International Journal of Ecology and Environmental Sciences
www.ecologyjournal.in
Online ISSN: 2664-7133, Print ISSN: 2664-7125
Received: 18-05-2021, Accepted: 01-06-2021, Published: 19-06-2021
Volume 3, Issue 2, 2021, Page No. 248-251

Study of selected vertical gardens of Ahmedabad city

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Abstract
Climate change has made the concept of changing our living ambience very important to make a quality living. Vertical gardens are the tools that can be employed to enhance the quality of air, solve the heat problems in urban areas and the same time improve the aesthetics of our living places. In current study different vertical gardens in Ahmedabad city were surveyed. The data was collected through physical visits like type of frame, design and texture of frame, media used for the plantation, irrigation systems used for the maintenance of the garden and plant species were noted in this study. Most commonly used irrigation method is electric motor regulating drip irrigation method. Common plant species surveyed were *Philodendron erubescens, Chlorophytum comosum, Polyscias fruticosa, Asparagus, Ribbon plant, Pothos, Syngonium* etc for the majority of vertical gardens.

Keywords: vertical gardens, eco-friendly, Ahmedabad city

Introduction

Though the concept of a vertical garden originated in Babylon's Hanging Gardens in 600 BC, it was not used often by successive gardeners like Persians, Mughals, Europeans and others. With the rapid growth of industrial cities and a lack of horizontal space for other services, this idea has been quickly adopted by modern gardeners. Vertical gardens are living walls with plants growing on them. The nature of the vertical garden system, the growing container, the irrigation arrangement, the plants are chosen, the growing media, and other factors all play a role in the success of plant growth in vertical garden systems. Shade-loving indoor ornamental plants such as *Philodendron* sp., *Asparagus* sp., *Chlorophytum* sp., *Polyscias fruticosa, Aglaonema, Rhoeo spathacea, Sempervivum,* and others are considered suitable options based on their ornamental features; however, studies demonstrating plant suitability for vertical garden systems are lacking in India. *Philodendron erubescens, Chlorophytum comosum,* and *Polyscias fruticosa*, members of the Araceae, Asparagaceae, and Araliaceae families, respectively, are used in this study due to their textural properties and easy adaptability in tropical to subtropical conditions. The most important factor in determining the success of a vertical garden system is the growing medium. The rising cost of these media materials, as well as a scarcity of mineral media such as cocopeat, perlite, and vermiculite, have prompted researchers to look for suitable substitutes in organic manures and hydrogel compounds for plant growing containers used in vertical garden systems. Further, a restricted volume of media and competition due to higher planting density may cause a confined root system. In due course of maintenance, this system needs heavy applications of fertilizer and water to maintain proper plant growth. In line with the above facts, a study was carried out with the objectives to study the influence of Coir pith, Stockosorb and Geohumus as components of growing media along with FYM, Vermicompost and Leaf mold compost on growth and performance of ornamental plants in wooden containers for the establishment of vertical garden and to standardize the growing media mixtures suitable for the establishment of vertical gardens.

Green Wall

Green walls are vertical structures that are embellished with various forms of plants or other greenery. Greenery is commonly grown in dirt, stone, or water as a growth medium. Built-in irrigation systems are popular in living plant walls**.** Facades, which are often seen creeping up the exterior walls of buildings as structural support, are not the same as green walls. The growth medium for green walls is on the wall's surface or structure, while facades are embedded in the earth. Furthermore, facade greenery takes a long time to grow large enough to cover an entire wall, while green walls can be pre-grown.

Benefits of Green Wall

Aesthetic Benefits

The use of a green wall to enhance the architectural value of a city is common. The visual contrast and relief from the densely built-up city landscape can be provided by vegetation. In the hard concrete jungle of the city, plants also provide a feeling of closeness to Mother Nature for city dwellers. Apart from that, the natural landscape offers elements of natural scale and visual elegance to buildings and streets, as well as seasonal indicators. Furthermore, the softness of the greenery in comparison to the rough surface of the concrete will offer visual relief to the plain walls. Green walls and plants may be used to hide unsightly building walls.

Indoor Air Quality Improvement

In the urban world, plants have long been thought to be successful scavengers of both gaseous and particulate contaminants. They can help to clean the air by removing airborne contaminants in

their leaves and branches and absorbing gaseous pollutants by photosynthesis. They use their leaves and branches to filter airborne contaminants and absorb gaseous pollutants. Volatile Organic Compounds, or VOCs, are consumed by both plants and planting medium by bio-filtration.

Economic Benefits
Plants placed around buildings can help to strengthen the structure by reducing the weather impact. Green walls alleviate climatic stress on building facades while also extending the service and practical life of structures. It also aids in the reduction of UV (ultraviolet) rays-induced building deterioration. One of the financial benefits of green walls is the lower cost of painting supplies. It has been recorded that in warmer climates, the energy required to cool a building can be reduced by 28%. Greenery may also increase the value of a house.

