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RESEARCH ARTICLE

# Exploring the features of plants threatening Malaysia's heritage buildings

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**ABSTRACT**

Plants contribute to various functions in landscape design such as shade, ornamentation, food sources and etc. For heritage buildings, the functions of plants are identified as elements that can enhance the heritage value of a building. The presence of plants also harms the stability of heritage buildings. Certain plants have been identified to cause damage such as roof damage, wall cracks, plaster layer damage, stains on the paint layer, paint peeling, gutter and drain blockage, and wooden component damage. Therefore, the objective of this study is to identify the features of plants that threaten heritage buildings. This study used a qualitative research design involving observation and interviews. Observation methods were carried out on 112 masonry heritage buildings listed by the National Heritage Department (JWN). In-depth interviews were conducted with eight (8) registered conservators who possess extensive experience and are actively involved in heritage building conservation. The collected data were analyzed thematically to produce a list of characteristics of plants that contribute to the damage of heritage buildings. The study revealed eight (8) plant characteristics, namely compact canopy, shedding leaves excessively, bearing fruit, dense flowering, creeping root, adventitious root, weak wooded, and wide-crowned tree. This study aims to assist conservators, building occupants, maintenance contractors, and landscape architects in selecting suitable plants for landscaping and environmental design surrounding heritage buildings in Malaysia.



## 1. INTRODUCTION

Landscape plants provide various benefits such as improving thermal comfort and beautifying the environment around buildings. However, plants can also contribute to structural deterioration if not managed properly (Abd Rahim et al., 2022; Mattheck, Tesari & Bethge, 2003; Cozzolini et al., 2025). In the context of heritage conservation, tree felling is often considered a preventive measure to avoid future structural risks. In urban areas, well-planned landscape design plays an important role in maintaining the identity of UNESCO World Heritage Sites (Giudice et al., 2024).

Previous studies have highlighted several plant-related threats to buildings. These include excessive moisture retention (Awang et al., 2020, 2024; Wang et al., 2024; Ab Rashid et al., 2025), blockage of drains and water channels due to falling leaves and branches (Awang et al., 2020, 2021, 2023, 2024), structural cracking due to root pressure (Satriani et al. 2010; Halwatura et al., 2013; Jim, 2018; Uchida et al., 2015; Yadav, 2015; Ceschin et al., 2016; Mattheck et al., 2003; Hosseini et al., 2021; Cozzolini et al., 2025), and wood decay due to termite infestation (Verma et al., 2018; Awang, 2020, 2024; Ab Rashid et al., 2025). Plants are opportunistic and can grow on both abandoned and occupied buildings, particularly on neglected walls and surfaces (Jim, 2018; Cozzolini et al., 2025).

These effects are usually associated with specific plant characteristics and not all species. Malaysia's hot and humid tropical climate accelerates plant growth, thus increasing the risk of vegetation invasion of built structures (Awang et al., 2020; Ab Rashid et al., 2025). Unfortunately, this issue is often overlooked in development planning, causing long-term threats to structural stability and public safety (Zainal et al., 2021). As a result, some restored heritage sites are now surrounded by unsuitable vegetation and require ongoing pruning or removal (Caneva et al., 2023). In some cases, landscape designs with minimal planting are used as a precautionary measure. However, identifying high-risk plant characteristics allows for more strategic planting decisions. This approach can reduce hazards to structures while maintaining landscape aesthetics and heritage values.

## 2. MATERIALS AND METHODS

The objective of this study is to identify the characteristics of plants that threaten heritage buildings in Malaysia. This study focuses on 112 masonry and brick and timber buildings that have been gazetted as Heritage Buildings by the National Heritage Department (JWN). Masonry buildings were selected because they are among the oldest structures still standing in Malaysia and are prone to repeated damage. This study is qualitative and uses on-site observation methods and in-depth interviews with experts.

