



Case Report

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# *Aspergillus fumigatus* and Aspergillosis

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## Introduction

*Aspergillus* species are saprophytic *fungi* distribute everywhere in the environment in the air, soil, on the surfaces, on plant leave surfaces and plant debris. While the saprophytic nature of *Aspergillus* spp means they fully depend on environmental materials [1], which allows them to produce enzymes [1,2]. Also, it is a spore-forming mold fungus reproduces asexually by producing spores in the form of conidia. Therefore, the conidial spores are densely produced into the air during sporulation and are consistently inhaled by humans and animals in hundreds per day [2]. For instance, the direct inoculation of the skin surgical wounds, and burns as result of dissemination [3]. The incidence of infection may be severely in immunosuppressed patients [3]. That it can be pathogenic in humans causing severe allergic reactions and respiratory opportunistic fungal infection known as aspergillosis especially in immune-compromised individuals [2]. Aspergillosis in its most significant form is an infectious disease caused by *Aspergillus* spp [3,4].

It is usually confined to the lungs, but sometimes spreads to other organ systems [3]. Also, the conidia of *Aspergillus fumigatus* have the ability to evade the innate immune defenses by cilia and the mucosal lining of the respiratory tract. Therefore, the conidia first start to invade the outer blood vessels, moving through the endothelial cells into the inner part of the blood vessels during growth of hyphae. However, signs and symptoms include asthma, pneumonia, sinusitis, or rapidly progressing systemic illness [5].

It was also found that, *Aspergillus flavus* was the second common etiological agent of invasive aspergillosis (IA) after *Aspergillus fumigatus* [6]. However, most literature describes IA in relation to *Aspergillus fumigatus* or together with other *Aspergillus* species causes the diseases. On the other hand, a broad spectrum of human diseases is caused by *Aspergillus flavus* in Asia, the Middle East, and Africa, compared to other *Aspergillus* spp may be due to its ability to survive better in hot and arid climatic conditions [6]. It was found that echinocandins is not the first choice but the combination with voriconazole or as monotherapy may be used when the azoles and amphotericin B are contraindicated [6].

## Characteristics of *Aspergillus Fumigatus*

*Aspergillus fumigatus* description due to Raper and Fennell [7]. Colonies reaching 7 cm diam. In ten days at 24-26°C. on Czapekes spreading broadly, thin, bluish green, with strictly columnar conidial heads. Pigmented conidiophores with clavate vesicles arising from clearly differentiated thick-walled foot cells. Conidia globose to subglobose, echinulate, mostly 2.5-3.0 diam. *Aspergillus fumigatus* is a thermo tolerant fungus with a worldwide distribution. Due to a rather wide temperature range for good growth. It has been reported as air spora and numerous finds in forest soils. It has a high competitive saprophytic ability. *Aspergillus fumigatus* is characterized by the ability to grow in the range between 12°C and 57°C with an optimum between 37°C and 43°C. It tolerates temperatures during pasteurization to 63°C for 25 min [8] and (Figure 1 & 2).



Figure 1.

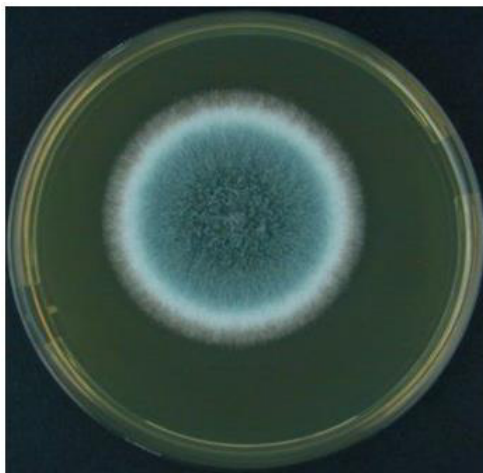


Figure 2.

**Scientific Classification**

Kingdom of Fung (Mycota) (Table 1 & Figure 3).



Figure 3: Asexual Reproduction.

Table 1.

