

**A Photographic Dichotomous Key to the Families of Auchenorrhyncha
of the Commonwealth of Dominica**

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ABSTRACT

Cicadoidea and Fulgoroidea are the two superfamilies of the suborder Auchenorrhyncha, with common presence on the island of Dominica. Initial surveys of Fulgoroidea have been done, but no work with Cicadoidea has been compiled. This project is a starting point to a photographic dichotomous key for the ten families of Auchenorrhyncha that are known to exist in Dominica; Cicadidae, Cercopidae, Membracidae, Cicadellidae, Delphacidae, Cixiidae, Issidae, Flatidae, Tropiduchidae and Kinnaridae.

KEYWORDS: Auchenorrhyncha, Cicadoidea, Fulgoroidea, Dominica, West Indies

INTRODUCTION

The order Hemiptera has three suborders, Heteroptera, Sternorrhyncha and Auchenorrhyncha. Auchenorrhyncha is the suborder that includes diverse types of phytophagous insects. They have short, bristle-like antennae and the tarsi have three segments. This suborder is divided into two superfamilies; Cicadoidea and Fulgoroidea.

Members of Fulgoroidea have a Y-vein in the anal area of the forewing and the antennae are positioned beneath the eyes. They are commonly known as “planthoppers” and can be economically significant as some species are known to be crop pests (Wilson 2005). Members of Cicadoidea do not have a Y-vein in the anal area of the forewing and the antennae are positioned between the eyes. Members include cicadas, treehoppers, leafhoppers and froghoppers.

The island of Dominica, where this study was carried out, is covered with a variety of vegetation, flora and plant life. Seeing that a unifying characteristic in this suborder is piercing-sucking mouthparts for herbivory, a variety of families from Auchenorrhyncha should be found on the island. In 2006, five families of Fulgoroidea were collected and identified; Delphacidae, Cixiidae, Tropiduchidae, Kinnaridae, and Issidae (Catanach 2006). In 2006 and 2009, eight families of Auchenorrhyncha were collected; Cicadidae, Cercopidae, Membracidae, Cicadellidae, Flatidae, Delphacidae, Cixiidae and Issidae and stored in the Insect Collection of Archbold Tropical Research and Education Centre (ATREC). Specimens were identified by Lois O'Brien, world expert on Fulgoroidea, now retired and living in Arizona.

My project aims to provide a photographic dichotomous key to the families of the suborder Auchenorrhyncha known to be present in the country of Dominica. The written key provided has been adapted from Borror & DeLong's *Introduction to the Study of Insects*.

METHODS AND MATERIALS

Area of Study

Areas of insect collection ranged from the trails at Middleham Falls to the trails throughout the Archbold Tropical Research and Education Centre. Insects were collected via a variety of methods. Hand collection was used when possible, through capturing the insect in the palm or ushering the insect into a vial. The aspirator kit was used for collecting insects that were too small or too quick to capture by hand. Auchenorrhyncha families that were not found during field collection but known to exist on the island were borrowed from the Insect Collection of ATREC and photographed. Collection ran from May 24th to May 28th 2012 and photography ran from May 28th to June 4th 2012.

Photographic Methods

The photography of collected and stored Auchenorrhynchs was accomplished using a Nikon D300 camera and various Nikon and Nikkor lenses and extension tubes. Flashes used include the Speedlight SB-700, Speedlight SB-900, and three Speedlight SB-R200s. Other accessories include the LP-Micro-Pro LED focusing light, focusing rail, tripod, stand for pinned insects and soft-light covers. All the equipment used is property of Dr. James Woolley, Department of Entomology, Texas A&M University and Texas A&M University.

Pinned specimens were shot using a Rose Engineering stand for pinned insects with the two Speedlight SBR200s on the right and left side, and the other positioned below the specimen. The Speedlight SB-900 was positioned to the left of the set up with a soft flash box and the Speedlight SB-700 was positioned to the right with the umbrella. An Apple MacBook Pro was connected to the Nikon D300 with Nikon Camera Capture Pro 2 for instant viewing of the images being shot. Lenses were chosen based upon the body size of the specimen and the size of the distinguishing feature of the specimen. The lens set up most used from the camera body out was: Nikon's 36mm,

20mm, 12mm, 14mm, 27.5mm, 25.2mm extension tubes, then Carl Zeiss' Makro-Planar 2/100 ZF lens. Next, Adobe Lightroom was used to organize and edit the photos. Clarity and fill light were adjusted for majority of photos in Adobe Lightroom. Images were initially saved as .NEF RAW image files and then were formatted into JPEGs.

