LESSON ASSIGNMENT

LESSON 6
Subcutaneous Fungi.

TEXT ASSIGNMENT
Paragraphs 6-1 through 6-5

TASK OBJECTIVES
After completing this lesson, you should be able to:

6-1. Select the statement that correctly describes the specific fungus that causes mycetoma.

6-2. Select the statement that correctly describes the specific fungus that causes chromomycosis.

6-3. Select the statement that correctly describes the specific fungus that causes rhinosporidiosis.

6-4. Select the statement that correctly describes the specific fungus that causes sporotrichosis.

SUGGESTION
After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.
LESSON 6

SUBCUTANEOUS FUNGI

6-1. INTRODUCTION

Subcutaneous fungi cause mycoses that involve the skin and subcutaneous tissue. Dissemination to the major organs of the body usually does not occur. However, involvement of large muscle mass and bone may develop. They are primarily soil organisms found in tropic and subtropic regions. Man, acting as an accidental host, becomes infected either by traumatic implantation of the organism or by the introduction of viable spores into a lesion. Subcutaneous disease processes include mycetomas, chromomycosis, rhinosporidiosis, and sporotrichosis.

6-2. MYCETOMA

a. Mycetoma is a chronic, progressive disease characterized by tumor-like swelling, abscess, and draining sinus tracts. Fluids that ooze from these tracts contain pigmented granules composed of microbial elements. The causative agents can be either bacterial or fungal. When bacteria are the cause of the disease process, three genera are usually suspected—Actinomyces, Nocardia, or streptomyces. Bacterial mycetomas, caused by anyone of these genera, are called actinomycotic mycetomas. Other bacteria may cause similar disease process called botryomycosis. The term eumycotic mycetoma is applied when the disease is caused by a fungus. Eumycotic mycetoma may also be referred to as Maduromycosis, and is often called "Madura foot." This name evolved because the disease, which causes primary infections of the foot, was first described in the Madura province of India.

b. Eumycotic mycetoma is usually resistant to chemotherapy. Definitive treatment may require amputation. There are several possible causative agents of which Pseudallescheria boydii is the most common. Other causative agents are Acremonium falciform, Exophiala jeanselmei, Madurella grisea, and Madurella mycetomatis. Recovery of the causative agent is obtained by culturing the pigmented granules. The granules range in color from yellowish to red and black. Color is dependent on the causative agent. Upon direct examination of a crushed granule, mycelial elements can be observed under the microscope. Remaining granules should be washed in sterile water or antibiotic solution and inoculated to SDA and SDA with chloramphenicol.

(1) Pseudallescheria boydii (Monosporium apiospermum—asexual).

(a) The granules produced by pseudallescheria boydii are white to yellow and soft to firm. Colonies are fluffy in texture and grayish to white color. Reverse is grayish-black.
(b) Microscopic examination of colonies show hyphae that are hyaline, broad, and septate. Conidia are numerous, pyriform to oval, small (6 to 9 mcm) and hyaline, or large and brown to golden. They are found as single cells or in bunches on a short conidiophore. (Figure 6-1.)

Figure 6-1. Microscopic morphology of Pseudallescheria boydii.

(2) Exophiala jeanselmei.

(a) Exophiala jeanselmei, the second most common cause of Madura foot, produces dark granules in host tissue. They are brown to black, irregular in shape, and fragile. Detached portions or fragments often are found in the lesion, within giant cells. Colonies are slow-growing on culture media and produce a black color with a velvety texture. The reverse is also black.

(b) Microscopic examination shows hyphae that are dematiaceous and septate. Young cultures appear as yeast-like budding cells. Eventually septate hyphae with conidiophores develop. Annellides are cylindrical, forming oval to oblong annelloconidia. The annelloconidia are loosely clustered at the tip of the annellides, and may be seen laterally along the hyphae.

(3) Acremonium falciform.

(a) Granules of Acremonium falciform are soft, and white to pale yellow. Colonies are slow-growing on culture media, producing color that is buff to lavender and a texture that is downy. Reverse is currant red to violet.

(b) Microscopic examination shows delicate septate hyphae. Tapering phialides rise directly from the hyphae and produce phialoconidia. These phialoconidia are hyaline, curved, and rounded on the upper end with a straight base. They are arranged in a ball at the tip of the phialide because they are held together with a mucin-like substance. (Figure 6-2.)
6-3. CHROMOMYCOSIS

a. Chromomycosis is a disease that affects the legs and feet. The causative agents are termed dematiaceous because they have a brown to black pigment due to the presence of melanin. These organisms are often referred to as "black molds." They are slow growing, geophilic fungi that belong to the class Deuteromycetes. Causative agents include *Cladosporium carrionii*, *Phialophora verrucosa*, *Fonsecaea pedrosoi*, and, rarely, *Fonsecaea compacta*.

