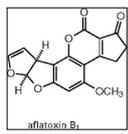
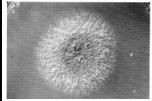




Curso de Graduação em Engenharia de Alimentos

**Disciplina ZMV-0368**  
**Microbiologia Fundamental**

  
aflatoxin B<sub>1</sub>





• **Morfologia, Ultraestrutura e Taxonomia de Fungos**

**Carlos Augusto F. de Oliveira**  
Professor Titular  
ZEA/FZEA/USP - Pirassununga

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**Fungos**

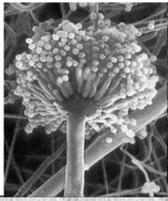
Eucarióticos, unicelulares, multinucleados e heterotróficos, caracterizados por uma parede celular quitinosa:  
**Reino FUNGI**

Maioria apresenta crescimento filamentosos e em colônias multicelulares (agrupados como micélio)

Crescem na forma de uma massa disforme

Se espalham rapidamente, podendo cobrir muitos cm<sup>2</sup> em 2 a 3 dias.

Micélio=composto por filamentos ou hifas



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**Fungos**

Desenvolvem-se em:

- Quase todas as condições climáticas do mundo;
- Qualquer suporte sólido ou líquido;
- T°C entre 10 e 40°C;
- Intervalo de pH de 4 a 8;
- Atividade de água acima de 0,70 (podendo também crescer em uma superfície muito seca).



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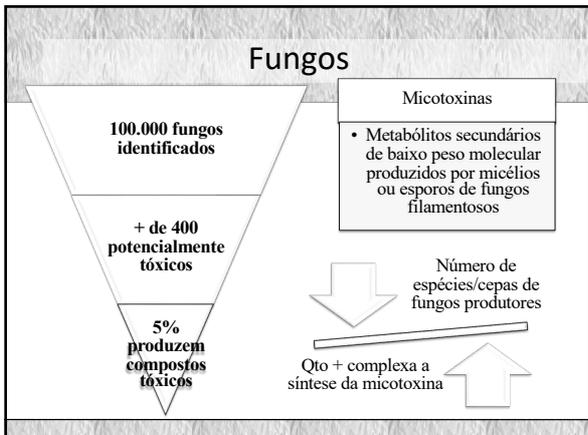
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### Classificação dos Fungos

- FUNGOS:
  - ✓ Unicelulares: leveduras
  - ✓ Pluricelulares:
    - Mofos ou bolores
    - Cogumelos

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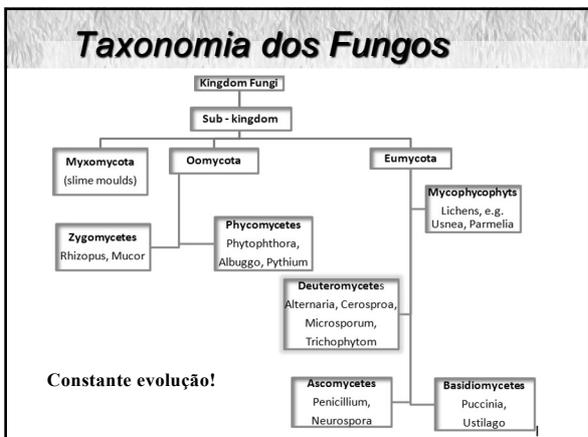
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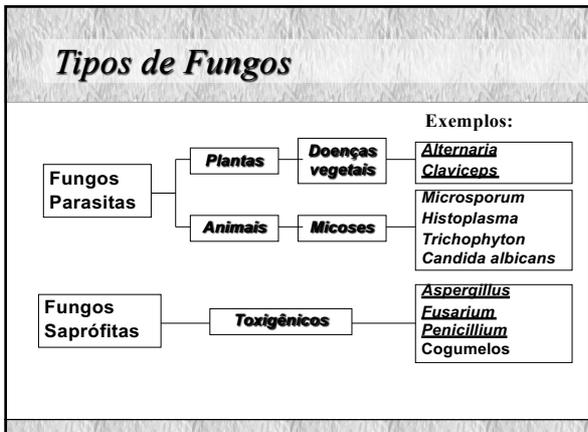
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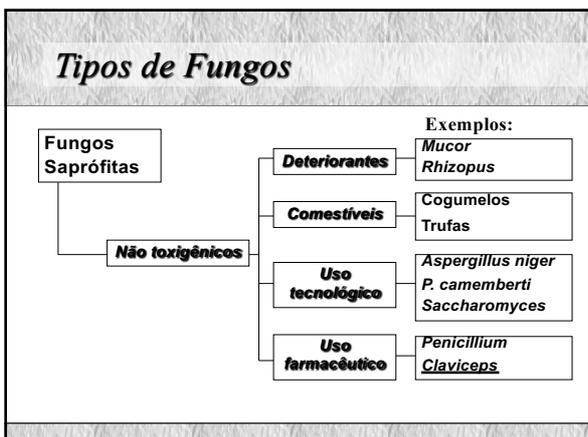
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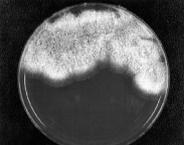
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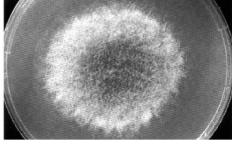
### MOFOS OU BOLORES