KEY TO THE SUBORDER AUCHENORRHYNCHA

Key to the Superfamilies

1	Antennae arise on side of head beneath the eyes, (Fig. 1) 2 anal veins in front wing usually meeting apically to form a Y vein	Superfamily Fulgoroidea
2	Antennae arise on the front of the head between eyes (Fig. 2) No Y-vein in anal area of front wing	Superfamily Cicadoidea

Key to Fulgoroidea

1	Hind tibiae with distinctive movable apical spur (Fig. 3)	Delphacidae (Fig. 15)
1'	Hind tibiae without distinctive movable apical spur	2
2(1')	Anal area of hind wings with veins that are net like, with many crossveins	Fulgoridae*
2'	Anal area of hind wings with veins that are not net like, without crossveins	3
3(2')	Second segment of hind tarsi with 2 apical spines (1 on each side), the tip is usually rounded or conical (Fig. 4)	4
3'	Second segment of hind tarsi with a row of apical spines, the tip is truncate or emarginated (Fig. 5)	7
4(3)	Forewings longer than the body, with numerous costal crossveins (Fig. 6). Wings positioned vertically against body at rest. Clavus (the oblong anal portion of the front wing) with several small, pustule-like tubercles	Flatidae (Fig. 13)
4'	Forewings variable in position and size at rest, without numerous costal crossveins (except sometimes apically). Without small, pustule-like tubercles on clavus	5
5(4')	Forewings longer than abdomen. Series of crossveins between the costal margin and apex of clavus, which separates off the more densely veined portion at apex of the wing. Slender, varies in color from shades of green or yellow to brown. 7-9mm long	Tropiduchidae
5'	Forewings without the differentiated apical section as described in preceding entry. Variable in length	6
6	Forewings variable in shape and size. Often shorter than abdomen, but if longer than abdomen, then usually oval. Spines on the sides, in addition to apical ones usually present on the hind tibiae (Fig. 7)	Issidae (Fig. 16)
6'	Forewings do not match above	7
7	The last segment of the beak is short, not more than 1.5 times as long as wide	Derbidae*
7'	The last segment of the beak long, at least twice as long as wide	8
8	Plates covering the dorsal surface of abdomen are 6-8 chevron shapes, might be sunk below rest of the dorsal plates. 3-4mm long	Kinnaridae
8'	Plates covering the dorsal surface of abdomen are 6-8 rectangular shapes. Size variable.	Cixiidae (Fig. 17)

Key to Cicadoidea

1	Three ocelli (Fig. 8), larger sized insects with membranous front wings (Fig. 9)	Cicadidae (Fig. 14)
1'	Zero or two (rarely 3) ocelli, smaller sized insects. Forewings sometimes thickened; usually jumping insects	2
2(1')	Pronotum broadly extended backward over wings and abdomen completely covering scutellum and extending to middle wings (Fig. 10) Sometimes with elaborate spines appearing like thorns, or other enlarged ornate shapes. Beak not extending to hind coxae	Membracidae (Fig. 18)
2'	Scutellum is nearly always well exposed as the pronotum does not extending back over abdomen. Hind tibiae with or without distinct spurs or spines	3
3(2')	Hind tibiae with 1 or more rows of small spines (Fig. 11). Hind coxae transverse	Cicadellidae (Fig. 19)
3'	Hind tibiae with 1 or 2 stout spines laterally (Fig. 12) and a crown of short spines at tip. Head normally is not largely covered by pronotum. Face slants backwards; beak length variable.	Cercopidae (Fig. 20)

FIGURES



Fig. 1 (left): Antennae arising from just below the compound eyes (Issidae). **Fig. 2** (right): Antennae arising from the front of the head and are between the eyes (Cicadidae).

