



Ecological Recommendation of Climber Plants in Dhaka City

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ABSTRACT

In the bustling urban landscape of Dhaka city, addressing ecological challenges has become essential for us. This research investigates the ecological advantages of climbing plants and their potential role in improving a city's environment by making them useful on the façade of buildings, including energy savings for home and cooling, and integrated them with nature into its surrounding landscapes with different scopes and recommendations for long term urban greenery. The current research on ecological advantages and best practices for urban climbing plants are quite limited, and the small field survey area hinders the differentiation between climbing plants at Ramna Park and Dhaka University. The aim of the study is to explore the ecological importance of climber plants in Dhaka city. Climber plants are becoming more common in subtropical monsoon countries, notably Bangladesh, allowing them to gather resources quicker than trees. By evaluating the climber plants and their species, which affect the environment in a quantitative and qualitative way, there is variation among more productive leaves with faster turnover and more costly leaves with slower turnover, as well as variance linked with wood and hydraulic features. Additionally, classifying the climber plants, alternatives at the stem and leaf, durability, effectiveness, supporting mechanism, and estimating their contributions throughout the years and how they will be beneficial.

1. Introduction

Bangladesh has a high plant diversity with many herbs, shrubs, and trees due to its fertile alluvial terrain and mild climatic conditions. Bangladesh's climate belongs to the subtropical monsoon area, which limits the nature of its vegetation. Dhaka city, depending on its ecosystem makeup, is home to 90 plant species from 73 genera and 42 families. Quantitative interrogation of parameters that may impact these plant species revealed increased relative density, frequency, and abundance. Native and alien species, notably climber plants, account for about 3% of the total. (Uddin, Shomrat. 2021).

Plant species variety in urban environments has garnered significant attention in recent decades, with the city being richer than the suburbs due to increased habitat variability and the presence of climbing plants. It was discovered that, in floristic terms, as the city expands with contemporary facades of various sorts, trees of various types are being planted, and climbing plants are being limited due to a lack of awareness. As a result, it has become a cause of concern for Dhaka's ecology. (Rahman, Rubel, 2021). This case study will discuss the necessity of climber plants in Dhaka city, integrating with nature through its supporting mechanisms.

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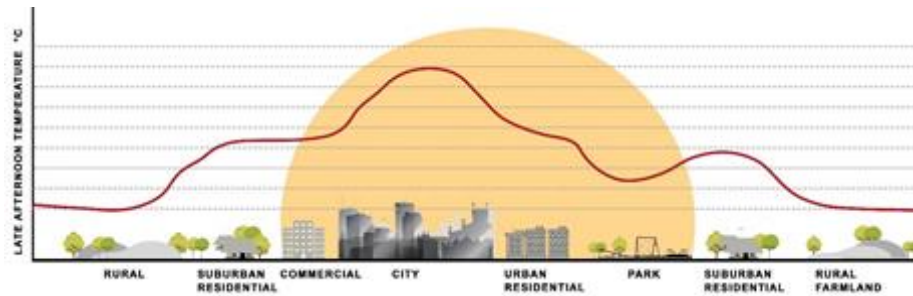


Figure:01 Dhaka City could benefit from implementing climber plants on vertical structures to mitigate Urban Heat Island effect, which can raise temperature by 5 °C to 10 °C.



Figure:02 Strength and weakness of climber plants

2. Objective and Scope for the research

The core objectives are as follows-

- Study of existing species and classification of different types of climber plants in Dhaka city.
- Implementation of climber plants to make the concrete jungle more green
- Determining the dominant climber plants which will be effective for building facades.
- Recommendation of supporting mechanism and management of climber plants in Dhaka city.

3. Literature Review

Climbers are plants that are unable to grow on their own to any significant height. There are both herbaceous and woody climbers, with the latter being known as lianas. (Putz, Mooney. 1991). Usually, the climbers need the support of their body as their stems are not self-supporting and weak.

