*Besnoittia darlingi* Natural Host: Bobcats (*Lynx rufus*)

Abstract

The parasite known as *Besonittia besnoiti* is the main cause of bovine besnoitiosis. This disease has a negative impact on the economy in countries that revolve around cattle production. It has not been identified on how the disease has been transmitted. Since researchers have not been able to find how this parasite is transmitted, it has scientist baffled on how to prevent the disease from spreading. By being able to understand how the parasite goes through its lifecycle, researchers could find a way to interrupt the lifecycle of *Besonitta besoniti*. Knowing where to disrupt or interrupt the lifecycle would help scientists understand how to stop the parasite from creating this disease that can harm large populations. This research shows that a definitive host, which is natural for the *Besnoittia darlingi,* could be the bobcat (*Lynx rufus*). There has been other experiments to find if there are different species of wildlife that could be a host for the *Besonittia darlingi* parasite. The main goal of the experiment was to transfer the parasite from a natural definitive host to a domesticated cat, the *Felis catus.* The results that were concluded stated that bobcats could potentially be an important link between the Besnoititia species and its natural definitive host.

Introduction

The disease Besnoitiosis which is caused by the parasite *Besnoitia besnoiti* is an economically damaging disease for cattle companies in many countries. This disease especially effects Africa and Europe’s profits due to the increase in cattle mortality. When cattle are infected, it can cause a decrease in milk production, weight loss, males becoming sterile, and eventually loss of life. These are the causes for the severe economic losses since the meat and milk production have had a dreadful decline. This decline affects the farms and eventually the country itself. There is also the fact that a large portion of the population in these countries thrive off this industry. Job loss and food production could lead to more poverty and even a higher mortality for the indigenous peoples. The importance of finding the main definitive natural host for the genus *Besnoitia* is so that researchers can find the source to stop the disease from spreading. The *B. besnoiti* parasite has multiple types of wildlife species that could potentially be its definitive host. “The life cycle of *B. besnoiti* remains a mystery: the definitive host is unknown and the transmission routed are poorly understood. *B. besnoiti* is thought to be transmitted mainly by hematophagous insects.” (Jacquiet, Liénard, Franc. 2010). There are multiple theories on what and how this species transferred, but nothing is proven scientifically. The genus *Besnoitia* has 10 separate species; a majority of these have an experimental common host. The domesticated cat (*Felis catus*). Cats that were fed murine that were filled with millions of cysts from these parasites excreted *Besnoitia* oocysts. Researchers therefore inferred that wild cats might be a more efficient host for this species of parasite. Wild cats could have a more natural way of coming across this type of parasite. Wildlife can be a better host since they have something in their body that the parasite will be able to have better living conditions. Eventually the main goal of this study was, “identification of bobcat (*Lynx rufus*) as a natural definitive host for *B. darlingi* of opossum and describe its successful experimental transmission to domestic cat (*Felis catus*).” (Verma et al., 2017)

Recent Progress

The scientists that performed this study legally trapped 25 bobcats in order to calculate the total number of *Besnoitia* oocysts in their feces. Therefore, the feces were carefully collected and sent to the Animal Parasitic Disease Laboratory (APDL). These samples were all put into multiple solutions in order to obtain an accurate count underneath the microscope. The APDL had two different types of mice one which was an outbred Swiss Webster (SW) and the other was an IFN-γ gene knock out (KO). This gene is responsible for making the mice more susceptible to disease by suppressing its immune system. Both types of mice were administered the oocysts through a feeding tube. The mice were then observed for any symptoms of illness. Than all the mice were euthanized at different time intervals were than observed for oocysts in their lymph nodes, lungs, and other organs. Multiple parts of the mice were taken for the purpose of receiving accurate results. In order to be able to tell apart the difference between *B. darlingi* and the other *Besnoitia* species DNA testing was done on the mice, more specifically from the lymph nodes and lung tissues.

It was concluded that there were *B. darlingi* oocysts found in the feces of the bobcats. Since there were multiple species of the genus *Besnoitia* the authors created a phylogeny based on one certain gene. The oocysts that were found in the feces of only two male bobcats were considered to be *B. darlingi.* These oocysts were also found to be unsporulated, and they were originally thought to be *T. gondii* since they are very morphologically similar. These findings were important for this study, because it correlated to how this species invades its potential hosts. The inoculated KO mice all developed Besnoitiosis which eventually caused them to die within 17 days. Their tissues were examined and showed that there were tachyzoites in both of their organs. Only the SW mice had oocysts in their tissues when they were euthanized after 48 days. The genes that were obtain showed that “The ITS-1 sequence (MF872605) obtained from the infected bobcats confirmed its membership among genus *Besonitia* and indicated an especially close relationship to *B. darlingi.”* (Verma et al., 2017). The originally sequence samples of B. darlingi were acquired from its intermediate host the Virginia opossum.

Discussion

 The results that this study concluded were brief and did not go into great detail about the negative results that this study had concluded. The images and graphs which were provided were also in great detail. With everything labeled properly and easy to understand in the article itself. The discussion part of the paper itself is short and not well rounded. The authors mainly discussed that the similarities between the *B. darlingi* species, and other parasite species that relate to each other morphologically, biologically, microscopically and molecularly. The writers did not go into any depth on what actually went wrong and how the experiment could have gone better if it was performed again. It is important for this to be done so that if it was redone by scientists they would have a better understanding of what would need to be changed. The way that the different species of the genus *Besnoitia* were discussed was confusing. They were used interchangeably which made it to where the multiple species explored had different characteristics. Although most of these species had similar morphologies and characteristics it was difficult to keep track of which species that the researcher was actually trying to experiment with. The steps that were conducted in order to get the cats to obtain the oocysts were not clear. These procedures were not put into the materials and methods section instead they were briefly discussed in the results section. It is important for the scientist to mention how they got the cats to ingest these parasite since that was the main target for this experiment and the main goal for this research.

References

Main Article

Verma, S. K., Cerqueira-Cézar, C. K., Murata, F. H., Lovallo, M. J., Rosenthal, B. M., & Dubey, J. P. (2017). Bobcats (*Lynx rufus*) are natural definitive host of Besnoitia darlingi. *Veterinary Parasitology,248*, 84-89. doi:10.1016/j.vetpar.2017.10.013

Collaborating articles

Jacquiet, P., Liénard, E., & Franc, M. (2010). Bovine besnoitiosis: Epidemiological and clinical aspects. *Veterinary Parasitology,174*(1-2), 30-36. doi:10.1016/j.vetpar.2010.08.013