

Systematics

**A Survey of the Necrophilous Diptera on the
Island of Dominica**

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Abstract

In this study, different baits and collecting methods were used to survey the necrophilous Diptera on the Island of Dominica. A man-made bait, carrion, and light sheet were used to attract the flies. Flies were also collected while sweeping vegetation. Thirteen species of flies were collected in eight different families: Calliphoridae – *Cochliomyia macellaria*, *Phaenicia eximia*, *Chrysomya megacephala*, *Chrysomya rufifacies*, *Phaenicia coeruliviridis*, and Calliphoridae sp. Four of these species are possible new records for the island. Sarcophagidae spp., Muscidae sp., Fanniidae sp., Sepsidae sp., Piophilidae sp., and two acalyptrate Muscoid spp. The bait/collecting method used to collect each fly is provided as well as brief descriptions of each fly collected.

Key Words: Diptera, Dominica, blow fly, forensic entomology, carrion

Introduction

Necrophilous Diptera are extremely important for many reasons. The main reason being that they feed on decaying matter, usually carrion, which aids in the process of breaking down this matter so that it is not polluting our environment. These flies lay their eggs on the carrion which then hatch into maggots that feed upon the decaying tissues of the animal. Without their help removing this decaying material, the earth would be covered in carrion (Triplehorn and Johnson 2005). The second reason these flies are extremely important stems from the fact they breed in decaying material. These flies colonize a dead animal very rapidly, sometimes within minutes of death, and therefore are very good indicators as to how long the animal has been deceased. The developmental rates of these flies, like all insects, are temperature driven, and the speed at which they develop follows a linear rate that fluctuates with changes in temperature. Each of these flies develops at a certain rate that is species specific. This rate can be applied to a formula to determine how long something has been dead, and establish post-mortem interval (PMI) in forensic cases. The species composition of a certain location is usually very specific. This information can be used in a forensic case to determine if a body has been moved from one location to another, which is where surveys such as this one become important. The aim of my study was to expand on what was found during the Bredin-Archbold-Smithsonian expedition to Dominica of 1964 to 1968, in which only two species of Calliphorids were found (James 1967). In the current study, eight families of necrophilous Diptera were recorded. The Calliphoridae, Sarcophagidae, Muscidae,

Fanniidae, Sepsidae, Piophilidae, and two Acalypterate Muscoids. The most important of these flies are those in the family Calliphoridae. The Calliphorids, commonly known as blow flies, are a large, diverse group that is distributed worldwide. They can be distinguished from other necrophilous Diptera in that they are usually metallic blue or green in color and the fourth wing vein is sharply bent. The antennal arista is plumose at the tip, and they usually have two notopleural bristles. Some species of blow flies, when reared under aseptic conditions, can be used to treat open sores and wounds that do not heal because they feed only on decaying tissues. Flies in the family Sarcophagidae, are also important to the decay process of dead animals. Although they are very similar to the Calliphorids, Sarcophagids, commonly known as flesh flies, can be distinguished because they are never metallic, and are usually grey in color with three dark longitudinal stripes on the thorax. The antennal arista is usually bare entirely or plumose only on the basal half, and they usually have four notopleural bristles. Flies in the family Muscidae are also important necrophilous Diptera. They breed in many kinds of filth and are usually very abundant (Triplehorn and Johnson 2005). These are small, grey flies, with four dark longitudinal stripes on the thorax. The sides of the abdomen are generally light yellowish in color (Dodge 1958). The three other families of flies recorded in this experiment, the Fanniidae, Sepsidae, and Piophilidae. All are minute, black flies that breed in filth, and are very widespread.

Materials and Methods

A two week study was conducted on the island of Dominica, West Indies, from May to June 2006. The majority of the survey took place at the Archbold Tropical Research and Education Center (ATREC), Springfield (15°20'33.9"N 61°22'41.4"W). Flies were attracted with various baits and collected by sweeping above the bait, a cage placed above the bait, or with a Trapper[®] Max glue trap. The first type of bait used was a solution composed of 1g ammonium carbonate ((NH₄)₂CO₃) and 100g dry active yeast dissolved in one gallon of hot water. The second bait used was a small dead bird found in the driveway of ATREC. The third bait was a dead Iguana, *Iguana delicatissima*, found in a Mango (*Mangifera indica*) grove at Batalie Beach. The final bait used was a dead fish found at Champagne Bay. Flies were collected at a light sheet at ATREC, Springfield in two different locations (15°20'55"N 61°22'04"W; 15°20'54"N 61°22'04"W). Flies were also collected through use of a sweep net along Syndicate Nature Trail (15°31'23"N 61°24'57"W), Diablotin National Park.

