

Project Title: Development of novel anthelmintics and antiparasitics derived from plant sources

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Abstract:

Currently, only a few anthelmintic drugs are used to control or treat livestock and human gastrointestinal nematodes (GIN). These parasites cause economic losses in livestock and morbidity in humans. In livestock, broad-scale anthelmintic treatment causes development of anthelmintic resistance. One option to combat resistance is the exploration of plants with experimental and anecdotal anthelmintic and antiparasitic activity. Therefore, it was hypothesized that biochemical products sourced from garlic (*Allium sativum*), pumpkin (*Curcubita spp.*) and artemisia (*Artemisia annua*) will be effective treatments for the GIN *Haemonchus contortus* adult worms. The objective of this study was to determine time to death for adult *H. contortus* worms exposed to plant treatments. Adult *H. contortus* worms were harvested post-slaughter from the abomasa of sheep and goats. Adult worms were placed into 6-well plates (3 worms/well) and treatments were applied in duplicate. Worm motility was observed hourly and concluded when all worms were considered dead. Each plant treatment was evaluated independently and effects on worm motility were compared to fenbendazole (PC), a commercially available anthelmintic and to a non-treated negative control (NC). Allcin, a chemical derived from garlic, exhibited the greatest anthelmintic activity (average time to death 2.15 ± 0.54 hrs, $p < 0.01$ vs. NC). Pumpkin seed oil also exhibited some anthelmintic activity, when compared to no treatment (average time to death 4.15 ± 0.73 hrs, $p < 0.01$ vs. NC). Artemisinin did not exhibit any anthelmintic effects at the tested dosages. These findings suggest that plant-based anthelmintics may be viable treatment options for GIN control in small ruminants.

External grants submitted:

Agency: United States Department of Agriculture (USDA), National Institute of Food and Agriculture (NIFA)

Program Name: Agriculture and Food Research Initiative Competitive Grants Program (AFRI)

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Amount Requested: \$500,000

Date Submitted: July 2018

External grants awarded: None at this time (due to shutdown, still waiting to hear from NIFA).

Planned external grant submissions:

At this time, I plan to re-submit to USDA NIFA if the current proposal is not funded. I

also anticipate preparing a proposal for the NIH “Dual Purpose with Dual Benefit: Research in Biomedicine and Agriculture Using Agriculturally Important Domestic Animal Species” in the future.

Problems encountered:

The main problem was procuring access to the funding available from the MIRG. This is not necessarily an issue of the funding source, but between administrative changes in our department and having a full teaching load, the ability to access and utilize the funds was definitely a challenge. I will also note that the goals for this project may have been overly ambitious with limited time and human resources to conduct the experiments. However, with the implementation of the M.S. in Integrated in Agriculture in Fall 2018, we have made substantial progress (as I now have three graduate students conducting the various experiments proposed in the original grant).

Other comments:

The MIRG was not only important for myself as a new faculty member for conducting the research, but it enabled me to build confidence in writing a grant proposal and gave me the confidence to attempt the grant with USDA. Furthermore, the MIRG has assisted in establishing important contacts within Texas State to help advance this research project. Currently we are analyzing the components of the botanicals utilized in this study in the Chemistry department, which will inform additional experiments in the future. I am confident that I am building a program that will (hopefully) sustain itself in the future, and without the MIRG, it would have been a greater challenge. I appreciate the opportunity the MIRG has given me to better myself as an investigator at Texas State.