Using DNA Barcoding to Determine the Relationship Between Spider Silk Strength and Spider Species

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Abstract

Spiders are all around the world and they produce exceptional silk, with high qualities in strength and durability. Spider silk is determined by the proteins and spidroins, in the spider's abdomen which give the characteristics spider silk is well known for. Specifically, the CO1 gene could have a mutation affecting the silk type released. If a spider had a specific genetic mutation in the CO1 gene, it would affect the spider's silk. The objective is to find how/if there is any change due to the mutation in the gene. To collect the DNA of the spiders, they were ground up with a pestle in solution to extract the DNA. Not all spiders have DNA results that were completely processed. The project began with 18 different spider samples and 4 got processed correctly. CWX-004, one specimen, was found to be something other than a spider. The silk from the web collection of the project was not completed, but 18 different spider species were found.

Introduction

Spiders possess spinnerets which produce silk. These spinnerets are located underneath their lower abdomen. The DNA sequence in their bodies makes it possible for them to produce different types of silk. The protein in the silk makes it infamous for its durability. The silk that is released from the spiders sometimes has different purposes, making a slight difference in the protein codes. Finding the differences in the CO1 gene in spider silk would help us learn a bit more about the bodies that produce certain silk for specific uses.

Results and Discussion

Results

Of the 18 total samples, only 4 were fully processed officially through Cold Spring Harbor laboratories. The part of the silk was not yet completed due to the season we collected the spider. There were not many places where the spiders could spin their webs to collect both. Sample numbers, 4, 6, 13, and 18 were all barcoded accurately. Sample number 4, specifically, matched with a bacteria called Rickettsiaceae instead of a spider. Number 6 was found to be a Barn Funnel Weaver or a Tegenaria domestica. Number 13 was found to be a common house spider or Parasteatoda tepidariorum. Lastly, number 18 was found to be an Eastern Parson Spider or Herpyllus ecclesiasticus.

Figure 1
(CWX-004) ↑

←Figure 2
(CWX-013)

Discussion

As stated earlier, getting results for the silk was unable to happen because of the lack of webs found along with the spiders. The study didn't go as planned originally because of the restrictions of finding spiders within or near their respective webs. Finding the matching webs would be something for the future work of this project. Especially sample number 4, Rickettsiaceae could have been contaminated with the spider species and the barcoding only could collect the DNA off of the bacteria instead of the spider. This spider was thought to be a cosmopolitan cellar spider or a Pholcus phalangioides. Other complications could have happened with the other 14 specimens that either had too much or too little amounts of DNA for the machines to get results. The centrifuge could have been faulty or older, making it work not as sufficiently as it could have been. The equipment located at Sayville High School is unlike that found at Cold Spring Harbor DNALC. More factors could be the people who worked with the DNA themselves if they have not done a project similar to this one before. Luckily, with the 3 species that have been correctly done, they are all three types of species.

←Figure 3
(CWX-018)

Methods

All of the experimental groups were just the 18 different spider samples being tested. While following the exact protocol of Cold Spring Harbor "Isolate DNA from Plant or Animal Samples", make sure not to come in full contact with the specimens and not to cross-contaminate. No modifications from the protocol was altered in any way. 16 out of the 18 spiders were found within the same town, making this more of a fair study.

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