
Exploration of Woody Wall Flora on the Banaras Hindu University Main Campus, India

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ABSTRACT

An observational study was conducted to explore the woody wall flora of urbanized and about a century old Banaras Hindu University main campus, spreading over 1,350 acres of land area. Twenty three woody plants belonging to 17 genera and 12 families were recorded from the walls of the university campus represented exclusively by the dicotyledonous angiosperms. Moraceae, Apocynaceae and Fabaceae were the dominant families constituting more than half of the woody wall plants of the Banaras Hindu University main campus. The representation by native species was about three times greater than the non-native species on the walls of the university campus.

Keywords: Banaras Hindu University, Varanasi city, wall flora, woody wall flora

INTRODUCTION

Banaras Hindu University is the largest teaching and residential university of Asia founded by great freedom fighter, social reformer and educationist Pandit Madan Mohan Malaviya in 1916 during the Indian freedom struggle as a national university with donations from both the rich and the poor, and the foundation stone of the university was laid by Lord Hardinge on 4 February 1916, the then Viceroy and Governor General of British ruled India [1]. This vast university presently has two campuses, 4 institutes, 16 faculties and 140 departments, 4 advanced centers and 4 interdisciplinary centers [2]. The newly established fourth institute of the university named Institute of Environment and Sustainable Development (I.E.S.D.) has been founded by internationally renowned Ecologist Professor J. S. Singh [3].

Walls are man-made habitats representing a specific environment which is partly similar to rocks and rock fissures [4]. The artificial origin, location in the urban and rural landscape and technology of wall building influence a range of plant species which are able to colonize such habitats [5]. Walls as a specialized microenvironment conditioned by human beings are colonized only by plant species with specific adaptations for development and reproduction [6, 7]. Considering vertical division, walls usually consist of three different zones (i) the base, (ii) the vertical wall surface with joints (fissures); and (iii) the wall top [5].

The study of wall flora provides a better understanding of the urban environment [4, 8-10]. Several studies have been conducted to explore the wall flora in urban environment [4, 5, 8-18]. The present study was undertaken with objective to explore the woody wall flora of the Banaras Hindu University main campus which is urbanized, and is located in the world's oldest city of Varanasi. The following questions were addressed in the study: (i) How many species of woody plants are hosted by the walls of the university campus? (ii) Which families dominate the woody wall flora of the university campus? and (iii) Woody plants of which origin status have greater representation on the walls of the Banaras Hindu University main campus?

STUDY AREA

Banaras Hindu University main campus which spreads over 1,350 acres of land area (Fig. 1) is located about 5 km south of Varanasi city on the western bank of sacred Ganges River in Uttar Pradesh state of India. It lies 25°18' north latitude and 83°1' east longitude on levelled topography at

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Arvind Singh “Exploration of Woody Wall Flora on the Banaras Hindu University Main Campus, India”

an elevation of 76 m [19]. The campus is covered with alluvial deposits of river Ganges. Soil is fertile and sandy loam in texture.