The observation method involves the use of tools such as measuring tapes, cameras, drones, and inventory forms to record the types of damage and plant species found in the study area. The interview sessions involved eight (8) certified conservators, each with at least 15 years of professional experience. They were selected based on their extensive expertise and active involvement in heritage building conservation projects. The interview sessions were conducted online via Google Meet in the form of open-ended questions.

To comply with research ethics, participant consent was obtained before fieldwork was conducted. Permission to conduct the study at each selected location was officially obtained via phone calls and emails. For the interview sessions, the conservators (labeled as K1 to K8 to protect their identities) provided informed consent by signing a written consent form as confirmation of participation. Each interview session was video recorded to support the transcription and data analysis process. Data obtained from site observations and interviews were then combined and analyzed using thematic analysis methods to identify plant characteristics that threaten heritage buildings in Malaysia.

## 3. RESULT

The study identified eight (8) types of characteristics that pose a threat to and contribute to the deterioration of heritage buildings in Malaysia (Figure 1). These characteristics are compact canopy, shedding leaves excessively, bearing fruit, dense flowering, creeping root, adventitious root, weak wooded, and wide-crowned tree. The details of these characteristics, their effects, and the types of plants corresponding to each characteristic are detailed as Figure 1.

### 3.1 Compact canopy

Dense plant canopies function like a roof, filtering sunlight and reducing its penetration. According to K4, K5 and K6, overly dense canopies cause dampness and damage to heritage buildings due to lack of sunlight. K5 also observed that mature trees located close to buildings encourage moss growth because their thick canopies prevent sunlight from penetrating to the ground surface. These dense canopies are usually formed by broad-leaved plants, closely branched species, clumping plants, and thick climbing species (Awang et al., 2020).

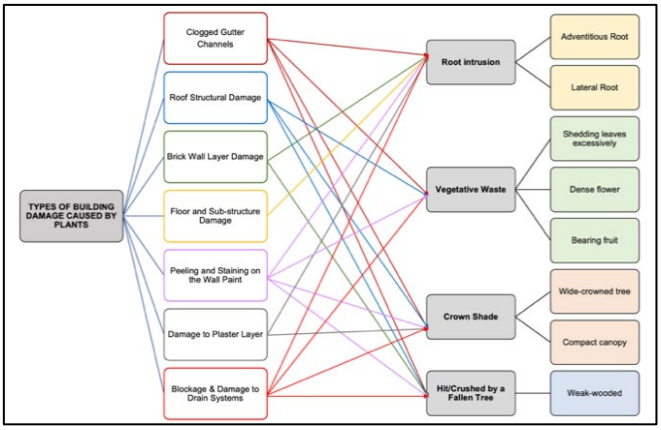


**Figure 1:** The relationship between building damage and the characteristics of plants that pose a threat to heritage buildings in Malaysia.

Broad-leaved plants with dense branches are often used as shade plants, buffers, and view screens. Shade plants are usually planted along driveways, on the sides of buildings, and around site areas to cool the environment. However, K4 stated that when planted too close to buildings, shade plants can threaten the structure by creating damp conditions due to lack of exposure to sunlight. Observations also found that leaf fall accumulated from dense canopies contributes to increased humidity around buildings. Screen plants, which usually consist of shrubs planted closely together or shaped as topiary, are placed near buildings to block views, provide privacy or mark boundaries, while at the same time limiting the penetration of sunlight.

Clumping plants include palms, bamboo, and herbaceous species. Clumping palms are often planted in rows as visual buffers or screens. When planted closely together, their shading effect is almost the same as that of woody trees. K2 reported that palm trees near the Sultan Abdul Samad Building were cut down due to excessive moisture at the base of the walls. Clumping bamboo species are usually planted at the corners of buildings or in fence areas to block views from adjacent areas. Clumping herb species are also used in the same way, namely planted near buildings as screens. Although not numerous, these clumping plants form a dense structure that blocks sunlight and increases humidity on the walls of buildings. Dense-leaved climbers also pose a threat by retaining moisture on the surfaces they cover. These species cling to the walls and increase humidity levels. Among the heritage buildings identified to have this type of climber are Christ Church in Melaka, Bangunan Kelab Diraja Selangor, Masjid Alwi, and Sekolah Menengah King George V in Seremban (Figure 2).