The peculiarity of climbing plants captivated 19th century luminaries such as Charles Darwin (1867). Despite their obvious utility, climbers have been

disregarded in the world of plants, particularly in tropical places, to summarize it all by Jacobs (1976), “The ecology of lianas is virtually blank.” However, the ecological significance of lianas in tropical places such as Bangladesh has only recently been identified and used. [1].

Climbers have evolved a wide range of climbing habits, and the presence of species that become epiphytes when their climbing stems lose contact with ground or make contact with earth via their long roots characterizes climbing plants. Climbers belong to over 130 plant families [2]. In tropical areas, vine species may account for more than 40% of species diversity. Climbing plants are divided into two groups by botanists: Bines and Vines. (Putz, 201200) [3].

All growth forms are essentially ‘ecological’ in design. There are a variety of adaptive restrictions that influence the mechanical structural growth forms, but vines can be mostly considered as a climber plant for being self-supporting.

- Some general characteristics of climbers are: [3]
1. Long, flexible stems with numerous soft tissue that allow for fast growth and vegetative regeneration;
 2. A vascular system that is extremely effective in water conduction but lacks internal structural support. Xylem vessels are frequently large and lengthy, with high hydraulic conductivities;
 3. Distinctive cambial activity results in stem with complicated tissue configurations, as observed in stem transversal slices;

Dhaka city being located in tropical region the limitation of climber plants is very limited to be used in the structural forms. However, the climbers are low-maintenance plants that don't require fertilizer or pesticides and are easy to grow. Therefore, the study shows the necessity of the climber plant in Dhaka city being beneficial ecologically, through observation, survey and qualitative data collection.

Case study

3.i. Ramna Park

In a study of Ramna Park, the abundance of liana vines has doubled in recent decades. As a result, these rapidly expanding vines are increasingly providing shades acting as canopies, having different kinds of leaf size and improving the amount of oxygen in the atmosphere. Plants growing through the help of walls, trees, trellis, steel etc. are added throughout the years (Kabir, 2009). The architects and the planners of Ramna Park have experimented with different kinds of trellis for the climber plants to grow and give a more aesthetic look to the environment. [6]



Fig:03 Ramna Park, Pakhi Square, Dhaka, Bangladesh

Ramna Park, with an area of 12 acres, is Dhaka’s largest and oldest urban open space. The Ramna area underwent several stages of ecological transition, providing habitat for 71 species of flowering trees, shrubs, and perennials, 36 kinds of fruits, 41 species of forestry, and 6 species of climbing plants.



Fig: 04 Ramna Park, Near Intercontinental Hotel Dhaka, Bangladesh



Fig: 05 Ramna Park, Infront of Rose Garden, Dhaka, Bangladesh.

The space in the figure acting as a threshold, has been developed throughout the time of 2004. Here climber plants are introduced with the help of net like trellis to give it more aesthetic look. This space has been created so that people can enjoy the view of rose garden next to it along with the climber plants surrounding the threshold.

Climber plants such as Catclaw and Lata Parul are installed mostly in the jail net. It is placed in front of the threshold to make it more welcoming.

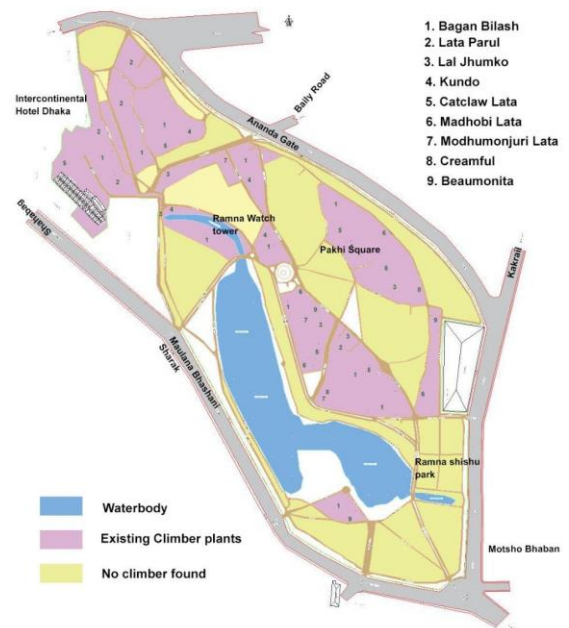


Fig: 06 Map of Ramna Park, Dhaka, Bangladesh

The Map study shows the existing climber plants and non-existing climber plants in the park. It also shows where the particular climber plants are located.

