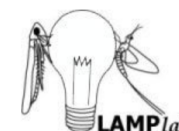




Substrate Preference in Stream-Inhabiting Damselfly Larvae

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Abstract

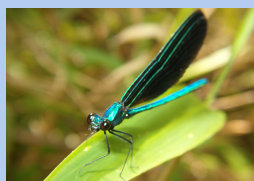
Damselflies are important for managing harmful insects, and they are being threatened by habitat degradation. As habitats are degraded through human activity, it is important that we have an understanding of substrate preference in emerging insects in order to preserve their habitat. This study investigates substrate preference in Coenagrionidae damselflies and *Calopteryx maculata* using a field and lab experiment. It was hypothesized that damselflies would prefer moss as a substrate to perch on. Although there was no significant substrate preference by the *C. maculata* larvae, they did prefer the moss, sediments, and leaves over the empty petri dishes. There was no clear substrate preference shown by the Coenagrionidae. Although these results do not point to a specific substrate as a preference by the larvae, there is room for improvement of experimental design and further research to be done.

Background

Odonata, including damselflies, provide the important ecosystem service of consuming agricultural pests, reducing the need for pesticides (Corbet, 1999). As the demand for agriculture increases globally, the importance of protecting Odonata increases (Godfray et al., 2010). However, as habitat degradation caused by humans continues, damselfly populations can be impacted. Studies have shown that increased habitat disturbances causes a decline in Odonata adult and larval abundances and species richness (Oppel, 2006, Monteiro-Júnior et al. 2014, Luke et al. 2017).

A major factor that could contribute to changes in species richness and abundance of damselflies due to habitat degradation is the loss of submerged vegetation within streams which larval damselflies use to cling to (Merritt et al. 1996). Loss of this substrate leaves the larvae vulnerable to predators and water flow. A study done in neotropical streams discovered that substrate type influences macroinvertebrate distribution (Buss et al. 2004). The majority of the taxa they studied had a preference for a specific kind of substrate when comparing riffle litter substrates, pool litter substrates, stone, and sediment (Buss et al. 2004). This indicates that the majority of macroinvertebrates need a specific kind of substrate to be present to thrive.

As habitat degradation increases, it is increasingly important to understand the specific needs of different macroinvertebrates. This study investigates substrate preferences in two damselfies; Coenagrionidae and *Calopteryx maculata* (adult *C. maculata* shown in picture 1) to better understand their habitat requirements.



Picture 1: Adult *Calopteryx maculata*. Photograph by Nathan Burkett-Cadena, Florida Medical Entomology Laboratory, University of Florida

Field experiment

- Conducted using bricks with packs of material tied to them
- Packs were created using deer fencing and filling them with straw, sycamore leaves, Spanish moss, and deer fencing
- Pack was fixed closed with cable tie and string and tied to bricks using string and green film tape (picture 2)
- One brick with each substrate type was placed at four locations in cut banks in Campus Creek at the University of Maryland (picture 3)
- Bricks were left submerged under water for one week
- Packs were retrieved by cutting them off the bricks and placing them into ziplock bags with water
- The Coenagrionidae were picked out of each pack and noted



Picture 2: The setup of bricks used in the field experiment

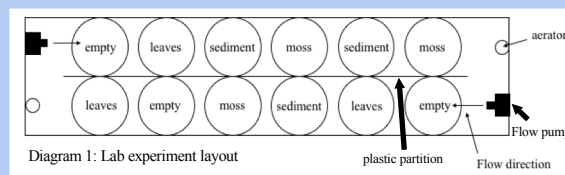
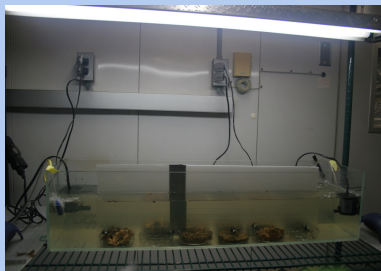


Diagram 1: Lab experiment layout



Picture 4: Lab experiment set up (detailed diagram shown above)

Methods



Picture 5: A painted *C. maculata* larvae



Picture 3: Arrangement of bricks at location 1

Lab experiment

- Nine petri dishes were filled with Spanish moss, sycamore leaves, and sediments collected from Campus creek (three of each substrate)
 - Three were left empty to serve as control
- Petri dishes were wrapped with deer fencing and secured with cable tie
- Petri dishes and tank were arranged as shown in diagram 1
- Seven *C. maculata* larvae were retrieved from Campus creek and brought back to lab in ziplock bags with stream water two weeks before start of experiment
- Each damselfly was marked on their abdomen with a red acrylic paint marker to make them easier to spot in tank (picture 5)
- Before and during the experiment, damselflies were kept in a chamber at 15°C with a light dark cycle of 12 hours light and 12 hours dark, and they were fed 7 mosquito larvae every other day
- During the experiment, the location of the larvae was recorded twice a day for one week at 9:15 am and 3:20 pm
- The petri dishes were removed from the tank at the end of the experiment, and the location of the larvae was noted

Field experiment

- The low sample size of seven Coenagrionidae larvae made it difficult to make conclusions about the data
- Chi square analysis revealed there was no significant preference of one substrate over others

Lab experiment

- C. maculata* larvae were observed in the moss and leaves equally
- Chi square analysis showed that there was no significant preference of one substrate over another
- However, chi square analysis showed the larvae preferred some kind of substrate over empty petri dish
- There were some time points in which not all of the larvae could be found
- Most of the time the larvae were perched on the deer fencing instead of the actual substrate

Results

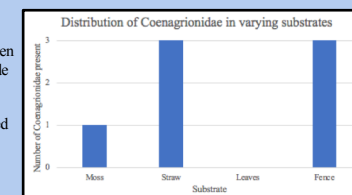


Figure 1: The distribution of Coenagrionidae found in each substrate

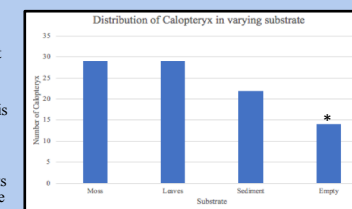


Figure 2: Number of *C. maculata* observed in each substrate during the lab experiment.

Discussion

- Results suggest *C. maculata* does prefer a substrate over no substrate
- Sample size of field experiment was too small
 - Packs of substrate could be left in stream longer
- C. maculata* larvae tended to sit on the fencing surrounding the petri dishes instead of on the actual substrate
 - Experiment could be done in a way that eliminates need for fencing
- Some larvae molted during lab experiment making it difficult to find them
- Because of inconclusive data, there is more research to be done
- Understanding substrate preference can help us understand how to restore streams in a way that conserves Odonata

References

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