Thelohania and Other Microsporidia

I. Causative Agent and Disease

Microsporidia is a protozoan order within the class Microsporea within the phylum Microspora. However, there is controversial genetic evidence for a closer affinity to the kingdom of Fungi rather than Protozoa. All microsporidians are intracellular parasites that produce microspores (3 to 10 µm) as the infectious stage and complete their life cycles in a single host cell, generally with no alternate hosts. Microsporidia are one of the more common groups of parasites in crustaceans with over 140 species reported from all orders. Some microsporidians cause significant pathology, mostly affecting skeletal muscle. *Thelohania duorara* parasitizing pink, white and brown shrimps causes an opaque white abdomen typifying "cotton" or "milky" disease that destroys muscle and connective tissues. *Agmasoma penaei* also parasitizes shrimp causing destruction of many different tissues as well as parasitic castration. Two different undescribed species of *Thelohania* cause "cottage cheese" disease in both red and blue king crabs from Bristol Bay and the Bering Sea characterized by massive numbers of spores in all major visceral organs causing the tissues to appear white and curd-like. Another unidentified microsporidian in the family Nosematidae parasitizes mostly the musculature, including the heart, of golden king crabs while other unidentified microsporidians have been observed in the antennal gland of blue king crabs and in the body musculature of a single coonstriped shrimp from southeast Alaska.

II. Host Species

Microsporidia are ubiquitous and have been reported parasitizing many different species of crabs, shrimps and other crustaceans in Europe, Thailand, Australia and on the Atlantic, Gulf and Pacific coasts of North America. In Alaska, microsporidia have been found in red, blue and golden king crabs from Bristol Bay and the Bering Sea and blue king crabs and coonstriped shrimp from southeast Alaska.

III. Clinical Signs

Clinical signs may include lethargy, mortality and tissues that are white or curd-like in appearance caused by tissue damage and replacement with the spores of the parasite. Shrimp often exhibit opaque white abdomens with a milky fluid exudate.

IV. Transmission

Transmission is horizontal when spores released from ruptured host cells are ingested by a suitable host. In the intestine of the new host each spore releases a hollow polar tube attaching the spore to a mucosal epithelial cell through which the internal amoeboid sporoplasm passes into the host cell cytoplasm. In some cases the parasite replicates in the host cell nucleus rather than in the cytoplasm. The sporoplasm may replicate in the intestinal cell or may be injected into a host phagocyte where it travels to other target tissues. In addition to transmission via the alimentary tract some species in amphipods may also be vertically transmitted to progeny from parasitized ova. Once in the target host cell the parasite undergoes further replication and development involving merogony producing plasmodia and meronts followed by sporogony producing sporonts that contain sporoblasts that mature into spores.

The entire process is complex and may have other intermediate stages depending on the species of microsporidian. Infected host cells and their nuclei also may respond by marked hypertrophy in which the enlarged cells become cysts or xenomas containing myriad numbers of the parasite.

V. Diagnosis

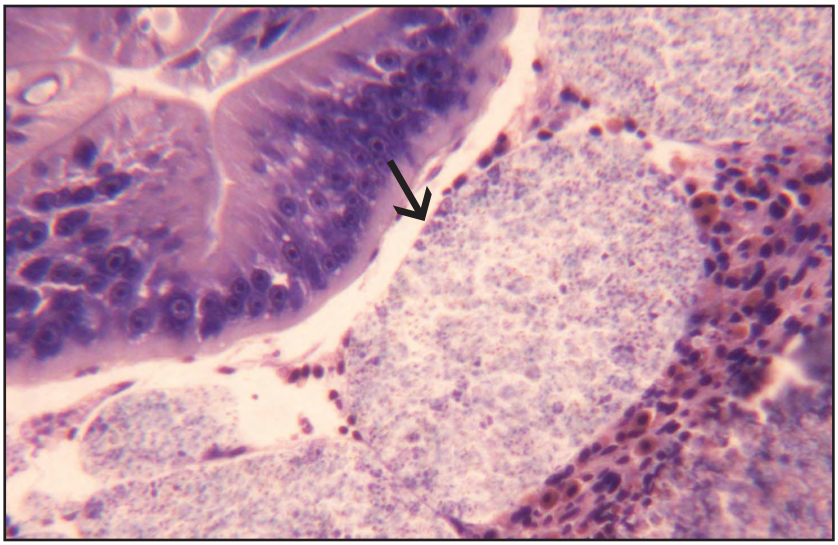
Stained and unstained hemolymph and/or tissue smears from parasitized animals generally demonstrate the microspores that can also be observed by histological examination. Major characteristics for classification of microsporidia are the size, shape and number of spores produced within sporonts. *Thelohania* has 8 spores each approximately 3 X 5 µm. DNA probes are available to identify some genera (*Agmasoma* sp.) of microsporidia.