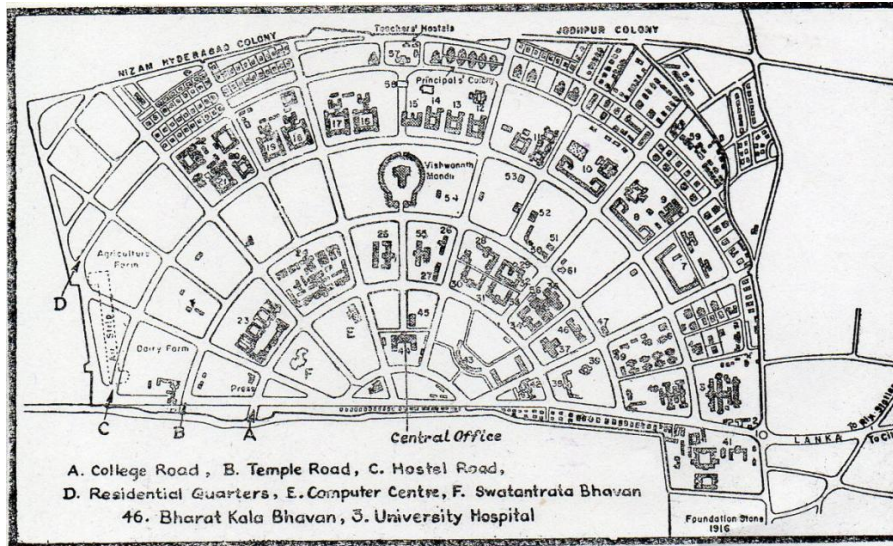


Figure1. Map of the Banaras Hindu University main campus



Figure2. Young plant of *Ficus religiosa* on wall of the building of State Bank of India (Shopping Center Branch) on the Banaras Hindu University main campus

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 strictly as 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 [20].

The protected campus of the Banaras Hindu University hosts a diverse variety of plant species dominated by the angiospermic group of plants [3, 21]. The commonly occurring woody plant species on the university campus are represented by *Aegle marmelos*, *Albizia lebbeck*, *Alstonia scholaris*, *Azadirachta indica*, *Cassia fistula*, *Ficus benghalensis*, *Ficus hispida*, *Ficus racemosa*, *Ficus religiosa*, *Ficus virens* var. *lancelolata*, *Madhuca longifolia*, *Mangifera indica*, *Melia azedarach*, *Holoptelea integrifolia*, *Millettia pinnata*, *Nyctanthes arbor-tristis*, *Syzygium cumini*, *Tamarindus indicus*, *Tectona grandis*, *Terminalia arjuna*, *Terminalia bellerica* and *Ziziphus nummularia* [1].

Ageratum conyzoides, *Lantana camara* and *Parthenium hysterophorus* are the common exotic invading plants on the Banaras Hindu University main campus [21].

METHODOLOGY

The present study is based on a yearlong field survey and collection taken from July 2014 to June 2015. One field visit was made in a month. Thus a total of 12 field visits were made in one year to record and collect the woody plants growing on the walls of the Banaras Hindu University main campus. During the field visit all attempts were made to cover the each and every corner of the vast university campus. The walls were thoroughly observed from the base to the top to record the woody plant species. The recorded woody plants were collected from the field for identification.

The walls surveyed to record and collect the woody plants included the main boundary wall surrounding the university campus, walls surrounding university hostels and schools (Central school, Shishu vihar and Mahamana vidyalaya), walls surrounding the new Vishwanath temple; and the walls of buildings represented by residences, hostels, banks, post offices, Sir Sunderlal hospital, health centers, canteens, motor garages and gymnasium. The walls of academic and administrative buildings were also examined as well. The flora of Hooker (1875-1897) [22] and Duthie (1903-1922) [23] were used for the identification of the collected plant specimens.

RESULTS AND DISCUSSION

Twenty three woody plant species belonging to 17 genera and 12 families were recorded from the walls of the university campus all of which were represented by the dicotyledonous angiosperms (Table 1). A previous study on the wall flora of the Banaras Hindu University main campus reports the dominance of dicotyledonous plant species on walls with greater variety compared to the monocotyledonous plant species [16]. In the present study, *Ficus* with 5 species was the dominant genus of the woody wall flora on the university campus.

Study on family wise representation by woody plants on the walls of university campus indicates that Moraceae family with 5 species has the maximum representation followed by the Apocynaceae and Fabaceae families represented by 4 and 3 woody plant species, respectively. Therefore, the study suggests that Moraceae, Apocynaceae and Fabaceae are the dominant families of the woody wall flora of the Banaras Hindu University main campus. These three families together constituted more than half of the woody plant species growing on the walls of university campus. A study on the woody wall flora of the Varanasi city also reveals the dominance of Moraceae, Apocynaceae and Fabaceae families [18]. Furthermore, study on the vascular wall flora of the Banaras Hindu University main campus reports the dominance of Asteraceae, Poaceae and Amaranthaceae families [16]. Many other studies conducted on the wall flora suggests the dominance of Asteraceae and Poaceae families [10, 14, 24-26].

