A Survey of Ectoparasitic Diversity of Bats in Texas

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Abstract:

Bats are a highly speciose group of mammals and play a crucial role in our ecosystems, providing essential services such as pollination, seed dispersal, and pest control. Over one-third of all bat species are assessed as threatened or data deficient. Despite their importance, bats remain a severely understudied group of mammals. Insufficient data causes difficulty when assessing their conservation needs. It is known that bats host a unique array of parasites, some of which are obligate and have evolved with their host. Ectoparasites can restrain resource investment in hosts and may affect their growth, survival, and reproduction. Ectoparasitic loads have been correlated with poor body condition in colonial birds, but for gregarious bat species the associations remain unclear. The goal of this study was to examine ectoparasitic diversity of bats found in Texas. Captured bats were surveyed and thoroughly examined in the field for ectoparasites. Any visible ectoparasites were collected and preserved in isopropyl alcohol for identification using taxonomic keys and microscopes. More gregarious species were expected to have higher ectoparasitic diversity than less gregarious species. Higher ectoparasitic diversity was observed in gregarious species, but this could be a sampling error as more individuals of gregarious species were captured. Little to no ectoparasites were found on species not considered gregarious. Another expectation was larger bats or bats with thicker hairs may host a wider array of parasites; this trend was not observed with our data. More data is needed for cogent conclusions, especially with respect to more solitary species which are underrepresented in this study because the COVID-19 lockdown limited sampling opportunities. Regardless, this study presents an introduction for future researchers interested in which ectoparasites can be found on bats of Texas.

Introduction:

- Declining populations could lead to a significant economic loss for the agriculture industry (3,5).
- Over one-third of all bat species are currently assessed threatened or data deficient. (9).
- Restraining resource investment in hosts may affect host negatively (16, 20).
- Little is known about the effects of ectoparasitism (12).
- Effects of host characteristics on ectoparasite diversity is not well known (7, 11).
- This study is a survey of ectoparasite diversity and is not limited to one taxon.
- Differences in ectoparasite abundance may differ from region to region (8).
- Parasite abundance can be affected by host behavior (8).

- The following are factors that could influence the observation of ectoparasites:

1. Roosting in close quarters promotes exchange of ectoparasites (6, 14).
   - Highly gregarious species may have higher ectoparasitic diversity than solitary species or species that roost in smaller social groups.
2. Fine hair increases aerodynamic abilities and is characteristic of mollosids whereas vespertilionids typically have thick hair (1).
   - Bats with thin, finer hair may have less ectoparasitic diversity than those with thicker, fuller hair.
3. Mollosids tend to be highly gregarious while vespertilionids are not (1).
   - Excluding *Myotis velifer*, mollosids may have more ectoparasites than vespertilionids.
4. Bats in Texas can range from small to medium (1).
   - Bats with larger body size provide more area for ectoparasites allowing an increased chance of greater number and diversity versus bats with smaller bodies.

Methods:

- This survey was conducted during the 2020 field season (March to October).
- Bats were captured via mist nests or hand nets, temporarily stored in separate cloth bags until processed, and released at the site of capture.
- Handling and use of all surveyed bats followed TPWD, USFWS, and IACUC protocols.
- Personal protective equipment was used to prevent transferring White Nose Fungus (*Pseudogymnoascus destructans*) or parasites from one individual to another. Equipment and clothing were decontaminated following USFWS White Nose Decontamination Protocol (18).
- Face masks were used to prevent human transmission of SARS-CoV-2 to bats.
- While surveying, wing and tail membranes were extended over a headlight to illuminate ectoparasites.
- Ectoparasites were removed using tweezers and preserved in 90% isopropyl alcohol until identification. Microscopes were used for identification and followed taxonomic keys (19, 20).

Left: Photo of bats temporarily stored in cloth bags while surveying in a Childress County cave.
Source: Melissa Moreno

Right: Photo of wing membrane being examined for ectoparasites.
Source: Melissa Moreno

Table 1. Species of bats and parasites found during field collections. Parasite orders and families following Dick et al. 2009.