<b>Division:</b>	Ascomycota
<b>Class:</b>	Eurotiomycetes
<b>Order:</b>	Eurotiales
<b>Family:</b>	Trichocomaceae
<b>Genus:</b>	<i>Aspergillus</i>
<b>Species:</b>	<i>A. fumigatus</i>
<b>Binomial Name</b>	
<i>Aspergillus fumigatus</i>	
Fresenius 1863	
<b>Synonyms</b>	
<i>Neosartorya Fumigata</i>	
O’Gorman, Fuller & Dyer 2008	

**Reproduction of *Aspergillus Fumigatus***

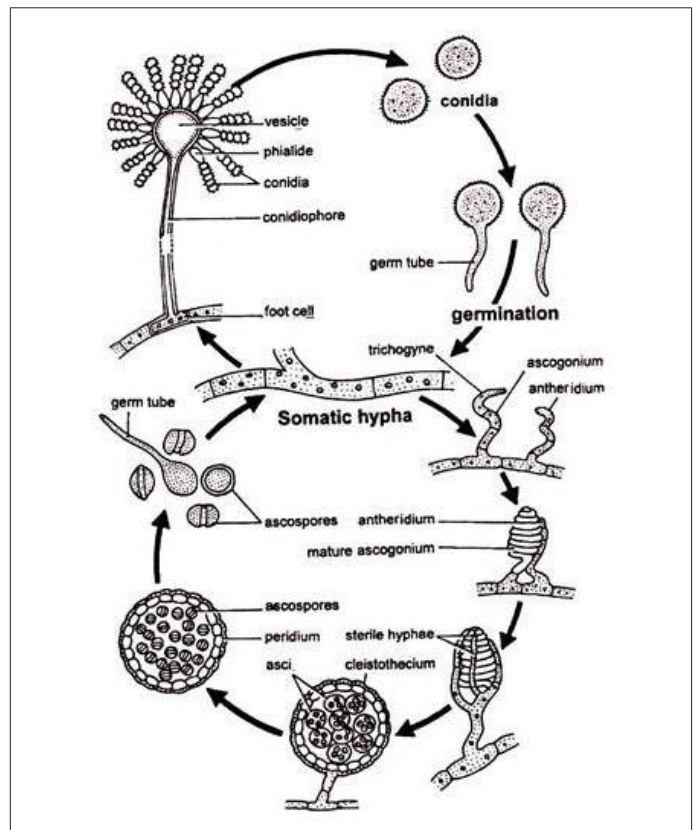


Figure 4: Life cycle of *Aspergillus* diagram by [11].

*Aspergillus fumigatus* reproduce only by asexual means [9] (Figure 3). While sexual stage for *A. fumigatus* was suggested that may identified yet be [4]. Typical of the supposedly ‘asexual’ fungi are many species of *Aspergillus*. The genus contains some 182 species and includes taxa with homothallic (selfing) and heterothallic (obligate outcrossing) sexual breeding systems. For instance, the majority of species are known to reproduce only by asexual means [10]. Asexual reproduction occurs by the formation of foot cell produces a special erect branch known as conidiophore.

The tip of the conidiophore swells up into an elliptical or globular multinucleate head called as vesicle [11]. It forms many radially arranged tubular outgrowths called sterigmata or phialides. The conidia when disseminate germinate by the formation of hypha. In some species primary sterigmata (uniseriate) bear secondary sterigmata. (Bi-seriate) [11] (Figure 4).

### Aspergillosis

Aspergillosis is an infectious disease caused by *Aspergillus* spp., it is usually confined to lungs, but sometimes spreads to other organ systems. The clinical types of aspergillosis are pulmonary aspergillosis including colonizing, allergic, aspergilloma. Miscellaneous forms of aspergillosis are otomycosis, cutaneous aspergillosis and onychomycosis [3].

#### Pulmonary Aspergillosis

Colonizing pulmonary Aspergillosis: *Aspergillus* spp. may be isolated from sputum of patients with chronic lung disease, the bronchopulmonary surfaces appear to be colonized by *Aspergillus fumigatus* [3].

#### Allergic Pulmonary Aspergillosis

Extrinsic allergic alveolitis is a hypersensitivity pneumonia that occurs in individuals exposed to large numbers of *Aspergillus* elements. For example, is the farmers' lung that follows exposure to moldy grains [3].

