A Survey of Bee (Hymenoptera: Apoidea: Apiformes)

Biodiversity in Dominica, Lesser Antilles

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Abstract

This study surveyed the biodiversity of bees (Hymenoptera: Apoidea: Apiformes) on the island of Dominica in the Lesser Antilles. Yellow, blue, and white pan traps, Malaise traps, sweep nets, and light sheets were used to collect bees at 11 sites on the island. Pan traps and sweep nets were the most effective techniques for collecting bees. A total of 77 specimens representing 12 species in the families Apidae and Halictidae were collected and identified between 29-V-2015 and 16-VI-2015. Of the bee species identified, *Centris decolorata* Lepeletier and *Centris lanipes* (F.) are new records for the island of Dominica. Additionally, a new species in the genus *Lasioglossum* and a new species in the genus *Sphecodes*, both in the family Halictidae, were also collected. Further research should be conducted to assess the distribution and behavior of Dominican bees as well as the floral sources they utilize. Future studies also have the potential to increase the understanding of bee biodiversity on Dominica.

Keywords. Apidae, Halictidae, pollinators, new species records, Caribbean

Many species of bees are valuable pollinators worldwide. The family Apidae includes honey, carpenter, stingless, orchid, and cuckoo bees while members of the family Halictidae are commonly known as sweat bees. There have been few research projects conducted on the species of bees occurring in Dominica. In 1913, an expedition was conducted to explore the biodiversity of bees on the island of Dominica and 14 species were identified (Crawford 1914). More recently, in 2012, a new species of sweat bee in the genus *Habralictus* was described from Dominica (Gibbs 2012). Jason Gibbs is currently in the process of revising the species of halictids from Dominica. As of 2012, only 18 species of bees representing the families Apidae, Halictidae, and Megachilidae have been recorded from Dominica (Gibbs 2012).

A comparison of non-formicid Hymenopteran insect trapping techniques was conducted at various sites in Dominica and bees were collected successfully (Decker 2003). Another study surveyed the biodiversity of non-formicid Hymenopteran insects in different habitats (Wells 2003). The results of these research projects indicated that non-formicid Hymonoptera, such as bees, could be collected by setting up pan and Malaise traps as well as sweep-netting at multiple sites on Dominica.

Pan traps consist of small, brightly colored plastic bowls filled with non-scented soapy water and placed on the ground in areas where bees and other insects are expected to be foraging. When an insect is attracted to the color of the bowl, which mimics a flower, it falls in and drowns because the surface tension of the water is reduced by the added soap. Malaise traps have a tent-like design and take advantage of some insects' natural behavior to fly upwards when they encounter an obstacle. The insect contacts the vertical mesh along the center of the trap and flies into the highest corner of the trap which contains a bottle of alcohol. Sweep-netting is the act of swinging the opening of an insect net over and through low-growing vegetation. Insects, especially ones that might not be seen otherwise, are collected as they are caught in the net's path. A light sheet is comprised of a mercury vapor lamp suspended over a standard white bed sheet. Light sheets are commonly attractive to insects that are active at night.

In this study, yellow, blue, and white pan traps, Malaise traps, sweep nets, and light sheets were used to survey for and collect bees from 11 localities in Dominica. The main objectives were to collect specimens of bees from multiple genera and both sexes as well as to broaden the range of localities that bees have been collected from on the island.

Materials and Methods

Survey Locations.

Field collecting and trapping was conducted at 11 different locations on the island of Dominica (Table 1).

Table 1. Dominican bee biodiversity survey locality and collection technique data.