  

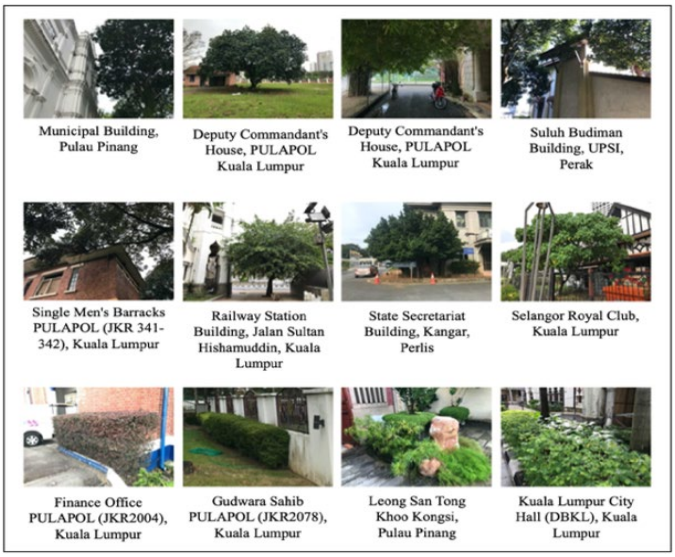


**Figure 2:** The location of heritage buildings with compact canopy.

### 3.2 Shedding leaves excessively

Plants that shed leaves in large quantities can pose a threat to heritage buildings because the leaves that accumulates in hard-to-reach areas can cause structural damage if not cleaned regularly. According to K1, this type of plant affects not only the building but also its surroundings and requires regular daily cleaning. Leaves are the most common form of plant waste. The two main types of plants that shed leaves in large quantities are deciduous plants and dense leaves plants.

Deciduous plants shed their leaves seasonally, and wind blows cause these leaves to spread widely. K2 states that maintenance of heritage buildings needs to be done more frequently to manage the loss of leaves and twigs. If not cleaned, the leaves can make the surrounding area look untidy, attract pests, and retain moisture in the soil and environment. These plants are often chosen as landscape elements around heritage buildings, usually planted as shade trees or along paths and near built structures. The main characteristic of deciduous plants is the size and quantity of their leaves. Small leaves are more easily blown by the wind, spread far and often get trapped in the cracks of buildings.

On-site observations also confirmed that deciduous trees planted outside the building area can also cause waste problems inside the building area. On the other hand, trees with dense leaves usually cause leaf litter to accumulate near the base of the tree. A total of 34 species of deciduous trees that continuously shed their leaves have been identified and require daily maintenance. Among these species are *Adenanthera pavonina, Azadirachta indica, Peltophorum pterocarpum, Phyllanthus emblica, Samanea saman* and *Terminalia catappa*, which have a significant impact because they have fine and light leaves, are difficult to clean and often clog drainage systems and gutters.

Dense-leave plants also contribute significantly to the production of leaf litter throughout the year. Unlike deciduous trees, these plants shed their leaves continuously and require frequent maintenance (Awang et al., 2020, 2024). Plants such as trees, bamboos and woody shrubs are often used as shade trees in heritage landscapes. K1 highlighted that two *Pterocarpus indicus* and one *Terminalia catappa* near the Stadthuys building frequently shed their leaves, making maintenance work more complicated (Figure 3). The study identified 105 dense-leaved plant species that threaten heritage buildings, including *Artocarpus heterophyllus, Durio zibethinus, Mangifera indica, Pinus caribaea, Swietenia macrophylla* and others.


**Figure 3:** The view and condition of the heritage buildings area with fallen leaves surrounding the heritage buildings before it was cleaned.

