A Survey of Forensically Important Flies (Diptera) in Toco, Trinidad

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Abstract: The island of Trinidad is not well surveyed and studied in the field of forensic entomology Keys to the blow fly genera in the West Indies are available but surveys on specific regions are not. Surveys of the area are needed to keep records of the dipterans that appear if new ones were to be found in that area. This survey is focused on surveying Toco, Trinidad for forensically important flies. Flies were collected for ten days from meat traps baited with raw chicken, beef liver, and shark. Five different families of flies were identified. The specimen families were Sarcophagidae, Muscidae, Stratiomyidae, Micropezidae, and Calliphoridae. The Calliphoridae (Diptera: Calliphoridae) were identified down to species of *Hemilucilia segmentaria* (Fabricius 1805), *Chrysomyia megacephala* (Fabricius), and *Chrysomyia albicepts* (Wiedemann 1819). A Shannon diversity index of value 1.78 was obtained, suggesting a normal distribution of carrion feeding flies in this area. All of the flies that were collected have been used in forensic entomology cases before.

Key words: Diptera, Neotropics, Forensic Entomology

Information on insect diversity is crucial to the field of forensic entomology as species that are used in cases can be eradicated from areas or new species could be introduced. What species are present in a certain area could affect a case in demonstrating the movement of organic material and what conditions that organic material could have been located in. Surveys are done periodically and are important as they show what insects are currently in the area that is being studied. Past surveys in the area can be compared to current and future surveys to estimate the immigration and emigration of insect populations. Forensic entomology is the study of the intersection of arthropods and the legal system (Catts & Goff, 1992). There are several reasons for arthropods to be at the scene of crimes or the subject homicide cases (Sukonatson *et al*., 2007). Blow flies are commonly used to determine when a body is available to insects to be colonized (Greenberg, 1991). This paper was focused specifically on members of the order Diptera (flies), which include the majority of the carrion feeding insects (Catts & Goff, 1992). Carrion feeding insects are important to forensic cases as they can provide an estimated time of colonization which shows when organic material that these insects feed on was available to them (Sukonatson *et al*., 2007). The purpose of this study was to survey the flies that colonize carrion in Toco, Trinidad, and was done by exposing carrion and collecting the dipterans that come to it. Larvae were collected for identification purposes as well.

Materials and Methods

The specimens were caught between May 24th and June 2nd, 2018. The insects were collected twice a day on the land that surrounds the Jammev Beach Resort property in Toco, Trinidad. A wire cage was assembled from dowel rods (Woodpeckers Strongsville, OH), chicken wire (Acorn International Memphis, TN), duct tape (Duck Brand Avon, OH), and zip ties (Uline Pleasant Prairie, WI) (Figure 1).

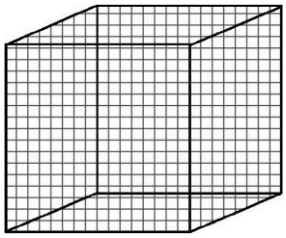

Figure 1 – Assembled Cage

The dowel rods were cut into thirds and arranged into a square, the corners were then taped together at the joints. Four more dowel rod segments were taped to the inside corner of the taped square. A sheet of chicken wire was cut so that each piece was the size of one of the faces of the square frame. After all the squares were cut and bent around the frame zip ties were used to secure the sheets to the frame. The cages were secured to the ground with tent stakes and rocks. After the cages were assembled and meat was placed out underneath them for 24 hours, both larvae and adult flies were collected from exposed meat (raw chicken, beef liver, and shark) and first instar larvae were kept for rearing. The reared larvae were placed into a mosquito breeder with substrate and beef liver. Once the larvae had eaten the liver and reached the third instar they were removed and blanched to be identified. The top layer of a compost pile was searched using a Berlese funnel to obtain larvae that would colonize garbage. Cut chicken was then placed into empty bottles and the bottles were partly buried with the nozzles exposed to allow for the flies to find the carrion. Once the flies were seen coming to the bottles a mesh cone fly trap (Rid-Max Products USA Dorset, OH) was placed over the mouth of the bottles so that the flies flew up and went into the trap and not could not escape (Figure 2). The trap was then placed into a freezer to kill the adult flies. The dead flies were then stored in 3-dram vials and preserved with 95% ethanol and later pinned. All the flies were identified to family first and then the Calliphoridae were identified to species using the Whitworth key to the Genera and Species of Blow Flies in the West Indies (Whitworth, 2010). The calliphorids are more widely studied and have more keys available to identify down to species. A Shannon diversity index was run with all the results found.