- Características:
  - ✓ Fungos filamentosos sem forma definida
  - ✓ Filamentos = hifas
  - ✓ Conjunto de hifas = micélio
  - ✓ Formam colônias com aspecto de algodão ou polvilhado

*A. flavus* em ágar sangue de carneiro



*Mucor pusillus* em ágar PDA



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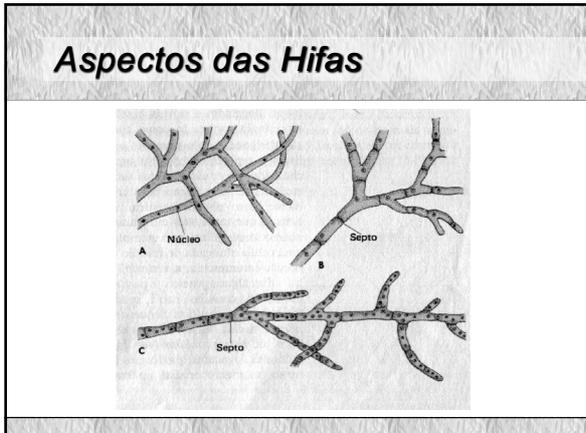
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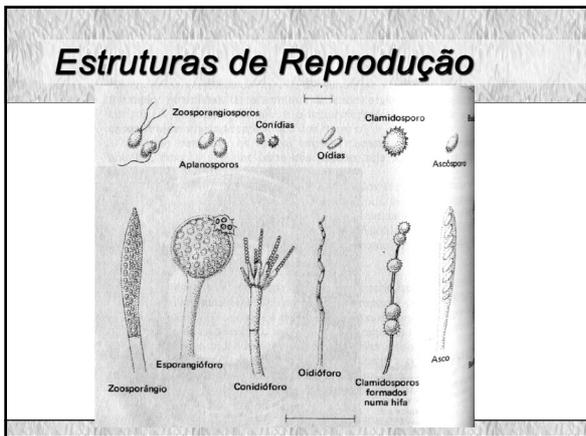
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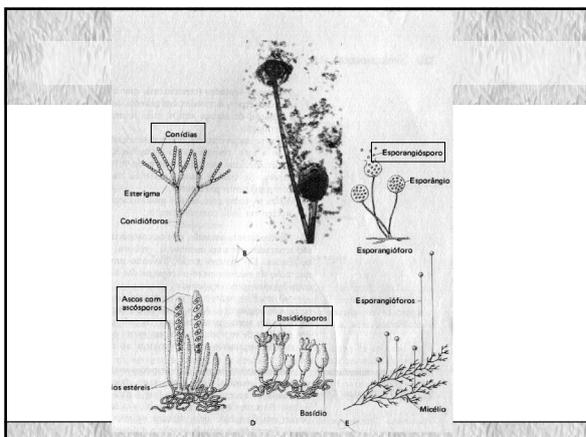
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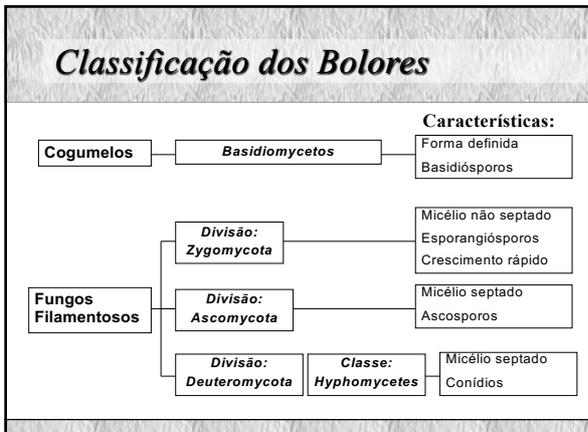
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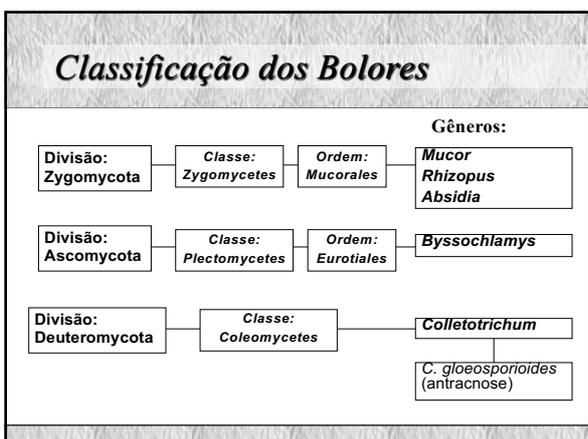
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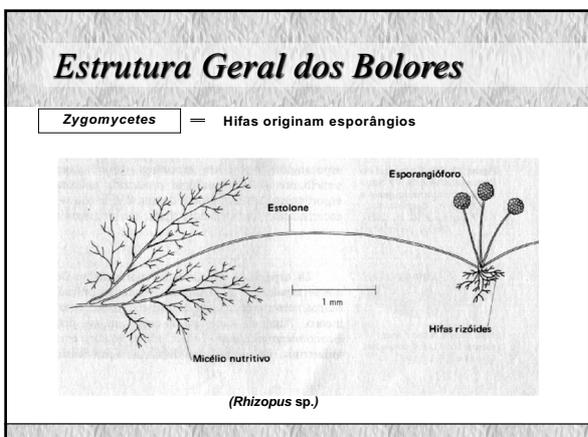
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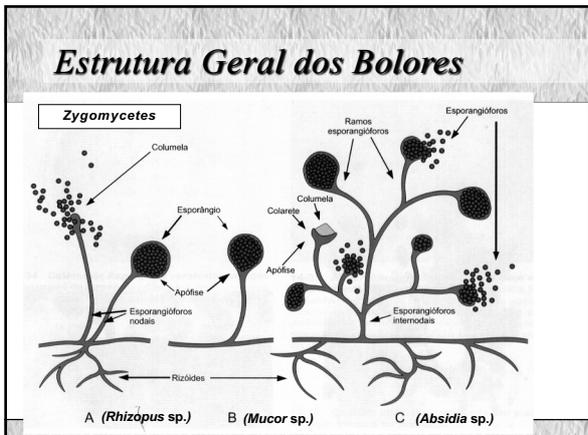
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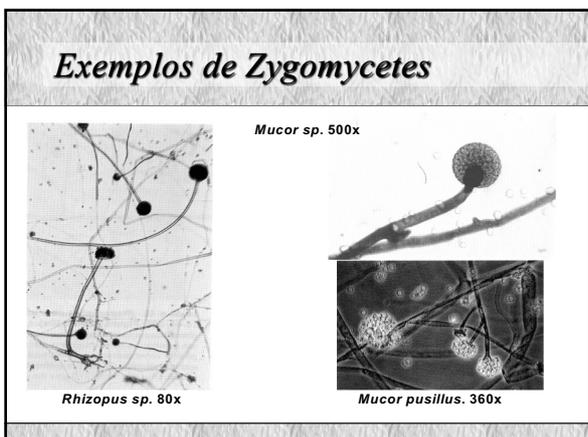
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### Estrutura Geral dos Bolores

