, *Lantana camara*, *Melilotus alba*, *Mimosa pudica*, *Nicotiana plumbaginifolia*, *Oxalis corniculata*, *Parthenium hysterophorus*, *Physalis minima*, *Portulaca oleracea*, *Punica granatum*, *Sonchus oleraceus*, *Sporobolus diander*, *Taraxacum officinale*, *Tridax procumbens* and *Urena lobata*. Thus the study reveals that 30 (25%) flora on the walls of University Campus is represented by the alien plant species. A good proportion of the wall flora is represented by alien species [15, 21].

CONCLUSION

It can be concluded from the study that vascular flora on the brick cement walls of the Banaras Hindu University Campus is dominated by Angiosperms. Most of the flora on walls appears during the rainy and winter seasons of the year. One-fourth of the wall flora is represented by the alien species. The Asteraceae, Poaceae and Amaranthaceae families represented exclusively by herbaceous species dominate the vascular wall floristic composition of the Banaras Hindu University Campus.

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