



Signs of snake fungal infection include opaque infected eye and roughened crusty scales. Photos courtesy of D. Green, USGS NWHC.

SNAKE FUNGAL DISEASE

Other names: *Ophidiomyces ophiodiicola*

CAUSE

Snake Fungal Disease (SFD) is an emerging disease affecting wild snakes in eastern North America. This disease is caused by the fungus *Ophidiomyces ophiodiicola*. This fungus is active at a range of temperatures and pH and grows well on a variety of common substrates including dead fish, dead insects, and dead mushrooms. It seems likely that the fungus lives on decaying organisms and opportunistically infects snakes, so the fungus may be present in a wide variety of ecosystems even in the absence of snakes.

SIGNIFICANCE

Reported population level effects have been highly variable. In some cases the fungal infection appears to be cleared when the snakes shed with no obvious impacts to the infected populations. However severe declines have been documented in some areas, such as a 50% decline in a population of timber rattlesnakes in New Hampshire in 2006, and 100% mortality in a population of massasauga rattlesnakes in Illinois in 2008. Because snakes can be difficult to find and often are solitary, long-term monitoring data are often lacking and it is difficult to assess mortality rates, transmission patterns and population-level effects. Small, isolated populations of susceptible snakes are considered especially at risk. Snake populations that hibernate in colder hibernacula are thought to experience less severe impacts during the spring than snake populations that hibernate at warmer sites. A rise in hibernacula temperatures accompanying global warming could lead to increasing vulnerability for Canadian snake populations.

SPECIES AFFECTED

Snake Fungal Disease has been confirmed in the eastern foxsnake (*Pantherophis vulpinus*), ring-necked snake (*Diadophis punctatus*), northern copperhead (*Agkistrodon contortrix*), northern pinesnake (*Pituophis melanoleucus*), cottonmouth (*Agkistrodon piscivorus*), northern watersnake (*Nerodia sipedon*), eastern racer (*Coluber constrictor*), ratsnake (*Pantherophis obsoletus* species complex), timber rattlesnake (*Crotalus horridus*), massasauga (*Sistrurus catenatus*), pygmy rattlesnake (*Sistrurus miliarius*), plains gartersnake (*Thamnophis radix*), mudsnake (*Farancia abacura*) and milksnake (*Lampropeltis triangulum*). Many of these species as well as closely related species are present in Canada, and several are already listed as species at risk.

DISTRIBUTION

First noted in 2006 in New Hampshire, where it caused significant mortality in a population of timber rattlesnakes (*Crotalus horridus*), SFD has now been confirmed in 16 eastern and midwestern U.S. states, of which five (Minnesota, Wisconsin, Michigan, New York and New Hampshire) share borders with Canadian Provinces (Manitoba, Ontario and Québec). In 2015, the Canadian Wildlife Health Cooperative (CWHC) confirmed SFD in Canada for the first time in an eastern foxsnake (*Pantherophis vulpinus*) in southwestern Ontario. As of July 6 2016 the CWHC has confirmed the disease in three eastern foxsnakes from Ontario. We do not know how widespread the fungus is in Ontario or if it occurs in other provinces.

TRANSMISSION

It seems likely the disease can be transmitted both by direct contact with infected animals and by contact with contaminated environments.



CLINICAL SIGNS

Reported clinical signs of SFD are highly variable. The most consistent signs include scabs or crusty scales, subcutaneous nodules, abnormal molting, white opaque cloudiness of the eyes (not associated with molting), and localized thickening or crusting of the skin. More severe cases display skin ulcers, swelling of the face, and nodules in the deeper tissues of the head. The fungus can invade deep muscle and bone, and, in exceptional cases, it can invade lungs, eyes, and liver. SFD may cause abnormal feeding, and inappropriate basking behaviour that greatly increase the risk of predation and may expose infected snakes to potentially lethal temperatures.

DIAGNOSIS

Presence of the fungus can be demonstrated with PCR or fungal culture. Suitable samples include swabs of the skin, shed skin, scute clips and biopsies. Disease must be confirmed by evidence of histopathology of a full-thickness section of skin.

TREATMENT

Treatment of captive snakes usually comprises thermal, fluid and nutritional support, surgical debridement, topical antifungals and antiseptics, and systemic antifungals and antibiotics. In free-ranging eastern massasauga snakes treatment with antifungal compounds has been unsuccessful to date. Many species of snakes in Canada are listed as Species At Risk and are closely monitored. Because monitored snakes are sometimes in veterinary care (for implantation of transmitters, and for biopsy when SFD is suspected) there may be opportunity for treatment that could reduce mortality if an effective treatment is available.

MANAGEMENT AND PREVENTION

It is not yet clear whether *Ophidiomyces ophiodiicola* is an invasive pathogen (like *Pseudogymnoascus destructans*, the fungus that causes White-nose Syndrome in bats) or a widespread endemic fungus that only occasionally causes severe disease because of host, environmental or other factors that are currently not known. It seems prudent to treat it as an invasive pathogen and observe appropriate biosecurity measures. Wild snakes should not be moved and released into new locations and captive reptiles should never be released into the wild. Boots, clothing and equipment should be disinfected before moving between sites. Disinfection protocols recommended for the control of chytrid fungi in amphibians are likely also to be effective for SFD in snakes. A minimum 2-min exposure to at least 3% bleach or 70% ethanol, or a 10-min exposure to 0.16% Roccal, Lysol products, CLR, NPD, or 409 are recommended for disinfection of *Ophidiomyces ophiodiicola* (for product details see Rzadzowska et al. 2016 <http://www.jwildlifedis.org/doi/abs/10.7589/2016-01-012>). Chlorhexidine, Simple Green and Spectricide do not appear to be effective against spores of this fungus.

SUGGESTED READING

https://www.nwhc.usgs.gov/disease_information/other_diseases/snake_fungal_disease.jsp

http://www.northeastparc.org/products/pdfs/NEPARC_SnakeFungalDiseaseFAQ.pdf



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