Bat species	Parasite Order	Parasite Family
Corynorhinus townsendii	Diptera	Streblidae
Eptesicus fuscus	None	None
Myotis velifer	Diptera	Streblidae
	Ixodida	Argasidae
	Mesostigmata	Macronyssidae or Spinturnicidae
	Siphonaptera	Ischnopsyllidae
Nycticeius humeralis	None	None
Perimyotis subflavus	None	None
Tadarida brasiliensis	Mesostigmata	Macronyssidae or Spinturnicidae

Corynorhinus townsendii
Source: Melissa Moreno

Figure 1. Percentage of ectoparasites present and absent based on all surveyed bats.

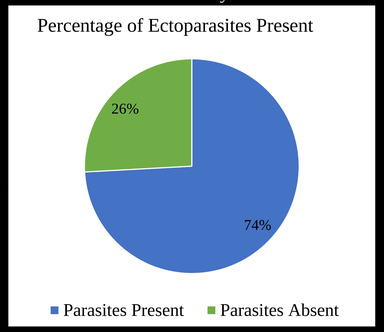
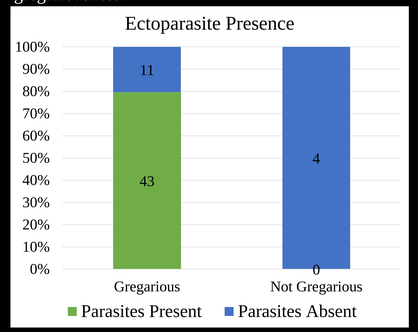


Figure 2. Presence of ectoparasites based on gregariousness.



Tadarida brasiliensis
Source: Julie A. Parlos

Figure 3. Number of *Myotis velifer* bats hosting ectoparasites.

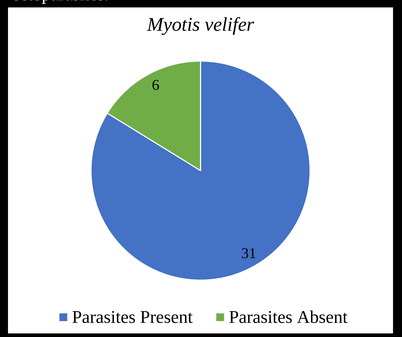
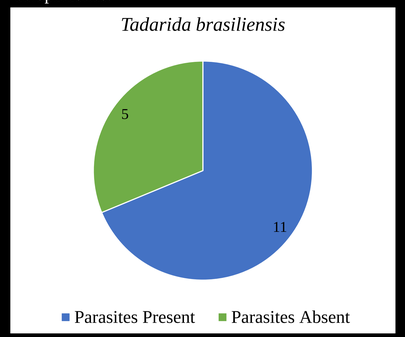


Figure 4. Number of *Tadarida brasiliensis* hosting ectoparasites.



Myotis velifer
Source: Julie A. Parlos

Results:

- Species include a total of 37 *Myotis velifer*, 16 *Tadarida brasiliensis*, two *Eptesicus fuscus*, one *Corynorhinus townsendii*, one *Nycticeius humeralis*, and one *Perimyotis subflavus*.
- 31 of 37 *M. velifer* hosted ectoparasites (Fig. 3).
  - *M. velifer* had the highest ectoparasitic diversity (Table 1).
- 11 of 16 *T. brasiliensis* hosted ectoparasites (Fig. 2).
  - Streblid bat flies were only found on *T. brasiliensis* (Table 1).
- No parasites were found on the collected *E. fuscus*, *N. humeralis*, and *P. subflavus*.

Conclusion:

- Our data suggest highly gregarious species host a larger diversity of ectoparasites.
- Our data does not suggest a relationship between hair thickness and ectoparasite diversity.
- More individuals per species need to be surveyed.
- Unable to statistically evaluate effects of body weight/size on ectoparasite diversity because our field season was reduced due to COVID-19 lockdown.

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