Survey of Aquatic Hymenoptera of Three Locations in Dominica, W.I..

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Abstract:

Aquatic parasitic Hymenoptera are present around the globe in many different regions. Neotropical areas have a very diverse fauna, including parasitic hymenoptera. This study was designed to observe the families diversity within aquatic and near aquatic habitats. The study resulted in multiple families that were expected from previous studies, but there were families seen that were not mentioned for the Neotropical region. This study also included the observation of a live specimen, and the testing of the abilities to move under the water's surface.

Introduction:

There are many wonders of nature, but there are few harder to believe than parasitic aquatic Hymenoptera. These are tiny wasps which dive into the water, either swimming or walking along rocks under the water's surface searching for their host. This method of parasitism has many skeptics, and is very hard to believe without observing first hand. Aquatic parasitism presents in many families and occurs throughout the globe (Bennet, 2007).

Aquatic parasitoids in particular have an interesting biology which still has only been studied in certain genera. The actual physiology and methods that the insects have adapted for their aquatic lifestyle are not well studied, but many methods are hypothesized based on other insect groups' similar methods. Many families do not swim but rather use rocks or other substrates within the water as an anchor point and crawl underneath water, all without a plastron or any other visible respiration method.

This study was designed to sample the fauna of parasitic hymenoptera in and around flowing water in order to see which families were the most prominent in that habitat. Bennet's (2007) paper on aquatic hymenoptera outlined six hymenopteran families in the neotropical region.

Previous studies by students did not focus on aquatic hymenoptera, and were not focused on the habitat in and surrounding fresh-water aquatic habitats. This study looked at the hymenoptera that were neglected by other studies in the same area.

Materials and Methods:

Collection was done using two methods, yellow pan traps and malaise traps. The collection took place in three locations; the Checkhall River, the Clark River, and stream along the Middleham Falls trail. The primary collection location was the Checkhall River, where multiple, frequent, collections took place.

Yellow pan traps were the primary collection method; at all locations the traps were placed in or near flowing water in order to ensure the sampling was testing Hymenoptera that were a part of the habitat associated with the streams or the immediately surrounding areas of the stream. The pan traps contained water with a surfactant, unscented dish soap. All samples were run during the daylight hours from approximately 9:00 to 17:00. The samples were filtered using a fine-meshed aquatic net during collection after the samples were inspected for any live specimens. Live specimens were collected using an eyedropper and placed in a vial contain water from the tested water source. Dead specimens were placed in 95% ethanol in order to preserve specimens for further classification.

The Malaise trap was placed within the splash zone on the edge of the Checkhall River. This was a standard Malaise trap, placed within a natural flight corridor between the river and the surrounding secondary forest. This method was a secondary method to yellow pan trapping and only a small portion of the sample was actually obtained from this method.

After the samples were collected and washed under running water they were sorted under a dissecting microscope. All micro-hymenoptera were placed in a separate vial to be sorted at a separate time and the rest of the sample was disposed of. The specimens were then sorted to family and placed within cryovials combining samples by collection locality. Further separation occurred by sorting each family into morphospecies, or if possible by genus. Morphospecies were defined by grouping specimens based on similar physical characteristics. A key to the genera of Diapriidae was used in order to identify a notable aquatic parasite, and Dr. Woolley was able to identify the notable genus of Encrytidae.

Results:

Specimens collected were identified to family and then sorted by morphospecies which is represented in Table 1. Two families in particular had specimens identified to genus, Diapriidae and Encrytidae. Morphospecies descriptions will be located in within the appendix.

	Checkhall River	Middleham falls	Clark River
Diapriidae	28	0	2
MSP #1	3	0	1
MSP #2	1	0	0
MSP #3	1	0	0
MSP #4	1	0	0
MSP #5	4	0	0
MSP #6	2	0	0
MSP #7	1	0	0
MSP #8	2	0	0

MSP #9	2	0	0
MSP #10	1	0	0
MSP #11	7	0	0
Psychopria sp. #1	0	0	1
Psychopria sp. #2	3	0	0
Scelionidae*	19	1	7
MSP #1*	4*	0	5
MSP #2	13	1	2
MSP #3	2	0	0
Encyrtidae	57	0	1
MSP #1	4	0	0
Rytidothorax sp.	53	0	0
Mymaridae	**14**	**1**	**0**
MSP #1	13	0	0
MSP #2	1	0	0
MSP #3	0	1	0
Figitidae	**2**	**0**	**0**
MSP #1	2	0	0

Pteromalidae	**4**	**0**	**0**
MSP #1	1	0	0
MSP #2	3	0	0

Table 1: Complete table of all specimens collected sorted by collection locality. *- specimen was collected alive and observed. MSP-Morphospecies.

Discussion:

One specimen belonging to Scelionidae was obtained while still alive within a yellow pan trap allowing for observation of the insect's activity while under water. The specimen did not swim, but rather attempt to "walk" under the water. The only times it used its' wings were in two cases. The first was to balance itself on an introduced substrate or while trying to move through the water, and the specimen kept its' hindwings folded while extending the forewings one at a time in order to balance. The second was to push itself in the water; the specimen forced back both forewings and pushed itself along in the water in a straight line. This was not a common behavior but was observed more than once. The next major observation was the lack of evidence of a plastron, gill or any other method of physical respiration. The specimen stayed under the water surface for more than one hour. The last tested observation regarded the insect's ability to use certain substrates within the water. The specimen would latch onto any introduced substrate except smooth glass. The specimen would latch onto the surface of the material, favoring attaching its' hindlegs first. The specimen was given the chance to break the water's surface using fine-tipped forceps, which the specimen did with remarkable ease. The specimen would break through the water surface head first with all wings folded. The specimen also dried very quickly with only a small amount of water observed on the gaster. The specimen was not allowed to expand its' wings in fear that it would be able to fly away. The potential biology for the specimen observed could be that the insect crawls along rocks under the water surface rather than truly swimming in the water. This would lead to the assumption that the specimen would parasitize insect eggs that are attached on or near the surface of rocks.

