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**Proposal Cover Sheet**

**Term:** Fall **Year:** 2011

**Instructor:** Dr. Nora Demers

**Name:** Sara Ryan

**Present Year in Education**: Senior

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**Major:** Biology, Liberal Arts

**Have you identified a research mentor for a senior thesis**? Yes

**Name:** Dr. Charles Gunnels

**Title of Proposal:**

What is the interspecies relationship between *Argyrodes theridiidae* (Dew Drop Spider)and *Nephila clavipes*(Golden Orb Weaver)?

**Keywords:** Parasitic, Commensal, And Mutualistic

**Checklist:**

**All required portions of the first submission are included:** Yes

**I had an external reviewer read the proposal:**  Yes

**If Yes, who**: Jason Ryan, Rachel Sherman **When**: 16 October 2011

**I authorize the use of this proposal as an example in future courses:** Yes

**Abstract**

 *Nephila clavipes*(Golden Orb Weaver) and *Argyrodes theridiidae*(Dew Drop) spider are two very different species of spiders living in close conjunction with one another. The Dew Drop spider pales in size comparison to the Golden Orb Weaver and is known to reside on the much larger spider’s web. It is unclear what kind of interspecies relationship exists between them. There are three possibilities: a parasitic relationship, commensal, or mutualistic. We will be using both experimental and observational data to specifically define a relationship between the two spiders as parasitic, commensal, or mutualistic. Testing many different variables for the Golden Orb Weaver: number of legs, size, and habituation as well as for the Dew Drops: distance from host, how many, location and also the web condition: size, tensile strength, broken strands, and debris should help us clearly define what type of relationship exists between these two spider species. We will be asking: What is the interspecies relationship between *Nephila clavipes* and *Argyrodes theridiidae?*

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**Introduction**

There are countless interspecies relationships throughout the animal kingdom. These relationships are often categorized into as: parasitic, mutualistic, and commensal. A parasitic relationship is defined as one species benefitting from the relationship while the other is damaged. (Iyengar, 2008). A mutualistic relationship is observed when both species benefit. (Elgar, 1994). A commensal relationship is when one species benefits while the other is not affected. (Grostal, Evans, 1997).

Different species of spiders have been shown to demonstrate one three different types of relationships. Parasitic relationships between spiders usually show one spider as a kleptoparasite (Tanaka, 1984). A kleptoparasite is an individual spider stealing prey items or web silk from the host spiders’ web. Often these kleptoparasites are able to spin their own webs however, they choose to reside on a different species webs instead. Mutualistic relationships among spiders often show the invading spider benefitting by increased prey consumption and the host benefitting by having its web cleaned of unwanted prey or prey that is too small for host consumption. This type of relationship is also described as commensal because it is debated whether the invading spider eating the unwanted prey items is actually benefitting the host. It can be difficult to decipher between commensal and mutualistic relationships among spiders (Curtis, 1980).

 *Nephila clavipes* is found in warmer temperatures across the globe. Wet, humid environments tend to show higher concentrations of *Nephila clavipes*. Consequently, *Argyrodes theridiidae* is found in similar environments. These two species have shown different relationships in different environments (Trail, 1980). This experiment will aim to determine the relationship between *Argyrodes theridiidae* and *Nephila Clavipes* in Fort Myers, Florida.

 There are many variables that seem to impact the type of relationship among the spiders. The size of the host in a parasitic relationship has been found to affect the number of Dew Drops on the web as well as the level of parasitism (Grostal, Evans, 1999). There have also been suggestions of reevaluating previously described parasitic relationships. In several cases the Dew Drop residing on the Golden Orb Weaver’s web did eat prey items off the web and was therefore considered a parasite however, closer evaluation found the host would most likely not have consumed these particular prey items due to their miniscule size. This could be viewed as the Dew Drop “cleaning” the host web suggesting a mutualistic relationship. This situation was also described as living commensally because it is debated whether the Dew Drop consuming the tiny prey actually helped the host or not (Coyle, O’Shields, Perlmutter, 1991). If the host did not benefit from the prey removal this would be a commensal relationship. Overall, the interspecies relationship between *Nephila clavipes* and *Argyrodes theridiidae* is unclear and needs further evaluation.

**Research Objectives**

This study will be observing the interspecies relationship between *Nephilia clavipes* (Golden Orb Weaver) and *Argyrodes theridiidae* (Dew Drop) spiders. The Dew Drops live on the much larger Golden Orb Weaver’s web. There are four hypotheses: The relationship is parasitic, mutualistic, commensal, and the null being no relationship. Overall health of the Golden Orb Weaver and its web will be examined as well as the number of Dew Drop spiders and male Golden Orb Weavers.

