



## King of Molds: *Aspergillus fumigatus*

### I \ Introduction

*Aspergillus fumigatus*, the king of molds, is one of the most common fungi in the environment, playing a crucial role in the carbon and nitrogen cycles in nature. It can survive in a wide range of pH values and temperatures and is efficiently dispersed by weak air currents. These characteristics make it one of the primary molds responsible for human infections.

The size of *A. fumigatus* spores allows them to penetrate the respiratory system, causing widespread infections. There are at least 16 million cases of pulmonary aspergillosis annually, with many resulting in death. Furthermore, *A. fumigatus* accounts for 80% of *Aspergillus*-related illnesses, including allergic pneumonia, allergic sinusitis, asthma, and severe allergic asthma, with mortality rates reaching up to 90% in certain patient groups (Dagenais & Keller, 2009).

However, *A. fumigatus* has been found to produce taxol, a compound

previously extracted from yew trees, which has shown promising anticancer activity through clinical trials (El-Sayed et al., 2021).

This paper explores the characteristics of *A. fumigatus*, its preferred growth conditions, and common environments. It also analyzes its pathogenicity and impact, as it causes severe diseases but also serves as an important alternative source for cancer treatment drugs. Therefore, in-depth research on *A. fumigatus* is essential for improving health and quality of life.

### II \ Literature Review

#### (i) Introduction of *Aspergillus fumigatus*

*Aspergillus fumigatus* is the predominant pathogenic species within the genus *Aspergillus* (Figure 1). It exhibits thermal resistance and can grow within a temperature range of 20 to 52°C, with an optimal temperature of 37°C. It can survive for extended periods at 55°C. Consequently, **A.**

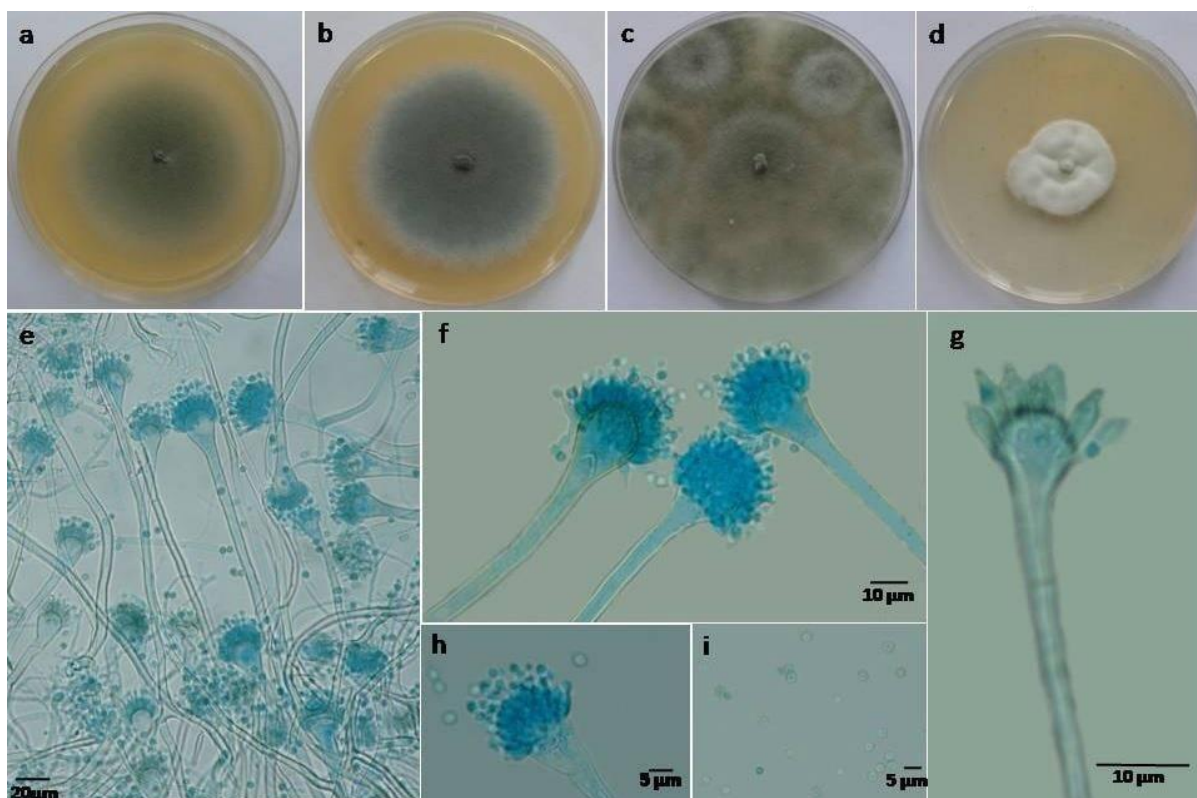


*fumigatus* is commonly found in environments undergoing spontaneous heating, such as hay, corn, and compost. It can also be isolated from herbivore dung, bird droppings, bird nests, inadequately heated and dried plant materials (such as spices or cannabis cultivation soil), and seeds of grass family plants (such as wheat, barley, oats, rice, sorghum, and corn) (Paulussen et al., 2016).