Table 1 contains all specimens collected organized by family and morphospecies. The most dominant family and genus is *Rytidothorax* (Encyrtidae). From contact with John Noyes, *Rytidothorax* biology is inferred from similar genera, but the inference is not consistent with what was observed. Noyes stated that the potential biology would either involve Diptera or Coleoptera associated with rotting leaf litter, but neither of these environmental factors were observed in high enough abundance in the collecting areas to support the high number of *Rytidothorax* that was caught.

Diapriidae had eleven morphospecies and one defined genus, making it the most diverse family in the study. *Psychopria*, a known aquatic parasite that targets Psychodidae, was found.

Bennett lists aquatic Hymenoptera families by biogeographical region. In the Neotropical region all families sampled except Pteromalidae, Figitidae, and Encyrtidae are known to have aquatic species in the neo-tropics. All the families, except Encyrtidae, are known to have aquatic species. Given the number of specimens collected in the area Encyrtidae must play a major role in the habitat in or directly surrounding the river, since the traps were placed within the flowing river. As for Pteromalidae and Figitidae, since the collection numbers were low it is likely that the collections were incidental, and they do not play a major role in the aquatic habitat.

References:

Bennet, Andrew, 2007, “Global diversity of hymenopterans (Hymenoptera; Insecta) in freshwater.” Hydrobiologia, 595:529-534,2008

Noyes, John. June, 2015. Personal Communication.

Masner, L. Garcia R., J.L., 2002, "The genera of Diapriinae (Hymenoptera: Diapriidae) in the new world." Bulletin of the American Museum of Natural History, 2002.

Appendix:

Diapriidae:

MSP #1: Checkhall River.

-Clubbed antennae, 3-segmented black club.

-Brown antenomeres, except club, black head, brown body.

-Pointed gaster, tapered to a point.

-Antennal shelf well defined.

MSP #2: Checkhall River.

-Larger, much larger than comparative specimens in the same family.

-Brown antennae, black head, brown mesosoma and pedicule, and black gaster.

-Pedicule extended, distinctly 2-segmented.

MSP #3: Checkhall River

-Larger, much larger than comparative specimens within the same family.

-Forelegs raptorial like.

-Pedicule and limbs lighter (Brown), Body Darker (Black)

MSP #4: Checkhall River

-Brown legs, black body,

-Reduced pedicule, Robust body.

-Long ovipositor

MSP #5: Checkhall River.

-Globose gaster

-All black body and legs

-Antennal shelf distinct, both dorsally and ventrally.

MSP #6: Checkhall River.

-All black body, lighter pattern on legs.

-Extended pedicule and visible “neck”

-Tappered gaster

-Fine setae on hind tibia.

MSP #7: Checkhall River

-Clubbed antennae, 3-segmented black club.

-Dark body, light limbs.

-Visible pedicule, light brown in color.

-Gaster laterally compressed.

MSP #9: Checkhall River

-Elbowed Antennae, 3-segmented club

-Head and mesosoma black.

-Light brown gaster and pedicule.

MSP #10: Checkhall River.

-Long, slender gaster, not much wider than pedicule.

-13-segmented antennae

-Black head, mesosoma, and gaster. Light brown pedicule, distinctly 2-segmented.

MSP #11: Checkhall River.

-Long filiform antennae, 12-segmented.

-Black head, mesosoma, and gaster. Light-brown pedicule

Psychopria sp. #1: Clark River.

-Brown appendages, black body.

Psychopria sp. #2: Checkhall River. Clark River.

-Black body and appendages.

Scelionidae:

MSP #1: Checkhall River.

-Body black, legs light brown.

-Postier margin of forewing, wring fringe only covering distal 1/3rd of the wing.

-12-segmented antennae.

-Pedicule robust, tappers into gaster.

MSP #2: Clark River. Middleham Falls. Checkhall River.

-Body black, legs light brown.

-Antennae 11-segmented, forming weak club in last 4 antennnomeres.

-Gaster tappered, narrower than mesothorax.

MSP #3: Checkhall River.

-Small, Black, Robust body, Light-brown limbs.

-Eyes on ventral side of head, forming "v-shape" inbetween eyes, visible from ventral side.

-Top of "V" with antennae attachments, antennal attachments close together.

-Antennae 8-segmented club.

Encyrtidae:

MSP #1: Checkhall River, Clark River.

-Robust, black body.

-8-segmented clubbed antennae.

Rytidothorax sp.: Checkhall River.

Mymaridae:

MSP #1: Checkhall River

-Antennae ended with club.

-Black robust body

MSP #2: Checkhall River

-Long moniliform Antennae.

-Body black, pedicule and legs brown.

MSP #3: Middleham Falls.

-Small, body robust.

-Black body and limbs, light antennae.

-Antennae moniliform.

Figitidae:

MSP #1: Checkhall River.

-13-segmented, moniliform antennae.

-"Hunch-backed"

-Black bod, light limbs

Pteromalidae:

MSP #1: Checkhall River.

-Long, filiform antennae

-Tips on antennae black, basal portion light.

-Gaster and Head dark.

MSP #2: Checkhall River.

-Elbowed Antennae, 8-segmented.

-Ventral side of gaster comes to a sharp point.

-Head smaller mesosoma.