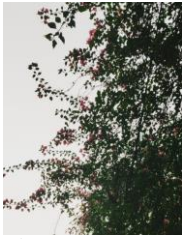


Fig: 07
Bagan Bilash



Fig: 08
Catclaw Lata



Fig: 09 Lata Parul



Fig: 10
Ornamental plants

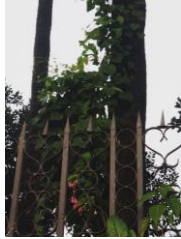


Fig: 11
Latabot plants



Fig: 12
Madhabilata

3. ii. Dhaka University

The Dhaka University campus serves as a heaven for both local and alien plant species. (Uddin and Hassan, 2016). Trees of various kinds, together with shrubs, herbs and climbers, are the primary component of plant variety. Herbs account for 37% of the species, trees for 29%, shrubs for 21%, climbers for 11%, epiphytes for 2%, and parasites for 0.2%. Malatilata, Bagan bilash, Lata parul etc. are found inside the campus. [7]



Fig: 13 Charukola, Bokultola, Dhaka University Campus, Bangladesh.

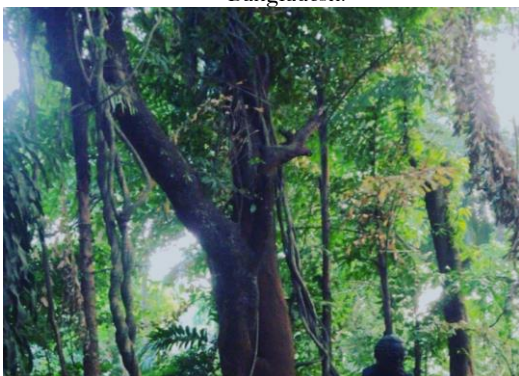


Fig: 14 Charukola, Dhaka University Campus, Bangladesh.

3. iii. Building Observations

Some vertical structures tend to use large climber plants to bring more aesthetic look for the buildings. It can be of great use in oxygen production as well as to avoid urban heat island effect.



Fig: 15 Tangail Saree
Kutir, Baily Road



Fig: 16 Rd A 13 Dhanmondi,
Dhaka

3. iv. Supporting Mechanism

The climber plants which tend to grow tall need supporting mechanisms, to avoid plant breaks and fall. These supporting mechanisms can come in various sizes and shapes and types. For example- Trellis, Jali, Arches, Cages, Weaves, Wall etc.



Fig: 17- Jali / Trellis



Fig: 18 - Grills/ cages

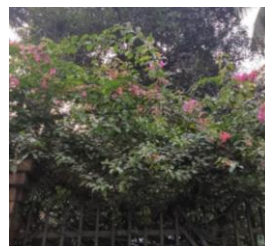


Fig: 19- Fencing



Fig: 20- Wall

Using such supporting mechanisms for climber plants, it will make the plants stand effectively with less management. Plants like twines or strips can wrap around

the objects and grow fast. It can give different types of shapes and aesthetic look in the environment.

3. v. Important use of Climber plants

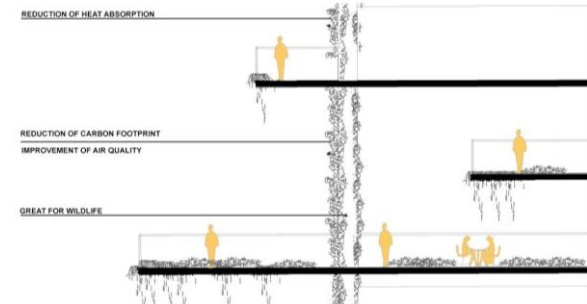


Fig: 21 Importance of climber plant in a vertical building.

As Dhaka city is becoming more vertically dependent, fewer people have access to garden space. In the city’s inner neighborhoods, the deployment of creative urban gardens such as rooftop farms, balcony herb gardens, and “jungle-like” walls.