b. Clinical symptoms vary depending on the age of the infection. Early lesions begin as small erythematous papules which satellite around the periphery of the primary lesion. As the infection progresses, the lesions aggregate, become red to violet, and ulcerate. Older lesions are described as "cauliflower-like." These lesions are dry, crusted, verrucous (rough or warty in appearance) and are darkly pigmented with defined margins. Complications often develop with bacterial superinfections occurring within the lesions.

c. Specimens include exudates and scrapings. Sclerotic bodies are observed upon direct microscopic examination. Regardless of the causative agent, sclerotic bodies appear to be round, thick-walled, 6 to 12 μm in size and chestnut brown in color. Because of their color and shape, they are commonly referred to as "copper pennies," although it is believed they are nothing more than chlamydospores.

d. Specimens are inoculated to SDA and Mycosel™. The causative agents usually require three weeks incubation for growth to occur. Because of the time needed for initial growth, a negative report may not be sent out until there is no growth at the end of six weeks incubation.

(1) *Cladosporium carrionii* vs. *Cladosporium spp.*

(a) Colonies of *cladosporium carrionii* are rapid-growing glabrous to velvety in texture, and produce a color that is gray-green to olive-black. The reverse color is black.
(b) Microscopic examination reveals branching chains of blastoconidia that are borne on a dematiaceous conidiophore. Microconidia are smooth to slightly echinulate, and range in color from pale to dark brown. Conidia closest to the conidiophore, where chains branch, are referred to as shield cells because of their shape. Distinguishing *Cladosporium carrionii* from other members of the genus requires either a Loeffler's serum slant liquefaction or a gelatinase test. In both tests, *Cladosporium carrionii* is negative while other members of the genus *Cladosporium* are positive. (Figure 6-3.)

![Figure 6-3. Microscopic morphology of Cladosporium carrionii.](image)

(2) *Phialophora verrucosa*.

(a) *Phialophora* colonies are rapid growing, wit a dark olive-gray to black color and a flat to velvety texture. Reverse color is black.

(b) Microscopic examination reveals darkly pigmented, vase-shaped phialides with a flared cup-shaped collarette. Phialoconidia are ovoid to ellipsoidal and hyaline with basal scar. Due to a mucin-like substance, the micronidiae usually remain clustered at the apex of the phialide, resembling a bouquet of flowers in a vase. (Figure 6-4.)

![Figure 6-4. Microscopic morphology of Phialophora verrucosa.](image)

(3) *Fonsecaea pedrosoi*.

(a) *Fonsecaea pedrosoi* colonies are slow growing, and velvety to fluffy, with a color that is black to brown-tinged as colonies age. Reverse color is black.
(b) Microscopic examination can show three types of sporulation that may be exhibited by this organism. For proper identification, at least two of the three types must be seen within the same culture. "Phialophora-type" sporulation shows vase-shaped phialides with flared cup-shaped collarettes. Phialoconidia are clustered at the tip of the phialides, as seen in *Phialophora verrucosa*. "Cladosporium-type" sporulation shows slender conidiophores that bear branched micronidia similar to the genus *Cladosporium*. "Rhinocladiella-type" sporulation shows oval microconidia formed along the top and sides of the conidiophore, similar to Figure 6-5.

![Figure 6-5. Microscopic morphology of *Fonsecaea pedrosoi*.](image)

(4) *Fonsecaea compacta*.

(a) *Fonsecaea compacta* is rarely isolated. When grown on culture media, colonies are dark olive to black, with a heaped, brittle texture. Reverse is black.

(b) Microscopic examination shows morphology similar to *Fonsecaea pedrosoi*, except that conidia are round.

6-4. RHINOSPORIDIOSIS

   a. *Rhinosporidiosis* is a mycotic infection of the mucous membranes characterized by development of polyps. Symptoms vary, depending upon the stage of tumor development and site infected. Polyps are usually pink to purple and brittle. Other symptoms include hyperplasia of mucous membranes and granulation tissue with scarring. Geographical distribution includes India and Ceylon. The source of infection is assumed to be water. Causative agent is *Rhinosporidium seeberi*.

   b. Direct examination of specimens show thick-walled and refractile spherules, 40 to 300 mcm in size. Endospores contained within the spherules are 6 to 8 mcm in size. Culture of the organism is usually not successful.

