

MSX DISEASE



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Introduction

MSX (Multinucleated Sphere Unknown) disease is caused by a single-celled Protozoan parasite, *Haplosporidium nelsoni*. MSX is lethal to the eastern oyster (*Crassostrea virginica*), but it is not known to be harmful to humans. The parasite is commonly present as a multinucleated cell (plasmodium) which ranges from 5 to 100 μm in diameter. Occasionally it forms spores. The early MSX infections are found in the oyster's gill. The infection spreads to the digestive diverticulum, and finally all the tissues of the oyster are filled with plasmodia.

Transmission of MSX

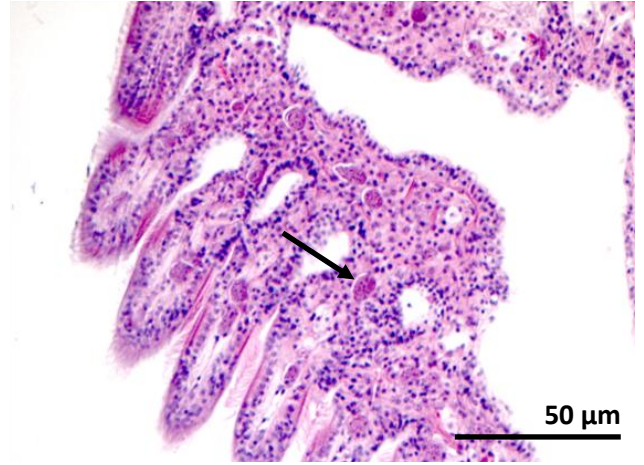
MSX infection is not directly transmissible from oyster to oyster. How the infection is transmitted is not yet known. Several researchers believe that an intermediate host is part of the life cycle of this parasite, but what the host is remains unknown. Molecular diagnostic tools detect that the same parasite is present in the Pacific oyster *Crassostrea gigas*, and there is evidence that the parasite was introduced to the eastern oyster population with known importations of the Pacific oyster.

History

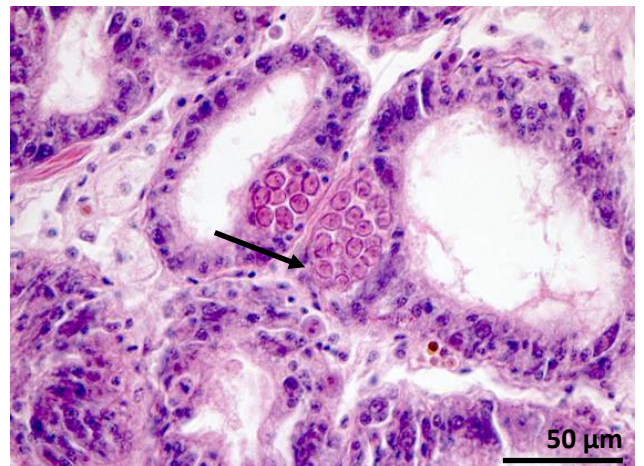
MSX disease caused massive oyster mortalities in Delaware Bay in 1957 and two years later in Chesapeake Bay. The parasite has been found from Florida to Maine and recently in Canada, but has not been associated with mortalities at all areas. MSX was described in oysters from Connecticut waters forty years ago.



MSX plasmodia and spores (Malcom Shute)



MSX plasmodia in gills in a histological section (Antonio Villalba)



MSX spores in digestive cells on a histological section (Antonio Villalba)

Epizootic (Disease Outbreak)

MSX disease may occur at epizootic levels in Connecticut waters. An outbreak in 1997 in market size oysters caused serious economic damage to the oyster industry. Next year, infection spread to seed oyster beds. Oyster production decreased from more than 500,000 bushels in 1996 to 80,000 bushels in 2000, reflecting high MSX-associated mortalities. MSX-prevalence in Connecticut oysters has been in steady decline after that. Presently, about five-percent prevalence causes low background mortalities. After 1998, lack of successful commercial oyster sets has limited the increase in oyster production, not mortalities caused by MSX-disease. Some limited areas may have high MSX-prevalence. These areas vary between years.