Improvement of Health and Wellness
Visual and physical interaction with plants has been shown to have significant health benefits. Green walls can have restorative effects that reduce stress, boost patient recovery rates, and increase vulnerability to illness. The vertical gardens absorb the noxious gases and volatile compounds emitted by modern conveniences, lowering the risk of cancer, stroke, depression, heart disease, and respiratory problems.
Other Benefits of Green Wall Includes:

- By installing them from the outside, you can reduce the internal room temperature by 5 to 10 degrees in the summer.
- Plants are away from soil-borne diseases.
- More plants within limited space
- Helps in saving water.
- Provides excellent air circulation for the plants

Materials and Methodology
In this survey research different data were collected from different sites where vertical gardens are located in Ahmedabad city. Survey parameters includes location, area covered by vertical garden (size), framework type, media used by different designers and gardeners, irrigation system used for the maintenance of the garden and total species of plants used in the garden. For the study different devices like Mobile, GPS system, Diary, Pen, Visit information form, digital camera, measure-tape were used for this survey. Different locations where survey work was carried out are given below with postal address.

The Bungalows
Address: satellite road, Ahmedabad 380015

Occura Eye Care Hospital
Address: Rajpath Rangoli Rd, beside Pandit Dindayal Upadhyay Auditorium, PRL Colony, Bodakdev, Ahmedabad, Gujarat 380059
Address Sindhu Bhavan Marg, PRL Colony, Bodakdev, Ahmedabad, Gujarat 380058

Poetry Hotel
Address: 1st Floor Mann Party Plot, Sindhu bhavan Marg, PRL Colony, Thaltej, Ahmedabad, Gujarat 380054

Amra Café
Address: Devnagar, Ahmedabad, Gujarat 382481

Hotel White Cloude
Address: nr. Kankaria Gate, No. 1, Ahmedabad, Gujarat 380022

Inder Residency
Address: Opp. Gujarat College, nr. BVR Ek, Ellisbridge, Ahmedabad, Gujarat 380006

Royal Manor
Address: Nr. Rangvala Tower, Ellis Bridge, Ahmedabad, Gujarat 380009

The Living Interiors
Address: Opp. Hero Honda Showroom, Opp. Central Bank of India, Nr, Vijay Cross Rd, Navrangpura, Ahmedabad, Gujarat 380009

Gujarat Gas Limited
Address: 2, Netaji Rd, Shanti Sadan Society, Ellis Bridge, Ahmedabad, Gujarat-380006

Income Tax Office
Address: First Floor, Narayan Chambers, Near Nehru Bridge, Ashram Road Circle, Ashram Road, Ahmedabad, Gujarat 380009

Under Nehru Bridge
Address: Pramukh Swami Maharaj Marg, Vishalpur, Ellis Bridge, Ahmedabad 380009

The Skycity
Address: Near 07 club road, off, Sardar Patel Ring Rd, Shela, Gujarat 380058

Result and Discussion
As per the data given in the table -1 different location has different space which were covered with vertical garden. Mostly in the survey Iron frame and wooden frame were used for the construction material. Mostly plastic pots were used for every garden except 2 places as mentioned in the figure 5 and 9. At selected places manually irrigation system was used, mostly electric motor drip irrigation method was used for the maintenance of the garden. Different types of media and bags were used for the preparation of vertical garden as noted in table-2 and 3.

Montecarlo Limited

Table 1: Showing Location and Area covered by vertical garden with date of visit

Name of Place	Location	Area Calculated
The Bungalows	23°01'34"N 72°30'31"E	15×15& 15×15=450 sq. feet
Occura Eye Care Hospital	23°02'06"N 72°30'08"E	13×15 & 17×18 =501 sq. feet
Montecarlo Limited	23°02'24"N 72°30'12"E	25×10 & 25×10=500 sq. feet

Poetry Hotel	23°02'29"N 72°30'18"E	8×6 & 8×7= 104 sq. feet
Amra Café	23°06'29"N 72°32'05"E	8×5 & 8×5= 80 sq. feet
Hotel White Cloude	23°00'12"N 72°35'49"E	5×25= 125 sq. feet
Inder Residency	23°01'20"N 72°34'02"E	6×10 = 60 sq. feet
Royal Manor	23°01'25"N 72°33'45"E	8×8 = 64 sq. feet
The Living Interiors	23°02'30"N 72°33'03"E	Whole building
Gujarat Gas Limited	23°01'09"N 72°33'28"E	160 sq. feet
Income Tax Office	23°02'24"N 72°34'10"E	320 sq. feet
Under Nehru Bridge	23°01'36"N 72°34'24"E	90 sq. feet

