The Biology of Blephariceridae in Dominica

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Abstract

A study was conducted to find immatures and adults of Blephariceridae in the island of Dominica and to describe their biology. The methods used in this study: a ground malaise trap across stream, an aquarium net and an aerial net. Video of larval behavior is provided. It was determined that net-winged midge adults show up during crepuscular hours and most of the Blephariceridae lifecycle is spent in torrential water ecosystems.

Introduction

Blephariceridae are delicate flies belonging to the Order Diptera, Suborder Nematocera. The flies possess very long legs and slender bodies. They are best known as net-winged midges due to their wing venation. They are uniform in their coloration lacking any bright color distinctions. An intriguing characteristic in this family is their larval sideways locomotive trait. This is an action taken whenever the larvae are alarmed by anything in their surroundings—other larvae, fast-flowing water, etc (Hogue 1981). Furthermore, larvae have suction disks on each abdominal segment on the venter, which allow them to adhere to the rocks found in the waterfall areas. This prevents them from being washed away by the fast-flowing water in their habitat. Another adaptation to their habitat is the gills found near their suction disks.

Blephariceridae are also known to exhibit sexual dimorphism in their mouthparts. This trait allows for easy distinction between male and female midges. The females of Neartic species are recorded as having a set of mandibles to feed on other insects, while males and some females reportedly lack mandibles. The lack of mandibles and what the food source is for these specific individuals remains a mystery (Hogue 1981). However, they are suspected to feed on nectar due to their long proboscis (Courtney 2001).

Net-winged midges inhabit places where fast-flowing bodies of clean water, preferably waterfalls, are located. These areas tend to play a major role for most of the Blephariceridae's lifecycle. Their egg, larval and pupal stages mainly revolve around highly oxygenated water ecosystems. Dominica is known to be an island that is rich in this type of habitat.

Even though Blephariceridae larvae have previously been found in Dominica, Stone (1966) reported that there had never been any findings of adult male net-winged midges, and so the species could not be formally described. However, a TAMU Dominica Study Abroad student reported adult midge sightings in her project video on riffle beetles (Shaw 2009).

The objective of this study was to rediscover the adult Blephariceridae, find males, study the species' natural habitat and behaviors in Dominica, and compare their behaviors with others reported for this family. Filming of the reported sideways-evasive movement of the larva was a secondary goal.

Materials and Methods

In order to catch adult midges we had to set up a ground Malaise trap in an environment containing fast-flowing water. The stream below the Springfield Station contained numerous areas surrounded by small and large waterfall areas. The Malaise trap was set up in an area surrounded by tall trees and a medium-sized waterfall. The Malaise trap contained a bottle filled with propylene glycol to kill any insects flying into the trap. The trap was run for 5 days. Every afternoon the samples from the trap were collected. Another method used to catch adult net-winged midges was an aerial net. The search for live adult Blephariceridae took place during dusk hours. This method was used for two evenings.

The larvae of this species were collected by using an aquarium net. The aquarium net was used to collect the larvae off the rocks in the waterfall areas. Larvae were collected and placed in vials containing ethanol. The collecting of larvae was done on 3 days.

A Leica® EZ4 microscope was used to identify the adult net-winged midges' gender. Finally, to study the larval behavior, a Nikon® D300 camera fitted with a Zeiss® 100mm Macro Lens, often with additional lens extensions and strobe flashes was used. The video recording of the behavior took place once during daytime hours using a Nikon D7000 camera on a tripod and a Nikon 200mm macro lens. Video editing was done using the iMovie® system in a MacBook® Pro laptop.

Results

For the first malaise sample, no midges were obtained. The second sample contained 6 adult midges—4 females and 2 males (Figure 1). The third sample had a total of 2 female adult midges. Lastly, the fourth sample only contained 1 female midge. The search for the live adult midges lasted 2 days. All captures happened during dusk hours. For the first catch, only one male midge was obtained (Figure 2). In the second catch, 3 male and 1 female midges were caught in a mating swarm over fast-flowing water.

In the search for the larvae, the first catch resulted in 20 Blephariceridae larvae. In the second search, we obtained a total of 8 larvae (Figure 3 and 4). All the larvae were found adhered to the rocks near fast-flowing water. The specimens were then identified as *Paltostoma sp.* from the key found in Stone (1966). In the third search, we observed and recorded their behavior, which showed the larvae performing their unique sideways progression (see video). The recording of the larvae took place in the splash zone of boulders found in the stream.