**Plectomycetes** = Hifas originam ascos

- Ascósporos termorresistentes
- Produzem enzimas (ex.: pectinases)
- Principais gêneros:
  - *Byssochlamys*
  - *Eupenicillium*
  - *Emericella*
  - *Eurotium*

Ascós com ascósporos

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### Classificação dos Bolores

<b>Divisão:</b> Deuteromycota	<b>Classe:</b> Hyphomycetes	<b>Ordem:</b> Hyphomycetales	<b>Gêneros:</b> <b>Alternaria</b> <b>Aspergillus</b> Botrytis Cladosporium <b>Fusarium</b> Geotrichum <b>Penicillium</b> Stachybotrys Trichotecium
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### Estrutura Geral dos Bolores

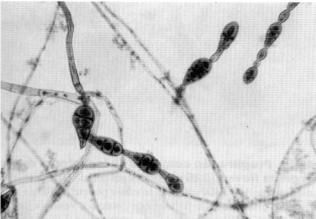
**Deuteromycetes**

**Hyphomycetes** = Hifas originam conídios

**Gênero Alternaria**

-Produzem podridão parda/negra em frutos (ex.: maçã, figo, tomate cítricos)

-Micotoxinas produzidas: alternariol, ácido tenuazóico



*Alternaria* sp.  
(500x)

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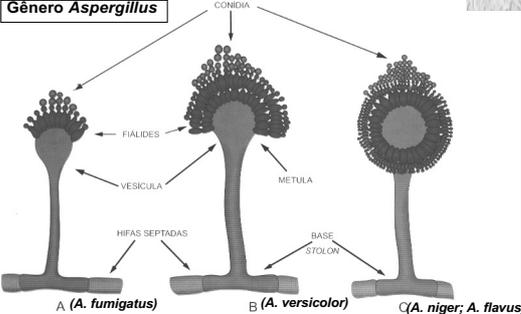
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### Estrutura Geral dos Bolores