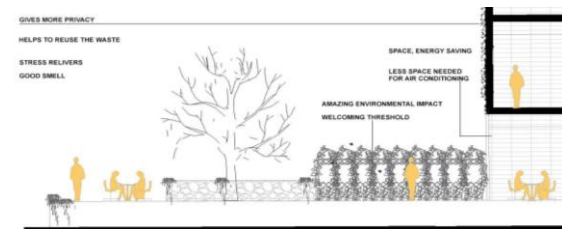


Fig: 22 Climber plants not only build up the environment vertically and horizontally, it also beautifies and detoxifies the interior space.

4. Methodology

The research employed a systematic methodology to investigate the ecological advantages of climbing plants in Dhaka City’s urban landscape and their potential contribution to environmental improvement. Two primary study areas, Ramna Park and Dhaka University Charukola Campus, were selected for comprehensive field observations to identify and classify different types of climber plants based on growth habits and support requirements. Visual documentation of spatial characteristics, such as shade, lighting and visibility, aided in understanding the role of climber plants in providing canopies and enhancing the atmosphere. Quantitative data on climbing plant abundance and distribution were collected through field surveys and secondary sources, enabling the determination of their percentage in the city compared to other plant types.

The research analyzed the prevalence and impact of climbing plants, particularly their significance in providing structural support and contributing to the city’s greenery. The study explored the integration of climbing plants with nature and surrounding landscapes, emphasizing their environmental benefits, including energy saving, cooling effects, and improved air quality. Based on the findings, the research provides valuable recommendations for strategically implementing and managing climbing plants in Dhaka City to promote sustainable urban greenery and address ecological challenges.

The systematic methodology facilitated a comprehensive examination of climbing plants’ ecological significance in Dhaka City, yielding valuable insights into their potential role in enhancing the urban environment. It offers a solid foundation for future urban planning initiatives, with the potential to create a greener and more sustainable urban landscape in Dhaka.

5. Finding and Analysis

The study of data collection of climber plants around Dhaka city was mainly based on field surveys. Photographs and the surveys assisting the present conditions and existing climber plants are demonstrated here.

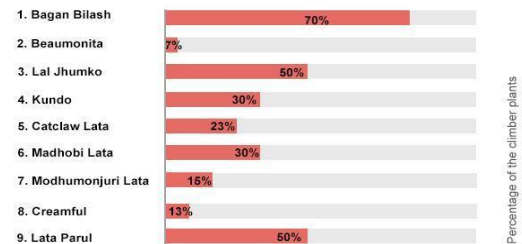


Fig: 23 Percentage of number of climber plants found in Ramna Park.

Bagan Bilash is commonly planted around the park and its surrounding areas. Where on the other hand Lata Parul, Lal Jhumko, Madhabilata, Catclaw Lata are commonly used in jali, fencing and other supporting mechanisms.

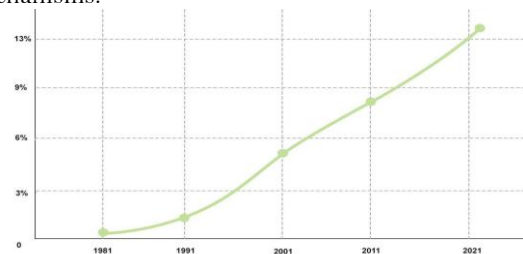


Fig: 24 Expansion of implanting climber plants in Ramna Park

The positive trend in the growth and density of climber plants, indicates their successful integration in urban environment. As a result, this upward trajectory suggests the effectiveness of effort toto promote greenery and address ecological challenges in the city.

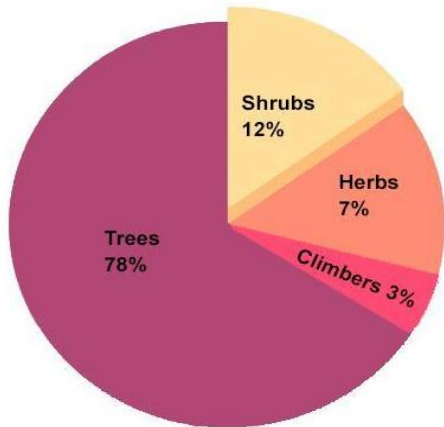


Fig: 25 Dhaka city's percentage of climber plants according to the Dhaka City.