Resistance

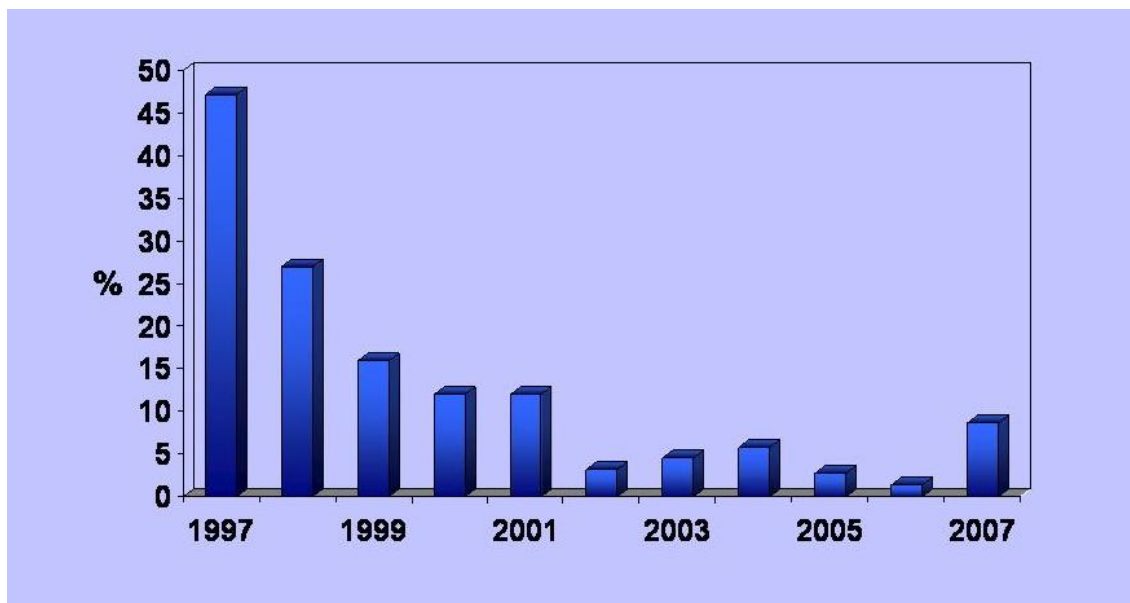
Under heavy infection pressure, oysters develop resistance to MSX disease. These oysters still get infected, but their mortality rate is lower than that of susceptible oysters. Native oysters will develop higher survival rates after a few years. This can be facilitated by selective breeding in hatcheries or by saving part of the survivors of an

epizootic in broodstock sanctuaries, which will produce resistant seed. Following the 1997 outbreak, an MSX-resistant oyster strain called Clinton was developed.

Infection and mortality

MSX disease is suppressed by low salinities and low temperatures. Oysters in Long Island Sound become infected in mid or late June. The infection period lasts through November. After initial infection, oysters start to die within a month. Heavy mortalities last from September through November. There is low mortality during the winter months and the prevalence and intensity of the disease decreases. A second mortality period occurs in late winter and early spring. Some of the infections acquired late during the infection period remain at a low level over winter and proliferate when water temperatures rise. These oysters die in June or July of the summer after the infection was acquired.

The disease can be diagnosed by light microscopical examination of tissue sections. The Bureau of Aquaculture provides a diagnostic pathology service for Connecticut's commercial oyster growers.



Prevalence (percent) of MSX plasmodia found in Connecticut oysters. (Inke Sunila)



MSX-resistant oysters from Noank Aquaculture Cooperative.
(Tessa Getchis)

Management of MSX in Connecticut

The State has developed guidelines to assist growers in managing MSX. The purpose of these guidelines is to:

- Prevent transmission of MSX to naive areas
- Avoid mortalities
- Avoid loss of the spawning population
- Establish broodstock sanctuaries in heavily infected sites to permit survivors to produce resistant seed
- Prevent extensive harvesting pressure
- Prevent mechanical damage to affected oyster grounds

Infected oyster grounds should be kept in operation and as an active part of the transplant program within certain limitations. Oysters should be provided with circumstances which allow growth to market size and harvest before mortality occurs. MSX disease does not lower the market value of the oyster, and infected oysters remain in good condition very close to death. However, oysters should be marketed before infection causes lowering of the condition index and an unpleasant appearance which will develop during the advanced disease situation.

GUIDELINES FOR MSX MANAGEMENT IN CONNECTICUT

- Transplanting of oysters from restricted relay areas to MSX infected conditionally approved or approved areas for purification can proceed as before, but maintaining oysters in infected areas between mid-June to the end of November should not exceed a period of three weeks.
- Oysters should not be transplanted from infected areas to uninfected areas, and infected areas should not be used as intermediate growing areas in transplantation programs.
- When using infected areas as growing areas, oysters should not be kept there for more than three weeks during the infection period (mid June - end of November). For example, oysters transplanted in November should be collected in the first week of July the next year.
- Do not harvest part of the infected lot (10% area) for a period of three years. After three spawning periods, these oysters can be harvested and marketed. These oysters will be the parents of MSX resistant oysters.
- Extend the growth season in seed areas.
- Culling oysters from an infected area should be done directly above the lease area, not on the way to the next harvest area or on the way back to the dock.