

ISSN: 1936-6019

www.midsouthentomologist.org.msstate.edu

The effect of coccidioidomycosis in livestock

Robert Wood, Mississippi State University

Abstract. Coccidioidomycosis, also known as Valley Fever, is a fungal infection that affects most mammals. It is found throughout the semi-arid parts of the Americas. Valley Fever was first described in 1892 as a parasitic disease with high mortality and morbidity, but is now considered to be a low morbidity and mortality fungal disease. Although the disease could have long lasting effects that ultimately lead to death, likelihood of mortality is low. Additionally, morbidity is reduced with appropriate treatment.

Keywords: Mycosis, Valley Fever, fungal

Background

Coccidioidomycosis, more commonly known as Valley Fever, is a fungal infection caused by the fungi *Coccidioides immitis* Stiles (Onygenales: Onygeaceae) and *C. posadasii*. Most mammals can contract this disease with variable levels of tolerance to infection. The only route of infection is by inhalation of spores (Figure 1). There is no animal to animal transmission of disease. Spores are released when *C. spp.* fruiting bodies are dried by the sun after rain. The spores become airborne and might enter lungs of any animal; however, spores present in the lungs do not necessarily result in infection. The spores must form spherules which are small orbs that reside in the lungs and release endospores. Endospores might prolong infection and promote the rare possibility of infection becoming systemic. Most cases of coccidioidomycosis will resolve without treatment in three to four weeks without any long lasting effects (Hector et al 2011, CDC 2015). Coccidioidomycosis is considered a seasonal disease requiring a wet season followed by a windy dry season (Spickler 2010).

