The Potential of *Thunbergia spp.* as a Green Facade Plant and Its Invasive Impact on Urban Biodiversity in Colombo, Sri Lanka

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Abstract:

The incorporation of green facades within urban architecture offers multifaceted benefits, including thermal regulation, air purification, carbon sequestration, and enhanced aesthetic value. Thunbergia spp., particularly Thunbergia grandiflora and Thunbergia fragrans, are widely utilized in tropical regions for rapid vertical greening due to their vigorous growth and dense foliage. However, the aggressive propagation and invasive potential of Thunbergia raise significant ecological concerns. This study critically examines the use of Thunbergia spp. as a green building covering plant in Colombo, Sri Lanka, with a focus on its growth performance, environmental adaptability, and potential adverse impacts on urban biodiversity. The research employs a mixed-methods approach comprising field experimentation, ecological impact assessments. The results indicate that while Thunbergia offers considerable. ecosystem services in the built environment, it poses substantial risks to native flora due to its invasive behavior. This paper concludes with evidence-based recommendations for the controlled application of Thunbergia in urban greening initiatives.

Keywords: Green Facade, Invasive species, Thunbergia spp, Urban Heat Island Effect, Sri Lanka

Introduction

Urban centres such as Colombo are experiencing escalating challenges associated with climate change, urban heat island (UHI) effects, declining green cover, and increasing biodiversity loss. Green infrastructure, including green walls and facades, is widely promoted to counteract these adverse trends (Perini & Rosasco, 2013).

The Sri Lankan government and private sector have prioritized green building initiatives as part of broader climate resilience and sustainable development strategies (Green Building Council of Sri Lanka, 2022). Green buildings, incorporating energy-efficient designs and green infrastructure such as green facades and walls, help reduce indoor and outdoor temperatures, lower greenhouse gas emissions,

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and improve urban microclimates (World Bank, 2023). The selection of suitable plant species is critical to ensuring both the ecological compatibility and sustainability of these green systems.

Thunbergia spp., renowned for their rapid growth, resilience, and aesthetic appeal, are increasingly employed in Colombo's green building designs. However, the ecological trade-offs of introducing potentially invasive species into urban ecosystems remain underexplored in the Sri Lankan context. Globally, *Thunbergia grandiflora* and *Thunbergia fragrans* have been classified as highly invasive, capable of outcompeting native flora and altering local ecosystems (GISD, 2023).

This study aims to critically assess the dual role of *Thunbergia spp.* as a green facade plant and an invasive species, particularly focusing on its potential to disrupt the urban biodiversity of Colombo.

Research Objectives

- To assess the invasive potential of *Thunbergia* spp. and its impact on biodiversity of native plants within urban green spaces in Colombo.
- To evaluate the growth performance of *Thunbergia* species under the urban environmental conditions of Colombo.
- To assess the dual role of *Thunbergia* spp. as a green facade plant and an invasive species

Literature review

Green Facades and Urban Ecosystem Services

Green facades are associated with numerous ecological and environmental benefits, including reducing building surface temperatures, improving air quality, sequestering carbon dioxide, and enhancing urban aesthetics (Manso & Castro-Gomes, 2015; Bakhshoodeh, 2023). The selection of plant species must balance rapid coverage potential with minimal ecological risk. They help lower building temperatures by providing shade and supporting evapotranspiration, which reduces the need for air conditioning (Bakhshoodeh, 2023; Perini & Rosasco, 2013). In recent studies, green facades and living walls have been shown to improve urban air quality by trapping particulate matter, reducing ambient temperatures through shade and evapotranspiration which helps to mitigating urban heat island effects, managing stormwater runoff, and offering habitat refuge for insects, birds, and other native species (Vélez-Landa et al., 2024).

Growth Characteristics of Thunbergia spp.

Thunbergia grandiflora exhibits rapid climbing behavior, facilitated by twining stems, extensive root systems, and anatomical adaptations supporting mechanical strength and water transport (Galapon et al., 2020). The species propagates vegetatively from stem fragments, contributing to aggressive expansion (Phusantisampan et al., 2021). These traits, while beneficial for vertical greening, also underpin their invasive potential. They demonstrate rapid vertical coverage and can thrive under various soil and moisture conditions, making them suitable for green facade applications. Their vigorous growth and dense foliage provide effective shading. (Phusantisampan et al., 2021; Bakhshoodeh, 2023).