Table 2: Showing List of plants used for the Vertical gardens

Sr. No	Plant Name	Local Name	Scientific Name	Family
1	Asparagus	Shatavari	*Asparagus racemosus*	Asparagaceae
2	Pandanus	Kewda	*Pandanus odorifer*	Pandanaceae
3	Jade Plant	Jade plant	*Crassula ovata*	Crassulaceae
4	Tradescantia	Inch plant	*Tradescantia sp.*	Commelinaceae
5	Ribbon Plant	Ribbon Plant	*Chlorophytum comosum*	Asparagaceae
6	Money Plant	Devil's ivy	*Epipremnum aureum*	Araceae
7	Snake plant	Dracaena	*Dracaena trifasciata*	Asparagaceae
8	Euphorbia	Crown of thorns	*Euphorbia milii*	Euphorbiaceae
9	Aloe Vera	Aloe Vera	*Aloe barbadensis*	Liliaceae
10	Lilly	Mdonna Lilly	*Lilium candidum*	Liliaceae
11	Syngonium	Syngonium	*Syngonium podophyllum*	Araceae
12	Conocarpus	Buttonwood	*Conocarpus erectus*	Combretaceae

Table 3: Showing list of types of frame, types of pots, plant media, irrigation methods used at different locations

Vertical Garden	Frame Type	Types of Pot	Plant Media	Irrigition Method	Plants
The Bungalows	Iron frame	Small plastic pot	Soil, & Red sand	Drip	*Asparagus, Pandanus*
Occura Eye Care Hospital	Iron frame	Small plastic pot	Soil & Cocopeat	Drip	*Asparagus*, Jade plant
Montecarlo Limited	Iron frame	Cotton & Carpet bags	Cocopeat	Automatic drip	*Asparagus, Pandanus*, Ribbon plant
Poetry Hotel	Iron frame	Cement big pot	Cocopeat & Soil	Manually	Money plant
Amra Café	Iron frame	Cement big pot	Cocopeat & Soil	Manually	*Asparagus*, *Sansevieria*, Jade plant, *Aloe vera*, *Euphorbia milli*
Hotel White Cloude	Iron frame	Small plastic pot	Soil	Drip	Money plant, Tradescantia
Inder Residency	Iron frame	Small plastic pot	Cocopeat & Soil	Drip	*Asparagus*, Spider plant, Money plant, *Tradescantia*, Jade plant
Royal Manor	Wooden frame	Small plastic pot	Soil	Drip	Allamanda, Madhumalti
The Living Interiors	Iron frame	No pots	Soil	Manually	Spider plant and Lily sp.
Gujarat Gas Limited	Metal Wire	Jute bags	Cocopeat, soil & Perlite	Manually	*Asparagus*, *Pandanus*, Money plat, *Tradescantia*, *Syngonium*
Income Tax Office	Iron frame	Cotton bags	Cocopeat & Perlite	Drip	*Asparagus*, *Tradescantia*, Ribbon plant
Under-Nehru Bridge	Iron frame	Plastic big pot	Soil	Manually	*Pandanus, Sansevieria, Aloe vera, Euphorbia milii*

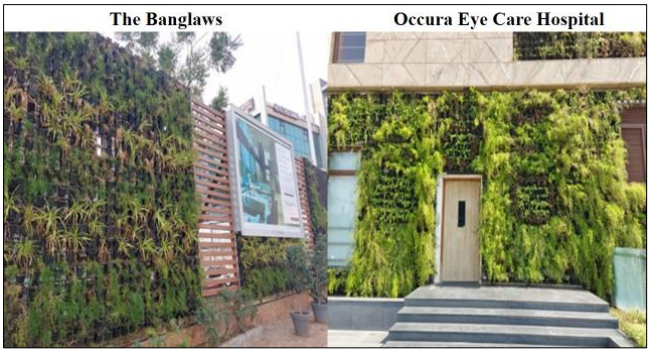

Fig 1

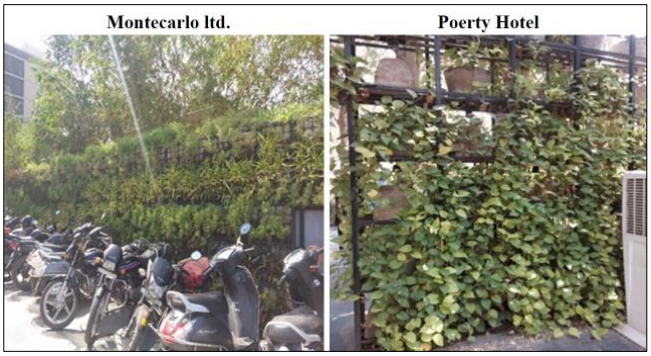

Fig 2

Fig 3

Fig 4

Fig 5

Conclusion

Vertical gardens are best eco-friendly option to increase green-cover within limited space. It also enhances the aesthetic appearance of the building or wall. Total twelve major vertical gardens were surveyed of the city. From which mostly iron frames with plastic pots were used to prepare vertical gardens they are easy to maintain also and long-lasted. Most common plants can be used for the vertical gardens are *Asparagus racemosus*, *Pandanuns odorifer*, *Crassula ovate*, *Tradescantia species*, *Chlorophytum comosum*, *Epipremnum aureum*, *Dracaena trifasciata*, *Syngonium podophyllum*, *Lilium candidum.* First time *Conocarpus erectus* plants were noticed during this survey, which were surveyed from the Sky city, Shela, Ahmedabad.

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