**Methods**

I will be determining what kind of relationship exists between the Golden Orb Weaving spider and the Dew Drop spider. This experiment will be conducted in CREW, this area is 15 miles west of I-75 on Corkscrew road in Fort Myers, Florida. The minimal sample size is 100 *Nephilia clavipes* webs, after an initial reconnaissance this sample size is obtainable. This experiment is designed to determine whether the relationship between *Nephilia clavipes*(Golden Orb Weaver) and *Argyrodes theridiidae*(Dew Drop) is parasitic, commensal, or mutualistic. Webs identified without dew drop spiders will serve as control. The data collection is organized into four categories: web health, host health, dew drops, and male Golden Orb Weaver. The “web health” will describe the overall health of the web. “Host health” will determine general quality of the Golden Orb Weaver. The “Dew Drop” category will provide information about the invading spider. The “male” category will describe the male Golden Orb Weavers residing on the web.

 Initially the web will be tagged and recorded. The host information being collected will include the host’s location from the hub, (the hub is the center of the web), the length and width of the host’s body at the longest points, and number of legs. Web health will include the distance between the two furthest points of the web, tensile strength of web strands(to be determined with a tensile strength monitor) number of broken strands, and number of debris found on the web. The Dew Drop information to be recorded is the number of Dew Drops, their distance from the hub, and their relative location in respect to the host (front, side, back). The information collection for male Golden Orb Weavers will be the same as Dew Drop information.

 Data analysis will first be separated into control and experimental categories. Each of the control categories will be averaged as well as determining standard deviation. The same will be done for the experimental webs. The information will be calculated using excel. I will also use a critical value level of .05 to determine accuracy. Averages and medians between the control and experimental will be compared. A parasitic relationship would show the overall health of the host and web declining in comparison to control. (Coyle, O’sheilds, Perlmutter, 1991) For example, the hosts would be smaller as well as missing legs. They could also show more debris, broken strands, and less tensile strength of their web strands. The number of Male Golden Orb Weavers on the web should decrease. We would also likely observe the Dew Drops occupying the perimeter of the web to stay as far from the host as possible. A commensal relationship would show no change between the control and experimental groups because the Dew Drop would not be affecting the host or its web. A mutualistic relationship would show the host benefitting from the Dew Drop spiders. This would be indicative by showing an overall decrease in debris on the web, broken strands, and loss of host legs. An increase in tensile strength could be observed as well as an increase in the number if male Golden Orb Weavers. Mutualism would also be reiterated if the Dew Drop spiders were often found in close proximity to the host. Overall, all of data collected is aimed at determining the relationship between these two spiders.

**Broader Implications**

 Spiders are a very important aspect in determining ecosystem health. Spiders consume some of the smallest prey items in ecosystems and can be some of the first warning signs of an ecosystem in trouble. This is observable because according to the laws of thermodynamics: prey items at this level should be much more abundant than the predators and in a healthy ecosystem this should result in a healthy population of predators. (Maloney, Drummond, Alford 2003).

The toxins in the Golden Orb Weaver’s venom and spiders in the same genus have recently been found to help treat neurological disorders (Strømgaard, Andersen, Krogsgaard-Larsen, Jaroszewski, 2001). The silk of the Orb Weaving spiders is also used commercially in the design of polymers and tough fabrics (Porter, Vollrath, Shao, 2005). Overall, there are undeniable benefits to the survival and health of spiders in our ecosystems.

**Timeline**

This experiment will be held September 2011 through December of 2011. The data collection will continue through these months and end in the first week of December. This experiment is shaped around the natural life cycle of the *Nephila clavipes* and *Argyrodes theridiidae. Nephila clavipes* is found in high numbers from August to December where they all abruptly die off before winter.

 The minimum sample size is set at 100 webs. There is 12 weeks for possible data collection to meet this sample size and after initial evaluations it is very possible to obtain 100 webs. The data collection per web is on average 10.6 minutes. This breaks down to 17.67 hours of data collection. I estimated 10 webs per collection day and 1 hour for transportation as well as 1 hour for transcribing data into excel. So 17.67 hours of data collection plus 10 hours of transcription, 10 hours for transportation, and 20 hours for cushion accounts for 57.67 hours of work. With 12 weeks to complete this work this is 4.81 hours of work per week. This is a very obtainable goal.

 Poster and presentation time should be accounted for under a different category and I will assume 15 hours of work for this. This is also very obtainable.

 I will be working with 4 other students as well as Dr. Charles Gunnels. We will be splitting the work up evenly among the 5 of us rotating which aspects of the study are being completed at each time.

 We are not quite halfway through the timetable for data collection and already have more than half of our minimum sample size. Not only will we meet our minimal sample size we should easily exceed it.