Invasiveness and Ecological Risk of Thunbergia spp.

Globally, *Thunbergia spp.* is recognized for its aggressive colonization in disturbed and unmanaged habitats. They are capable of forming dense mats that suppress native vegetation (GISD, 2023).

Thunbergia is a genus of perennial climbing vines native primarily to tropical regions of Africa and Asia, with *Thunbergia grandiflora* specifically originating from India and Southeast Asia (Britannica Kids, n.d.; WIKTROP, 2019). In Sri Lanka, *T. grandiflora* was introduced as an ornamental plant and has since become naturalized across the country, it's now considered as an exotic and potentially invasive species in Sri Lanka (Flora of Sri Lanka, 2025; SL Flora, 2014).

Thunbergia spp. can outcompete native flora, reduce biodiversity, and cause physical damage to urban infrastructure. Their ability to spread via seeds and vegetative propagation poses ecological risks, especially in fragmented urban habitats where native species are vulnerable (Williams, 2021; Reef Catchments, 2011; Tomorrow.City, 2023).

Application of Thunbergia spp. in green facades

Thunbergia grandiflora is widely applied in tropical urban green facades due to its rapid growth and dense canopy. It is commonly grown on braided steel or trellis supports to maximize wall coverage. However, its shading can reduce natural lighting by 20–80%, which requires consideration in architectural design. Controlled use and regular maintenance are essential to prevent invasive spread and structural damage (Phusantisampan et al., 2021; Bakhshoodeh, 2023).

Colombo's Urban Biodiversity

Colombo hosts a mosaic of urban green spaces, including wetlands, roadside vegetation, home gardens, and parks. The city's biodiversity is increasingly threatened by habitat fragmentation, pollution, and the introduction of exotic invasive species (IUCN Sri Lanka, 2020).

Methods

This study utilized a mixed-methods approach combining primary data from field observations, findings and secondary data derived from an extensive literature review. This integrated methodology was designed to comprehensively evaluate the growth performance, environmental adaptability, and invasive potential of *Thunbergia spp.* used as green facade plants in Colombo, Sri Lanka.

Population and Sampling

The study population comprised within Colombo city where *Thunbergia grandiflora* is predominantly employed. Sampling sites were purposely selected based on the presence of *Thunbergia* on building facades, public parks, institutional premises, and riparian zones adjacent to urban infrastructure, these sites were chosen to capture different contexts in which people interact with the environment, where awareness of the *Thunbergia* plant remains limited. In addition, the selected sites represent a diverse range of urban microclimates and land-use types, which is essential for a comprehensive evaluation of the plant's growth performance and invasive potential in a urban context. Totally 5 sampling sites were selected from different areas of Colombo. Location of the sites are

S1 - Faculty of Engineering Technology, Open University of Sri Lanka

S2 - From a Home Garden at Navinna Area

S3 - From a residence at Madiwela area

S4 - A commercial Building at Union Place, Colombo

S5 - LadyJ, Maharagama

Field observation and data collection

Field visits were conducted throughout a week (Starting from the 18th of May to the 24th of May 2025) to gather primary data from the 5 selected sites. The following list represents the type of data that was collected from the site.

8. Observed growth performance
9. Sunlight exposure
10. Soil type
11. Soil moisture level
12. Maintenance level
13. Coverage density
14. Evidence of spread
15. Interaction with natives
16. Pest /Disease incidents