### 3.3 Bearing fruit

Fruits are regarded as plant waste when not removed, posing risks to heritage buildings in two main ways: naturally fallen fruits and those brought in by animals. Like dry leaves and twigs, fallen fruits rot if left unattended. When trapped on roofs, gutters, or within structural crevices, they stain surfaces and may germinate. Seeds that sprout and grow on buildings can cause serious structural damage over time. Fruits that leave stains are typically soft, containing sap or pigments, such as *Livistona chinensis*, *Terminalia mentaly*, and *Veitchia merrillii*. On the other hand, heavy fruits with hard shells such as *Cocos nucifera, Durio zibethinus, Artocarpus altilis, Artocarpus heterophyllus* and *Artocarpus integer* can cause impact damage when they fall from trees taller than the building's roof. Animals also contribute to fruit-related damage.

According to K1, K2, K3, K4, K5, K6 and K8, fruit trees attract bats, which eat the fruit and leave behind their droppings and fruit waste when perching on buildings. K2, K3, K4 and K5 observed that bats often hang from exposed roof beams or rafters near rainwater drains, where their fruit waste and droppings accumulate on floors, platforms and walls. K2 also stated that the location of fruit trees too close to buildings causes the walls to be contaminated with bat droppings and

  

food waste (Figure 4). Fruits favoured by bats are generally soft and small, such as *Syzygium aqueum, Syzygium jambos, Lansium domesticum Corr., Ficus fistulosa, Ficus variegata, Dimocarpus longan, Nephelium lappaceum, Nephelium mutabile* and *Manilkara zapota*. K8 identified rose apples and mangoes (*Mangifera indica*) as frequently brought into buildings by bats. Beyond bats, K3 reported that civets also carry fruit into buildings, leaving behind faeces and fruit waste that require frequent cleaning. Birds nesting in buildings further increase this threat. The fruits they consume are small and often contain undigested seeds. According to K4, these seeds easily become trapped in the carvings and crevices of heritage buildings, potentially sprouting into unwanted plants. K4 further warned that introducing green building concepts to heritage structures, without proper adaptation, may worsen existing damage.


**Figure 4:** Fruit-bearing plants contribute to debris around the heritage building.

### 3.4 Dense flower

Flowers are not a major threat to the deterioration of heritage buildings, but they do contribute, to some extent, to the accumulation of plant debris. In this context, the study identified that flowering plants fall into two (2) categories: those that bloom continuously and those that bloom seasonally. Both categories contribute differing amounts of plant litter. For continuously flowering plants, the quantity of fallen flowers is not excessive, but they shed flowers on a daily basis such as *Allamanda cathartica, Bougainvillea spectabilis, Plumeria obtusa, Plumeria rubra* and *Wrightia religiosa*. Seasonally flowering plants, on the other hand, produce a large volume of flowers during specific seasons (Figure 5). During these periods, fallen flowers often cover the surrounding area. Once the flowering season ends, some of these plants begin to bear fruit, which then falls and poses a threat to heritage buildings. Outside of the flowering season, these plants do not produce flowers and instead appear green and shady, making it difficult for the public to recognise them as seasonal bloomers. Some commonly planted seasonally flowering species include *Peltophorum pterocarpum, Pterocarpus indicus* and *Tabebuia pentaphylla*.


**Figure 5:** Debris from seasonal flowering plants planted around the heritage buildings.

According to K4, the presence of flowers on heritage buildings is often attributed to wind dispersion. This was observed at Surau Jamhuriah (Tok Sheikh Surau) in Kuala Besut, where the flowers of *Bougainvillea spectabilis* (bunga kertas), planted one metre from the building, were blown by the wind and accumulated in the drainage system. Similar occurrences were recorded at the Stadthuys building, Christ Church, Museum building, Irrigation Office, and Religious Office buildings in Melaka, *Peltophorum pterocarpum* (Yellow Flame tree) was planted nearby, resulting in fallen flowers becoming trapped and accumulated in gutters and drains. While flower droppings can enhance the valuable experience for visitors by creating a beautiful view like a yellow carpet, they can also have a negative impact on heritage buildings. Observations have shown that flower debris accumulates in the roof gutters even though the plants are up to eight (8) metres away from the building. This is due to the sea breeze carrying the flowers towards the building.