Two collections were performed using the ammonium carbonate and yeast bait solution on 31 May and 2 June at ATREC, Springfield (15°20'54"N 61°22'04"W). Bait and collecting equipment were placed at approximately 1000 hours and removed at 1900 hours. Four ounces of solution were poured into a 12 ounce yellow plastic Solo[®] party bowl [PN PSB2Y 0099]. A screen cage was placed above the bowl, and a Trapper[®] Max glue trap was placed on the west side approximately six inches away. The glue trap was folded in half and wooden clothes pins were placed on each corner (four) forming a "tent" to elevate the trap off the ground. The cages and glue traps were both placed in the freezer to kill the collected flies. The cage was removed approximately one hour after being placed in the freezer and the flies were transferred to a 50 ml plastic vial containing a Kimwipe[®] with 10 drops of ethyl acetate (C₄H₈O₂) to preserve the flies.

On 27 May, two collections were performed on carrion. The first was on a small dead bird found in the driveway of ATREC, Springfield (15°20'33.9"N 61°22'41.4"W). Flies were swept off the carrion using a BioQuip® Medium Sweep Insect Net. Sweeping was performed above the carrion in the standard figure eight method to prevent the flies from escaping the net. Collected flies were transferred to a 50 ml plastic vial containing a Kimwipe® with 10 drops of ethyl acetate (C₄H₈O₂) as a killing and preserving agent. The second collection was on a dead Iguana (*Iguana delicatissima*) found in the middle of a Mango (*Mangifera indica*) grove at Batalie Beach. Flies were again swept above the carrion with a sweep net using the standard figure eight method. Collected flies were transferred to a 50 ml plastic vial containing a Kimwipe® with 10 drops of ethyl acetate (C₄H₈O₂) as a killing and preserving agent.

The third collection was performed on 2 June on a dead fish (Beloniformes: Exocoetidae) that had been found at Champagne Bay. The fish was collected and relocated to ATREC, Springfield (15°20'55"N 61°22'04"W), and placed in the grass on the station grounds. A screen cage was placed above the fish and a Trapper® Max baited glue trap was placed on the west side approximately six inches away. The glue trap was folded in half and wooden clothes pins were placed on each corner (four) forming a "tent" to elevate the trap off the ground. The cages and glue traps were both placed in the freezer to kill the collected flies. The cage was removed approximately one hour after being placed in the freezer and the flies were transferred to a 50 ml plastic vial containing a Kimwipe® with 10 drops of ethyl acetate (C₄H₈O₂) to kill and preserve the flies.

The fourth method of collection was using a light sheet. Flies were attracted to the light sheet which is composed of an aluminum frame with a vertical white sheet stretched across it with two 450 watt EYE self-ballasted mercury vapor lamps, one suspended on either side of the sheet. The flies were collected into a 50 ml vial containing a Kimwipe® with 10 drops of ethyl acetate (C₄H₈O₂) to kill and preserve the flies.

The final method of collection was sweeping vegetation with a BioQuip® insect sweep net. Vegetation was swept along Syndicate Nature Trail (15°31'23"N 61°24'57"W) in Diablotin National Park. Collected flies were transferred to a 50 ml plastic vial containing a Kimwipe® with 10 drops of ethyl acetate (C₄H₈O₂) to kill and preserve the flies.

Collected flies were pinned or point mounted based on size with #2 or #3 Kostal black enameled insect pins. Identifications were made using Dodge (1958), Dear (1985), De Carvalho and Ribeiro (2000), Triplehorn and Johnson (2005).

Results

The following species of necrophilous Diptera were collected during this study:

- Cochliomyia macellaria* – The Secondary Screwworm Fly
- Phaenicia eximia* – The Common Tropical Green Bottle Fly - NR
- Chrysomya megacephala* – The Oriental Blow Fly - NR
- Chrysomya rufifacies* - NR
- Phaenicia coeruliviridis* - NR
- Calliphoridae sp. - NR
- Sarcophagidae spp. – Flesh Flies
- Muscidae sp. – House Flies
- Fanniidae sp. – Lesser House Flies
- Sepsidae sp. – Black Scavenger Flies
- Piophilidae sp. – Skipper Flies
- Acalypterate Muscoid sp. 1
- Acalypterate Muscoid sp. 2

NR = New Species Record for Dominica

The table below shows the species collected and how each was collected:

	((NH ₄) ₂ CO ₃) and yeast	Bird Carrion	<i>Iguana delicatissima</i> Carrion	Exocoetidae Carrion	Light Sheet	Sweep
<i>Cochliomyia macellaria</i>	X		X	X	X	
<i>Phaenicia eximia</i>	X			X	X	
<i>Chrysomya megacephala</i>	X	X	X	X	X	
<i>Chrysomya putoria</i>	X			X		
<i>Phaenicia coeruliviridis</i>					X	
Calliphoridae sp.						X
Sarcophagidae spp.	X			X	X	
Muscidae sp.	X		X	X	X	
Fanniidae sp.	X		X	X		
Sepsidae sp.			X			
Piophilidae sp.		X	X			
Acalypterate Muscoid sp. 1			X			
Acalypterate Muscoid sp. 2			X			

Discussion

Cochliomyia macellaria, the secondary screwworm fly is easily identified because it has a shiny, metallic thorax and abdomen. The fourth wing vein is sharply angled. There are three dark stripes on the thorax that are equal in length, the gena is yellow and anterior thoracic spiracle white.