Geography	Locality	GPS Coordinates	Elevation (meters)	Habitat Type	Collecting Technique(s) Used
Saint David Parish, Dominica	Castle Bruce Beach & Estuary	15.4322245°, -61.255387°	10 m	Beachfront	Yellow, blue, and white pan traps and sweep nets
	Kalinago Territory	15.488554°, -61.253029°	167 m	Disturbed Atlantic Coast Forest	Sweep nets
Saint George Parish, Dominica	Roseau	15.2974167°, -61.388833°	8 m	Urban	Sweep nets
	Dominica Botanical Gardens, Roseau	15.299607°, -61.382524°	30 m	Urban Park	Sweep nets
Saint John Parish, Dominica	Cabrits National Park	15.587650°, -61.472767°	66 m	Secondary Dry Forest	Malaise trap
	Cabrits National Park	15.587359°, -61.472155°	68 m	Secondary Dry Forest	Malaise trap
Saint Paul Parish, Dominica	Archbold Tropical Research and Education Center (ATREC), Springfield	15.346558°, -61.369010°	345 m	Secondary Rainforest/ Former Plantation	Yellow, blue, and white pan traps, Malaise trap, sweep nets, light sheet
	Checkhall River, ATREC, Springfield	15.3454833°, -61.3691000°	330 m	Secondary Rainforest	Malaise trap
	Mount Joy, ATREC, Springfield	15.3477167°, -61.3348500°	690 m	Secondary Rainforest	Malaise trap
	Trail to Middleham Falls, Morne Trois Pitons National Park	15.346703°, -61.347716°	652 m	Secondary Rainforest	Malaise trap
	Trail to Middleham Falls, Morne Trois Pitons National Park	15.348421°, -61.345659°	683 m	Secondary Rainforest	Malaise trap

Collecting Procedures.

An approximate total of 60 yellow, blue, and white pan traps with a diameter of 17.5 cm and half-filled with non-scented soapy water were deployed at Archbold Tropical Research and Education Center (ATREC) daily between the dates of 30-V-2015 and 16-VI-2015 (Table 1, Fig. 1). The traps were serviced and bees were collected from each of the pan traps at about 6:00 P.M. each evening. Additionally, pan traps were placed at Castle Bruce Beach and Estuary from approximately 3:30 P.M. to 4:30 P.M on 8-VI-2015 (Table 1).

Malaise traps were placed at ATREC and the Checkhall River from 30-V-2015 to 13-VI-2015, on Mount Joy from 30-V-2015 to 11-VI-2015, at two sites in Cabrits National Park from 2-VI-2015 to 8-VI-2015, and at two sites along the trail to Middleham Falls from 31-V-2015 to 7-VI-2015 (Table 1, Fig. 1). Sweeping and other insect net techniques were used periodically at ATREC, Kalinago Territory, the Dominica Botanical Gardens, Castle Bruce Beach and Estuary, and Roseau between the dates of 29-V-2015 and 16-VI-2015 (Table 1). Kill jars charged with ethyl acetate were used to kill the bees after they had been captured in the nets. Some bees were also killed in 95% ethanol. Additionally, a light sheet was set up each evening from approximately 8:00 P.M. to 1:00 A.M. at ATREC between 30-V-2015 and 7-VI-2015.

Fig. 1. Yellow, blue, and white pan traps and a Malaise trap at ATREC on 13-VI-2015.

Specimen Preservation and Identification.

The collected specimens were placed in labeled containers and processed immediately or stored in 95% ethanol until they could be examined. The specimens were pinned or preserved in 95% ethanol for later molecular analysis and labeled following standard entomological guidelines. The bees were sorted from the other insects, determined as male or female if possible, quantified, and identified to family, genus, and species where feasible using *The Bees of the World* (Michener 2007), a key to the Halictidae of Dominica (Gibbs 2015, unpublished data), and photographs of previously collected specimens (Prado 2015). Specimens will be deposited in the Texas A&M University Insect Collection to be further classified and used in future research.

Results

Over the course of this survey, between 29-V-2015 and 16-VI-2015, a total of 77 bees representing 10 species in the family Apidae and two species in the family Halictidae were collected and identified. Nearly all of the bees were collected from pan traps and sweep nets, while only two were captured in Malaise traps and two were collected at the light sheet. Bees were collected from all sites listed previously except for Cabrits National Park and the Trail to Middleham Falls (Table 1).

Family Apidae.

A total of 11 female *Apis mellifera* Linnaeus workers were collected at four localities around the island (Table 2). While they were primarily collected using sweep nets, a few individuals were also collected in pan traps and at the light sheet at ATREC as well as in the Checkhall River Malaise trap (Table 2).