### 3.5 Creeping root

Plants with creeping or spreading root systems on the surface have been identified as a cause of structural cracking in heritage buildings. According to K3, K4, K5, K6 and K7, such damage is usually caused by plants growing too close to the building structure. K4 emphasizes that plants with aggressive root systems should be avoided near heritage buildings to maintain structural stability (Figure 6). Damage caused by roots is difficult to detect in the early stages as it occurs underground and usually requires excavation work to confirm (Awang et al., 2024; Jim, 2018; Mattheck et al., 2003).

**Figure 6:** Exposed creeping roots can be seen damaging the nearby structure at the Old State Legislative Assembly Building, Melaka.

  

K3 explains that root barriers or root walls are used to prevent or divert root growth, while K2 adds that root pruning is carried out when encroachment is detected. K2 and K7 suggest the use of potted plants to limit root growth and facilitate maintenance. K4 and K5 emphasize that trees such as *Samanea saman* have wide-spreading roots and often damage building structures. K4 also suggests that all plants within a one-meter radius of a heritage building be removed as this distance represents the root growth range. K6 also recommends that shrubs and shade trees be planted at least 2 to 3 meters away from buildings to avoid damage.

K5 states that most woody plant species pose a risk to structures due to their extensive root systems. K1 explains that these roots can even push up to the building's floor. Observations show that many plants have been planted without considering the Critical Root Zone (CRZ), causing the tree canopy to cover the roof and branches to touch the building's walls. This situation places the building within the CRZ and increases the risk of damage to the substructure. However, pruning the canopy only solves the problem on the surface and does not address root invasion below ground.

K6 observed that shrubs planted 2 to 3 metres from buildings generally did not cause root damage. This suggests that the Critical Root Zone (CRZ) guideline is more appropriate for tree species as they have larger and more robust root systems. Most woody plants were found to have strong lateral root systems. Forest tree species such as *Hopea odorata, Neobalanocarpus heimii* and *Swietenia macrophylla* are unsuitable near buildings due to their size and timber classification. Species like S*amanea saman, Azadirachta indica* and several *Ficus species* possess extensive lateral root systems and require caution. Bamboo (*Bambusa spp*.), with its rhizomatous running roots, is also invasive and difficult to control, posing a significant threat if planted in open soil near heritage structures.

### 3.6 Adventitious root

Apart from lateral roots, plants with adventitious roots have also been identified as threats to heritage buildings. Unlike lateral roots, adventitious roots are more visible, and the damage they cause can be detected with the naked eye. These roots do not originate from the main root system but emerge from stems or branches, attaching themselves to building surfaces. Species such as *Ficus spp*. produce adventitious roots that grip and encircle structures, starting as fine roots that thicken and harden over time (Figure 7). The extent of damage depends on the plant's size and growth, the larger the plant, the greater the damage due to its strong grip on the building.

**Figure 7:** Ferns and Ficus species growing and thriving on the ventilation openings, beams, and roof crown of Serkam Pantai Mosque, Jasin, Melaka.

Epiphytic plants also pose risks as they grow on surfaces other than soil, often appearing in moist, hidden parts of buildings or near leaking drainage (Ceschin et al. 2016). Seeds dispersed by birds or wind often germinate in nutrient-rich crevices, and their roots expand into walls, causing dampness and moss growth. K4 advised that aerial and parasitic root types should not be used in landscaping near heritage buildings, as they accelerate structural damage. These roots can penetrate plaster and wall materials, especially in buildings constructed with lime plaster or clay bricks, which are more vulnerable. K1 observed that the presence of such plants often indicates nearby parent plants. K2 added that seeds are usually dispersed by birds and bats that leave droppings and food waste.