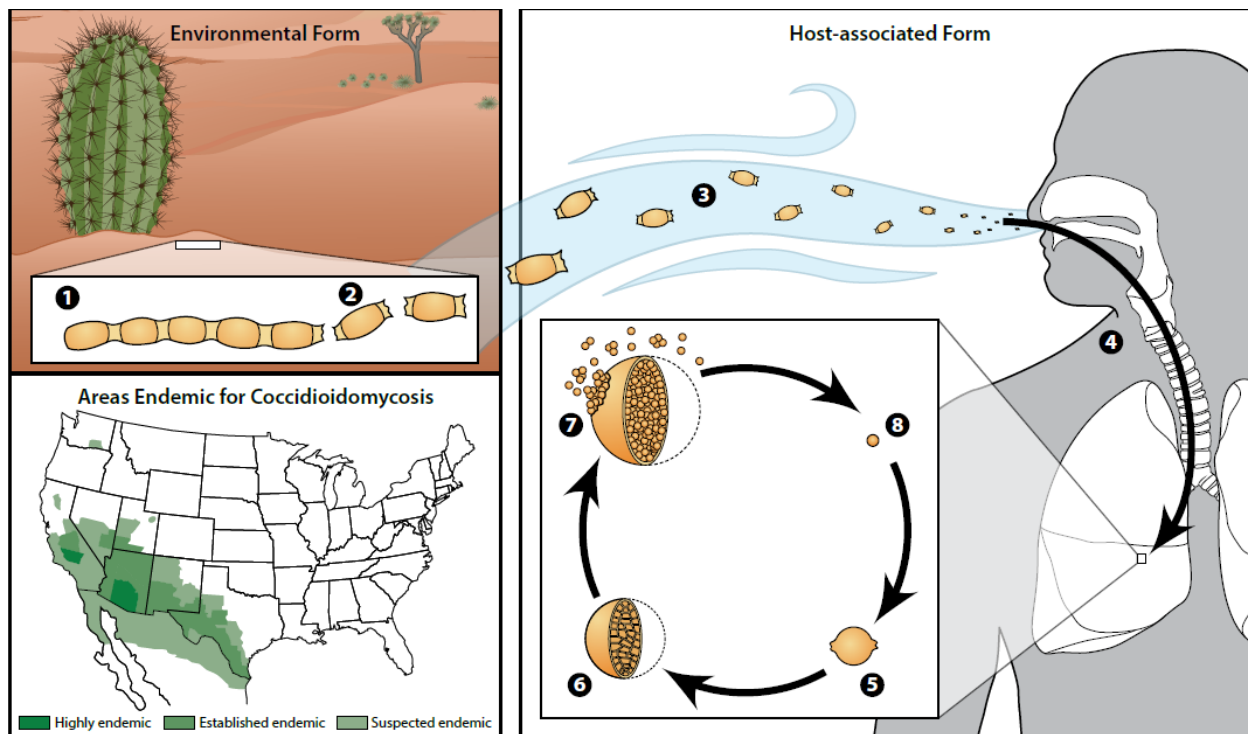


Figure 1. Biology of Coccidioidomycosis. In the environment, *Coccidioides spp.* exists as a mold (1) with septate hyphae. The hyphae fragment into arthroconidia (2), which measure only 2-4 μm in diameter and are easily aerosolized when disturbed (3). Arthroconidia are inhaled by a susceptible host (4) and settle into the lungs. The new environment signals a morphologic change, and the arthroconidia become spherules (5). Spherules divide internally until they are filled with endospores (6). When a spherule ruptures (7) the endospores are released and disseminate within surrounding tissue. Endospores are then able to develop into new spherules (6) and repeat the cycle.

<http://www.cdc.gov/fungal/pdf/coccidioidomycosis-lifecycle508c.pdf>

Coccidioidomycosis can be contracted by many mammals, including people (Spickler 2010). Some of the most noticeable signs and symptoms are fatigue, a persistent cough, headaches, night sweats, joint and muscle pain, a large rash on the upper body, and, as one of the more common names suggest, fever (CDC 2015).

Introduction

Some common livestock at risk for coccidioidomycosis are pigs, sheep, horses, lamas, and cattle (Spickler 2010). Although meat and quality of yield after infection might not be significantly altered, shortened life span might result in decreased meat production.

There is no decrease in milk production in dairy cattle due to coccidioidomycosis (Spickler 2010). The general problem in animals that contract coccidioidomycosis is that of subclinical disease. That is, multiple animals become infected by inhaling spores, but few animals show signs (Spickler 2010). Subclinical infection might lead to unexpected loss of livestock and a decrease in the overall profit of farms (Spickler 2010). There were 58 cases of coccidioidomycosis per 100,000 people reported in 2005 (CDC 2015, Spickler 2010, Hector et al. 2011). Sixty per cent of these cases are mild enough not to be recognized and 40% are mild to severe. Only about 10% of infected people have pulmonary lesions or become disseminated (travels away from the origin of infection). If the infection has progressed to a disseminated disease and remains untreated, there is a 30-50% chance of developing meningitis

(Spickler 2010, Hector et al. 2011). That is, about 3-5% of all people who contract coccidioidomycosis progress to disseminated disease (Spickler 2010, Hector et al. 2011).

Fungal meningitis is caused by blood or fluid around the brain filling with spores, leading to inflammation of the brain and possibly spinal cord (CDC 2014). Infection which has disseminated to the central nervous system can lead to lifelong problems such as photophobia (light sensitivity) and an altered mental state. Such conditions require therapy and large doses of antifungal medication for the affected individual to remain fully functional (CDC 2014).

One Health

Coccidioidomycosis is a multicontinental disease which affects the Southern U.S., Central America, and Northern South America. Over all this area most mammals can become infected by this disease. (CDC 2015) Coccidioidomycosis is not limited to land based mammals. There is also a record of an incidental finding in a dolphin at necropsy. Since mortality of livestock is possible, the result could be fewer animals arriving at slaughter and an overall decrease in meat yield. Ultimately, if a large number of livestock fall victim to coccidioidomycosis, this could lead to impact on the availability of meat and in turn higher meat prices (Spickler 2010).

Epidemiology

Coccidioidomycosis was first discovered in Argentina in 1892 by Posadas (an intern at Buenos Aires) who observed a patient with lesions on his face with more appearing over time. Eventually the lesions developed purulent exudate. A patient with purulent exudate in 1898 was able to infect other people and it was eventually discovered that most mammals were able to contract the disease. Posadas published a description of the disease as caused by a protozoan, as he originally thought, and considered it fatal (Hirschmann 2007). Posadas arrived at the original assumption that the disease was caused by a protozoan after conducting a skin test on the patient in 1896 and finding an organism that looked like a protozoan. However, after more testing he later described the organisms as fungal spherules (Hirschmann 2007). Additional research was conducted in 1890 corroborating the finding that the agent was indeed fungal. (Hirschmann 2007)

Approximately 40 years after Posadas's conclusion, Farness and Mills noticed that a case of coccidioidomycosis had resolved without treatment (Hirschmann 2007). Additional research on the fungus was conducted. It was documented that some people had contracted coccidioidomycosis and recovered. In fact, about 95% of cases recovered from the effects of coccidioidomycosis (Hirschmann 2007). Often people who have inhaled spores will remain asymptomatic and others will have less severe symptoms than previously described, although not completely asymptomatic (Hirschmann 2007). These findings led to the conclusion that coccidioidomycosis is not usually fatal. (Hirschmann 2007).

