

Bat ectoparasites in Hong Kong and Their Specificity of Host-parasite Interaction

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1. Abstract

The variety of bat flies, an obligate ectoparasite of bat, in Hong Kong as well as the specificity of host-parasite association are investigated in this study. In the 344 bat fly individuals collected, a total of 9 taxon groups is identified based on morphological observation and DNA barcoding results, with the most abundant ones being *Phthiridium* sp. and *Brachytarsina kanoi*. Host specificity of the bat flies greatly varies among different species, with some of them being associated with only one hosts while some are found to be infesting multiple bat genera.

2. Introduction

Bat flies (Diptera: Hippoboscoidea)

- Highly specialized bat ectoparasites in two families: Nycteribiidae and Streblidae¹.
- Spend most their lifetimes on the fur or wing membrane of a bat and feed only on bat's blood¹.

Host specificity of bat flies

- Considered to infest a wide range of host species due to multiple bat species in a single roost and the flight ability of Streblid flies^{1,3}.
- Shown in recent controlled studies that bat flies are highly host-specific, with most of them only associated with a narrow range of congeneric bat species³.
- Degree of specificity varies with bat fly or host morphology, ecology and behaviour³.

Objectives

- To investigate the variety of bat flies in Hong Kong.
- To investigate the host-parasite association between bat flies and their hosts bats, and hence the host specificity of bat flies.



Figure 1: *Hipposideros armiger*; Credit: Hon Shing FUNG

3. Methodology

Step 1: Morphological characterization

Specimens were separated into morphospecies using a compound microscope with reference to literatures and taxonomic keys of other regions^{4,5}.



Step 2: DNA barcoding

DNA was extracted from whole specimen of individuals of selected groups. A region of the mitochondrial cytochrome *c* oxidase subunit I (COI) gene was targeted and amplified for sequencing.



Figure 2: Lateral (left) and dorsal (right) view of a mounted bat fly (Nycteribiidae); Credit: Dr. Simon SIN

4. Result

Table 1: Associations between bats and bat flies in Hong Kong

Bat species (Nb)	Bat fly species (Ne)	Nib	SI
<i>Rhinolophus sinicus</i> (57)	<i>Phthiridium</i> sp. (116)	49	100
	<i>Brachytarsina kanoi</i> (14)	12	11.8
<i>Rhinolophus affinis</i> (8)	<i>Brachytarsina kanoi</i> (16)	6	13.4
	<i>Nycteribia</i> sp. (1)	1	5
<i>Rhinolophus pusillus</i> (2)	Unknown Streblidae sp. (1)	1	1.9
	<i>Nycteribia</i> sp. (1)	1	5
<i>Myotis chinensis</i> (5)	Unknown Streblidae sp. (1)	1	1.9
	<i>Brachytarsina kanoi</i> (7)	4	5.9
<i>Myotis ricketti</i> (17)	<i>Brachytarsina</i> sp. B (1)	1	50
	<i>Brachytarsina kanoi</i> (18)	11	15.1
<i>Miniopterus magnater</i> (24)	<i>Nycteribia</i> sp. (10)	5	50
	<i>Nycteribia allotopa</i> (1)	1	25
	<i>Brachytarsina kanoi</i> (32)	17	26.8
	<i>Penicillidia</i> sp. (11)	9	44
<i>Myotis chinensis</i>	<i>Nycteribia</i> sp. (7)	7	35
	<i>Nycteribia allotopa</i> (4)	3	75
	<i>Brachytarsina</i> sp. B (1)	1	50
<i>Miniopterus schreibersii</i> (1)	<i>Brachytarsina kanoi</i> (2)	1	1.7
	<i>Penicillidia</i> sp. (1)	1	4
<i>Miniopterus pusillus</i> (19)	<i>Brachytarsina kanoi</i> (29)	18	24.4
	<i>Penicillidia</i> sp. (13)	7	52
	<i>Nycteribia</i> sp. (1)	1	5
<i>Hipposideros pomona</i> (23)	Unknown Nycteribiidae sp. (1)	1	100
	<i>Brachytarsina kanoi</i> (1)	1	0.8
<i>Rousettus leschenaultii</i> (3)	Unknown Streblidae sp. (51)	22	96.2
	<i>Brachytarsina</i> sp. A (3)	3	100

Nb: Number of bats; Ne: Number of ectoparasites; Nib: Number of infested bats; SI: Specificity Index