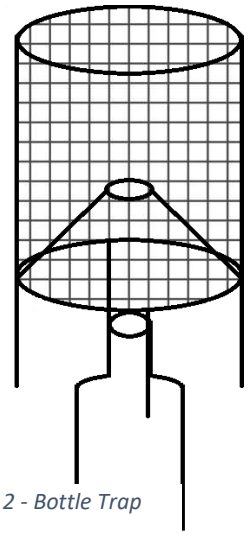

Figure 2 - Bottle Trap

Results

Of the dipterans that were found at the Jammev Beach Resort in Toco, Trinidad during this survey there were nine Stratiomyidae larvae, 23 adult and 43 larvae of Sarcophagidae, 27 adult Micropezidae, 21 adult *Hemilucilia segmentaria,* 38 adult *Chrysomyia megacephala,* 68 adult *Chrysomyia albicepts,* and 29 Muscidae were collected.

A list of what was collected is below (Table 1). Based on the numbers of individuals that were collected a Shannon diversity index was ran and a result of 1.78 was calculated. A graph of the distribution of the flies collected was created (Figure 1).

Family	Species	Number	Bait
Stratiomyidae		9 Larvae	Compost
Sarcophagidae		23 Adults, 43 Larvae	Chicken, Shark, Liver
Micropezidae		27 Adults	Chicken
Calliphoridae	*Hemilucilia segmentaria*	21 Adults	Chicken
Calliphoridae	*Chrysomyia megacephala*	38 Adults	Chicken
Calliphoridae	*Chrysomyia albicepts*	68 Adults	Chicken
Muscidae		29 Adults	Chicken

Table 1. List of forensically important flies collected in Toco, Trinidad and bait specimens were caught on.