The percentage of the climber plants in Dhaka city is so low, it is limiting the knowledge of better management of the environment and building facades. Even if the growth of climbing plants has evolved throughout the decades, there is still a lack of knowledge of their necessity in Dhaka city. When compared to self- supporting plants, the growth pattern of lianas has limited structural support, with greater resources given to canopy expansion, reproduction, and stem and root elongation. Climbers exhibit novel morphological climbing mechanisms, stem architecture, and vegetative regeneration; stem tissues frequently include a high number of parenchymatous cells, with the vascular cambium exhibiting abnormal development due to consultant cambial activity. (Ali, Isah, Mujib, 2016).



Fig: 26 Height of climber plants which can be implanted on supporting mechanisms such as trellis, fencing, walls etc.



Fig: 27 Height of climber plants which can be implanted on thresholds, entrance gate etc.



Fig: 28 Height of climber plants which can grow to vertical building on the basis of its requirements.

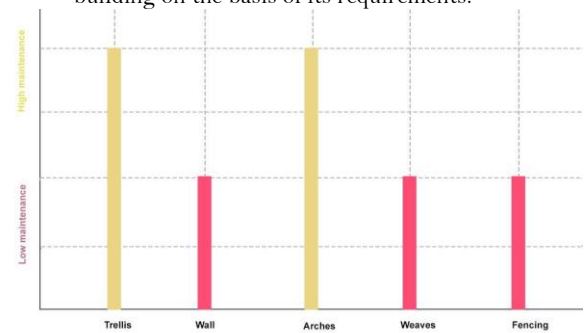


Fig: 29 Maintenance of the supporting mechanisms for climber plants.

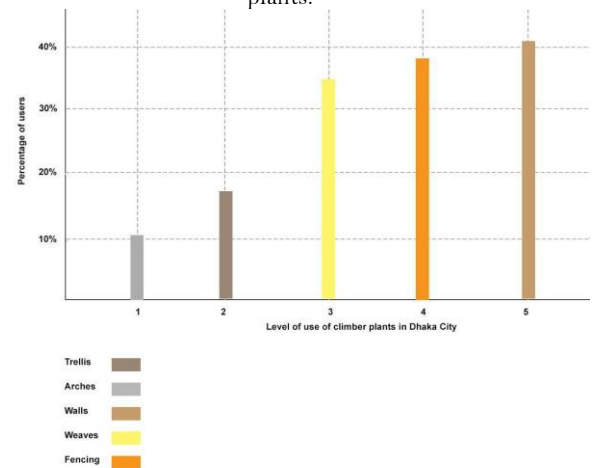


Fig: 30 Trellis, Arches, Walls, Weaves, Fencing used in most of the buildings of Dhaka city

