Rats, GAS and Nematodes: Interactions in Barbados

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Barbados is in the midst of dealing with the invasive Giant African Snails (GAS). Not only does this snail present a potential burden on agriculture and horticulture on the island, it also poses a health risk, as GAS is a vector for angiostrongylid nematodes, such as Angiostrongylus *cantonensis* (Rebello et al., 2011, Slom et al., 2002). Snails serve as an intermediate host for the infective third stage juvenile of the nematode. The adult stage lives in the arteries of the lungs of rats (*Ratus norweigicus* and *R. rattus*) earning this nematode the nickname of rat lungworm (Slom et al., 2002). In a summer 2000 study of 80 rats (59 *R. norweigicus* and 21 *R. rattus*) in Barbados, none were infected with *A. cantonensis* (Levett et al., 2004). Unfortunately, judging by the rapid spread of GAS in the Greater Antillean islands, it will not be long before it is positively identified in Barbados. As such, rodent control and public education on prevention methods are imperative measures to help prevent human infection.

A. cantonensis poses a threat to humans as it can cause eosiniophillic meningitis, a condition that is quite serious and can result in permanent brain damage or even death (Slom et al., 2002). This zoonotic rat lung worm is endemic to Asia, North America, Africa and Australia, but has been spreading throughout the world (Chikweto et al., 2009; Martin-Alonso et al., 2011). The prevalence and wide distribution of *A. cantonensis* in rats and the intermediate hosts of the rat lungworm, increases the risk of humans becoming infected. More than 2,800 cases of human angiostrongyliasis caused by *A. cantonensis* have been reported since 1945 in approximately 30 countries. Now this zoonosis is an emerging tropical disease that threatens the island of Barbados amongst other Caribbean islands (Martin-Alonso et al., 2011).

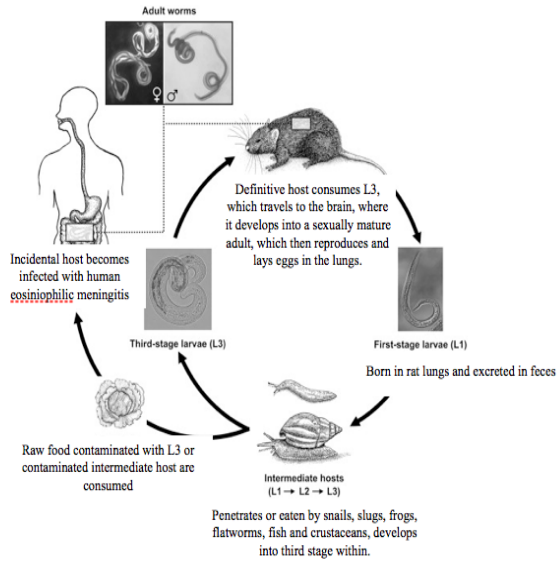

Figure 1: Diagram of the life cycles of *Angiostrongylus cantonensis* and *A. costaricensis* (Rebello et al., 2011).

In the past, morphological techniques were used to identify the nematode species (Ash, 1970). This was done following snail tissue digestion and nematode extraction. A 2011 BITS project used this method to extract larvae from GAS collected at 30 sites. The larvae were later examined using a light microscope, but attempts to identify them using morphological characteristics were inconclusive. This procedure is labor intensive as well as error-prone because many nematode species that are closely related to *A. cantonensis* have very similar outer appearances, only differing slightly in tail shape (Qvarnstrom et al., 2007; Ash, 1970). This is why researchers, (ex:

Qvarnstrom et al., 2007) developed PCR methods to identify the nematode by using a small snail tissue sample. While Qvarnstrom et al., 2007 used the semi-slug, *Parmarion* cf. *martensi*, it can be used as a model for our work with the giant African snail, but it needs to be adapted for the Barbadian situation.

We worked under the supervision of Dr. Angela Fields, a mollusk expert at UWI's Cave Hill campus, to try to detect and potentially link the life cycles of rats, GAS and angiostrongylid nematodes. In order to complete our project we learned the methods for extracting DNA and performing PCR, examined rat and GAS samples for the presence of *A. cantonensis* and tried to determine the prevalence of nematode larvae in the GAS populations at selected sites.

Figure 2: GAS measurement and dissection.

Rats were collected using baited traps and GAS were collected by hand, with the assistance of Jeff Chandler (UWI). We mainly worked on GAS and rats collected at sites that appeared nematode-positive in 2011. We worked at UWI Cave Hill campus to dissect snails, perform PCR and do the microscopy. Rats were examined under the guidance of veterinarian Dr. St. John at the Diagnostic Veterinary Laboratory, who taught us to euthanize and dissect rats in a humane and sanitary manner. In the end, PCR was not successful, so we used the microscopy technique from last year and found few nematode positive GAS samples and no nematode positive rat samples.

We learned a lot from this project. Not only did we truly feel accepted as scientists, we got to experience this type of work in a completely different culture. While we ran into a few bumps along the road, we learned that if you are patient and keep a positive attitude, things will work out. We found ourselves doing a lot of waiting this summer. Through this experience, we learned the true meaning of "island time"; everyone and everything runs at its own personally-set pace and you just have to be patient.

Overall, this summer was one we will never forget. With the guidance and support of our mentors, we learned a lot about the island and more specifically about the interactions between rats, GAS and nematodes in Barbados. Being able to learn in a hands-on fashion directly in the field was something we are not able to experience as often at our home university of McGill. Having personal communication and interactions with scientists and researchers allowed us to understand our experiment at a more professional level. We found a way to deal with all of the obstacles we encountered throughout the course of our project. Whether we had to ditch an idea and start over or modify our process, we eventually obtained positive results in the end. Although we still cannot make any definitive correlations linking the life cycles of the samples we studied here in Barbados, through our efforts, the project has moved one giant step closer.

Figure 3: GAS tissue digestion.

For future projects, we encourage everyone to work together. Be sure to plan in advance and if things are not the way that you planned, simply go along with the island flow and things will usually work themselves out. If not, take some initiative! Nothing will get done if no one starts it, so put your thinking caps on and get some ideas rolling. Creative thoughts put into action are better than no action at all, even if you do not obtain the results you expected or hoped for, you will still learn something along the way. We would like to extend our thanks to everyone that helped us this summer and we encourage them and others to continue on the positive progress we have made over the past three and a half months.

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