Figure 1: *Cochliomyia macellaria*, dorsal view

Figure 2: *C. macellaria*, lateral view

Phaenicia eximia, the common tropical green bottle fly can be easily identified because the thorax and abdomen are shiny and metallic, and has a sharply angled fourth wing vein. The gena is dark, anterior thoracic spiracle dark, and squamae white. Dorsal thoracic bristles are strong. The abdomen is very shiny with not dorsal pollinosity. The anterior margin of the thorax is pollinose, and antennae reddish in color.



Figure 3: *Phaenicia eximia*, lateral view

Chrysomya megacephala, the Oriental blow fly or big-headed fly, has a shiny, metallic thorax and abdomen. The fourth wing vein is sharply angled. The gena is yellow and anterior thoracic spiracle dark (brown to black). Like the name suggests, especially in males, the head is extremely large and has large, conspicuous red eyes.



Figure 4: *Chrysomya megacephala*, lateral view

Chrysomya rufifacies has a shiny, metallic green abdomen and thorax. The fourth wing vein is sharply angled. The gena, anterior thoracic spiracle, and squamae are all white in color. This identification is not definite, but if it is ever able to be confirmed, it will be. Once confirmed, it will be a new species record for the island.



Figure 5: *Chrysomya rufifacies*, lateral view

Phaenicia coeruliviridis is identified as having a shiny, metallic thorax and abdomen, and a sharply angled fourth wing vein. The gena and anterior thoracic spiracle are dark, and squamae white. It has strong dorsal thoracic bristles and the abdomen is strongly shiny, lacking pollinosity. The front margin of the thorax is strongly shining (never pollinose; this distinguishes from *P. eximia*). Antennae and palpi are both reddish in color. This identification also needs confirmation, and is possibly a new species record for Dominica.



Figure 6: *Phaenicia coeruliviridis*, lateral view

Calliphoridae sp. has a shiny, metallic blue thorax and abdomen. The fourth wing vein is sharply angled. Gena, anterior thoracic spiracle, and squamae are all dark. This is also a possible new species record for Dominica pending a confirmed identification.



Figure 7: Calliphoridae sp., lateral view

Sarcophagidae spp., the flesh flies, are large in size. The fourth wing vein is angled. They are grey in color and have three dark longitudinal stripes on the thorax. The abdomen is checkered black and grey, and usually has a red tip.



Figure 8: Sarcophagidae sp., dorsal view

Muscidae sp. is a small fly, grey in color, and the fourth wing vein is angled. There are four dark, longitudinal stripes on the thorax, and the sides of the abdomen are pale yellowish in color.

Fanniidae sp. is a small, shiny, black fly. The thorax is humped in appearance and the abdomen is narrow and slender in appearance when viewed laterally. The squamae is hyaline with a dark silvery margin.

Sepsidae sp. is a small, shiny, black fly. The head is very spherical, and the abdomen is narrowed at the base. Palps are vestigial. The coxae, trochanters, and legs are yellow (at least on the ventral side). The halteres are also yellow.

Piophilidae sp. is small, shiny and black. The eyes are very large and conspicuous. Anterior margin and dorsal side of thorax are pollinose. Coxae and trochanters are also pollinose. The squamae are hyaline with a silvery margin and the halteres are white.

Acalypterate Muscoid sp. 1 is a very small fly. The thorax is dark and the abdomen is transparent yellow with dark bands. The head is yellow except for the eyes and ocular triangle. The legs are also yellow.

Acalypterate Muscoid sp. 2 is a very small fly. The thorax and abdomen are shiny black. The parafrontal area is yellowish. Halteres and legs are also yellow, and the tarsi are dark.

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References

- Dear, J.P. A Revision of the New World Chrysomyini (Diptera: Calliphoridae).
Revta Bras. Zool. 3(3):109-169.
- De Carvalho, C.J.B. and P.B. Ribeiro. 2000. Chave de Identificação das Espécies de Calliphoridae (Diptera) do sul do Brasil. Rev. Bras. Parasitol. Vet. 9(2):169-173.
- Dodge, H.R. 1958. Domestic Flies: Pictorial Key to Common Species in the U.S. U.S. Department of Health, Education, and Welfare. Public Health Service. Communicable Disease Center Training Branch. Atlanta, Georgia.
- James, M. T. 1967. The Blow Flies of Dominica (Diptera: Calliphoridae). Proceedings of the Entomological Society of Washington. 69(4):368.
- Triplehorn, C.A. and N.F. Johnson. 2005. Borror and DeLong's Introduction to the Study of Insects. 7th ed. 864 pp.