Table 2. Data for *A. mellifera* specimens collected between 29-V-2015 and 16-VI-2015.

Date	Locality	Collecting Technique Used	Number of Specimens Collected
30-V-2015	ATREC	Light sheet	1
30-V-1-VI-2015	Checkhall River	Malaise trap	1
3-VI-2015	ATREC	Sweep net	1
5-VI-2015	Castle Bruce Beach & Estuary	Sweep net	2
6-VI-2015	ATREC	Light sheet	1
6-VI-2015	Roseau	Sweep net	1
10-VI-2015	Dominica Botanical Gardens	Sweep net	3
13-VI-2015	ATREC	Pan Traps	1

Centris decolorata was identified from three specimens collected at Castle Bruce Beach and Estuary using sweep nets on 5-VI-2015 (Fig. 2).

Fig. 2. Dorsal, lateral, and anterior views of *C. decolorata* collected at Castle Bruce Beach and Estuary on 5-VI-2015 via sweep net.

Two *C. lanipes* individuals were collected at the Dominica Botanical Gardens using sweep nets on 10-VI-2015 (Fig. 3).

Fig. 3. Dorsal, lateral, and anterior views of *C. lanipes* collected at Dominica Botanical Gardens on 10-VI-2015 via sweep net.

Centris versicolor (F.) was represented by two specimens collected at ATREC in blue pan traps on 1-VI-2015 and 13-VI-2015, one collected in a pan trap on 3-VI-2015, one collected via sweep net on 13-VI-2015, and one collected in the Malaise trap between 1-VI-2015 and 13-VI-2015 (Fig. 4).

Fig. 4. Dorsal, lateral, and anterior views of *C. versicolor* collected at ATREC on 3-VI-2015 via pan traps.

One male and two female bees in the genus *Melissodes* were collected at Castle Bruce Beach and Estuary using sweep nets on 5-VI-2015 (Fig. 5, Fig. 6).

Fig. 5. Dorsal, lateral, and anterior views of a female *Melissodes sp. 1* collected at Castle Bruce Beach and Estuary on 5-VI-2015 via sweep net.

Fig. 6. Dorsal, lateral, and anterior views of a male *Melissodes sp. 1* collected at Castle Bruce Beach and Estuary on 5-VI-2015 via sweep net.

All six *Mesoplia azurea* (Lepeletier and Audinet-Serville) specimens were collected at ATREC (Fig. 5). Two were captured using sweep nets, one each on 29-V-2015 and 30-V-2015, two were caught in pan traps on 31-V-2015, and two were found in blue pan traps on 1-VI-2015 (Fig. 7).

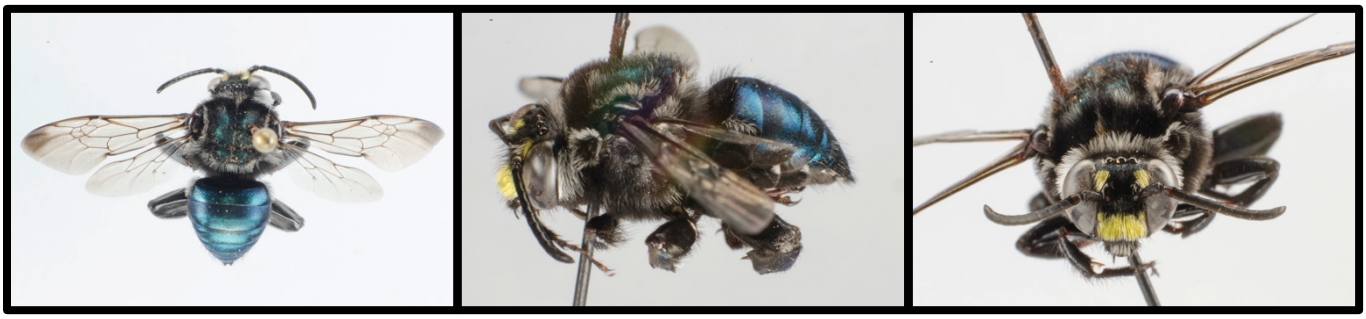

Fig. 7. Dorsal, lateral, and anterior views of *M. azurea* collected at ATREC on 30-V-2015 via sweep net.

