MOU Savaloja Grant Report – 2015 Field Season
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Parasites influence many fundamental aspects of the evolutionary ecology of their avian hosts. Consequently, birds have evolved different defense mechanisms to combat their parasites. Once exposed, birds can defend themselves against parasites in two main ways: 1) using resistance mechanisms to reduce parasite damage by decreasing parasite abundance (e.g. via the immune response), or 2) using tolerance mechanisms that reduce parasite damage without affecting parasite abundance. These defenses not only differentially affect the evolution of host life history traits but also affect the co-evolutionary trajectories among birds and their parasites.

My ultimate goal is to develop a long-term research program in northern Minnesota on the importance of host defenses in box-nesting birds, such as Tree Swallows (*Tachycineta bicolor*) and Eastern Bluebirds (*Sialia sialis*), against the parasitic nest fly *Protocalliphora*. Adult *Protocalliphora* flies are non-parasitic but they lay their eggs in the nests of birds. Once the fly eggs hatch, the maggots feed on the blood and fluids of incubating/brooding parents and nestlings. *Box nesting birds and their parasites are an ecological model system to address the proposed research project; such studies can address basic biological questions that are yet to be explored.*

Figure 1. Pitera (left) and Knutie (right) setting up the 100th nest box near Itasca State Park.

During the 2015 field season, I established my 100th nest box near Itasca State Park, MN (Figure 1). I hired a recent graduate from the University of Minnesota, Angela Pitera, to conduct the proposed study in 2015. We were also able to secure her a teaching assistant position for the ornithology class at the Itasca Biological Station; therefore, students from the class were able to help her with the study, which was great hands-on research experience for the students. Since this was one of the first years that the boxes were established, we were not expecting substantial occupancy. However, 25% of boxes were used by tree swallows (10 nests), eastern bluebirds (11 nests), and black-capped chickadees (4 nests). We experimentally manipulated the parasitic nest fly *Protocalliphora* in the nests of each bird species; nests were either treated with an insecticide to kill the parasites (non-parasitized) or treated with water to serve as a control (parasitized).

Figure 2. Hungry eastern bluebird hatchlings.

For tree swallows, 5 nests were parasitized and 5 nests were non-parasitized. Within the parasitized nests, we found 100% prevalence of the fly, with a mean of 46 parasites per nest. We found that nearly all nestlings fledged from both treatments (non-parasitized: 21/24 nestlings fledged, parasitized: 27/28 nestlings fledged). For parasitized swallow nestlings, we found a significant negative relationship between parasite abundance and antibody-mediated immune response, suggesting that the nestling immune response is effective at decreasing parasite abundance; this data is preliminary but promising.

For eastern bluebirds, 6 nests were parasitized and 5 nests were non-parasitized (Figure 2). Within the parasitized nests we found 100% prevalence of the fly with a mean of 41 parasites per nest. Fledging data was not collected from all nests, but the data collected suggests no difference in fledging success between parasitized and non-parasitized nests. For parasitized bluebird nestlings, we did not find a significant relationship between parasite abundance and antibody-mediated immune response and levels were relatively low; this suggests that bluebird nestlings are not investing heavily in an immune response, but instead investing in other defense mechanisms, such as tolerance, to deal with the parasites. Alternatively, brooding parents may either 1) mount a significant immune response to reduce parasite abundance, or 2) behaviorally remove parasites from nests; these hypotheses will be explored during the 2016 field season.

For black-capped chickadees, 2 nests were parasitized and 2 nests were non-parasitized. Both parasitized nests were indeed parasitized (7 parasites and 105 parasites). For the parasitized nests, 77% of nestlings fledged and for the non-parasitized nests, 40% of nestlings fledged, which included one nest that failed due to depredation. The immune response has not been quantified in chickadees yet, though the sample size is too low to conclude its significance.

The data collected in 2015 suggest that bluebirds and swallows have similar parasite abundances but invest in different defense mechanisms to deal with the parasites. In 2016, we will increase our sample size and explore other potential defense mechanisms in both the nestlings and adults. The Savaloja Grant provided the seed money to collect this exciting preliminary data and provides enough data to continue our work at Itasca State Park, as well as apply for more funds to support future research endeavors.

Figure 3. Pitera looking through a nest for parasitic nest flies.