VI. Prognosis for Host

Microsporidians in several crustacean hosts are serious pathogens causing significant mortality and/or debilitation resulting in predation or secondary pathogen infections. The prevalences of parasitism are generally low in most wild populations of crustaceans but can be very high in cultured shrimp. The king crab microsporidians are considered to be lethal parasites as well but have occurred at low prevalences (2-10%) that may not significantly impact king crab populations.

VII. Human Health Significance

Affected shrimp are generally unmarketable due to poor aesthetic quality. However, there are no zoonotic human health concerns regarding the parasitism of crustacean tissues by microsporidia.



Histological section of *Thelohania* microspores (arrow) within digestive gland of red king crab (Photo: J. Frank Morado, National Marine Fisheries Service, Seattle)

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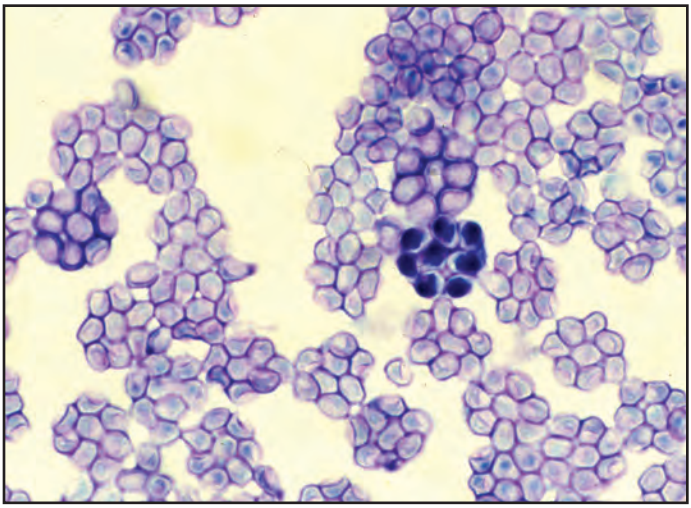
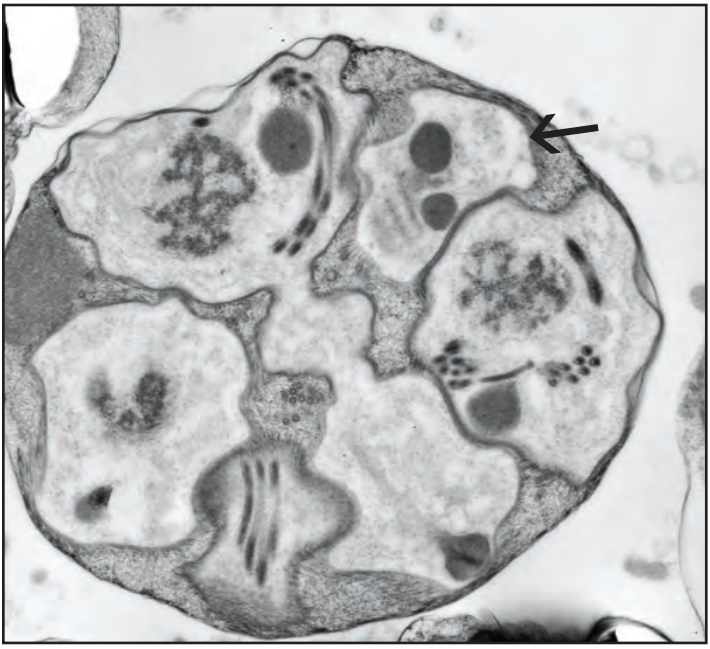
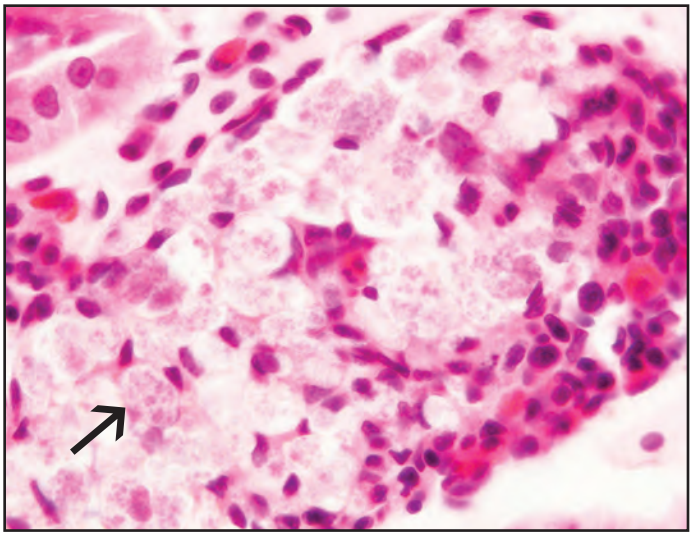


Stained tissue smear showing packets of 8 spores typical of *Thelohania* sp.



TEM of spores (arrow) within sporont of *Thelohania* sp. (Photo: J. Frank Morado, National Marine Fisheries Service, Seattle)



Histological section of degenerating unidentified microsporidian spores (arrow) in the antennal gland of blue king crab