The genus *Xylocopa* was represented by a single bee collected in Kalinago Territory on 5-VI-2015 using a sweep net (Fig. 8).

Fig. 8. Dorsal, lateral, and anterior views of *Xylocopa sp. 1* collected in Kalinago Territory on 5-VI-2015 via sweep net.

Two individuals of Apidae 1 were collected at ATREC on 31-V-2015 in pan traps (Fig. 9).

Fig. 9. Dorsal, lateral, and anterior views of Apidae 1 collected at ATREC on 31-V-2015 via pan traps.

Two additional Apidae bees, Apidae 2 and Apidae 3, were collected at ATREC in a pan trap between the dates of 7-VI-2015 and 8-VI-2015 and in a yellow pan trap on 16-VI-2015 respectively.

Family Halictidae.

Thirty-seven individuals of a new *Lasioglossum* species were collected over the course of the survey (Fig. 10). The majority of the specimens were collected in pan traps at ATREC, however some were also captured in sweep nets at Castle Bruce Beach and Estuary as well as the Dominica Botanical Gardens (Table 3).

Table 3. Data for *Lasioglossum n.sp.* specimens collected between 29-V-2015 and 16-VI-2015.

Date	**Locality**	**Collecting Technique Used**	**Number of Specimens Collected**
31-V-2015	ATREC	Pan traps	2
3-VI-2015	ATREC	Pan traps	1
5-VI-2015	ATREC	Pan traps	8
6-VI-2015	ATREC	Pan traps	2
7-8-VI-2015	ATREC	Pan traps	7
8-VI-2015	Castle Bruce Beach & Estuary	Sweep net	4
10-VI-2015	Dominica Botanical Gardens	Sweep net	9
12-VI-2015	ATREC	Pan traps	2
16-VI-2015	ATREC	White pan traps	2

Fig. 10. Dorsal, lateral, and anterior views of *Lasioglossum n.sp.* collected at ATREC on 31-V-2015 via pan traps.

Five specimens representing a new *Sphecodes* species were collected over the course of the survey (Fig. 11). All of the individuals were captured in pan traps at ATREC, one each on 3 and 6-VI-2015 as well as two between the dates of 7-VI-2015 and 8-VI-2015.

Fig. 11. Dorsal, lateral, and anterior views of a female *Sphecodes n.sp.* collected at ATREC on 6-VI-2015 via pan traps.

Discussion

Centris versicolor and *M. azurea* have been collected in Dominica previously (Crawford 1914). Two species of *Melissodes* and two species of *Xylocopa* are also known from the island (Gibbs 2012). The specimens collected from these genera as well as the three unidentified Apidae bees in this survey require further examination for species level identification. *Apis mellifera*, used for crop pollination and honey production on the island, was collected at five different localities, the highest number of localities for any species collected during the survey. Of the three bee families reported from the island of Dominica, the family Apidae has the largest number of species, 10 as of 2012 (Gibbs 2012). This survey reflects the biodiversity of the family Apidae through the 10 species collected over the course of it. Based on previous records of bees from Dominica, this survey resulted in the first collection of *C. decolorata* and *C. lanipes* on the island. These new species records bring the total of Apidae bees from Dominica to 12 species. Previously described species of halictids were not collected in this study and the identification of two new species in the *Lasioglossum* and *Sphecodes* genera suggest that other unknown species of bees may be

present in Dominica. It is of note that no specimens in the family Megachilidae were collected over the course of this survey when four have been discovered previously (Gibbs 2012). Although the time available for bee collecting was relatively short, this study resulted in new records of bee species on the island of Dominica. Further research should be conducted to determine the distribution of the bee species collected, especially *C. decolorata* and *C. lanipes*, as they represent new records for the island of Dominica. Potential future studies include year-round trapping and surveying to collect behavioral data and information about floral resource preferences for the bee species observed in Dominica to date. Due to the fairly limited knowledge of Dominican bee species, these studies may also result in increased understanding of biodiversity on the island.

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