

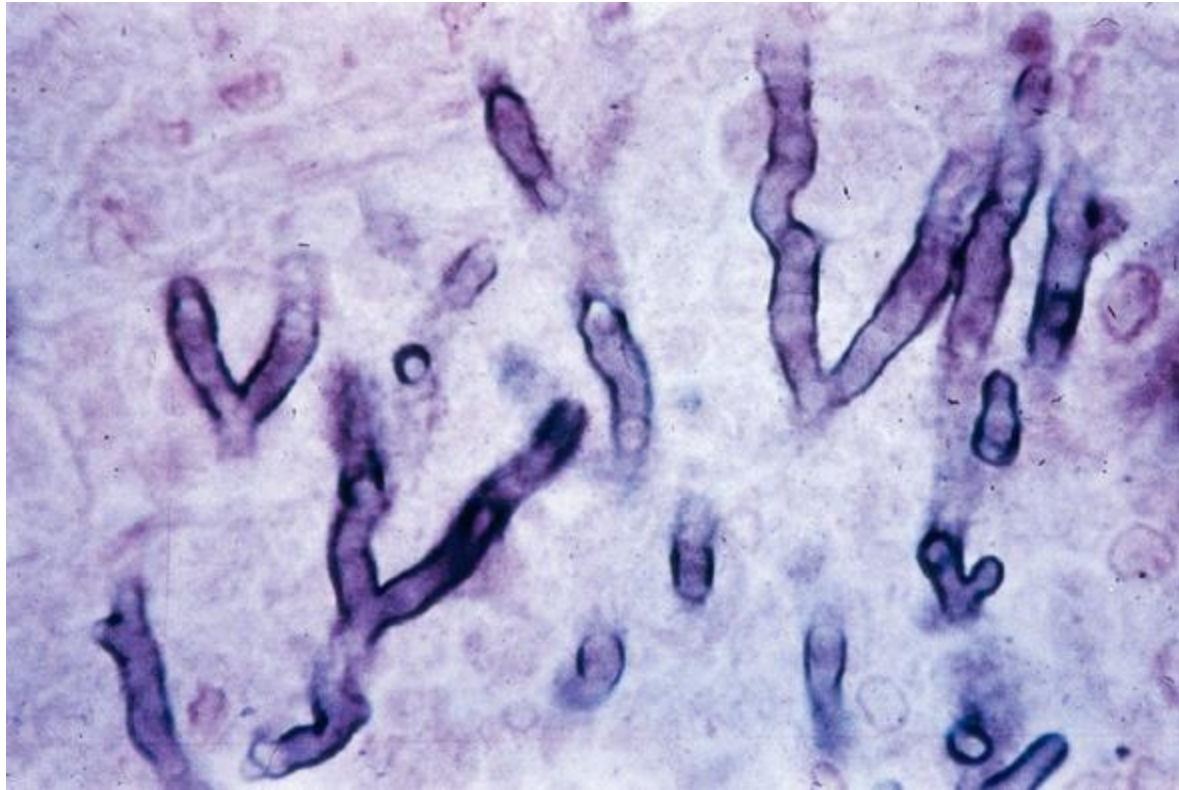
# **ZYGOMYCETES**

Dr. Poonam Shakya

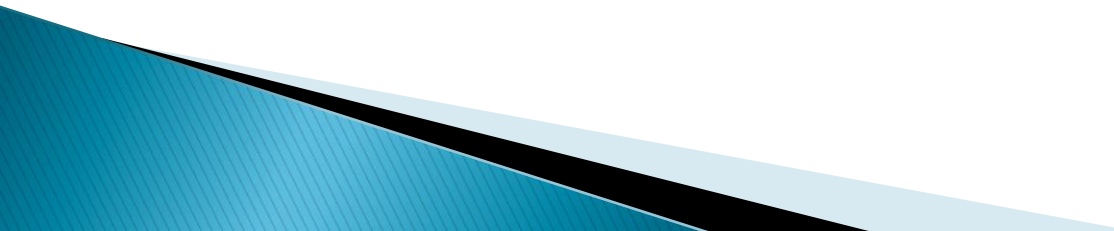


# INTRODUCTION

- ▶ Zygomycosis (older term phycomycosis)- infection due to a fungus in the taxonomic Class *Zygomycetes*, phylum *Zygomycota*.
- ▶ Saprophytes and widespread in the environment but some of them can be opportunistic pathogens.
- ▶ Clinical disease usually occurs if the host's defences are lowered or if large numbers of spores are ingested or inhaled.
- ▶ The hyphae, in cultures and in animal tissues, are wide (5–15  $\mu\text{m}$  diameter), irregular and ballooning



*Rhizopus species non-septate hyphae in the wall of bovine rumen. (Silver stain, ×1000)*

- ▶ They lack septa except near fruiting structures and if there has been damage to hyphae or in older cultures.