Figure 1: Female Blephariceridae

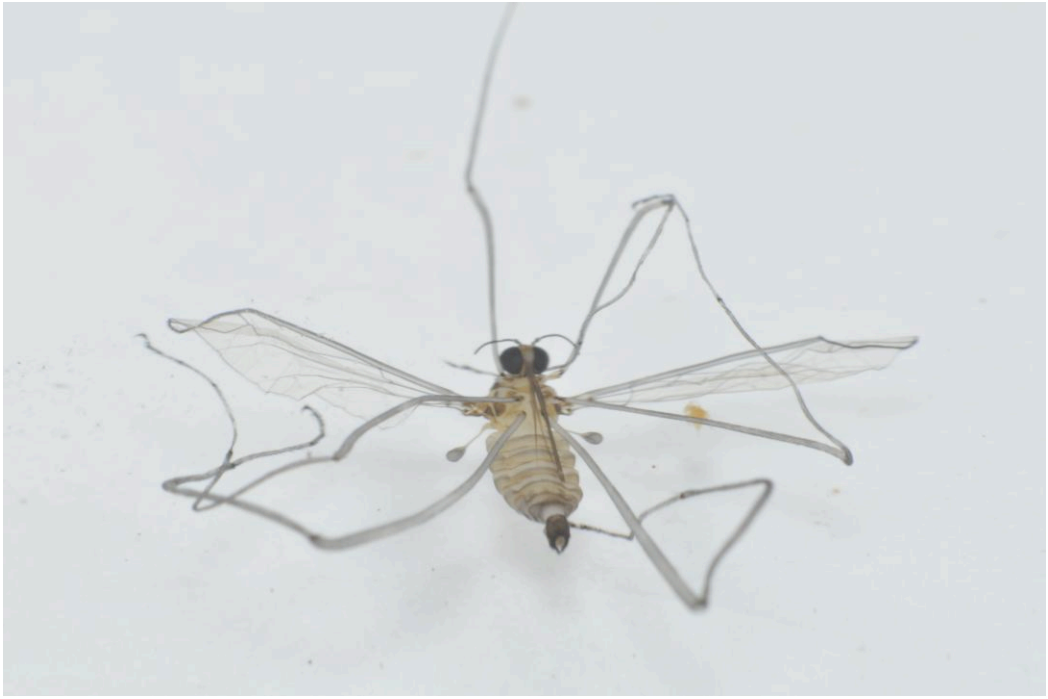

Figure 2: Male Blephariceridae

Figure 3: Ventral view of larvae

Figure 4: Dorsal view of larvae

Blephariceridae_Larvae.mov

(Video for larvae locomotion)

Discussion

From this study, it was observed that adult midges were more prevalent during dusk hours rather than daytime hours. In the stream, most were found in fast-flowing waters, flying near the splash zone of rocks or boulders. In one of the observations, a mating swarm was seen over the waterfall, which suggests that most of the Blephariceridae's life is spent in this aquatic environment. Even though Hogue (1981) stated that these flies are normally not seen in swarms,

it was concluded that when mating, they hover over the rocky area of the waterfall. In Stone's paper reporting Blephariceridae in Dominica, it was clear that larvae and females had been collected; however, it is also mentioned that no males were collected. The egg, larva and pupa stages were already known to be present in the waterfall areas; however, the limited sightings of the adults seen in 2009 kept the behavior for the adults a mystery. Therefore, successfully trapping the adult midges in their natural habitat show that they mostly spent their time in water so when mating occurs, the female has easy access to rocks with highly oxygenated water to oviposit her eggs.

For their sexual dimorphism, just like Hogue (1981) stated, they do exhibit a significant difference in their mouthparts. Females seen under the microscope possessed long, rostrate mouthparts with a pair of maxillary palps at the base; the mouthparts appear to consist of a dorsal medial element and two paired lateral stylets; however, further morphological studies will be required to clarify these structures. The mouthparts for the female showed a length equal to that of the base of their head in dorsal view. Males displayed the same long, stylet mouth, yet, for males the size of their beak and maxillary palps were twice the size of the female Blephariceridae. However, further analysis of this dimorphism must be done. Dissecting of the mouthparts will be required to acquire more knowledge in their structure.

In this study the larval behavior was also observed. In the recording provided, it was observed that the larva used the sideways progression when encountering other larvae or other stimuli in their surroundings, such as the splashing of water in the rock. Nevertheless, whenever they felt safe, they would once again start to move in a forward motion. While handling the larvae, the strength in their suction discs demonstrated their capacity to adhere in torrential waters. However, they did not live long when kept outside of highly oxygenated water.

Courtney (2001) mentions that the larvae for Blephariceridae could be a good indicator for uncontaminated water bodies. Since the larvae have demonstrated a high need for this type of water, it could be a good follow-up project for someone to use the larvae as bio-indicators in suspected contaminated streams or other bodies of water.

References

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