

Identification of Fungus Issue in the Government's Purpose-Built Office (GPBO) - A Case Study of Suruhanjaya Pilihan Raya (SPR) Malaysia Tower

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DOI: <https://doi.org/10.30880/mari.2025.06.04.017>

Article Info

Received: 01 September 2025
Accepted: 15 October 2025
Available online: 01 December 2025

Keywords

Government purpose-built offices (GPBOs), building maintenance, fungal infestations, fungus in building

Abstract

The research investigates fungal issues in the Government's Purpose-Built Office (GPBO) through a case study of the Suruhanjaya Pilihan Raya (SPR) Malaysia Tower. The study identifies specific types of fungi and examines factors contributing to their growth within the building by utilising document analysis of past research and unpublished technical reports. The study finds multiple types of fungi present across various levels of the SPR Tower. Key findings emphasise the urgent need for effective moisture control and enhanced ventilation systems to mitigate fungal growth, crucial for safeguarding the health of occupants and visitors. These findings highlight the importance of implementing proper rectification measures to ensure both structural integrity and a safe indoor environment conducive to public health. This research contributes valuable insights for improving building management practices and policy frameworks aimed at addressing fungal issues in GPBOs, promoting healthier and sustainable office environments.

1. Introduction

The development of Government's Purpose-Built Offices (GPBO) in Malaysia, tailored to meet ministry needs and often involving collaboration among agencies such as Jabatan Kerja Raya (JKR), is crucial for ensuring efficient governance. However, these buildings, especially those exceeding five storeys, are subject to rigorous annual inspections under the Street, Drainage, and Building Act 1974. This regulatory framework aims to detect and address issues like fungal infestations, which pose significant health risks to occupants and can lead to costly remediation efforts [1].

Fungal growth in multi-storey government buildings, exemplified by the Suruhanjaya Pilihan Raya (SPR) Malaysia Tower, not only jeopardises the health and well-being of individuals but also compromises the structural integrity of these essential public facilities [1]. Recent studies underscore the severity of fungal issues in large office buildings, indicating a correlation between indoor fungal exposure and respiratory ailments such as asthma and allergies [2]. Moreover, economic impacts associated with fungal infestations include direct costs of remediation and potential indirect costs such as reduced productivity due to occupant health concerns and building closures [3].

Therefore, the research aims to address the following objectives: 1) to identify the generic types of fungi and the contributing factors to fungal growth in GPBO; 2) document specific instances of fungal issues within the SPR

Malaysia Tower; and 3) propose effective remedial measures based on data gathered from the SPR Malaysia Tower, ensuring both the health of occupants and the longevity of these essential governmental structures.

2. Methodology

The research employs a qualitative approach towards all stated objectives, namely, document analysis. This approach was helped by the Multiple-Layered Thematic (MLT) method (as in Figure 1). Based on Figure 1, the first layer consists of the use of the Research Gate search engine with a limited search terms and screening of references. The second layer consists of the removal of less relevant documents, guided by several keywords. Then, the final layer (Layer 3) entails finalising the outcomes from all predetermined clusters, along with the quality sub-process [4].

