BACKGROUND

Insects are one of the largest and most diverse groups of animals. Cockroaches belong to this group. While some cockroaches benefit the environment, there are many species that are considered serious pests because they live in close association with humans and contaminate food and other household items. They also can cause serious allergenic diseases such as asthma. One of the most common pest species of cockroach is the German cockroach, *Blattella germanica*. German cockroaches are common worldwide and are anthropophilic (human loving). They pass through six juvenile stages in a short seven weeks, and they live as reproductive adults for approximately three months. Adult females will produce between two and seven egg cases, each housing about 40 juveniles, so females can potentially produce over 200 offspring in their lifetime (Muller-Graf et al. 2001).

Millions of dollars are spent each year on cockroach control methods. These include chemicals, which can be detrimental to the environment and to the organisms living there, including humans. Another possibility is to use biological control, which means using natural enemies against them. Parasites are one potential biological control agent.

Parasites are among the most abundant organisms on earth. A parasite is an organism that lives in a physically intimate relationship with another organism. In this association, the parasite benefits and the host is harmed (Marquardt et al. 2000). Pinworms are roundworm parasites that infect nearly all animal species including humans. They live and reproduce in the gut of their host. They exhibit a direct life cycle which means they infect only one host species. Pinworm infections spread when hosts come in contact with eggs and accidentally ingest them. Cockroaches are frequently infected with several species of pinworm parasites, some of which could be potential biological control agents.

Muller-Graf et al. (2001), examined whether the pinworm, *Blatticola blattae,* could be used to control German cockroach populations. In laboratory populations, cockroaches harbored only one or two pinworms. *Blatticola blattae* had significant but small effects on juvenile survival rates, and female

reproductive rates. A mathematical model that incorporated these effects suggested that *B. blattae* could depress a population slightly, but not enough to serve as a good biological control agent. While this worm may not be a good candidate for controlling cockroach populations, it remains possible that other cockroach pinworms may be effective biological control agents.

OBJECTIVES

For my Masters' Thesis research, I propose to examine the potential of another cockroach pinworm as a biological control agent. In my WIU Honors Thesis (Size matters: Factors affecting pinworm parasitism in the Australian cockroach, *Periplaneta australasiae*), I found that *Leidynema appendiculata* is extremely common in the cockroach population in the WIU greenhouse (Waggoner Hall). Over 80% of the cockroaches are infected. Furthermore, *L. appendiculata* occurs at much higher intensities (5- 7 worms per host) than *B. blattae*. Both of these features suggest that this parasite could serve as a control agent for the German cockroach.

I will test the utility of *L. appendiculata* as a biological control agent by comparing the success of control and infected cockroach individuals and populations. The objectives of this research project are to 1) determine how *L. appendiculata* affects the survival rates of juveniles, 2) determine what affects *L. appendiculata* has on the reproductive output of females, and 3) examine the effects of *L. appendiculata* on population growth in experimental populations. If *L. appendiculata* has potential as a biological control agent, then infection will cause slowed development and decreased survival rates in juvenile German cockroaches, decreased reproductive output in females, and reduced population sizes.

METHODS

All experimental animals will be drawn from a large uninfected colony. To infect cockroaches, I will feed them apples with pinworm eggs on them. To test for the effects of *L. appendiculata* on individual cockroach survival, I will house 50 juvenile German cockroaches (25 uninfected and 25 infected) in individual containers. I will examine cockroaches daily in order to measure the time

between molts (shedding the exoskeleton), and mortality rates of each group. To test for the effects of *L. appendiculata* on female fecundity (overall reproductive output), I will house 50 pregnant adult females (25 uninfected and 25 uninfected) in individual containers. I will measure the time required to produce the first egg case, the number of egg cases produced in total by each female, and the number of juveniles produced from each egg case. To measure the effects of *L. appendiculata* on cockroach population growth, I will use ten 10-gallon tanks and house 100 cockroaches in each. Five tanks will contain uninfected cockroaches and five tanks will contain infected cockroaches. I will dissect five cockroaches from each tank monthly to check for the presence or absence of pinworms. I will monitor populations bi-weekly in order to estimate total population size, age distribution, and the number of juveniles molting to adulthood will be recorded. The number of egg cases produced by females in both populations will be recorded as will the number of juveniles that hatch from the egg cases.

I will analyze data using t-tests for paired comparisons (infected vs. uninfected, in juvenile and adult females), and analysis of variance (ANOVA) to compare infected and uninfected populations over time.

SIGNIFICANCE

This research is significant because if *L. appendiculata* does reduce population growth, it may be useful as a biological control agent which would allow us to use fewer chemicals to control this pest.

REFERENCES

Marquardt W. C., R. S. Demaree, and R. B. Grieve. 2000. Parasitology and vector biology. Second Edition.Academic Press, San Diego, California. 702 pp.

Muller-Graf C. D. M., E. Jobet, A. Cloarec, C. Rivault, M. van Baalen and S. Morand. 2001. Population dynamics of host-parasite interactions in a cockroach-oxyuroid system. Oikos 95: 431-440

BUDGET

I need a light source which will illuminate from the bottom up on a dissecting microscope, to be able to identify pinworm eggs which I can use to infect my sample populations. This illumination stand costs $1530.97. This grant will provide partial funding for the dissecting illumination stand. We already have $400.00 from a grant received from the College of Arts and Sciences in the fall of 2008. Other funds are anticipated from the College of Arts and Sciences through undergraduate research proposals for the spring semester.

Item	Amount needed	Total price
Transmitted Light Illumination Stand	$ 500.00	$ 1530.97