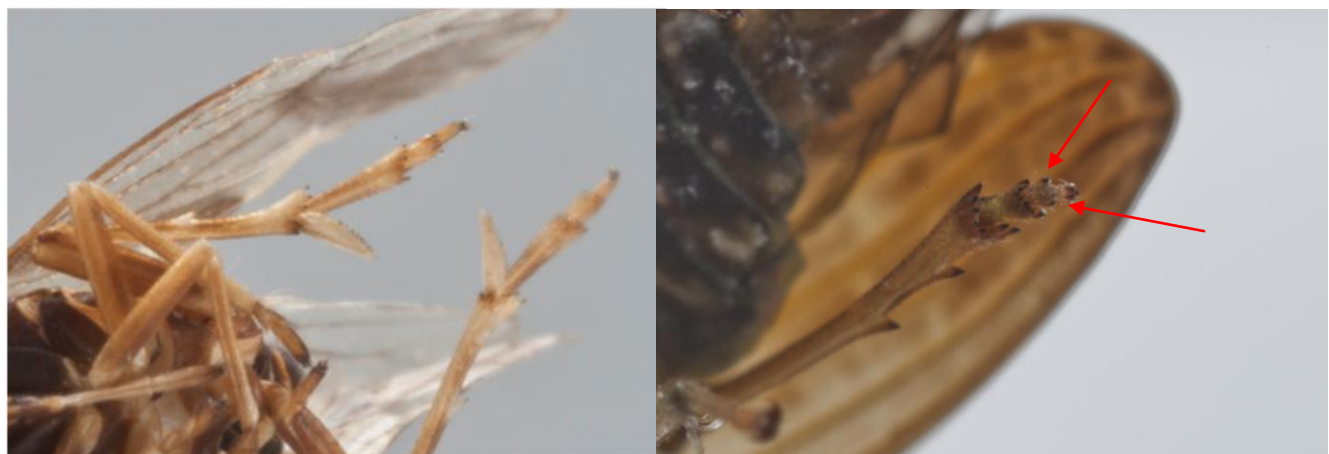


Fig. 3 (left): One distinctive larger apical spur on each tibia of hind leg (Delphacidae). **Fig. 4** (right): Two prominent apical spines, 1 on each side of the second segment of the hind tarsi (Issidae).



Fig. 5 (left): Row of spines on the second segment of the hind tarsi (Cixiidae). **Fig. 6** (right): Front wings with numerous costal (margin of wing) crossveins (Flatidae).



Fig. 7 (right): Faint spines on the side in addition to larger apical spines (Issidae). **Fig. 8** (right): Three prominent ocelli between compound eyes (Cicadidae)



Fig. 9 (left): Membranous front wings (Cicadidae). **Fig. 10** (right): Pronotum extending backward extending to the middle of the wings, covering scutellum (Membracidae)



Fig. 11 (left): Hind tibiae with two rows of small spines. **Fig. 12** (right): Two stout spines laterally on each hind tibia with crown of short spines at the tip.



Fig. 13 (left): Flatidae. **Fig. 14** (right): Cicadidae



Fig. 15-17 (from left to right): Delphacidae, Issidae, Cixiidae



Fig. 18-20 (from left to right): Membracidae, Cicadellidae, Cercopidae

RESULTS AND DISCUSSION

During the four days of collection, nine Cicadellids, five Cixiids, three Cercopids, one Flatid, one Issid, one Delphacid and one Membracid were found. I then moved to focus on the photography aspect of this project. I photographed insects only from the Insect Collection of ATREC because they had been authoritatively identified by Lois O'Brien. From this collection I was able to photograph Cicadidae, Cercopidae, Membracidae, Cicadellidae, Delphacidae, Cixiidae, Issidae and Flatidae. The families Tropiciduchidae and Kinnaridae were included in this key because they were collected and identified in 2006 (Catanach 2006). However, there are no photos of them in this report as they were not in the Insect Collection of ATREC.

The families Fulgoridae and Derbidae are not known to exist in Dominica but were included to make comparisons in couplets in order to move down the key more easily. They are noted with an asterisk (*) in the key.

For the photography aspect, the results of the photos turned out better than I expected. I was not only able to photograph the dorsal and side view of each family, but also the distinguishing characteristic of each. Due to constraints of the equipment, I was hesitant to include two characteristics of the key, figure 4 and figure 5, as upon cropping the image the distinguishing feature was still not precisely clear. However I included them in this key to help the reader better understand and interpret the couplet.

CONCLUSIONS

Ten out of the fifteen existing families of the suborder Auchenorrhyncha can be found on the island of Dominica and were included in this key. Of these, eight out of the ten were photographed. Through completion of this project I am now able to identify members of Auchenorrhyncha more readily and my macro-photography skills are enhanced. In the future I hope this diagnostic key helps assist the reader in recognition and identification of the Auchenorrhyncha specimens they encounter in Dominica. To extend this project, one day I hope to photograph families of Auchenorrhyncha in Texas and subsequently create a photographic dichotomous key for Texas.

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