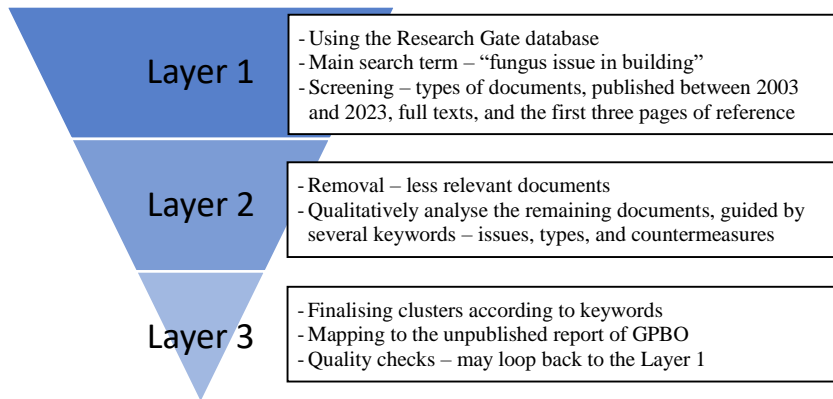


Fig. 1 A brief Multiple-Layered Thematic (MLT) process

The MLT method, as used in the research, involves a qualitative document analysis approach. It begins with gathering research materials specifically from open online sources to investigate fungal issues in the Government's Purpose-Built Offices (GPBOs), with a final focus on the unpublished building structural integrity report of Suruhanjaya Pilihan Raya (SPR) Malaysia Tower. The method emulates Subri et al.'s MLT framework to identify, populate, and analyse the issue, type, and countermeasures related to fungal problems, while integrating insights from a real report of the said building [5]. This approach ensures a comprehensive examination of literature pertaining to fungal issues and practice regarding building investigation. Finally, a proposal for rectification measures is put forward based on categorising fungal types and contributing factors, thereby enhancing understanding and recommendations for addressing fungal challenges in the building.

3. Result and Discussion

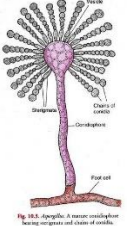
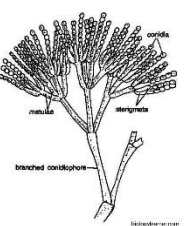
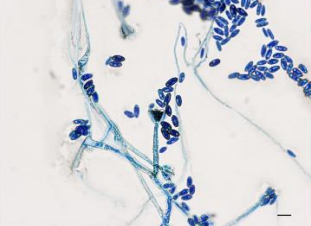

The chapter presents the findings and results of a qualitative investigation into the fungal issues within the Suruhanjaya Pilihan Raya (SPR) Malaysia Tower. The results presented in this chapter highlight the general types of fungi and their characteristics. Further, it has been mapped against findings from the unpublished building report of the building. Finally, a proposal for countermeasures had been put forth for the betterment of the building. This might enhance the understanding of fungal issues in similar settings and offer actionable recommendations for effective management.

The findings from this investigation also provide valuable insight into the environmental conditions that contribute to fungal proliferation in high-rise government buildings such as the SPR Malaysia Tower. Factors such as inconsistent maintenance schedules, insufficient ventilation in certain enclosed areas, and undetected water seepage have been identified as contributing to persistent moisture, which in turn supports fungal growth. Comparing the on-site observations with the unpublished building report helped to validate these conditions, indicating that some previously noted issues may have persisted over time without adequate remediation. This continuity of problems suggests that the building may benefit from a long-term moisture management plan that integrates both preventive and corrective measures.

Furthermore, the mapping of fungal characteristics against the building's structural and environmental data serves as a practical tool for targeted intervention. By understanding the specific locations and environmental parameters where each fungal species thrives, maintenance teams can prioritise high-risk zones and implement tailored control measures. For example, areas prone to condensation may require enhanced air circulation systems, while surfaces identified as cellulose-rich should be coated with protective treatments to reduce susceptibility. Such targeted approaches not only improve the efficiency of remedial work but also ensure resource optimisation, leading to more sustainable building management practices in the long term.

3.1 Type of fungi

Table 1 *Types of Fungi*

Type	Aspergillus	Penicillium	Stachybotrys	Cladosporium
General photo				
Characteristic	<ul style="list-style-type: none"> • White colour • Growth on the surface with high humidity 	<ul style="list-style-type: none"> • Found on surfaces like painted walls and other damp areas 	<ul style="list-style-type: none"> • Dark green colour or black • Grows on material with high cellulose content 	<ul style="list-style-type: none"> • White colour • Grows on the wall

As shown in Table 1, the presence of different types of fungi such as Aspergillus, Penicillium, Stachybotrys, and Cladosporium highlights the variation in their growth environments, appearance, and potential impact on affected materials. Aspergillus is typically white in colour and thrives on surfaces exposed to high humidity, making it common in areas with poor ventilation [2]. Penicillium is often found on painted walls and other damp surfaces, indicating its ability to adapt to different substrates [6]. In contrast, Stachybotrys is dark green or black in colour and prefers materials with high cellulose content, such as wood, paper, or drywall, which may be severely affected under prolonged moisture exposure [7]. Cladosporium also appears white in colour and commonly grows on wall surfaces, especially in areas with moisture intrusion [8].