  - ▶ The sexual spores are thick-walled zygospores produced through fusion of gametangia, often from two different strains of the species.
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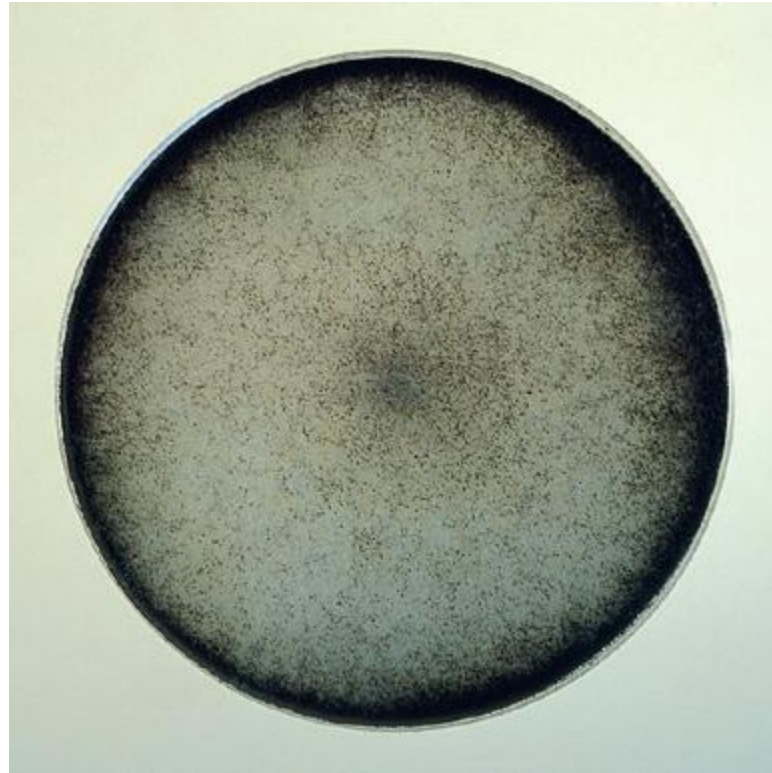


*Rhizopus species: zygospore. (×400)*

- ▶ The Class contains three Orders of veterinary significance – *Mucorales*, *Mortierellales* and *Entomophthorales*.
- ▶ Pathogenic species within the Order *Mucorales* are found within several genera including *Lichtheimia* (*Absidia*), *Mucor*, *Rhizopus*, *Rhizomucor*, *Saksenaea*.
- ▶ The Order *Mortierellales* contains one genus of veterinary significance, *Mortierella*.
- ▶ The Order *Entomophthorales* includes *Basidiobolus ranarum* and *Conidiobolus coronatus* both of which can cause disease in animals and humans.