Nineteen plant species with adventitious roots were identified: four with fibrous roots, seven with clinging roots, and eight of other types. Strangling roots, found in woody tree species, can grow on nearly any part of a building, entering cracks and beneath paint layers. Fibrous adventitious roots, such as those of ferns, were seen in cracks and leaking areas. These are less damaging due to their non-woody structure. Clinging roots from ornamental potted plants were also noted, which, if neglected, can dominate and damage building walls.

### 3.7 Weak wooded

Several plant species have been identified as prone to decay, making them hazardous to heritage buildings. These fragile plants are physically weak, easily broken, and frequently shed branches. They may collapse during strong winds, when diseased, pest-infested, or even under normal conditions (Awang et al., 2020, 2021, 2023). Twigs and branches are the most fallen parts, often preceded by sparse or absent foliage. Trunk decay can be observed through holes, peeling bark, and softness, while root decay may be signalled by termite or ant nests. Over time, rot in the trunk and roots can lead to plant collapse, endangering both the structure and occupants.

K3 reported large, hazardous trees along Jalan Kota in Melaka, near the Islamic Museum and Irrigation Office. Observations during rainfall showed scattered leaves and twigs around drains and buildings. K2 and K7 noted fallen

  

branches damaging government quarters in Kuching during conservation works, while at King George V School in Seremban, *Swietenia macrophylla* branches damaged a covered walkway (Figure 8).


**Figure 8:** A fallen branch of the *Swietenia macrophylla* or mahogany tree that struck the roof of SMK King George V, Seremban, Negeri Sembilan.

Plants with weak roots, like *Pterocarpus indicus*, were found to collapse and damage structures at Kellie's Castle. At SK Tungku Putera in Kedah, an *Alstonia angustiloba* tree failed on a slope and damaged a heritage building. K4 shared that a leaning *Durio zibethinus* at Masjid Kuala Dal, Perak, had to be removed due to falling brittle branches and the risk posed to the building. K1 and K6 linked such incidents, especially in uninhabited buildings, to poor planning and inadequate maintenance. Decaying plants attract pests like termites, which feed on dead matter and can spread to building interiors.

K1, K2, K3, K4 and K5 reported termites infesting nearby dead trees and timber building components. K5 emphasised that high-cellulose plants are particularly attractive to termites and should be avoided in heritage landscapes. Additionally, palms, though low impact structurally, are prone to beetle attacks. Species identified with brittle branches include *Artocarpus heterophyllus, Durio zibethinus, Cinnamomum iners, Spathodea campanulata* and *Swietenia macrophylla*, while those prone to trunk rot include *Pterocarpus indicus, Durio zibethinus* and *Artocarpus heterophyllus*.

### 3.8 Wide-crowned tree

Due to the age of heritage buildings which are usually hundreds of years old, it is common to find large, mature trees around them. Many of these trees are retained for their historical value and function to provide shade to the surrounding area as well as the building itself. When the woody trees reach maturity, they form a wide canopy, making them a popular choice in landscape design.

However, observations have shown that almost all plants around heritage buildings have expanded their canopy to touch or cover the roof. This situation contributes to moisture problems on the walls of the building (Figure 9). K1 explained that *Mangifera indica* is a traditional plant of the Baba and Nyonya communities in Melaka and Penang that is usually planted in front of the house. If not pruned properly, even distant trees can have an impact on the building. K4 shared that *Samanea saman* trees in Taiping that were planted too close to the building have caused rainwater to seep through the walls. Trees with wide canopies like this require careful planning before planting as their growth is difficult to control when mature. Although they provide shade, these trees also produce a large amount of debris.


**Figure 9:** A *Mangifera indica* (mango tree) providing shade to the heritage building.

Many tall and large trees have been gazetted as heritage trees due to their age, most of which are over a hundred years old, and their historical connection to the building in question. According to K2, these trees need to be carefully studied as they often become habitats for insects and pests. Older trees are also at risk of falling due to invisible internal damage. K2 and K7 reported that there was a heritage tree over 20 metres tall that broke during a storm and almost hit a nearby building.