Table 01

Climber plant species with bangla name, height, leaf type, growth system.			
Bangla Name	Height	Leaf type	Growth system
Roti	10-20 ft	pinnate-leafleted leaves	twines around trees, grows in fairly dry regions at low elevations.
Malalilata	8-25 ft	elliptical acuminate tip, rounded base	cultivated and naturalized in tropical areas
Kaikhepui	20 ft	does not twine, nor have tendrils or aerial roots, pruned into a shrub form	if pruned it can sprawl, cultivated as a house plant
Harkara	8-25 ft	elliptic to obovate leaves	yellow flowers are terminal in summer, grown as an ornamental plant, it has become a weed in several countries
Anantalata	via tendrils 25 ft	perennial, vine with pink and white flower	fast-growing climbing vine that holds on via tendrils
Guguli	8-25 ft	perennial climbing vines	grown in a warm greenhouse. Elsewhere, it is grown on arbours, pergolas, walls, or trees. It is often grown professionally under glass in a loam-based potting compost
Ishwarmul	5-10 ft	leaves of plants are food for insects	found in open lowland thickets, climbing over bushes and trees
Kanthalichampa	18-30 ft	simple, alternate, petiolated	cultivated in gardens throughout the country for its fragrant flowers, propagated through stem cutting
Satamuli	3- 4600 ft	pine-needle-like phylloclades that are uniform and shiny green	constantly rises in 3-6 ft, used for harvesting also
Bagan bilas	3-36 ft	Leaves are ovate shaped	woody vine like plant, using its spike, it can easily entangle other plants or fence.
Koikephul	10-25 ft	leaves are willow-like, linear-lanceolate, and glossy green in color	Flowers bloom from summer to fall, drought resistant and tolerant.
Phutka	3-6 ft	green leaves of spinach	cultivated during March and april used as food
Harjoralota	10- 60 ft	simple tendrils, born opposed to leaf	large branched climber's leaves are simple, 3-6 cm long and 2-7 cm wide, fleshy, cordate, 3-5 lobed, toothed, acute to obtuse at apex, petioled, glabrous on both surfaces, opposite.
Bleeding heart	3-9 ft	3-lobed compound leaves on fleshy green to pink stems	In a moist and cool climate, it will grow in full sun, but in warmer and drier climates it requires some shade
Aparajita	3-9 ft	elliptic, obtuse leaves	grown as an ornamental plant and as a revegetation species ,requiring little care when cultivated
Kongia	3-4 ft	leathery leaves are thick with an undulating leaf edge	grows well in full sun with some shade at mid day in deep fertile moist soil
Suprialu	3-4 ft	variable, ovate, cordate or hastate with round basal lobes	forming leafless panicles cultivated in the tropical region
Malialu	3-60 ft	perennial vine with broad, alternate leaves	edible and cultivated as a food crop, grows extremely quick roughly 8 in. per day
Gila	6-25 ft	leaves pinnately compound, pinnae 2 pairs, leaflets 3-4 pair	grown as straight lightly curved rising each stem 6-8 cm
Ayapana	3- 10 ft	long slender leaves	Leaves contain a volatile oil, ayapana oil, 1.14%, ascending, slender perennial occuring rich source of chemical
Latabot	8-13 ft	small thin leaves, oval, cordate, asymmetrical, with opposite veins	often used in gardens and landscapes where it covers the ground and climbs up trees and walls
Ulatchandal	3- 13 ft	modified leaf-tip tendrils, lance shaped, alternately arranged	cultivated as garden plant may vary from these wild-type characteristics
Jhep gamari	3-15 ft	Evergreen spiny Shrub	grows full sun or partial shade, preferring a moist but well-drained soil
Chera pata	3-6 ft	epiphytic, leaves petiolate, glabrous, ovateelliptic, lanceolated	grows 10-16 cm and used as medicine
Mislealeu	10-25 ft	smooth-edged, oval, evergreen leaves	grow on a wide range of host trees, some of which experience side effects including reduced growth, stunting, and loss of infested outer branches
Deshi kalmi	3-9 ft	heart-shaped or 3-lobed leaves	grown as an ornamental for its attractive flowers, but it is invasive in many regions of the world
Beguni kalmi	6-9 ft	heart-shaped and the stems are covered with brown hairs	predisposed to moist and rich soil, but can be found growing in a wide array of soil types
Gatephul	3-10 ft	lobes on each side of the leaf	popular as a medicinal plant and later as an ornamental, naturalised in many tropical areas
Jui	6-9 ft	borne in opposing or alternating arrangement, simple, trifoliolate, or pinnate formation	tropical and warm temperate regions, widely cultivated for the characteristic fragrance of their flowers
Chameli	6-12 ft	leaves are opposite, 5-12 cm long, pinnate with 5-11 leaflets	grow in shrubs that are semi-spreading, have green, woody, pubescent stems that are either angular or grooved shape
Chameli	6-12 ft	leaves are opposite, 5-12 cm long, pinnate with 5-11 leaflets	grow in shrubs that are semi-spreading, have green, woody, pubescent stems that are either angular or grooved shape
Bali	1.6-9.8 ft	evergreen vine or shrub reaching, leaves are ovate	widely grown throughout the tropics, ornamental plant and for its strongly scented flowers
Dundul	6-10 ft	evergreen, leaves like spinach	best grown with a trellis support, requires much heat and much water to thrive.
Modhu Ionicera	10-25 ft	elliptical with an acuminate tip and a rounded base	cultivated and naturalized in tropical areas
Rasun lata	6-10 ft	evergreen vine or shrub reaching, leaves are ovate	vine grows further and become thicker, starts flowering within the month
Kakrol	4- 10 ft	Leaves are petioled, 4-8 cm long and 3-6 cm wide, broadly ovate, base cordate, margin denticulate, apex acute.	grows in tropical areas, mainly in house garden, exported and locally used
Gandhaveduli	3-9 ft	leaves and stems provide sulphur chemical	tropical and warm temperate regions, widely cultivated for the characteristic
Laljumko lata	3-10 ft	2 layers of long leaves smaller in width	grows in tropical and warm temperate in dry regions
Tankal	3-7 ft	perennial vine, tendrils are borne in leaf axils, and have a red or purple hue when young	cultivated commercially in tropical and subtropical areas for its sweet, seedy fruit.
Mela jhumka	3-18 ft	leaves are simple, alternate, entire to three-lobed	tropical and warm temperate regions, widely cultivated for the characteristic
Nilmoniota	3-18 ft	leaves are elongated, creeping shrub of the Petrea genus Verbenaceae	The indigo species is said to be in danger of extinction soon and is considered safe in Bangladesh.
Pan	3-9 ft	evergreen, glossy heart-shaped leaves and white catkin.	needs a compatible tree or a long pole for support, requires well-drained fertile soil.
Chui	3- 9 ft	leaves are oval-shaped and about 2 to 3 inches long	cultivated near house garden, used as spice food ingredient
Goalmorich	3-9 ft	leaves are oval-shaped	extensively cultivated there and in other tropical regions.
Sunat	6-10 ft	leaves are oval-shaped	tropical and warm temperate regions, widely cultivated for the characteristic