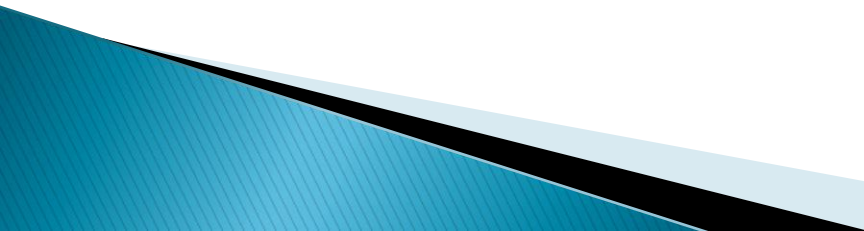
# THE MUCORACEOUS ZYGOMYCETES (ORDERS *MUCORALES* AND *MORTIERELLALES*)

- ▶ The mucoraceous zygomycetes characteristically have rapidly growing colonies with greyish, woolly mycelium that fills the Petri dish in three to five days and often reaches and raises the lid of the plate



*Rhizopus species on Sabouraud agar, seven days.*



- ▶ The aerial hyphae (sporangiophores) arise from stolons and usually end in a columella that is enclosed in the sac-like sporangium.
  - ▶ Within the sporangium the asexual spores (sporangiospores) are formed.
  - ▶ These spores can be colourless, yellowish or brown and the sporangia, packed with spores, often appear as dark, pinhead-sized dots within the woolly grey mycelium.
  - ▶ As the spores mature, the wall of the sporangium becomes fragile and ruptures releasing spores
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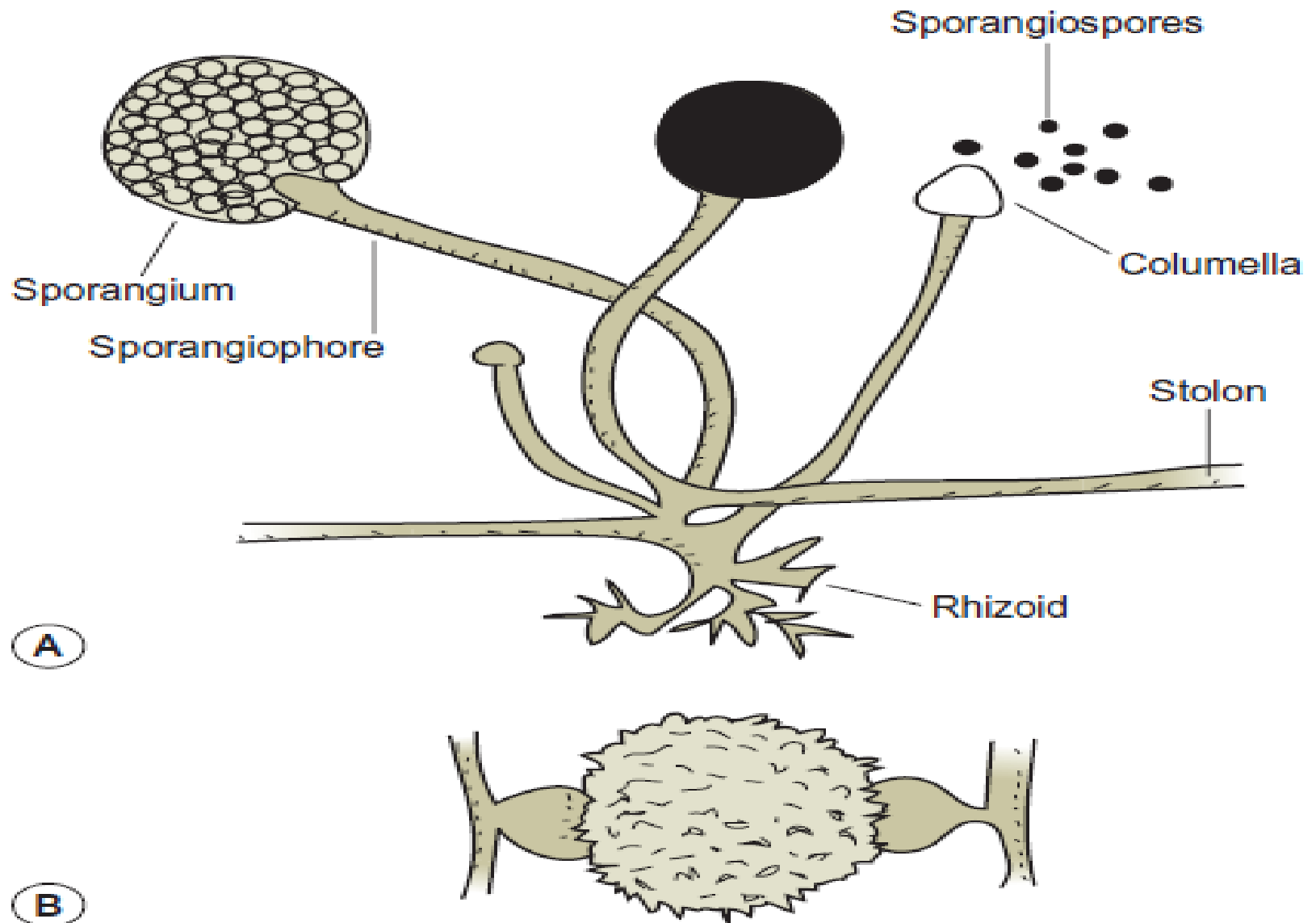
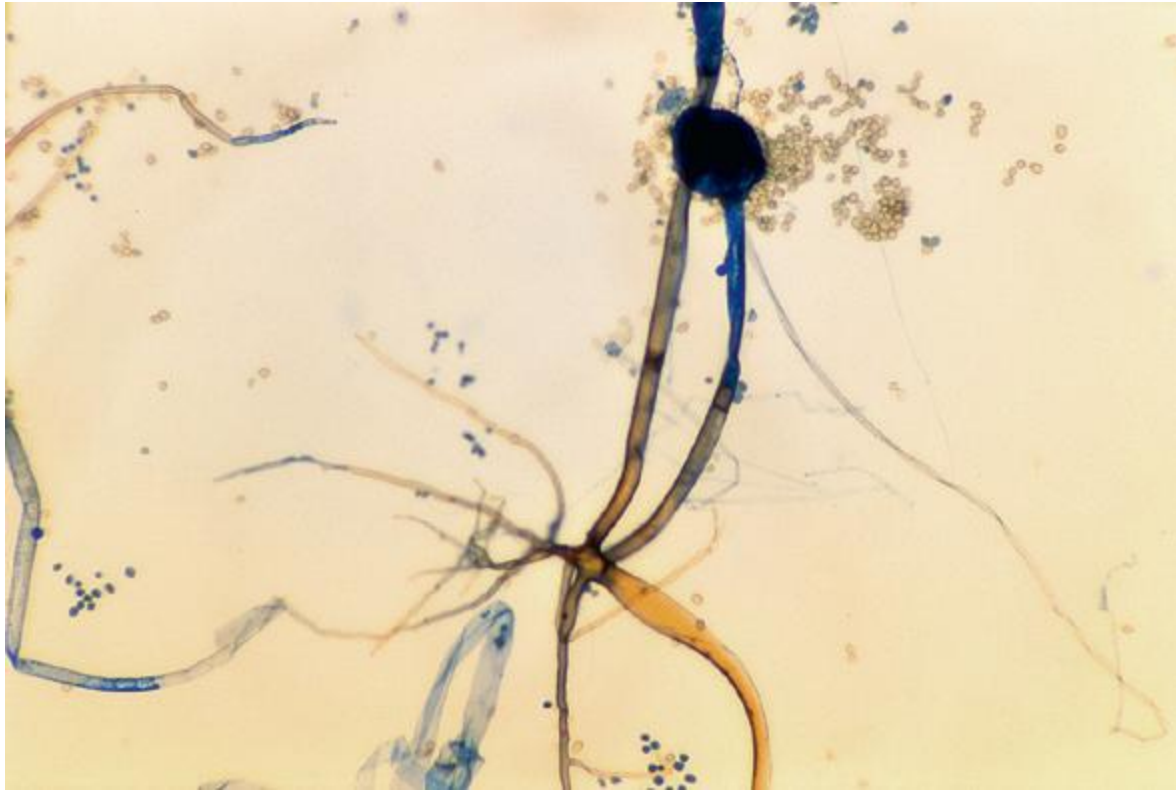
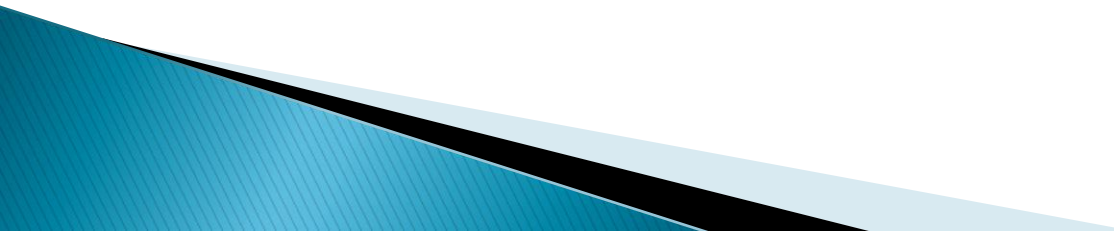