These differences suggest that the identification of fungal species is crucial for effective remediation strategies, as their growth patterns and preferred environments vary [9]. Understanding these characteristics can help in determining the source of moisture problems, preventing recurrence, and protecting the integrity of the building materials.













In addition to the structural and aesthetic damage caused by these fungi, their presence can also have significant health implications for occupants. Aspergillus and Penicillium, for example, are known to release airborne spores that can trigger allergic reactions, respiratory issues, and in severe cases, infections in individuals with weakened immune systems. Stachybotrys, often referred to as “black mould,” is particularly concerning due to its potential to produce mycotoxins, which have been linked to more serious health problems such as chronic coughing, skin irritation, and neurological effects when exposure is prolonged. Even Cladosporium, which is generally less toxic, can aggravate asthma symptoms and contribute to poor indoor air quality if left unchecked. These risks underscore the importance of timely detection and removal of fungal colonies before they escalate into health hazards.

From a building management perspective, the variation in fungal growth preferences reinforces the need for a multi-pronged remediation and prevention strategy. Simple cleaning or surface treatment may only offer short-term relief if the root causes, such as water leaks, condensation, or inadequate ventilation, are not addressed. A more sustainable approach would involve integrating environmental monitoring systems to detect changes in humidity levels, improving airflow in enclosed areas, and selecting building materials that are resistant to mould colonisation. Additionally, scheduled maintenance inspections and staff training in fungal identification can ensure that early signs of growth are promptly addressed, thereby reducing the likelihood of widespread contamination and costly repairs in the future.

3.2 Findings from the Suruhanjaya Pilihan Raya (SPR) Malaysia Tower

Table 2 represents the Suruhanjaya Pilihan Raya (SPR) building tower, where, Aspergillus mould, which appears white and thrives in high-humidity areas, is the most common type. Meanwhile, Penicillium (or another form of Aspergillus) also grows in high-humidity environments. On the other hand, Stachybotrys (also known as black mould) is identified by its dark green or black colour and grows on materials with high cellulose content, such as drywall, especially in constantly wet or damp areas, indicating severe moisture issues. Finally, Cladosporium mould prefers cool, damp areas and is often found on painted walls. The frequent occurrence of these moulds in humid and wet areas suggests an urgent need for better moisture control.

Table 2 Population of Fungi in the SPR building (Malaysia Tower)

Type	Aspergillus	Penicillium	Stachybotrys	Cladosporium
Sampled site photos				
				
				
				
Found on level (SPR Building)	1, 3, 4, 6, 7, & 8	1, 2, & 3	3 & 4	1m & 2

3.3 Rectification Suggestions

The SPR Building Tower is affected by moulds like Aspergillus, Stachybotrys (black mould), Cladosporium, and Penicillium, thriving in moist and poorly ventilated areas. Aspergillus is common, while Stachybotrys indicates severe water damage. These moulds pose health risks, including respiratory issues, allergies, and infections. Stachybotrys can produce mycotoxins, causing severe respiratory problems. Aspergillus causes allergies and infections, Cladosporium triggers asthma and allergies, and Penicillium can lead to sinus infections and lung inflammation. To mitigate these risks, Table 3 suggests viable rectifications based on the literature.