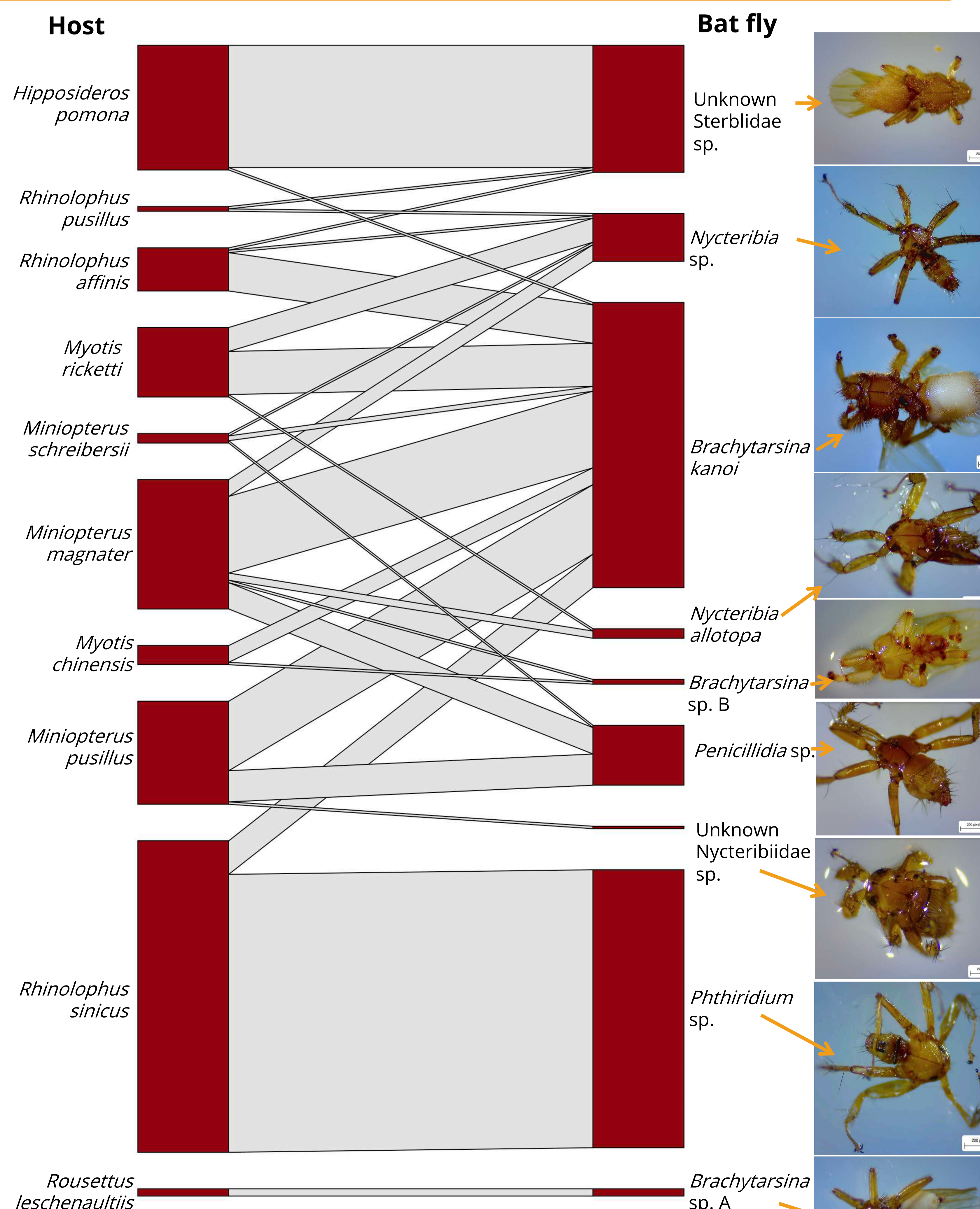


Figure 3: Interaction web between bats and bat flies in Hong Kong. Bar widths are proportional to the number of individual for each group. Photos of the bat fly groups are presented next to their names.

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5. Discussion and Conclusion

- A total of 9 taxon groups of bat flies were discovered from 10 bat species, with most of these genera are well known from the old world and nearby regions⁶.
- Host specificity of bat flies was found to be varying with different species. Different from previous studies, some groups were found to be infesting multiple bat species from different genera, suggesting a possibility in behavioural difference or accidental infestation.