6-5. SPOROTHRIX HICHOsis

   a. *Sporothrix hichiosis* is a disease process caused by only one etiological agent--*sporotrich schenckii*. The primary lesion, usually on a finger, begins as a small movable, nontender, subcutaneous nodule that slowly enlarges, adheres to the skin,
becomes pink and later necrotic, and finally ulcerates. In a few days or weeks, similarly
discolored subcutaneous nodules appear along the course of the draining lymphatic tract.

b. Clinical specimens may include skin scrapings, pus, and biopsy material. Use of a periodic acid-Schiff stain for direct examination reveals small budding blastoconidia, "cigar bodies" (elongated, non-budding blastoconidia), and possible "asteroid bodies" (a basophilic staining yeast cell surrounded by an eosinophilic covering consisting of a precipitated antibody-antigen complex).

c. Specimens are inoculated to SDA and SDA with cycloheximide. *Sporothrix schenckii* is a diphasic organism. When an inoculated BHIA is incubated at 35°C, the yeast phase is seen. Microscopically, elongated, budding blastoconidia are observed. These are the same structures seen under direct examination. When cultured and incubated at 25°C, the mold phase is recovered. Growth is obtained in 3 to 7 days. Color is white to tan, with a glabrous texture.

d. Microscopic examination shows finely branching, septate hyphae. Small micronidonia are arranged along the sides of the hyphae giving an "en thyrse" formation, but are more characteristically seen bunched on a common conidiophore, in a "flowerette" formation. Clinical symptoms along with isolation and identification of the organism *Sporothrix schenckii* in a culture is diagnostic. (Figure 6-6.)

![Microscopic morphology of Sporothrix schenckii.](image)

Figure 6-6. Microscopic morphology of *Sporothrix schenckii*. 

Continue with Exercises
EXERCISES, LESSON 6.

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise, by completing the incomplete statement, or by writing the answer in the space provided at the end of the exercise.

After you have completed all of these exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. List three disease processes that can be caused by subcutaneous fungi.
   
   ________________________________.
   ________________________________.
   ________________________________.

2. "Madura foot" is the common term used to refer to eumycotic mycetoma infections of the foot.
   
   a. True.
   
   b. False.

3. What organism is the most common cause of Madura foot?
   
   a. Actinomyces.
   
   b. Pseudallescheria boydii.
   
   c. Exophiala jeaneselmei.
   
   d. Streptomyces
4. Granules produced by *Exophiala jeanselmei* are:
   a. White to yellow in color.
   b. Found as fragments in a lesion.
   c. Caused by bacterial contamination
   d. Consistent in shane.

5. Microscopic examination of *Acremonium falciform* shows:
   a. Conidia held together by a mucin-like substance.
   b. Septate hyphae.
   c. Phialoconidia that are curved.
   d. All of the above.

6. Chromomycosis is a disease process caused by:
   a. Dematiaceous fungi.
   b. Cutaneous fungi.
   c. Anthropophilic fungi.
   d. Eumycotic fungi.

7. List two genera that cause chromomycosis.
   ________________________________
   ________________________________
   ________________________________
   ________________________________
8. Cladosporium *carrionii* differs from other members of the genus in which of the following ways?
   
   a. Production of conidia referred to as spear cells.
   
   b. Negative reaction to gelatinase and Loeffler's serum slant liquefication tests.
   
   c. Negative reaction to gelatinase, positive to Loeffler's serum slant liquefication tests.
   
   d. Positive reaction to gelatinase test only.

9. Identification of phialoconidia that are ovoid to ellipsoidal, and hyaline with basal scar, suggests the presence of which organism?
   
   a. *Cladosporium carrionii*.
   
   b. *Exophiala jeanselmei*.
   
   c. *Phialophora verrucosa*.
   
   d. *Rhinosporidium seeberi*.

10. Which three types of sporulation are diagnostic of *Fonsecaea pedrosoi*?

    
    __________________________________________________________________________
    
    __________________________________________________________________________
    
    __________________________________________________________________________

11. Rhinosporidiosis is defined as a mycotic infection of:

   a. Mucous membranes.
   
   b. Legs and feet.
   
   c. Hands and fingers.
   
   d. Large muscle mass.
12. Which of the following body areas is most likely to be infected by *Sporothrix schenckii*?

a. Scalp.

b. Scalp.

c. Intestinal tract.

c. Lymphatic tract.

Check Your Answers on Next Page
SOLUTIONS TO EXERCISES, LESSON 6

1. Mycetoma
   Chromomycosis
   Rhinosporidiosis
   Sporotrichosis. (para 6-1)

2. a (para 6-2a)

3. b (para 6-2b)

4. b (para 6-2b(2)(a))

5. d (para 6-2b(3)(b))

6. a (para 6-3a)

7. Cladosporium
   Phialophora
   Fonsecaea (para 6-3a)

8. b (para 6-3d(1)(b))

9. c (para 6-3d(2)(b))

10. Phialophora-type
    Cladosporium-type
    Rhinocladiella-type (para 6-3d(3)(b))

11. a (para 6-4a)

12. d (para 6-5a)

End of Lesson 6