Effect of Batrachochytrium Dendrobatidis on Anura Populations

Batrachochytrium

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Abstract. Chytrium (Batrachochytrium Dendrobatidis) is a chytrium fungus that causes amphibian chytriomycosis. They were first discovered in 1998 and have been responsible for a large number of amphibian deaths over the next decade. Chytrid fungus grows on amphibian skin and produces free aquatic spores. They are widely distributed in deserts and lowland forests to cold hilltops. They can cause disease in upland (low temperature) amphibians, causing significant mortality. Chytrid infection has been associated with large numbers of amphibian deaths in north, south and central America, Europe and Australia. In this paper, the author summarized several factors influencing the transmission of chytrid by analyzing the existing data and data, including the transmission route, the worldwide distribution range and harm degree of chytrid, and the existing research and discussion on the elimination and prevention methods of chytrid. After collecting and analyzing data and literature, the author comes to the following conclusions: Firstly, the fungus originated in Africa and spread around the world through trade in animals such as xenopus africanus, and was endemic in Africa for many years before spreading around the world. Secondly, chytridiomycosis is one of the important factors contributing to the extinction of some amphibians in many places, including Africa and Australia. Thirdly, the factors that will affect the chytrid strain of chytrid fungus, the active degree and spread range of factors are temperature, human activities, amphibian's own immunity, chemicals in pesticides, etc.

1. Introduction
With the development of society and the exploitation of natural resources by human beings, the existence of all kinds of creatures is increasingly threatened. For amphibians, they are in addition to the threat of human damage to natural habitats and the excessive capture of commercial use, they are also faced with from nature, threatened by human activities contribute to, for example, in recent decades to large-scale spread throughout the world and, attracted much attention by the chytrid fungus door fungi Batrachochytrium Dendrobatidis chytrid fungus disease.

Chytridiomycosis seriously threatens the survival of some amphibians and may even lead to the extinction of some species. In this paper, the author will summarize several factors influencing the transmission of chytrid by analyzing the existing data and data, including the transmission route, the worldwide distribution range and harm degree of Chytrid, and the existing research and discussion on the elimination and prevention methods of Chytrid. Through the study of Anura in amphibians, the author will give some typical examples to determine the influence of chytrid fungus and the effective control methods at present.

2. Data Analysis

2.1. The mode of transmission of Chytrid fungus
According to a genetic study led by Matthew Fisher of Imperial College London, with the vigorous development of the international trade in the early 20th century, a kind of variation of toxic infectious
strains in particular, is the frog chytrid fungus, was spread to all over the world from Africa and Asia, infected animals or other strains is carried, might be hiding in the train, ship, or be used as a food or pet ship them out, and eventually spread around the world. It is also thought to be one of the main culprits in the spread of chytrid fungus to all continents, as it is highly resistant to chytrid fungus and thus has been spared the threat of chytrid disease. As new invasive species, this type of fungi was inadvertently carried to all over the world, there will be other parasites and pathogens, resulting in a serious loss of biodiversity of amphibians, frog chytrid fungus such fungi can pass test, to be transported to all parts of the world quickly, without losing the original activity, which affect the local amphibians, and made a round of another round of large-scale infections and deaths.

Figure 1. Genetic diversity and phylogenetic tree of a global panel of 234 B[5].

2.2. Effects of Chytrid fungus on amphibians
Over the past half century, chytrid fungi have caused a devastating extinction event that some scientists are calling the "sixth Mass extinction."
Figure 2. Dating the emergence of BdGPL.

Chytrid fungus gradually eats away at the skin of frogs and other amphibians, triggering deadly heart attacks that eventually kill them. The fungus has caused the extinction of 200 amphibian species since it was first discovered and recorded.

The team, led by Ecologist Ben Scheele of the Australian National University, estimates that the fungus has caused a decline of 501 amphibian species -- about 6.5 percent of the total known amphibian species. Of these, 90 species have become completely extinct, and 124 have seen their populations fall by 90%, with little hope of recovery.

An amphibious disease called chytrid disease killed countless salamanders and frogs in Panama between 2004 and 2007. However, despite the persistence of the deadly fungus, some species have recovered. In a new study, researchers from the United States and Panama studied pathogenic fungi and their hosts, and found that while the fungus remains as deadly as ever, surviving host species are less susceptible to infection. The study, published March 30 in the journal Science, is entitled "Disease Dynamics in Tropical Amphibian communities not due to parametric relationships." Corresponding author is Jamie Voyles, a chytrid expert at the University of Nevada, United States\[2\].

The fungus Batrachochytrium Dendrobatidis causes chytrium, which infects amphibian skin, thereby disrupting osmotic regulation in these animals. The resulting fluid imbalance can lead to organ failure and death. First identified in Australia and Central America in 1998, the disease has now wreaked havoc around the world, killing amphibians in transit. Part of the reason is human-induced amphibian migration. There are all kinds of frog markets in the world, such as pet markets and food markets. Wherever frogs go, fungal pathogens hitch a ride.

In fact, the 2004 outbreak in Panama was thought to have been caused by an invasion of amphibians who had never been exposed to the pathogen before. In terms of the number of dead and dying frogs, the disease has had a significant impact on these amphibian populations.