K2 suggested planting such trees at least 10–15 metres away. K7 added that the species' growth characteristics should be studied to predict future size. While this planting distance may prevent root intrusion, it may not account for tree falls. Observations show some trees had been pruned to reduce height, and trees with canopies exceeding roof height (6 metres and above) have been linked to building damage.

## 4. DISCUSSION

The eight plant traits in this study were found to contribute to structural degradation through different mechanisms, depending on the growth form and the plant's response to the environment. Dense canopy characteristics were found to create a shady and humid environment, which could encourage the growth of moss, algae and fungi on the surface of walls and roofs. This condition weakens the paint layer, accelerates the deterioration of plaster, and increases the absorption of moisture into the bricks, which affects the structural integrity of the building.

Plants that shed leaves excessively also pose a major challenge in terms of maintenance. Fallen leaves and

  

branches can clog water channels and drainage systems, increase humidity if there is an overflow and become a breeding ground for mosquitoes. Similarly, fruiting plants were found to pose a double risk through fallen and rotting fruits. This causes dirt marks on the building surface, blocks the flow of water, and attracts animals such as bats and foxes. The presence of these animals in turn accelerates the deterioration when their droppings and food waste stain and damage the walls and floors.

Heavy flowering characteristics also contribute to the accumulation of flower petals, especially in the spring. Like leaves, fallen flowers often clog drains, which ultimately leads to dirt on the floor surface. On the other hand, creeping root systems are a major cause of structural damage when lateral roots spread beneath the foundation of a building, pushing against walls and floors and disrupting the substructure. Adventitious roots, commonly found in species such as Ficus and ferns, also pose a serious threat when they attach to the surface of walls, penetrate cracks, and allow water to seep in, weakening plaster and brickwork.

Plants with rotting stems are also prone to breaking or falling during heavy rains and strong winds, causing physical damage to roofs, walls and walkways. Rotting wood also provides food for termites and wood-boring insects, which can spread to the wooden components of a building. Finally, trees with wide canopies put environmental and physical stress on heritage structures. A wide, dense canopy blocks sunlight, retains moisture, and increases the risk of branches breaking during storms. This situation, if left unchecked, will accelerate the process of deterioration and damage to buildings.

Overall, these eight plant characteristics indicate the need for careful species selection. Strategic landscape planning and ongoing maintenance are essential in heritage conservation efforts. Integrating arboricultural principles with conservation management such as the implementation of the Critical Root Zone (CRZ) concept, periodic pruning and the use of species that are less deciduous and structurally stable are seen to significantly reduce long-term risks. Identifying the CRZ is very important to prevent root invasion. Setting random planting distances, such as the 10 to 15 meter distance suggested by K2, is less reliable because each tree species has a different growth pattern. This CRZ concept is specifically applied to trees and serves to ensure safe planting distances around heritage buildings.

Sustainable heritage conservation requires a balanced approach to harmonise aesthetic, ecological and structural aspects so that landscape elements complement rather than threaten the country's historical heritage assets.

**Table 1**: Detailed characteristics of plants that threaten and damage heritage buildings according to conservators.

| NO. | CONSERVATOR | CHARACTERISTICS OF PLANTS THAT DAMAGE HERITAGE BUILDINGS | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Compact canopy | Shedding leaves excessively | Bearing fruit | Dense flower | Creeping Root | Adventitious Root | Weak-wooded | Wide-crowned tree |
| 1. | K1 | | / | / | | / | / | / | / |
| 2. | K2 | | / | / | | / | / | / | / |
| 3. | K3 | | | / | | / | | / | |
| 4. | K4 | / | | / | / | / | / | / | / |
| 5. | K5 | / | | / | | / | | / | |
| 6. | K6 | / | | / | | / | / | / | |
| 7. | K7 | | | | | / | | / | / |
| 8. | K8 | | | / | | | | | |