Table1. Woody plants recorded from the walls of the Banaras Hindu University main campus

S. No.	Plant species	Family	Origin status
1.	<i>Abutilon indicum</i> (L.) Sw.	Malvaceae	Native
2.	<i>Aegle marmelos</i> (L.) Corr.	Rutaceae	Native
3.	<i>Albizia lebbek</i> (L.) Willd.	Fabaceae	Native
4.	<i>Alstonia scholaris</i> R. Br.	Apocynaceae	Native
5.	<i>Azadirachta indica</i> A. Juss.	Meliaceae	Native
6.	<i>Bombax ceiba</i> L.	Malvaceae	Native
7.	<i>Calotropis gigantea</i> (L.) R. Br.	Apocynaceae	Native
8.	<i>Calotropis procera</i> (Ait.) R. Br.	Apocynaceae	Native
9.	<i>Ficus benghalensis</i> L.	Moraceae	Native
10.	<i>Ficus hispida</i> L. f.	Moraceae	Native
11.	<i>Ficus racemosa</i> L.	Moraceae	Exotic
12.	<i>Ficus religiosa</i> L.	Moraceae	Native
13.	<i>Ficus virens</i> var. <i>sublanceolata</i> Miq. Corner	Moraceae	Native
14.	<i>Holoptelea integrifolia</i> (Roxb.) Planch.	Ulmaceae	Native
15.	<i>Lantana camara</i> L.	Verbenaceae	Exotic
16.	<i>Nyctanthes arbor-tristis</i> L.	Oleaceae	Native
17.	<i>Punica granatum</i> L.	Lythraceae	Exotic
18.	<i>Senna occidentalis</i> (L.) Link.	Fabaceae	Exotic
19.	<i>Tecoma stans</i> (L.) H.B. & K	Bignoniaceae	Exotic
20.	<i>Thevetia peruviana</i> Schum	Apocynaceae	Exotic
21.	<i>Vachellia nilotica</i> (L.) P.J.H. Hurter & Mabb.	Fabaceae	Native
22.	<i>Ziziphus nummularia</i> (Burm. f.) Wt. & Arn.	Rhamnaceae	Native
23.	<i>Ziziphus oenoplia</i> Mill.	Rhamnaceae	Native

Several studies on the wall flora reports adequate representation by the exotic species [10, 16, 18, 27]. In the present study analysis on the origin status of the plants reveals that of total woody plants recorded from the walls of university campus, 17 (73.91%) were represented by the native species while 6 (26.09%) were represented by the exotic species. Therefore, the study clearly suggests that the representation by the native woody species on the walls of Banaras Hindu University main campus was about three times greater than the exotic woody species.

It was observed during the study that *Ficus benghalensis*, *Ficus racemosa*, *Ficus religiosa* and *Ficus virens* var. *sublanceolata* were the most common woody plants which colonized the vertical wall surfaces and the wall tops of the Banaras Hindu University main campus. Colonization of plants on vertical wall surfaces depends on the level of disintegration of mortar, concrete or any other type of binding material while the colonization of plant species is determined by the disintegration of material on the wall tops [5].

Woody plants colonizing the wall bases of the Banaras Hindu University main campus were represented by *Calotropis gigantea*, *Calotropis procera*, *Ficus hispida*, *Lantana camara*, *Senna occidentalis*, *Ziziphus nummularia* and *Ziziphus oenoplia*. These woody species are the component species of the dense flora of the Banaras Hindu University main campus [21]. According to Duchoslav (2002) [5] species composition of the basal zone of walls consists of plant species growing on vertical surface and species of nearby vegetation.

CONCLUSION

It can be concluded from the study that the walls of the Banaras Hindu University main campus hosts 23 woody plants species dominated by the Moraceae, Apocynaceae and Fabaceae families. The vertical wall surfaces and the wall tops of the university campus were frequently colonized by the members of Moraceae family. The representation by indigenous species was greater than the non-indigenous species on the walls of the Banaras Hindu University main campus.

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Arvind Singh “Exploration of Woody Wall Flora on the Banaras Hindu University Main Campus, India”

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