Most of the previous reports focused on the Americas and Europe, and few were in Asia. However, follow-up studies found that chytrid fungus had already existed in Asia, but there had not been a large-scale outbreak. Japan, South Korea, Laos, Indonesia, the Philippines, Vietnam, Malaysia, Sri Lanka and other countries have detected cases of chytrid fungus infection, and the infection rate is high in some areas. In 2010, it was reported that chytrid fungus infection was confirmed in Yunnan province of China, and positive test results were obtained on four native amphibians (Rana yunnanensis, Rana Zhaojue, Rana Yunnanensis and Toadus grandis) and invasive species Bullfrog. There have also been reports of chytrid infection in Tainan area of China.
From 2004 to 2007, an outbreak of CELIac disease in Panama killed countless salamanders and frogs. When Voyles and her team returned to Panama to monitor the CD outbreak, they found that while CELIac disease was still present, some amphibians had recovered.

There was no significant difference between the current CD sample and several measures of the 2004 CD outbreak-celiac disease has not changed much in decades.

So the crew turned their attention to the amphibians themselves. The researchers collected samples of amphibian skin secretions before and after the ampulla outbreak, and found differences in their ability to inhibit ampulla growth. The inhibition of the samples before the outbreak of CD was less than that of the recovered samples. Prof Voorhies believes that more resistant species may not only hide antimicrobial peptides, but also develop genes, behaviours and other adaptations that help them resist disease-causing fungi.

2.3. How to deal with the chytrid fungus
Infectious and sexually transmitted diseases in amphibians, such as chytriomycosis caused by an emerging pathogen (Batrachochytrium Dendrobatidis), have been identified as one of the most important drivers of the current decline in amphibian populations.

The global spread of the pathogen has not only led to a decline in amphibian populations, but has also led to the extinction of species in some countries.

As part of the Amphibian Conservation Action Plan, the IUCN has recommended the relocation of amphibian species to try to stop the global extinction of amphibian species. Since chytrid disease is one of the most serious threats to amphibians, it poses an additional threat to migratory breeding programmes. It is therefore necessary to take safe and effective measures to treat chytridiomycosis, especially in breeding programmes for endangered species.

According to the article [1], F10 is a veterinary preservative known to be 100% effective in killing chytrid cultures in vitro. Before any chemical treatment can be used, the effectiveness of F10 must be determined to determine whether it can be used effectively in different amphibian species and at different stages of life. The researchers are working to determine, for example, the survival rates of mites tadpoles at different concentrations of F10, the paper said. In the presence of F10, the survival rate of zoospores of ampullaria was determined.

Figure 3. FST and site-by-site STRUCTURE analysis[6].
The results showed that the tadpoles could live for 30 minutes when the concentration of F10 was 1:10,000, but could only live for thirty to three minutes when the concentration of F10 was 1:30,000, which could not be implemented. In addition, in vitro experiments showed that animal spores died after 10 min at 1:10,000 concentration and 30 min at 1:15,000 concentration.

Successful treatment of the tadpoles will increase the species' chances of survival, as the pathogen will be destroyed before the tadpoles develop into the life stage of susceptible diseases. "By establishing partnerships between academia and the zoo or wildlife community, I hope they will maximize the possibility of this project being implemented in the future to ensure long-term sustainability to combat the effects of chytrid disease," the authors say[1].

3. Conclusion
The fungus originated in Africa and spread around the world through trade in animals such as xenopus africanus, and was endemic in Africa for many years before spreading around the world.

Chytridiomycosis is one of the important factors contributing to the extinction of some amphibians in many places, including Africa and Australia. It will affect the chytrid strain of chytrid fungus, the active degree and spread range of factors are temperature, human activities, amphibian's own immunity, chemicals in pesticides, etc.

The result is consistent with the hypothesis of the author. Exposing frogs infected with chytrid fungus to temperatures above 25 degrees Celsius can kill the chytrid fungus, giving the infected animals a chance to recover. Although many amphibian declines are attributed to chytrid fungus, some species are resistant to infection and survive low levels of infection. In addition, some species can even resist non-pathogen chytrid bacteria. Reducing human activity in the natural environment (including academic research) can effectively prevent the rapid spread of chytrid fungus and improve amphibian conservation.

The selection of materials and personal research experience of this paper are limited, and the title is also targeted (only one branch of amphibians, not all of them; Only a few specific areas were considered), and the results don't apply to all areas.

The transmission of chytridiomycosis is mainly affected by temperature, human activity and the resistance of the amphibian population itself.

There are no effective prevention and control measures for wild individuals at present, so we can only choose to move the frogs to the non-chytrid area before the invasion of frog chytrid bacteria. For amphibians in the wild, frog chytrid fungus in the environment can be inactivated under high temperature to prevent infection. Other researchers are exploring probiotic treatments for frogs. Amphibians are between fish and reptiles. In biological evolution, it is the transition period from aquatic to terrestrial life. Amphibians are a very important part of the evolutionary story, and need human's attention and protection.

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[5] <img class="fragment-image" aria-describedby="F2-caption" src="https://science.sciencemag.org/content/sci/360/6389/621/F2.medium.gif"/>

[6] <img class="fragment-image" aria-describedby="F3-caption" src="https://science.sciencemag.org/content/sci/360/6389/621/F3.medium.gif"/>