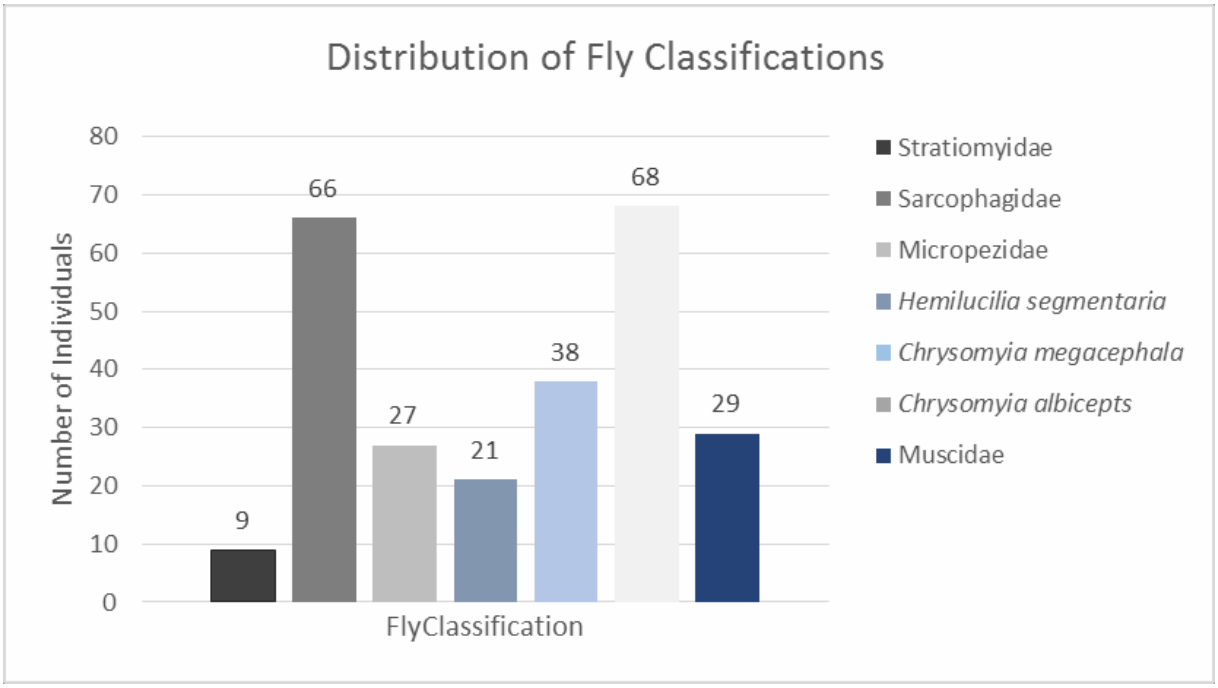

Figure 1. Distribution of density of the forensically important flies collected in Toco, Trinidad.

Discussion

This survey provides a list of dipterans that could be used in forensic entomology and were collected in Toco, Trinidad. Surveys of these dipterans are important to the field of forensic entomology because they provide insight to what dipterans should appear in the area. If flies are colonizing the body that should not appear in the area then it could indicate that the body had been moved. Dipterans are used in forensic entomology to determine the time of colonization of a body

(Greenberg, 1991). These times of colonization can align very closely to the post mortem interval as well as show if a body has been moved or abused prior to death (Sukonatson *et al*., 2007).

In this survey carrion was placed in the field and both larvae and adult flies were collected for identification. Compost soil was collected and put into a Berlese funnel to collect garbage feeding maggots.

Stratiomyidae are the family of soldier flies, the specimens that were collected were found in a compost pile. Straiomyid larvae feed on garbage and have been seen feeding on carrion (Lord *et al*., 1991). These flies have been observed feeding on pig remains, which mimic human remains, as well as feces and garbage (Myers, *al*, 2008).

Sarcophagidae includes the flesh flies, a family of flies that commonly show up on carrion to colonize (Cherix *et al*, 2012). Sarcophagid flies are encountered frequently on carrion that is located indoors (Pohjoismäki *et al*, 2010).

Micropezidae includes the stilt legged flies, which are commonly considered opportunistic feeders and colonizers of carrion (Chin *et al*, 2011). These flies can be used in forensic cases under certain conditions and have mostly been observed on rat and pig carcasses (Chin *et al*, 2011, Velásquez Zambrano, 2007).

Blow flies in the family Calliphoridae are commonly used as time of colonization estimates (Wells *et al*, 2001). *Hemilucilia segmentaria* is a blow fly in the family Calliphoridae and has been used for time of colonization estimates in a case in Brazil (Kosmann *et al*, 2011). *Chrysomyia megacephala* and *Chrysomyia albicepts* are two blow fly species that can be used to calculate the time of colonization (Monzon *et al*, 1991, Kosmann *et al*, 2011).

Muscidae includes the muscid flies. Muscids have been observed colonizing carrion before and could be used for forensics in certain conditions (Barreto *et al*, 2002, Monzon, R *et al*, 1991).

Limitations of this survey include the size of carrion that was placed out and the collection method of the larvae. The size and type of meat used does not accurately represent that of a human body that could be the center of a forensic investigation. When collecting larvae, larger chunks of meat were placed under a manmade cage and staked to the ground and then covered in rocks. The cages were made to keep animals out of the meat. Larvae were able to be collected twice soon after the meat was placed out and then all of the traps were broken into by animals and were no longer able to be used. This did not allow for the meat to get several waves of flies to visit to obtain samples of larvae from.

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