#### Symptoms

Malaise, chills, fever, cough, dyspnea and myalgia. Granulomatous disease and pulmonary fibrosis as a result of repeated infection [3].

#### Allergic Bronchopulmonary Aspergillosis

Is a hypersensitivity reaction to colonization of bronchial tree by *Aspergillus fumigatus* [3].

#### Aspergilloma (Fungus Ball)

Is the most common of the noninvasive pulmonary *Aspergillus* infections. That *Aspergillus fumigatus* takes up residence in a lung cavity produced by preexisting disease, particularly, tuberculosis, histoplasmosis and sarcoidosis. *Aspergillus fumigatus* multiple in lung cavity and produce a mycelial mass referred to fungus ball, Signs and symptoms may be absent for years, but in some cases blood vessels in the cavity wall lead to hemoptysis and hemorrhages that may be severe [3] (Figure 5 & 6 & 7).

#### Cutaneous Aspergillosis

*Aspergillus* skin infections may be primary the result of traumatic or iatrogenic implantation of the organism in the skin [3].

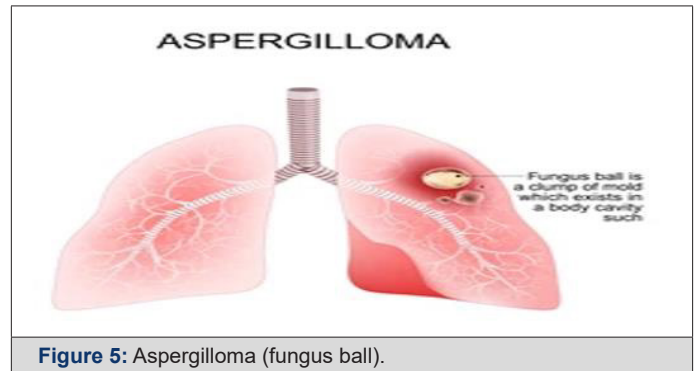


Figure 5: Aspergilloma (fungus ball).



Figure 6: Aspergilloma (fungus ball).



Figure 7: Aspergilloma (fungus ball).

#### Onychomycosis

*Aspergillus terreus* (Figure 8 & 9) sometimes causes onychomycosis. The nail plate is involved and shows peripheral greenish discoloration or white spots (Figure 10 & 11). *Aspergillus niger* also has been isolated from pulmonary infections and

cutaneous aspergillosis, and the most common cause of otomycosis [3] (Figure 12 & 13). *A. flavus* sometimes causes pulmonary, nasal-orbital, corneal and otomycosis [3]. *A. flavus* group due to Raper and Fennell [8] Colonies 3-7cm diam. In ten days at 24-26°C on Cz medium. Yellow green in color. Conidiophores hyaline, 0.4-1 mm long with rough wall. Conidial heads radiating, conidia globose to subglobose roughened to echinulate mostly 3.5-4.5 diam. Some isolates produce light to dark red and brown sclerotia. It was found that 50% of *A. flavus* species produces aflatoxins. It can cause pulmonary infections in birds [7].

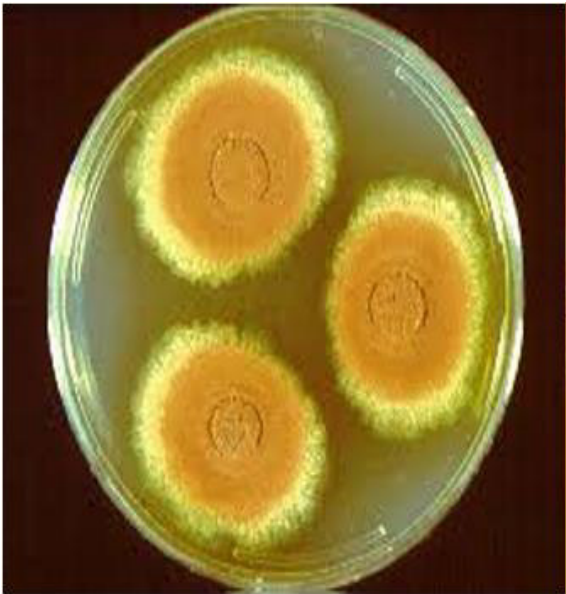


Figure 8: *Aspergillus Terreus*.