Table 3 Rectification Suggestions

Type of Fungus	Rectification	Long-term Solution
Aspergillus	Reduce humidity levels in affected areas using dehumidifiers and ensure proper ventilation, particularly in bathrooms, kitchens, and other high-humidity zones. Regularly clean and disinfect surfaces to prevent mould growth.	Install exhaust fans in high-humidity areas and use air purifiers with HEPA filters to reduce airborne spores.
Penicillium	Control humidity levels and ensure proper air circulation. Regularly clean areas where mould is likely to grow, such as behind appliances and in storage areas.	Implement routine maintenance checks for heating, ventilation, and air conditioning (HVAC) systems to ensure they are effectively controlling indoor

		humidity. Encourage the use of moisture-resistant materials in building interiors.
Stachybotrys	Identify and repair any leaks or sources of water damage immediately. Remove and replace affected materials, such as drywall or wood, that have been heavily infested. Use mould-killing solutions to clean the area thoroughly.	Ensure that the building's plumbing and roofing systems are regularly inspected and maintained to prevent future leaks. Consider waterproofing measures in vulnerable areas.
Cladosporium	Improve ventilation in cooler areas of the building, such as basements or storage rooms. Use dehumidifiers to maintain a dry environment and clean surfaces regularly with mould inhibitors.	Insulate walls and windows to reduce condensation and maintain a consistent indoor temperature to prevent mould-friendly conditions.

4. Conclusion and General Recommendations

The research has successfully identified the type of fungus and the related issues affecting the building. Based on these findings, several general recommendations are proposed. Firstly, periodic mould inspections should be conducted throughout the building to detect and address any mould growth at an early stage. For severe infestations, the engagement of professional mould remediation services is essential to ensure complete removal and prevent recurrence. Additionally, education and awareness programmes should be implemented to inform building occupants about the importance of ventilation, moisture control, and cleanliness in preventing mould growth. The installation of humidity monitors in key areas is also recommended to proactively track and manage indoor humidity levels.

To offer specific examples for improving moisture control and ventilation in GPBO, several measures can be considered for both building development and ongoing maintenance. For HVAC systems, regular maintenance is crucial, with the inclusion of dehumidifiers to control humidity levels. High-efficiency particulate air (HEPA) filters should be incorporated to reduce mould spores and improve air quality, alongside a schedule for cleaning and inspecting air ducts and vents. In terms of building design, GPBOs should be equipped with proper drainage systems to channel water away from the building foundation, constructed using moisture-resistant materials such as treated wood and mould-resistant drywall, and fitted with double-glazed windows to minimise condensation and enhance insulation.

For restrooms and kitchens, exhaust fans should be installed to expel humid air and prevent moisture buildup, while water-resistant flooring materials can reduce the risk of mould growth. Plumbing fixtures must be regularly inspected for leaks and repaired promptly. In basements and storage areas, waterproof coatings on walls and floors, vapour barriers to limit ground moisture penetration, and sump pumps in flood-prone basements are recommended to mitigate water-related risks.

From a general maintenance perspective, a routine inspection schedule should be implemented to detect early signs of water damage or mould growth. Maintenance staff should be trained to identify and resolve potential moisture issues immediately, and building occupants encouraged to report leaks, condensation, or other moisture-related problems without delay. By adopting these rectification measures and long-term strategies, the Suruhanjaya Pilihan Raya Malaysia Tower and other GPBOs can effectively address existing mould problems and prevent future occurrences, ultimately ensuring a healthier and safer indoor environment for all occupants.

Acknowledgement

This research was supported by Universiti Tun Hussein Onn Malaysia (UTHM) through Tier 1 (VOT Q960).

Conflict of Interest

Authors declare that there is no conflict of interest regarding the publication of the paper.

Author Contribution

*The authors confirm contribution to the paper as follows: **study conception and design, collection, analysis and interpretation of results, draft manuscript preparation:** Irsyad Zainuddin, Muhammad Alif Mohd Amin, Nik Adam Nik Li, Hairuddin Mohammad. All authors reviewed the results and approved the final version of the manuscript.*

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