**Gênero Aspergillus**



A (*A. fumigatus*)      B (*A. versicolor*)      C (*A. niger*; *A. flavus*)

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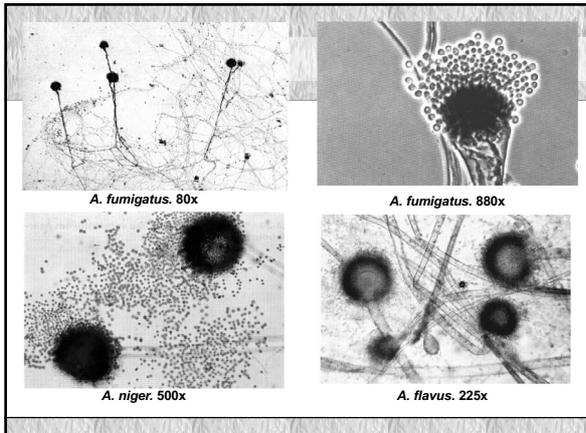
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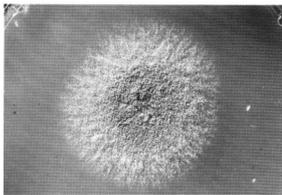
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### Exemplos de Aspergillus

☛ **Toxigénicos:**

- A. flavus, A. parasiticus, A. nomius: aflatoxinas B<sub>1</sub>, B<sub>2</sub>, G<sub>1</sub>, G<sub>2</sub>, esterigmatocistina, ácido ciclopiazônico);
- A. ochraceus: ocratoxinas A e B);

☛ **Uso tecnológico: A. niger**



A. flavus (ágar Czapeck, 6 dias)

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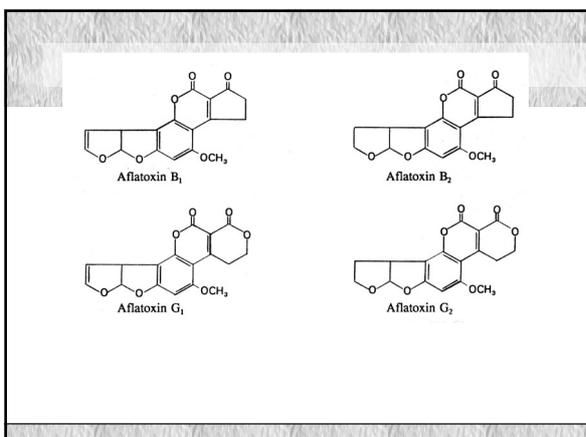
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### Estrutura Geral dos Bolores

**Gênero *Penicillium***

The diagram shows the general structure of a Penicillium mold. It consists of a central stalk (RAMOS) that branches into several smaller stalks (METULAS). Each METULA further branches into many smaller stalks (FIALIDES). At the end of each FIALIDE are numerous small, round spores (CONIDIA). A micrograph to the right shows a similar structure of Penicillium sp. at 250x magnification, with the caption: *Penicillium sp. 250x* (coloração: calcofluor).

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### Exemplos de *Penicillium*

**Toxigênicos:**

- *P. verrucosum* (ocratoxinas);
- *P. citrinum* (citrinina);
- *P. patulum* (patulina)

**Uso tecnológico:** *P. camemberti*, *P. roqueforti*, *P. candidum* (ex.: queijos)

The micrograph shows Penicillium sp. at 500x magnification. Below it is a photograph of a round piece of cheese with a white, moldy surface.

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### Estrutura Geral dos Bolores

**Gênero *Fusarium***

-Produzem podridão parda em cereais (ex.: milho, trigo, aveia, cevada)

-Produzem toxinas: fumonisinas, zearalenona, tricotecenos (T-2, HT-2, DON)

The micrograph shows Fusarium sp. at 500x magnification, with a label pointing to 'Microconidias'. Below it is a photograph of a corn kernel with a dark, moldy spot.

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### Principais Toxinas de *Fusarium*

☞ Gênero *Fusarium*:

- ✓ *F. graminearum*, *F. roseum*: Zearalenona
- ✓ *F. sporotrichoides*, *F. poae*, *F. nivale*, *F. culmorum* e outros: Tricotecenos (Nivalenol, Deoxinivalenol -DON, T-2, HT-2 e outras)
- ✓ *F. verticillioides* (moniliforme), *F. proliferatum*, *F. subglutinans*: Fumonisinás

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-Fungos de campo (ground molds): *Alternaria*, *Fusarium*, *Cladosporium*, *Chaetomium*  
-Fungos de armazenamento: *Aspergillus*, *Penicillium*  
-Fungos de decomposição: *Mucor*, *Rhizopus*

Van Gogh: A Colheita na Provença.

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