Assessment of Data

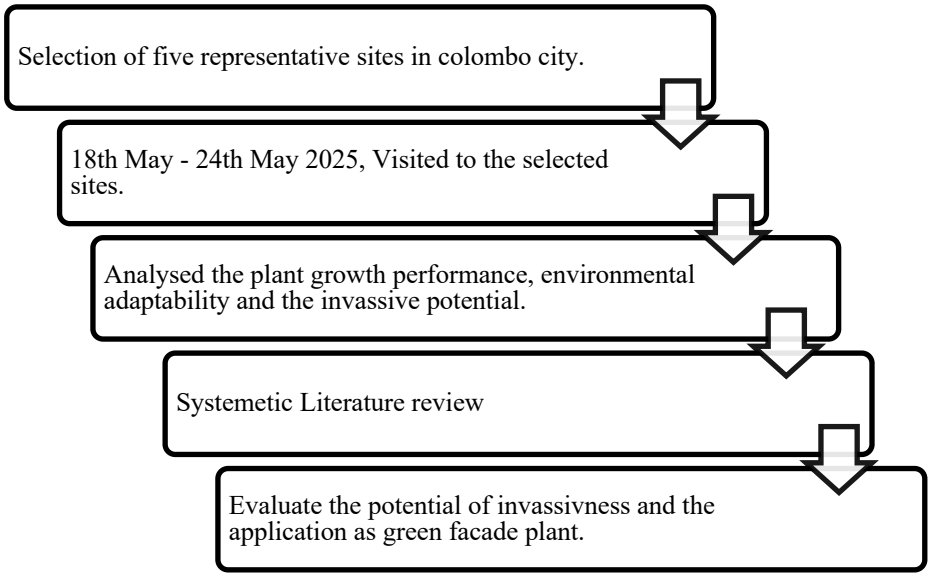
Collected data from the sites were comprehensively analysed to assess environmental adaptability, growth performance and invasive potential of Thunbergia *grandiflora* plants at the study areas.

Data integration and analysis

To evaluate potential of *Thunbergia spp.* as a green facade plant and its invasive impact on urban biodiversity, field observations and the literature review information were mapped.

Figure 08

Flow of the methodology



Results and Discussion

Table 010

Observed Morphological Characteristics of Thunbergia grandiflora

	Figure 02	**Description**
Leaves	**Figure 02a.** 	Simple, opposite, petiolate Blade shapes vary from ovate, ovate-elliptic to hastate margins entire to dentate. Scabrous surface

Flowers	**Figure 02b.** 	Large, funnel-shaped flower, with 5 lobes Corolla tube cylindrical at the base then widened. Observed colour blue Size varies from 6 – 8 cm
Stem	**Figure 02c.** 	Young stems are smooth and flexible Diameter is around – 1.5cm Cross section appeared like not an exact round slightly square shape

Table 011

Observed Characteristics of Thunbergia grandiflora across the Representative Sites

Figure 03	**Observation**

S1

They planted for the ornamental purpose now those plants spread over the electricity cables and walls

S2

This *Thunbergia grandiflora* plant spread all over the curry leaves plant.
Due to the less sunlight curry leaves plant was wilted.

S3

They planted with the purpose of getting shade and an aesthetically appealing look.
Now it's spreading over the remaining wall area.

S4

Entire wall space covered with *Thunbergia grandiflora* plants

S5

The shopping complex is covered with several plants for the greenery and cooling.

Thunbergia grandiflora plant was used as a green cover for the wall.

The *Thunbergia* plant is growing over the curtain creeper plant

Table 012

Comparison of all five-site data and observation

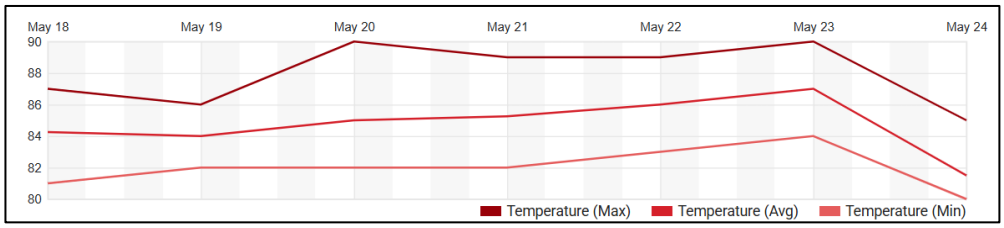
	S1	**S2**	**S3**	**S4**	**S5**
Observed growth performance	Vigorous	Vigorous	Vigorous	Moderate	Moderate
Environmental adaptability					
Sunlight exposure	Full sun	Full sun	Full sun	Partial shade	Partial shade
Soil type	Loamy soil	Sandy soil	Loamy soil	Mixed soil	Mixed soil
Soil moisture level	Moist	Moist	Moist	Wet	Dry
Maintenance level	Low	Low	Medium	High	Low
Coverage density	Medium	High	High	Moderate	Moderate

