Ectoparasites on Bats in Dominica

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Introduction

Every organism is an ecosystem within itself and can harbor a number of parasite species. Little is known about the diversity and prevalence of ectoparasites on the tropical bats of Dominica. This study attempts to investigate the different species and density of ectoparasites present on four species of bats and to determine patterns among species and between sexes. There are two types of bat ectoparasites, those that live in the hosts roost and those that live on the host itself. This study focuses on the continuous feeders, small ectoparasites that are found on the bat's body at all times. Some ectoparasites exhibit a preference for an area of the hosts body. These parasites selectively choose these areas because they are hard to reach places and the bats will have difficulty removing them while grooming. The descriptions of bat-ectoparasite relationships are based on collections from four bat species.

Materials and Methods

Study Area

Dominica is the largest of the Windward Islands lying halfway between Guadeloupe and Martinique in the Eastern Caribbean. The island is volcanic in origin and measures 29 miles long by 16 miles wide. It ranges from sea level to peaks of almost 5000 feet with dense tropical forests, deep valleys, seasonal and elfin forests, and dry scrub. There are six variations of forests on the island, however most of the data were collected in secondary transitional forest and tropical dry forest habitats. Bat nets were set up at five different locations: Fort Shirley in Cabrits National Park, Mt. Joy, Check Hall River, and at the bee house and stream house of Springfield Plantation.

Host Description

Dominica has a great variety of flora and fauna but is home to relatively few mammals. Bats comprise the majority of the mammalian species on the island. This study focuses on four of these bat species: *Tadarida brasiliensis, Molossus molossus, Sturnira lilium, and Artibeus jamaicensis.*

The Mexican free tailed bat, *Tadarida brasiliensis* is a small colonial bat in the family Molossidae. This family is characterized by a stout tail extending beyond the uropatagium. They have no noseleaf and their ears are short, round, thick and jointed across the head. *T. brasiliensis* has unusually wrinkled lips and a hairless rump. Upon capture these bats are quite animated and recover quickly. There is a roost of about 70 *T. brasiliensis* in the ceiling cracks of the garrison in the ruins at Fort Shirley.

Also in family Molossidae is *Molossus molossus.* These bats look similar to *T. brasiliensis* and are also colonial insectivores. There is a colony of roosting females in the upstairs shower of Springfield stream house. *M. molossus* is darker in color than *T. brasiliensis* and is not as resilient to handling.

The other two species of bats belong to the family Phyllostomidae. These are spear nosed frugivorous bats. *Artibeus jamaicensis*, the Jamaican fruit bat consumes a range of fruits, and has been known to eat flowers and insects. This is the largest bat of the four species collected and is identified by its distinctive face and nose leaf. Many of

the female bats of this species collected were lactating. Most *A. jamaicensis* were found at the bee house and Check Hall River.

Sturnira lilium also has a nose leaf but is considerably smaller in size than *A. jamaicensis.* It is distinguishable because it has no uropatagium, the membrane between the hind legs. Also a fruit bat, *S. lilium* were mostly caught by the Check Hall River under a fig tree and on Mt. Joy, where fruit is plentiful.

Field Collections

Bats were collected over a two week period from late May to early June 2000. Tall bamboo poles were used to stretch a large mist net 6 meters in length. We placed these nets in areas with high bat concentrations. Usually we let down the nets before dusk and checked them regularly until about 11:00 p.m. Using leather gloves the bats were carefully detangled from the net and either examined for ectoparasites or put into a sock until examination could take place. We closely searched the head, face, ears, body, ventral and dorsal wing and tail membranes for ectoparasites. Using soft forceps and q-tips the ectoparasites were removed and placed in vials containing 70% ethyl alcohol. One vial was used for each bat and later separation of ectoparasite species took place in the lab. All bats were released after being processed.

Eight species of ectoparasites were collected off of four bat species. There were three different species of mites, which will be identified at a later date with higher power microscopes. Multiple species of streblid flies were collected. Streblids are obligate bat parasites found on both of the fruit bats. The streblids collected were two different species of *Trichobius, Megistopoda aranea, Aspidoptera phyllostomatus,* and an unknown streblid that will be identified at Texas A&M University.

Results:

	Artibeus (F)		Artibeus (M)		Tadarida (F)		Tadarida (M)		Sturnira (F)	
	Total	Avg	Total	Avg	Total	Avg	Total	Avg	Total	Avg
Mite	55	3.44	38	5.4	0	0	0	0	0	0
Small Mite	2	0.13	3	0.43	14	2.3	32	4.57	2	0.67
Large White Mite	27	1.7	18	2.56	0	0	0	0	0	0
Megistopoda	14	0.88	6	0.85	0	0	0	0	8	2.67
Trichobeus I	5	0.31	5	0.71	0	0	0	0	0	0
Trichobeus II	2	0.13	0	0	0	0	0	0	0	0
Aspidoptera	1	0.06	1	0.14	0	0	0	0	0	0
Unknown Streblid	2	0.13	0	0	0	0	0	0	0	0
Total Infested Bats	16		7		6		7		3	

Ectoparasites obviously exhibited preferences for an area of the host's body. For example mites were found in a higher frequency on the underside of the wings and along crevices where the membrane covers the metacarpals and forearm. The streblid flies

were found in higher frequency around the face area and armpit of the host.