Figure 9: *Aspergillus Terreus*.

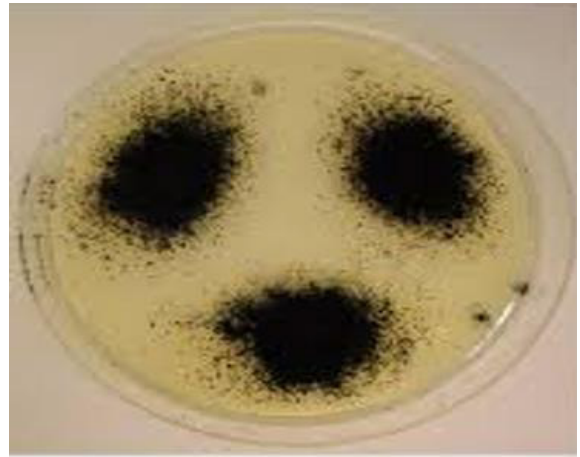


Figure 10: *Aspergillus Niger*.



Figure 11: *Aspergillus Niger*.

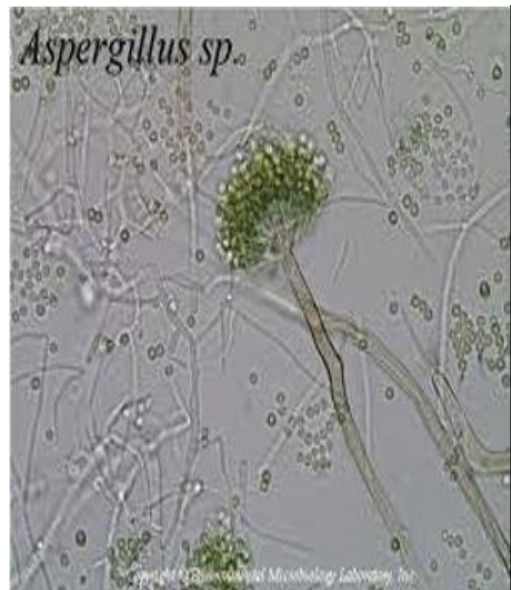


Figure 12: *Aspergillus Flavus*.

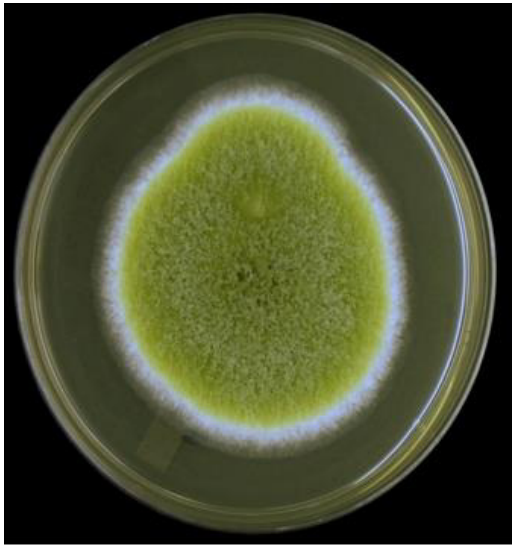


Figure 13: *Aspergillus Flavus*.

## Treatment

Systemic corticosteroids are indicated in controlling the disease. Amphotericin B has been the drug for invasive aspergillosis, also, is used for zygomycosis. Nystatin and aluminum subacetate solution Burows solution are used for *Aspergillus* otomycosis. Application of nystatin and thymol iodide for onychomycosis [3].

## Conclusion

*Aspergillus fumigatus* is a saprobe and weak opportunistic fungus, that spreads by its conidia in the air especially in the fields

where the fungus grows on infectious grains, or on plant debris that the conidia inhaled by humans and causes severe allergic reactions and respiratory opportunistic fungal infection known as Aspergillosis, especially in immune-compromised individuals. Inhalation of airborne *Aspergillus's* conidia is the initial event in pulmonary aspergillosis and dissemination of infection.

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