Table 02

Climber plant species with bangla name, height, leaf type, growth system.			
Bangla Name	Height	Leaf type	Growth system
Madhuriata	3- 15 ft	Leaves are glossy green, petioled, elliptic, 10-15 cm long, opposite, leathery.	It is grown in parks, gardens and homestead for flowers. It needs strong support for trailing or climbing.
Money plant	10-30 ft	leaves are alternate, heart-shaped, entire on juvenile plants, but irregularly pinnatifid on mature plants	In temperate regions, it is a popular houseplant with numerous cultivars selected for leaves with white, yellow, or light green variegation
Tusafido	1-3 ft	Leaf solitary, cataphylls 2-10 cm long, pale carmine, leaf blade trifoliolate	grows in evergreen tropical lowland
Kurniata	1-3 ft	leaves alternate, petiole stout, always narrowly shaeting below the middle	grows in hill tracts and dry regions
Lalguranialu	6-15 ft	evergreen leaves and elongated	lowland areas in the moist tropics, found at elevations from 250 - 1,200 metres, growing in regions where there is a distinct dry season.
Baroslatakachu	30-60 ft	leaf forms are often much more lobed than the juvenile forms usually seen	often grown as house plants, usually only in the juvenile foliage stages
Sarupati lata	1-6 ft	leaves in whorls of four or more, not three.	found in many temperate and subtropical regions throughout the world
Gulanca	3-15 ft via support	Leaves are simple, alternate, and exstipulate with long petioles	indigenous to tropical regions of the Indian subcontinent, grows will top of building facade
Vanila	1-3 ft	leafless	growing epiphyte at elevations of 20 to 500 meters with a somewhat flattened, green, angular, fleshy stem
Angur	39-49 ft	leaves are alternate, palmately lobed, deciduous, with 3 to 5 pointed lobes	grow the leaves, flowers, tendrils and between-core and where to train future buds. During their hardening, the twigs become woody branches that can reach a great length
Lotaam	10-60 ft	Leaves are elliptic, narrowly ovate-round or obovate-elliptic	grows in lowland in wet tropic regions
Malati	6-15 ft	entire, elliptical, opposite, 8 cm long and 4 cm wide, apex acute	grown on wall and railing. A kind oil (Chameli oil) is extracted from the fruit and it is used in various therapeutic purposes
Modhumonjuri Lata	3-25 ft	Leaves are green, rough, opposite, ovate, apex acuminate, edge	grown in garden as ornamental flower plant in Bangladesh. Leaves, roots and seeds are used in skin disease
Beaumontia	3-30 ft	large leaves can reach 9 inches long and are a glossy green color with prominent veins	grows in our nursery crops, as well as in the nursery's garden and those in other gardens
Catclaw Lata	3-66 ft	Leaves are dark green, opposite and bifoliate.	grow alone or in groups of two or three. Long primary roots extend beneath the soil surface
Madhobi Lata	3-15 ft	Leaves are glossy green, petioled, elliptic, 10-15 cm long, opposite, leathery.	grows in hilly areas and gardens in tropical region
Lata Parul	2-9 ft	evergreen climbing shrub, elliptical-oblong	tropical rainforests. Prefers a moisture-retentive, humus-rich soil
Creamful	3-80 ft	Leaves are elliptic, narrowly ovate-round or obovate-elliptic	tropical and warm temperate regions, widely cultivated for the characteristic

