



Pseudogymnoascus destructans culture
Photo: Dan Linder, USDA

ARE ENVIRONMENTAL CHANGES DRIVING FUNGAL DISEASE EMERGENCE?

SUMMARY

Invasive fungal diseases are an increasing cause of morbidity and mortality in people, animals and plants. Climate change and globalization are driving fungal disease emergence. Fungal infections are predicted to increase in variety and distribution due to changing weather and expanding global trade. Canada is not immune to these trends as its populations at risk expand and exposure opportunities from environmental sources grow. Wildlife fungal infections have served as early warning of emerging zoonotic fungi. The effects of fungal disease in wildlife has ripple effects in agriculture and public health due to their effects on vector and pest control, loss of pollination services and interruptions of infectious disease cycles. Response often focuses on new treatments and biosecurity, but may lay in ecosystem resilience and enhanced awareness amongst diagnosticians.

BACKGROUND

The epidemiology of invasive fungal diseases has changed dramatically over the past 30 years. The incidence and impact of fungal infections has increased in people, animals and plants. The occurrence of devastating fungal diseases in wildlife have highlighted the changing risk to animals. These animal health events have implications for human health and agriculture. In some cases, wildlife cases signals emergence, as with the discovery of *Cryptococcus gattii* in British Columbia where cases in marine mammals were sentinel events. Subsequent investigations found infections in pets, livestock, people and other wildlife as this disease spread throughout the Pacific Northwest. The recent discovery by the CWHC of *C. gattii* in a deer in Nova Scotia revealed a geographically expanding population at risk. In other cases, the effects of wildlife infections have indirect implications for people, agriculture and economies. White-nose syndrome, caused by *Pseudogymnoascus destructans*, was likely introduced from Europe and has killed 7 million bats in North America since its introduction about 7 years ago. The subsequent reduction in vector and pest control by bats put public health, agriculture and forestry at risk. Apart from reduced vector-borne disease control (which is a climate change preparedness priority), increased reliance on pesticides produces new occupational and food exposure risks plus increased costs of production. Several Canadian bat species are now on the endangered or threatened species list due to this infection. Frog chytrid disease, due to *Batrachochytrium dendrobatidis*,

has been called the worst ever infection of vertebrates. It has led to large scale extinctions and exists in Canada. Its equivalent in salamanders is on Canada's doorstep. The implications of biodiversity loss on the epidemiology and ecology of infections, including zoonoses, is of growing concern. Emerging fungal plant diseases are threatening a wide variety of crops internationally. Canada's crops, including wheat, corn and potatoes are vulnerable. International food security concerns have been linked to fungal plant diseases.

DRIVERS OF EMERGENCE

Changes in diagnostic capacity coupled with a growing population of immunocompromised people have been cited as key reasons for the growth of fungal disease in people. As most fungal infections are acquired from environmental sources environmental changes are important drivers of fungal disease emergence. Human mediated intercontinental dispersion of fungi is seen as a major contributor to new chains of transmissions. Introduced fungi not only establish new host-pathogen relations but also can hybridize with fungi in the receiving environment, changing host preferences and virulence. Changes in temperature and moisture associated with climate change will alter the suitability of environments for fungal survival and dispersion, thus affecting human and animal exposure risks. There is evidence, but active debate, that climate warming will select for more heat tolerant fungi, thus expanding the number that might infect mammals. These changes are being seen in plants and corals. Snake fungal disease (caused by *Ophidiomyces ophiodiicola* and recently detected in Canada by the CWHC), may be an example of where changing environmental conditions (habitat change, loss of prey, climate change) are affecting the populations capacity to cope with an endemic environmental opportunist.

RESPONSE OPTIONS

Fungal infections have not received the same attention in zoonotic disease or foreign animal disease preparedness as have bacterial and viral diseases. There is a quest for better and more accessible antifungal medications to assist in disease treatment. This is rarely an option for wildlife due to the cost of treatment and difficulties in delivering effective doses to free-ranging animals. Costs can also limit access to treatment for domestic animals. Improved biosecurity is an often cited mechanism to prevent intercontinental transport, but; (1) this can be slow (e.g. after 2 years of efforts, Canada has still been unable to launch import controls to prevent the introduction of salamander chytrid disease) and (2) the fungi can be imported on/ in environmental fomites (such as has been hypothesized for *C. gatti* in Canada where imported lumber was implicated). Ensuring adequate awareness amongst frontline diagnosticians and ensuring ready access to suitable diagnostic tests are key to early detection. Because wildlife, people and domestic animals are often exposed from shared environmental sources, reducing the environmental load by reducing the likelihood and size of outbreaks may be an important strategy for risk reduction. Promoting the primordial determinants of health is an attractive strategy for wildlife. Providing legal protection to species helps protect their habitat and food sources, bolstering their innate capacity to cope and recover from infections. This has been used as the cornerstone of white-nose syndrome response, led by the CWHC. This may be a model for preparing for new emerging fungal diseases expected with climate change and global trade.

CONTACT US

CWHC National Office

Western College of Veterinary Medicine

52 Campus Dr. Saskatoon, SK S7N 5B4

info@cwbc-rscf.ca

1.800.567.2033

www.cwbc-rscf.ca

www.healthywildlife.ca

FOLLOW CWHC



www.cwbc-rscf.ca