Invasive Potential						
	Evidence of spread (present beyond boundary)	Yes	Yes	Yes	No	Yes
	Interaction with natives	Competitive shading	Over growth	Competitive spreading	None	Over growth
	Pest /Disease incidents – on Thunbergia	Low	Low	Low	Low	Low

Analysis of environmental adaptability of Thunbergia grandiflora

Figure 09

Average temperature data of Colombo throughout the experiment period



Source: https://www.wunderground.com/history

According to the climate data throughout the period of the experiment as shown in the Figure 02, Colombo experienced a range of temperatures (maximum – 32.2 °C, minimum – 27 °C)

As illustrated in Table 3, *Thunbergia* exhibited a strong degree of environmental adaptability, as evidenced by its ability to establish and persist across a range of urban site conditions. The species performed best under full sun and moist, well-drained soils, but also maintained moderate growth and coverage in partial shade and mixed soil environments. Its presence in both low and high maintenance settings, further highlight is its resilience and low maintenance requirements under favourable conditions. *Thunbergia* demonstrates flexibility in adapting to varying urban microclimates.

Assessment of invasive potential of the Thunbergia grandiflora plants

The invasive potential of *Thunbergia* is clearly evidenced by its ability to spread beyond intended boundaries at four (S1, S2, S3, S5) out of five sites, regardless of differences in soil type, maintenance level, or coverage density. Interactions with native vegetation were predominantly competitive, with observations of shading, overgrowth, and spreading at most sites, this suggests that in most conditions, *Thunbergia* can outcompete native vegetation. further underscoring its aggressive growth habit. Pest and disease incidents were uniformly low, indicating that biotic resistance is not a significant limiting factor for this species. Collectively, these findings highlight the robust invasive capacity of *Thunbergia* in urban landscapes.

Assessment of the dual role of Thunbergia through a literature review

Thunbergia grandiflora is a fast-growing climbing vine, which is widely cultivated for its attractive flowers and dense foliage (Tinio and Combalicer 2021). While *Thunbergia* species provide aesthetic and microclimatic benefits, such as shading and cooling effects in urban green facades, their ecological impacts warrant careful consideration. The dense foliage of *T. grandiflora* can effectively reduce surface temperatures and building energy demand, as noted in urban landscaping studies (Wong et al., 2010; Perez et al., 2014). However, its aggressive growth habit allows it to smother native vegetation, leading to biodiversity loss in invaded areas (Global Invasive Species Database, 2025). The species forms impenetrable stands that exclude native plants.

T. grandiflora is listed among the most problematic invasive plants in Australia, capable of covering large areas and outcompeting native flora (GISD, 2025). Its rapid growth, extensive root system, and ability to spread vegetatively make it difficult to control once established (Department of Primary Industries, Queensland, n.d.). Similarly, *T. alata*'s functional traits, including its symbiotic fungal associations and pollinator interactions, contribute to its invasiveness. (Quijano-Abril et al., 2021).

Management strategies must therefore balance the species utility in urban greening with the risks of ecological disruption. Understanding the physiological and ecological traits that underlie *Thunbergia*'s success is crucial for developing effective control measures and preventing further spread (Quijano-Abril et al., 2021; Tinio & Combalicer, 2021).

Conclusion

Thunbergia grandiflora demonstrates a high range of adaptability and resilience, characterized by vigorous growth, attractive flowers, dense foliage and low susceptibility to pests and diseases, making it a highly suitable species for urban green façade applications. Its robust growth contributes positively to urban aesthetics and microclimate regulation. However, the species' propensity to form dense monocultures presents notable ecological concerns. It aggressively smothers native vegetation and outcompetes understory plants, thereby impeding the natural regeneration and seedling establishment of indigenous flora negatively, it causes stress to the natural vegetation. This competitive dominance alters ecosystem dynamics and imposes stress on native plant communities, potentially reducing biodiversity within urban green spaces. While *Thunbergia grandiflora* offers significant benefits for the urban greening and reducing the urban heat island effect, its invasive tendencies necessitate careful management and integration into green façade systems to mitigate adverse impacts on native ecosystems. Balancing functional advantages with ecological stewardship is essential to ensure the sustainable development of green spaces.

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