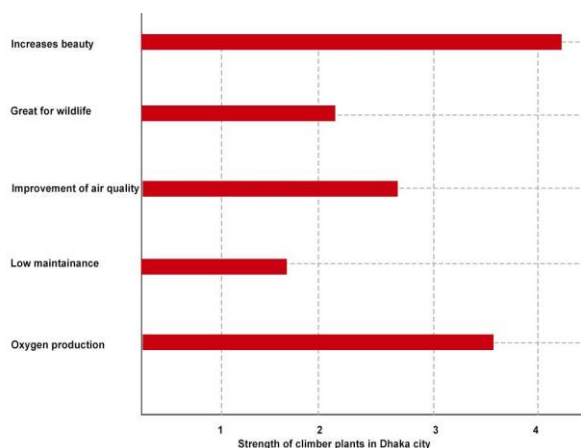


Fig: 31 Strength of climber plants in Dhaka city.

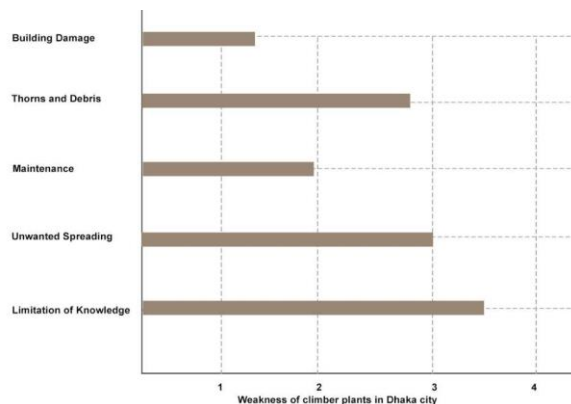


Fig: 32 Weakness of climber plants in Dhaka city.

6. Limitations of the Research

The study's shortcomings were a small field survey area; however, if additional fields were examined, the findings would be more credible. The climbing plants identified at Ramna Park and Dhaka University shared many traits, making it difficult to tell them apart in certain cases.

7. Conclusion

To conclude the observation, the ecological importance of climber plants in Dhaka city plays a vital role in terms of better environment opportunity and building facade responding towards the climate of subtropical monsoon region. The paper Showed that climber plants may be very important in environment development with lots of scopes without limiting one's knowledge, learning more about climber trees through data analysis and existence along with their characteristics. As a result, the architects/planners may know which climber plants to use in future designs. Unlike other trees, climber plants simultaneously may need some maintenance, as might vanish soon from the culture of tropical regions.

Hence it is important to approach the necessity steps to bring back the culture of climbing plants, extending and integrating them with nature. Therefore, Dhaka city may have some more good examples of a climber plants environment in the upcoming future through this paper.

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