Figure 42.5 A mucoraceous zygomycete showing: A asexual fruiting structure, B sexual zygosporangium.



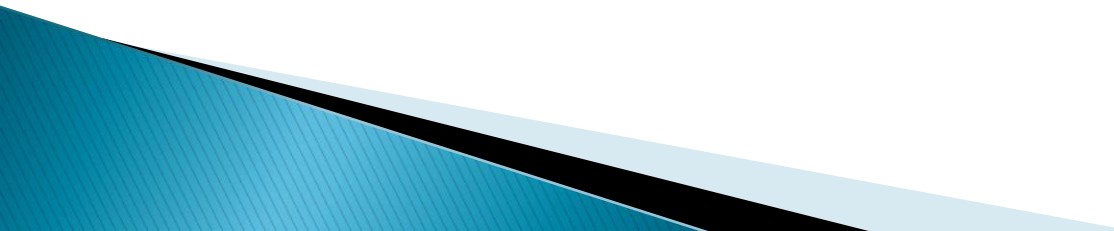
***Rhizopus species: sporangiophore, collapsed sporangium, sporangiospores and a rhizoid. (LPCB, ×100)***

# Natural Habitat

- ▶ Saprophytes
  - ▶ widespread in soil, vegetation and air.
  - ▶ worldwide
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# Pathogenesis

- ▶ Infection with these fungi is associated with immunodeficiency, corticosteroid treatment, prolonged administration of antibiotics and immunosuppressive viral infections
- ▶ Members of the genera *Rhizopus*, *Rhizomucor* and *Lichtheimia* (*Absidia*) are thermotolerant and able to grow at core mammalian body temperature.
- ▶ The enzyme ketone reductase is produced by *Rhizopus* species and facilitates the growth of this fungus in the acidic and glucose-rich environment of the rumen following grain overload.

- ▶ Proteases and lipases produced by *Rhizopus species* probably assist in the invasion of host tissues.
  - ▶ *Lichtheimia (Absidia)* species produce siderophores that aid iron scavenging.
  - ▶ Inhalation-pulmonary disease
  - ▶ ingestion - intestinal infection.
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- ▶ Infection is thought to reach the placenta via the bloodstream from the respiratory or alimentary tract.
- ▶ The most common form of zygomycosis (sometimes referred to as mucormycosis) affects the lymph nodes of the respiratory and intestinal tracts.
- ▶ Infection is most common in cattle, pigs and dogs.
- ▶ Young animals are more prone to intestinal tract infections, clinically manifested by diarrhoea.
- ▶ A granulomatous reaction, ulceration and caseous necrosis occur in the intestinal tract.
- ▶ In acute and severe infections the fungi characteristically display a pronounced angiotropism and invade blood vessels, causing a necrotizing vasculitis with thrombosis and haemorrhage.

