Hyamine and Mucorales Molds

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DOI: 10.15428/CCTC.2019.304881
Objectives

• Name methods for mold identification

• Describe the characteristics of hyaline molds

• Discuss some of the most commonly Mucorales fungi isolated in the laboratory
Methods of Identification

• Direct visualization
  • Slide prepared before setting fungal cultures
  • Calcofluor White fluorescent stain
    o Non-specific

• Histology
  o Hematoxilin & Eosin stain (H&E)
  o Gomori Methenamine Silver stain (GMS)
  o Periodic acid–Schiff (PAS)
  o Non-specific

1 Hyaline mold stained with Calcofluor White fluorescent stain. **Photo credit:** Melinda Wills

2 **Rhizopus spp.** - H&E, 60x
Methods of Identification

• Culture
  • Colony morphology
  • Lactophenol cotton blue stain
• Media types:
  o Non-selective
  o With antibiotics
  o With cycloheximide
• MALDI-TOF MS
• DNA sequencing

Penicillium spp., lactophenol cotton blue stain, 60x
Hyaline Molds

- Rapid growth
- Thin, regularly septate hyphae
- Acute angle branching septations (blue arrows)
- *Aspergillus* spp., *Fusarium* spp., and *Scedosporium* spp. may be indistinguishable by histology

Hyaline mold, H&E stain, 60x
Hyaline Molds - Aspergillus fumigatus Complex

- Most common cause of invasive aspergillosis, allergic aspergillosis, fungal sinusitis, and aspergilloma (fungus ball)

- Fast growing blue-green colonies with white borders (image 1), white to tan on reverse

- Dome or flask-shaped vesicle with uniseriate phialides covering 2/3 of the vesicle (red arrows image 2)
Hyaline Molds - *Aspergillus flavus* Complex

- Second most common cause of invasive aspergillosis
  - Producer of aflatoxin
- Fast growing, yellow-green colonies, yellowish on reverse (image 1)
- Rough or spiny conidiophore, may be hard to see (red arrow image 2)
- Globose vesicle covered by uniseriate or biseriate phialides

*A. flavus* complex – Lactophenol cotton blue stain, 60x
Hyaline Molds - *Aspergillus niger* Complex

- Cause of aspergilloma (fungus ball) and otitis externa
- Fast growing black colonies, white on reverse (image 1)
- Globose vesicle with biserate phialides and brown conidia (image 2)

*A. niger* complex - Lactophenol cotton blue stain, 60x
Hyaline Molds - *Aspergillus terreus* Complex

- Can cause disseminated disease
- Resistant to amphotericin B
- Fast growing cinnamon-brown colonies, yellow on reverse
- Upper half of the dome-shaped vesicle has biserate phialides (red arrow)

A. *terreus* complex - Lactophenol cotton blue stain, 60x
Hyaline Molds - *Penicillium* spp.

- Most often considered to be a contaminant
  - *Talaromyces marneffei* (*Penicillium marneffei*)

- Fast growing, powdery blue-green colonies (image 1)

- Branched and unbranched conidiophores with clusters of phialides with round conidia in chains (image 2)
Hyaline Molds - *Paecilomyces* spp.

- Considered a contaminant
  - May be a cause of keratitis

- Usually fast growing, flat, yellow-brown colonies, with off-white reverse

- Branched conidiophores with clusters of phialides with delicate tapering ends and oval conidia in chains

*Paecilomyces* spp. – Lactophenol cotton blue stain, 60x
Hyaline Molds – *Penicillium* Vs. *Paecilomyces*

- **Penicillium**
  - Blue-green colonies
  - Blunt phialides
  - Round conidia

- **Paecilomyces**
  - Yellow-brown colonies
  - Long tapering phialides
  - Oval conidia
Hyaline Molds - *Fusarium* ssp.

- Can cause a wide array of infections, from nail to disseminated disease (in immunocompromised patients)
- Fast growing wooly colonies
  - White, cream, pink, or purple
  - Light or deeply colored reverse
- Produces micro and macroconidia
  - 1-2 celled microconidia
  - Curved macroconidia (banana or sickled shaped), septate, usually in clusters

*Fusarium* spp. - Lactophenol cotton blue stain, 60x
Hyaline Molds – *Acremonium* *spp.*

- Cause of white-grain mycetoma, keratitis, and nail infection
- Slow growing rose to white colonies
- Clusters of single cell conidia at the end of narrow phialides (red arrow), usually in masses

*Photo credit: Melinda Wills*
Mucormycosis

- Caused fungi from the Mucorales order
  - *Rhizopus* spp., *Mucor* spp., *Lichtheimia* (previously *Absidia*) spp., *Rhizomucor*, and *Apophysomyces* spp and others rarely

- Zygomycetes - obsolete term

- Cause of rhinocerebral, pulmonary, cutaneous, and systemic invasive disease
  - Diabetes, iron overload, immune suppressed
Mucorales

- Rapidly growing mycelium
- Pauciseptated, ribbon-like or broad hyphae
- Wide-angle branching
  - Histology

*Rhizopus spp. - H&E stain, 60x*
Mucorales - *Rhizopus* spp.

- Most common cause of mucormycosis
- White, cottony, fast growing colonies that darken with age. White to pale grey or brown reverse
- Characterized by presence of rhizoids
  - Root like structures (red arrow)
- Multispored, spherical sporangia
- Unbranched sporangiophores directly connected to rhizoids

*Rhizopus* spp. - Lactophenol cotton blue stain, 60x
Mucorales - *Mucor* spp.

- Less common cause of mucormycosis

- White-yellow to grey, cottony, fast growing colonies that darken with age (Image 1). Reverse is white

- Hyaline sporangiophores
- Multispored, spherical sporangia
- No rhizoids (red arrow image 2)
  - Identification of exclusion

*Mucor* spp. - Lactophenol cotton blue stain, 60x
Mucorales

- Differential characteristics between *Lichtheimia*, *Rhizomucor*, and *Apophysomyces*

<table>
<thead>
<tr>
<th>Genus</th>
<th>Sporangiophore</th>
<th>Apophysis</th>
<th>Columella</th>
<th>Sporangium</th>
<th>Rhizoids</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Apophysomyces</em></td>
<td>Unbranched grey-brown</td>
<td>Bell-shaped, not prominent</td>
<td>Dome shaped</td>
<td>Pyriform</td>
<td>Present</td>
</tr>
<tr>
<td><em>Lichtheimia</em></td>
<td>Branched hyaline</td>
<td>Conical, not prominent</td>
<td>Dome shaped</td>
<td>Pyriform</td>
<td>Primitive, present</td>
</tr>
<tr>
<td><em>Rhizomucor</em></td>
<td>Branched brown</td>
<td>Absent</td>
<td>Round</td>
<td>Globose</td>
<td>Present, few</td>
</tr>
</tbody>
</table>
References


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