Due to coccidioidomycosis being spread through spores, no preventative measures have been found that are practical. Treatments do exist in the form of antifungal drugs, but for a minor case treatment is not recommended because of the possibility of liver damage from antifungal medication. Severe cases require antifungal medications because the risk of systemic infection of coccidioidomycosis outweighs the risk of the effect of antifungal medications (CDC 2014, CDC 2015). If a systemic infection is left untreated it may lead to meningitis, which definitely requires antifungal medication and possibly even additional therapy. (Spickler 2010, Hector et al. 2011, CDC 2014, CDC 2015)

Livestock affected include horses, cattle, llamas, sheep, and pigs (Spickler 2010, Hector et al. 2011). In general the signs of an animal having coccidioidomycosis are loss of appetite, lethargy, respiratory problems such as a dry cough, and limping, or swollen joints (Spickler 2010, Hector et al.

2011). In more severe cases, lesions on the skin might be present. Animals have a higher risk of infection causing pericardial problems than infection in people (Spickler 2010). Often an entire herd of animals will have acquired the spore that causes coccidioidomycosis if one has been confirmed to have it due to its airborne nature (Spickler 2010). However, because natural immunity is different per animal, the resultant reactions might also differ (Spickler 2010). It is usually recommended to look for signs in the entire herd if it has been confirmed in one animal so treatment of the herd can be initiated (Spickler 2010).

Many studies of coccidioidomycosis in horses were initiated because a horse died as a result of it. From those studies it was found the most common sign in a horse with coccidioidomycosis is not a respiratory problem like with most other animals, but chronic weight loss without any other change in environment or health (Spickler 2010).

Llamas are seen to be one of the most susceptible livestock to coccidioidomycosis (Fowler et al 1992). Most cases of coccidioidomycosis in llamas become systemic and result in long term problems (Fowler et al 1992). Most other livestock remain relatively unaffected by the disease long-term, although it has been noted that cattle, sheep, and pigs might retain scarring caused by lesions in the lungs (Spickler 2010).

One of the most susceptible animals to coccidioidomycosis is dogs (Spickler 2010). It is also more likely for coccidioidomycosis in dogs to progress to a systemic infection (Spickler 2010). In dogs signs can take up to one year to appear (Spickler 2010). In addition to previously described problems, major effects on bone develop whenever disease becomes systemic (Spickler 2010). In all mammals, including people, there is a chance of paralysis due to nerve damage when it becomes systemic (Spickler 2010).

Approach

Research on Coccidioidomycosis included a history of case studies that were used to initially identify the disease. The result of these case descriptions was to document clinical signs observed in affected animals and symptoms described by affected people. After originally describing the causal agent as protozoan, research it was confirmed that the agent was indeed fungal. (Hirschmann 2007)

Conclusion

Coccidioidomycosis is a fungal disease that has low mortality. It is potentially fatal, but that only happens if it becomes systemic and remains untreated. It is most infectious during the switch from a wet season to a dry season but can be contracted year round. Overall, infected animals' health is not impacted for extended periods of time.

References

- Fowler, M. E., D. Pappagianis, I. Ingram. 1992.** Coccidioidomycosis in llamas in the United States: 19 cases (1981-1989). *J Am Vet Med Assoc.* Nov 15; 201(10):1609-14.
- Hector, R. F., et al. 2011.** The Public Health Impact of Coccidioidomycosis in Arizona and California. *Int J Environ Res Public Health.* Vol. 8:4: 1150-173.
- Hirschmann J.V. 2007.** The early history of coccidioidomycosis: 1892–1945. *Clin. Infect. Dis.* 44: 1202–1207.
- Centers for Disease Control and Prevention, 2014.** Fungal Meningitis Online posting (<http://www.cdc.gov/meningitis/fungal.html>). Accessed 08 Oct. 2015.
- Centers for Disease Control and Prevention, 2015.** Valley Fever (Coccidioidomycosis). Online posting (<http://www.cdc.gov/fungal/diseases/coccidioidomycosis/index.html>). Accessed 24 Sept. 2015.
- Spickler, A.R. 2010.** *Coccidioidomycosis*. Center for Food Security and Public Health. Iowa State University, Ames. Online posting (<http://www.cfsph.iastate.edu/Factsheets/pdfs/coccidioidomycosis.pdf>), accessed November 23, 2015.