- ▶ *Mortierella wolfii*- causes abortion in cattle and in about 5% of these animals an acute, fulminating pneumonia followed by death occurs within 48 hours of the abortion.
- ▶ Lesions are characteristic of mycotic abortion and resemble those seen in *Aspergillus fumigatus* infections.
- ▶ *The placenta* is thickened and ‘wooden’ in appearance and the foetus may have ringworm-like fungal skin plaques





**Bovine mycotic placentitis (*Mortierella wolfii*).**



**Fungal plaques on a bovine foetus characteristic of mycotic abortion (*Mortierella wolfii*).**

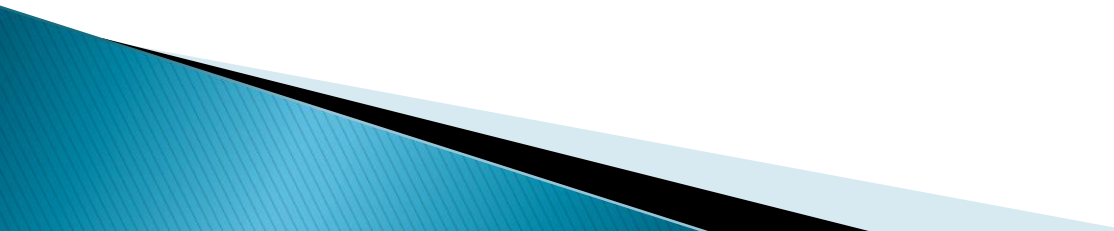


**Bovine lung. Acute, diffuse, mycotic pneumonia**  
(*Mortierella wolfii*).

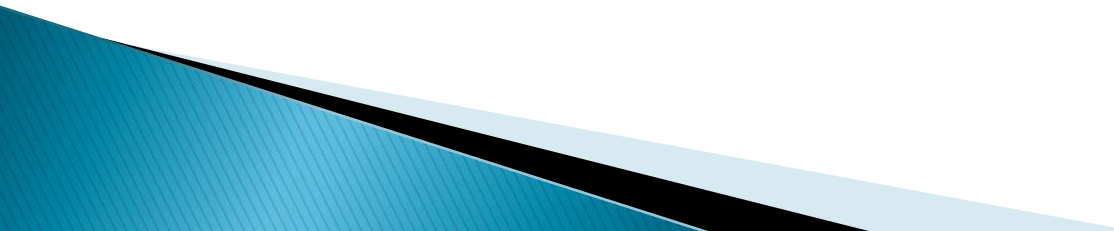
**Table 42.1 Diseases caused by the mucoraceous zygomycetes**

<b>Host</b>	<b>Disease</b>
Cattle	Rumenitis, abomasal ulcers
	Abortion
	Mesenteric and mediastinal lymphadenitis
	Enteritis in calves
	Pneumonia following mycotic abortion due to <i>Mortierella wolfii</i>
Pigs	Gastric ulcers
	Mediastinal and submandibular lymphadenitis
	Enteritis in piglets
Horse	Abortion
Dogs	Enteritis
Cats	Enteritis
	Pneumonia

# Laboratory Diagnosis

- ▶ **Specimens**
  - ▶ Lesion biopsies or tissues from dead animals, cotyledons, foetal abomasal contents and uterine discharges can be collected.
  - ▶ Tissue samples, in 10% formalin for histopathology.
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# Direct microscopy

- ▶ Histological examination of tissue sections
  - ▶ They are PAS-positive (pink staining).
  - ▶ methenamine silver staining
  - ▶ KOH wet preparations.
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# Culture

- ▶ Sabouraud dextrose agar without cycloheximide or
- ▶ Emmons' modification can be used.
- ▶ The inoculated plates are incubated aerobically for up to 10 days
- ▶ The zygomycetes will grow well on blood agar plates

# Identification

- ▶ At present there are no identification kits,
  - ▶ nucleic acid probes or widely available
  - ▶ immunological or serological
  - ▶ histological examination
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