

Aktueller Wissensstand und langfristige Überwachung der Weißnasenkrankheit bei überwinternden Fledermäusen

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Current knowledge and long-term monitoring of white-nose disease in hibernating bats

Abstract

White-nose disease, also known as white-nose syndrome, is a fungal disease that occurs in hibernating bats. The disease first appeared in North America in 2006, when bats were observed with a mysterious white mould on their muzzles that apparently led to many deaths. In the following years, the disease spread rapidly across the North American continent, killing millions of bats. The cold-loving pathogenic fungus, *Pseudogymnoascus destructans*, attacks the animals while they are in torpor and can invade deep into skin layers where it causes severe damage. The bats react with increased arousal frequencies and immunological reactions. This leads to a premature consumption of fat reserves, which is the main reason for the lethal course.

The fungal disease has also been found on hibernating bats across Europe, but so far without any detectable mortality. Molecular genetic studies showed that the fungus is native to Europe and Asia and appears to have been carried to the Americas. Immunological studies suggest that European bats are adapted to the fungus and show immunological tolerance to the pathogen. This tolerance strategy prevents energetically costly increased arousal frequencies as well as excessive immune reactions, so that the animals save their energy and survive the infections at least during hibernation.

However, it is unclear whether the previously diseased individuals suffer disadvantages in

spring, such as reduced reproductive rate or so far undetected deaths due to costly healing after hibernation when food resources are still scarce. Furthermore, it is unclear how the disease will continue to develop. Microorganisms such as pathogenic fungi may mutate or disease courses may change if, for example, environmental variables such as food availability change.

It is therefore advisable to monitor white-nose disease in Europe as well. For this purpose, a field-ready, non-invasive method is proposed to assess the disease status of animals by means of visual classification and to collect data on a long-term and large-scale basis - a need that has also been demanded by EUROBATS for a long time.

Furthermore, there is a general call to reduce the spread of fungal spores through shoes, clothing and equipment between hibernation sites.

Keywords

White-nose disease, surveillance, *Pseudogymnoascus destructans*, hibernation, bats, visual Pd-score

Zusammenfassung

Die Weißnasenkrankheit, auch bekannt als Weißnasensyndrom, ist eine Pilzkrankheit, die bei winterschlafenden Fledermäusen auftritt. In Nordamerika trat die Krankheit erstmals im Jahr

2006 auf, wo Fledermäuse mit einem mysteriösen weißen Schimmel an der Schnauze beobachtet wurden, der offenbar zu vielen Todesfällen führte. In den folgenden Jahren breitete sich die Krankheit rasant auf dem nordamerikanischen Kontinent aus, wobei Millionen von Fledermäusen starben. Der kälteliebende pathogene Pilz, *Pseudogymnoascus destructans*, befällt die Tiere während sie im Torpor sind und kann tief in die Hautschichten eindringen, wo er schwere Schäden verursacht. Die Fledermäuse reagieren darauf mit erhöhten Aufwachraten und immunologischen Reaktionen. Dies führt zu einem vorzeitigen Verbrauch der Fettreserven, was den Hauptgrund für den letalen Verlauf darstellt.

Auch in Europa wurde die Pilzkrankheit auf winterschlafenden Fledermäusen festgestellt, jedoch bislang ohne feststellbare Mortalität. Molekulargenetische Studien zeigten, dass der Pilz in Europa und Asien heimisch ist und offenbar nach Amerika verschleppt wurde. Immunologische Untersuchungen suggerieren, dass europäische Fledermäuse an den Pilz angepasst sind und eine immunologische Toleranz gegenüber dem Pathogen zeigen. Diese Toleranz verhindert ein energetisch kostspieliges häufiges Aufwachen sowie übermäßige Immunreaktionen, so dass die Tiere ihre Energie sparen und die Infektionen während der Winterschlafphase überleben.

1 Einleitung

Neu auftretende Pilzkrankheiten können zu einer ernststen Bedrohung für wildlebende Tiere werden. Bekannte Beispiele sind die Chytridiomykose bei Amphibien (LIPS 2016, O'HANLON et al. 2018) oder die Weißnasenkrankheit bei Fledermäusen (engl. White-nose disease bzw. White-nose syndrome) (VEILLEUX 2008, BLEHERT et al. 2009). Bei letzterer befällt der kälteliebende Pilz *Pseudogymnoascus destructans* Fledermäuse während des Winterschlafs (BLEHERT et al. 2009) und hat in Nordamerika bereits zum Tod von Millionen von Fledermäusen geführt (FRICK et al. 2010, 2015, FROSCHAUER & COLEMAN 2012).

Es ist jedoch ungeklärt, ob die zuvor erkrankten Individuen im Frühjahr Nachteile erleiden, wie zum Beispiel verminderte Reproduktionsraten oder bislang unentdeckte Todesfälle aufgrund einer kostspieligen Heilung nach dem Winterschlaf, wenn die Nahrungsressourcen noch knapp sind. Des Weiteren ist unklar, wie sich die Krankheit weiterhin entwickeln wird. Mikroorganismen wie pathogene Pilze können mutieren oder Krankheitsverläufe können sich ändern, wenn sich zum Beispiel Umweltvariablen wie die Nahrungsverfügbarkeit ändern.

Es ist deshalb ratsam, die Weißnasenkrankheit auch in Europa zu überwachen. Hierfür wird eine felddaugliche, nicht-invasive Methode vorgeschlagen, um mittels visueller Klassifizierung den Krankheitsstatus der Tiere einzuschätzen und langfristig und großflächig Daten zu sammeln - ein Bedarf, der auch von EUROBATS seit langer Zeit nachgefragt wird.

Des Weiteren wird dazu aufgerufen, generell die Verschleppung von Pilzsporen durch Schuhe, Kleidung und Equipment zwischen den Winterquartieren zu reduzieren.

Schlüsselwörter

Weißnasenkrankheit, Überwachung, *Pseudogymnoascus destructans*, Winterschlaf, Fledermäuse, Visueller Pd-Score

P. destructans wurde auch in Eurasien nachgewiesen (PUECHMAILLE et al. 2011; ZUKAL et al. 2016, KOVACOVA et al. 2018), jedoch konnten hier bislang keine Todesfälle eindeutig der Pilzkrankung zugewiesen werden (PUECHMAILLE et al. 2011, FRITZE & PUECHMAILLE 2018). Deshalb liegt die Annahme nahe, dass europäische Fledermäuse bereits an die Pilzkrankheit angepasst sind, während den amerikanischen Fledermäusen diese Anpassung noch fehlt. Es besteht jedoch noch Unklarheit über die unmittelbaren oder mittelbaren Folgen der Weißnasenkrankheit, auch bei europäischen Arten, weshalb der vorliegende

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