



Chytridiomycosis Fact Sheet

The Pathogen

Chytridiomycosis is a disease of amphibians caused by the fungus *Batrachochytrium dendrobatidis* (Bd). This pathogen lives on keratinized tissues of amphibians and has low host specificity; however, its ability to cause disease (chytridiomycosis) varies considerably among amphibian species. It is suspected that Bd can survive off the host because it has been recovered from soil and rocks within natural environments, and has grown on surfaces within a laboratory. Although the pathogen can grow over a wide temperature range (4-25 °C), it prefers 17-25 °C. There are two stages within the life cycle, a motile stage and a non-motile stage. The motile stage is found in water; it is the means of dispersal, and thus short lived. The non-motile stage is the thallus, which develops to the zoosporangium for asexual reproduction. The thalli are found within living cells but finish their development to zoosporangia in non-living cells.

The Hosts

Amphibians are the hosts for Bd and keratinized tissues are affected. In larval amphibians, keratinized tissues are the tooth rows. Infection of the tooth rows with Bd results in loss of pigmentation but rarely affects survival because the larvae are able to continue to feed. However, once metamorphosis takes place, the pathogen can spread throughout the keratinized skin of the juvenile and become fatal. The skin of juveniles and adults is keratinized and thus infection with Bd at any time can be fatal for susceptible species. Subclinical infections occur in resistant species (e.g., American bullfrogs (*Lithobates catesbeianus*) African clawed frogs (*Xenopus laevis*), eastern newts (*Notophthalmus viridescens*), tiger salamanders (*Ambystoma tigrinum*) and may play a role in Bd distribution and transmission within captive environments and in the wild. Distribution: The pathogen has been found on all continents inhabited by amphibians. The distribution of the pathogen has been facilitated by anthropogenic spread on equipment and infected animals.

Transmission and Pathogenesis

Transmission is by direct contact or water exposure. Pathogenesis is unclear but 2 hypotheses are 1) the pathogen releases proteolytic enzymes that are absorbed through the permeable amphibian skin, and 2) damage to the skin results in disturbance of osmoregulation and ultimately death. Clinical signs include pigment loss of tooth rows in larvae. In adults, clinical signs include hyperplasia and hyperkeratosis of the skin, reluctance to move and inappetance.

Significance

Chytridiomycosis has contributed to global amphibian population declines and has been associated with extinction (primarily in Australia). To date, amphibians in Central and South America and in Australia have been most severely affected.

Treatment

- Antifungal Drugs: Itraconazole is commonly used on postmetamorphic amphibians in zoos and amphibian conservation programs. This treatment is toxic to larvae and postmetamorphs of some amphibian species.
- Antibiotics: Chloramphenicol has been shown to be safe and effective in both larvae and postmetamorphs. This treatment has not been extensively investigated.
- Heat: Elevated temperatures (27°C or higher, with 37°C being ideal for quick treatment) can be used to treat chytridiomycosis; however, some hosts may not be able to withstand these high temperatures. Heat is especially effective for species that have abundant glandular secretions on their skin, preventing the effectiveness of fungicides and antibiotics (e.g., hellbenders, *Cryptobranchus alleganiensis*).

Disinfection

- Chemicals: Effective chemical disinfection of surfaces can be achieved with sodium hypochlorite (compound found in bleach), quarternary ammonium compounds, potassium peroxymonosulfate (Virkon), 70% Ethanol, ozone
- Non-Chemical: Heat, complete dessication

Prevention and Control

- In wild: prevent anthropogenic spread by disinfecting boots and equipment. Prevent translocation of hosts. For amphibian conservation programs, test individuals before release.
- In captivity: quarantine and test new arrivals. Isolate animals with clinical signs or those that test positive. If possible, each tank/pond should have a separate water source.

Zoonotic Potential: None

Wildlife Impact: Susceptible species may experience population declines or local extinctions. Subclinically infected hosts may act as a source of infection for susceptible species.

Status: Chytridiomycosis is listed as notifiable by the World Organization of Animal Health (OIE). Information regarding the OIE listing can be found within the [Aquatic Animal health Code](#), with Bd specific information at http://www.oie.int/index.php?id=171&L=0&htmfile=chapitre_1.8.1.htm. The OIE approved diagnostic tests can be found within the [Manual of Diagnostic Tests for Aquatic Animals](#).