**Materials**

Ladder

Measuring tape (metric)

Tensile Strength Meter

Marking Tape

Caliper

Camera

Excel

**Literature Cited**

Coyle, Frederick A., O’Shields, Theresa, Perlmutter, Daniel. 1991. Observations on the Behavior of the kleptoparasitic spider Mysmenopsis furtive(Araneae, Mysmendidae). Journal of Arachnology. 19:62-66.

Curtis, D.J., 1980. Pitfalls in spider community studies (Arachnida: Araneae). Journal of Arachnology. 8: 271–280.

Elgar, Mark A. 1994. Experimental Evidence of a Mutualistic Association Between Two Web Building Spiders. Journal of Animal Ecology. 63: 880-886.

Grostal, Paul and Walter, David Evans. 1997. Kleptoparasites or commensals? Effects of Argyrodes antipodianus (Araneae: Theridiidae) on Nephila plumipes (Araneae: Tetragnathidae). OecologIa. 111:570-574.

Grostal, Paul and Walter, David Evans. 1999. Host Specificity and Distribution of the Kleptobiotic Spider Argyrodes Antipodianus (Araneae, Theridiidae) On Orb Webs in Queennsland, Austrailia. The Journal of Arachnology. 27:522–530.

Iyengar, Erika V. 2008. Kleptoparasitic interactions throughout the animal kingdom and a re-evaluation, based on participant mobility, of the conditions promoting the evolution of kleptoparasitism. Biological Journal of the Linnean Society. 93: 745–762.

Porter, D., Vollrath, F. & Shao, Z. 2005. Predicting the mechanical properties of spider silk as a model for nanostructured polymer. European Physiology. 16: 199–206.

Strømgaard K, Andersen K, Krogsgaard-Larsen P, Jaroszewski J. 2001. Recent advances in the medicinal chemistry of polyamine toxins. Mini Rev Med Chem.1:317–338.

Tanaka K, . 1984. Rate of predation by a kleptoparasitic spider, Argyrodes fissisifrons, upon a large host spider, Agelena limbata( Araneae). Journal of Arachnology. 2 :363-367.

Trail, Deborah Smith. 1980. Predation by Argyrodes(Theridiidae) on Solitary and Communal Spiders. Neurobiology and Behavior. 87:349-355.

**Curriculum Vitae**

Sara Ryan

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**EDUCATION**

BA- Florida Gulf Coast University, Fort Myers (anticipated graduation: December 2011)

Major: Biology, Liberal Arts (GPA 3.46)

High School: Southwest Florida Christian Academy (GPA 3.6)

**ASSOCIATED COURSES**

Environmental Policy (2007)

Mammalogy (2007)

Evolutionary Biology (2008)

Environmental Microbiology (2008)

Marine Affairs in Science (2009)

Wetland Ecology (2009)

Everglades Freshwater Ecology (2011)

Animal Behavior (2011)

**SCIENTIFIC SKILLS**

Gel Chromatography

Thin Layer Chromatography

NMR Reading

Spectrophotometer Reading

Microsoft Excel

Collecting Specimens

Maintaining Live Specimens

Preserving Specimens

Microscopy

Electrophoresis

**EMPLOYMENT**

The Beach Pierside Grill

1000 Estero Blvd

Fort Myers Beach, FL 33931

Manager: Karen Lyons

|  |  |  |  |
| --- | --- | --- | --- |
| Current: | Server/Bartender |   |  |
| 2010 | Declined Management Offer |  |
| 2009 | Declined Management Offer |  |
| 2008 | Declined Management Offer |  |
| 2006 | Promoted to Bartender |   |  |
| 2003 | Promoted to Server |   |  |
| 2002 | Promoted to Hostess |  |
| 2001 | Busser |   |   |  |

Management offers were declined several times due to the extreme increase of hours required to hold this position with inadequate compensation.

In conjunction with working at The Beach Pierside Grill

 2005-Current: Creator and C.E.O. of “Hammock Events”, an event planning business

2010: Ordained Minister License

**SERVICE**

Volunteer:

2003-2009: Volunteered with Turtle Time Incorporation. While working with this organization I patrolled the beaches of Fort Myers Beach for Loggerhead Sea Turtle nests. I also worked with land owners to reduce possible complications pertaining to the Loggerhead’s ability to safely lay a nest.

 After several years of experience I began teaching a Sea Turtle information class in elementary schools around Southwest Florida.

2002-2005: Volunteered at Bay Oaks Recreational Center providing child care under the supervision of Kelly Ryan.

2011-Current: Assisting with independent research in Corkscrew Regional Ecosystem Watershed (CREW) on *Nephila clavipes* (Golden Orb Weaving Spider) and  *Argyrodes theridiidae.*

**AWARDS**

Academic Dean’s List: 2005, 2007, 2008 at Florida Gulf Coast University

Florida Bright Futures Scholarship

All Conference Varsity Tennis: 2000 (Elk River, MN)