## **(ii) Pathogenicity of *Aspergillus fumigatus***

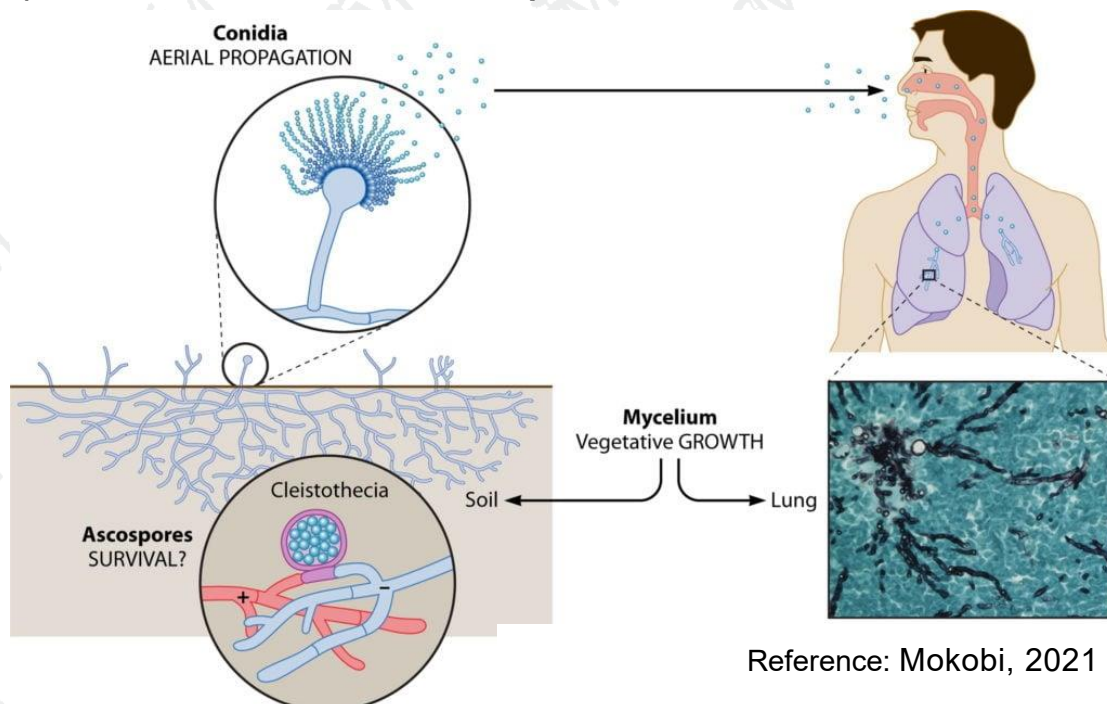
The conidia of *Aspergillus fumigatus* are dispersed in the air, and their tiny size allows them to reach all levels of the respiratory tract (Figure 2). Therefore, *Aspergillus fumigatus* is a

common and life-threatening airborne pathogen if humans and animals continuously inhale large quantities of its conidia. In immunocompetent hosts, the conidia are typically cleared by the immune system, but they can still trigger related diseases, including allergic bronchopulmonary aspergillosis (ABPA), fungal keratitis, otomycosis, and sinusitis infections. In patients with immune deficiencies, in addition to the aforementioned infections, it can also lead to invasive and disseminated aspergillosis, which often occurs during the treatment of hematological diseases in hospitals (Paulussen et al., 2016).



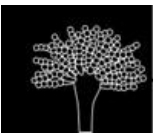
Reference: Mokobi, 2021

**Figure 1. Morphology of *Aspergillus fumigatus* grown on Sabouraud Dextrose Agar (SDA) and observed under a microscope.**



Reference: Mokobi, 2021

**Figure 2. Schematic diagram of *Aspergillus fumigatus* spores invading the body.**



### **(iii) Applications of *Aspergillus fumigatus***

*Aspergillus fumigatus* can be applied in cancer treatment. Research indicates that it can be utilized for synthesizing paclitaxel, which possesses anti-cancer properties, inducing apoptosis in cancer cells, and is widely used in the treatment of breast cancer, ovarian cancer, and other cancers. Paclitaxel is primarily isolated from *Taxus brevifolia*. Studies have identified 34 different endophytic fungi isolated from *Taxus brevifolia*. Based on experimental results and characteristic identification, it was confirmed that one of the strains is *Aspergillus fumigatus*. Therefore, it was discovered that *Aspergillus fumigatus* can serve as an excellent alternative source of paclitaxel. Through large-scale cultivation and extraction using microbial technology, the cost of drug treatment can be effectively reduced (Nywening et al., 2020).

### **(iv) Common Household Environments of *Aspergillus fumigatus***

*Aspergillus fumigatus* is present in soil, decaying plants, seeds, and grains, where they thrive as saprophytes. They pose a significant threat to human health, ranging from moderate allergies and severe asthma to widespread infections. Indoor plants represent a natural environment for the growth of these fungi; however, the sources of fungal proliferation in these indoor spaces (plants and flowers) are often overlooked. Furthermore, previous studies have shown that molds growing in damp buildings can lead to adverse health effects. Various molds may adversely affect human health based on toxicity, allergy, and infection. They are capable of producing secondary metabolites or mycotoxins. Inhaling high concentrations of mixed organic dust, including mycotoxins, volatile organic compounds (VOCs), and allergens (glucans), can lead to sick building syndrome. Therefore, it is important to pay attention to these



often-overlooked areas in daily household environments to reduce exposure to molds (Mousavi, 2016).

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### III - Conclusion

This article delves into the characteristics and applications of *Aspergillus fumigatus*, a common pathogenic microorganism. *Aspergillus fumigatus* is not only one of the common pathogens in humans but also closely associated with the production of paclitaxel. The isolation and cultivation techniques of *Aspergillus fumigatus* can enable large-scale production of paclitaxel, thereby reducing the cost of

drug therapy, which is of significant importance for the global supply of anticancer drugs. Moreover, further research is needed on the impact of *Aspergillus fumigatus* on human health, especially in terms of infections and other diseases in immunocompromised patients. Therefore, further research on *Aspergillus fumigatus* and its related characteristics can lead to a better understanding of its impact on human health and the development of effective preventive and treatment methods. In summary, *Aspergillus fumigatus* is a microorganism worthy of further study, with important implications for cancer treatment and human health.





## IV - Reference

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