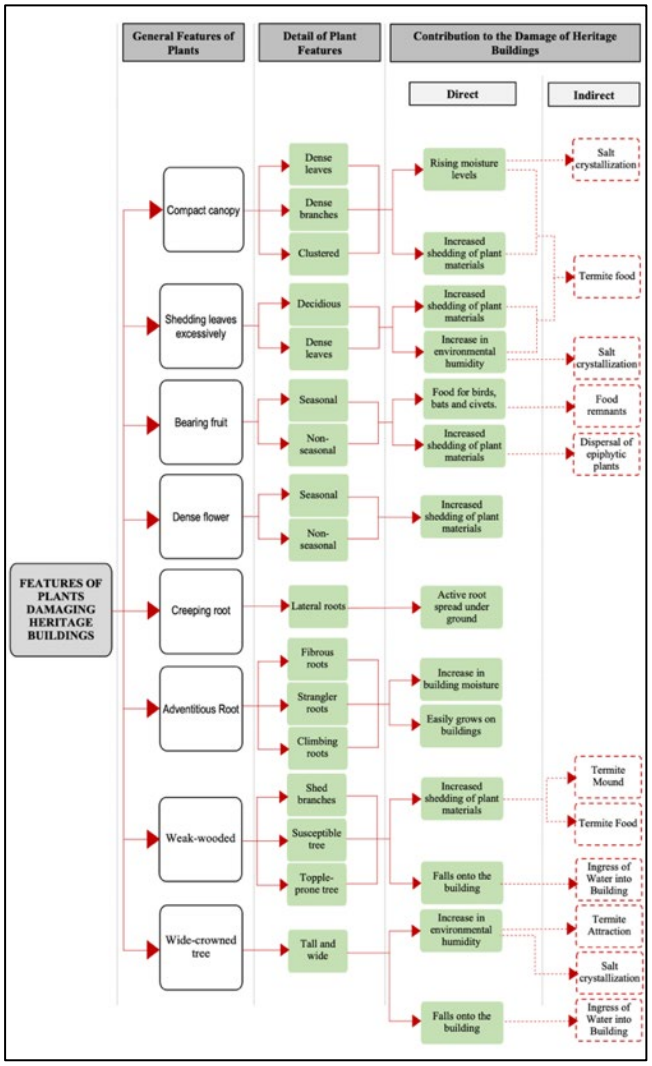


**Figure 10:** Comprehensive chart of plant traits that threaten and damage heritage buildings.

## 5. CONCLUSION

The findings of this study indicate that the interaction between plants and heritage structures in Malaysia is strongly influenced by certain plant characteristics that shape the environmental conditions and built structures. These characteristics determine how plants affect the physical

  

deterioration of the building fabric. Therefore, the relationship between plant growth and the level of building vulnerability is not only limited to visual proximity but also involves physiological and ecological behaviours that accelerate the decay process. Understanding this interaction is very important in formulating maintenance strategies that are appropriate for tropical climate conditions and conservation priorities.

Although the diversity of plant species around heritage buildings enhances aesthetic and historical value, it also brings various effects due to the differences in the characteristics of the plants. Each species has its own uniqueness that affects its impact on the environment. The diversity of these species allows studies to examine various forms of impact on building structures. These characteristics contribute either directly or indirectly to building deterioration.

Malaysia's tropical climate with abundant rainfall and sunlight encourages plants to form thick canopies and lush foliage. When trees are planted too close together, the overlapping canopies create a “roof” effect, causing the soil beneath them to become damp and waterlogged. This is an ideal habitat for epiphytic plants such as Ficus species to grow on brick buildings. Tropical plants differ from plants in non-tropical areas in that they produce more moisture and organic waste, while non-tropical species are more often associated with root invasion. Studies that focus solely on root invasion may not be suitable for application in the context of tropical climates. Therefore, landscape planning should start from the planting stage by setting the correct spacing to avoid future damage.

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