Overall there is a greater number of the smaller parasites such as mites and a smaller number of the larger streblid flies. This demonstrates an inverse relationship between size of the parasite and density of that species. Physically the mites are better suited for survival on a bat because of their flattened bodies and small size, therefore they are present in higher numbers.

Almost all of the captured *A. jamaicensis* were infected to some degree with ectoparasites. Twenty-three of the twenty-five collected bats were hosts, representing 92% infestation of *A. jamaicensis*. Not only were the incidence of ectoparasites high for this fruit bat but the diversity of mites and streblids were incredible. *A. jamaicensis* housed all eight species of ectoparasites collected in this study, with one individual having as many as four of the ectoparasites on it at one time (two species of mite and two species of streblid flies). On average, male *A. jamaicensis* were hosts to more ectoparasites per specie than the females. However, females had greater ectoparasite specie diversity, hosting all eight species of ectoparasites.

There were three infested *Sturnira lilium* out of a small sample of five, representing a 60% infestation rate. A large number of the long-legged streblid fly, *Megistopoda aranea*, and a few small mites were collected from *Sturnira lilium*.

T. brasiliensis had a 48% ectoparasite infestation rate. Thirteen out of the twenty-seven processed Mexican free-tailed bats were hosts to small, almost microscopic white mites. There were no incidences of the larger mites or streblid flies on *T. brasiliensis*.

Molossus molossus had a 0% infestation rate. All of the seven processed female *M. molossus* were free from any type of mite, streblid fly, or any other type of ectoparasite.

Discussion:

The two frugiverous bats had greater incidence and diversity of ectoparasites than the two insectiverous bats collected. Perhaps this phenomenon occurs because the insectivores are more skilled at catching insects and are consequently better at removing ectoparasites during grooming. Frugiverous bats are accustomed to foraging for fruits and are therefore less skilled at catching ectoparasites. Also, the two frugivores, *A. jamaicensis* and *S. lilium* belong to the same family of bats and likely exhibit similar foraging and more specifically grooming practices. Similarly, *M. molossus* and *T. brasiliensis* are in the same family and both bats are relatively free of ectoparasites.

It has been observed that cave dwelling species of bats tend to have a higher infestation and greater diversity of streblid flies than bats that live in tree-roosts. *A. jamaicensis* are known to have both tree-roosts and live in caves. The collected data leads us to believe that the *A. jamaicensis* that we captured are cave dwelling because of the high numbers of streblids. Bats that live in close proximity to each other in a cave present the opportunity for lots of ectoparasite transfer.

The greater average per bat ectoparasite value for male *Artibeus jamaicensis* can be explained by their roosting patterns. This specie lives in harems, where one male bat defends an entire roost of female bats. If the males were to spend more time than the females in the roost defending it, we would predict that they would be infested to a greater degree with ectoparasites than their counterparts. Also consistent with this idea is

the fact that the majority of the female *A. jamaicensis* collected were lactating and spending more time outside of the roost foraging in order to fuel the metabolic cost of feeding their young. Studies on sexual dimorphism of this specie conclude that the actual body size of the sexes don't differ significantly. The greater male infestation of ectoparasites is not likely associated with a larger body size or more surface area. Males may simply spend less time grooming than the female *A. jamaicensis.*

The small sample size of *Sturnira lilium* makes it difficult to draw conclusions from the data. However, it is significant to note that they were highly infested with a single streblid fly, *Megistopoda aranea.* Previously other streblid flies may have existed on *S. lilium* but the prevalence of *Megistopoda aranea* caused competition and eventual removal of the other streblids. Also, tree-roosting bats like *S. lilium* generally have little to no diversity of streblids because their habitat is not very stable and inconducive to streblid survival.

The percentage of ectoparasite infestation on *Tadarida brasiliensis* was grossly underestimated. The small white mites present on *T. brasiliensis* were very difficult to remove with the tools available. Almost microscopic in size, the mites were hard to locate and capture with soft forceps. Not only were they small but also they moved quickly, further complicating matters. Once back in the laboratory, many of the collection vials were found to be empty. The majority of *T. brasiliensis* caught and examined did have small white mites on their wing membranes. It was the technical difficulty of removing the mites that is responsible for the under-inflation of the data. It is estimated that at least 80% of the caught bats were infested to some degree with the small white mites.

Molossus molossus had no ectoparasites present. This is consistent with data from a similar study performed two years ago. This species of bat is a colonial dweller and lives in a female roosting colony under the corrugated roofing of the stream house. The most likely explanation for the lack of ectoparasites is that *M. molossus* exhibit allogrooming. This mutual grooming practice allows the bats to remove parasites from hard to reach areas.

In conclusion, I feel that the most significant finding of this study is that the range of ectoparasite dispersal on Dominican bats can vary widely. It covers a broad spectrum from no ectoparasites on *Molossus molossus* to the large numbers and diversity of ectoparasites present on *Artibeus jamaicensis.* Also interesting to note is the fact that more ectoparasites were collected on the male *Artibeus jamaicensis* but a greater ectoparasite specie diversity was observed on the female *A. jamaicensis.* Little is known about the relationship between streblid flies and their bat hosts. This creates a gap in our scientific bank of knowledge that could be filled by subsequent studies. Bats are the most abundant mammalian species and in the future, their importance to ecosystems because of their value in numerous biological roles will come to the forefront of our attention.

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