Ectoparasites (Diptera: Streblidae and Nycteribiidae) of bats from some localities of the Coast of Ecuador

Ectoparásitos (Diptera: Streblidae y Nycteribiidae) de murciélagos en algunas localidades de la Costa del Ecuador

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ABSTRACT

In Ecuador, studies of parasitic bat flies are scarce and biased towards the family Streblidae: reports indicate the existence of 50 species, five of them on the western lowlands. In this study, in addition to Streblidae, we include information of the family Nycteribiidae that has not been studied in Ecuador. Both families are associated with bats in several localities of the western lowlands of the country. We used samples from the associated collection of parasites of the Mammalogy Section of the Museo de Zoología at Pontificia Universidad Católica del Ecuador (QCAZ-M), as well as the database of the collection that allowed obtaining information on the host taxa. Thus, 145 individuals of bats of 22 species of the families Phyllostomidae and Vespertilionidae and 424 individuals of 29 species of parasitic flies are reported. Of these, five species are new in Ecuador, 19 are confirmed records in the west and the geographic distribution was extended for species previously reported in this region. *Trichobius joblingi* was the most abundant parasitic fly species and together with *Speiseria ambigua* were associated

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with the greatest number of bat species. Species of the genus *Carollia* were the most abundant and harbored the greatest diversity of flies. The study constitutes the first extensive review of Diptera (Streblidae and Nycteribiidae) in the area and, therefore, contributes to expanding the knowledge of the diversity of ectoparasites of bats in Ecuador.

**Keywords:** bats, ectoparasites, host, parasitic flies, Ecuadorian coast.

**RESUMEN**
En Ecuador, los estudios de moscas parásitas de murciélagos son escasos y sesgados hacia la familia Streblidae: los reportes indican la existencia de 50 especies, cinco de ellas en las tierras bajas del occidente. En este estudio, además de Streblidae, incluimos información de la familia Nycteribiidae que no ha sido estudiada en Ecuador. Las dos familias están asociadas a murciélagos de varias localidades del occidente. Utilizamos muestras de la colección asociada de parásitos de la sección de Mamíferos del Museo de Zoología de la Pontificia Universidad Católica del Ecuador (QCAZ-M), así como de la base de datos de la colección para obtener información de los taxones hospederos. Reportamos 145 individuos de murciélagos de 22 especies de las familias Phyllostomidae y Vespertilionidae y 424 individuos y 29 especies de las moscas parásitas. De ellas, cinco especies son nuevos registros para Ecuador, 19 son registros confirmados en el Litoral y ampliamos la distribución geográfica para especies previamente reportadas en esta región. *Trichobius joblingi* fue la especie de mosca parásita más abundante y, en conjunto con, *Speiseria ambigua*, se asociaron con el mayor número de especies de murciélagos. Las especies de murciélagos del género *Carollia* fueron las más abundantes y albergaron la mayor diversidad de moscas. El estudio constituye la primera revisión extensa de dipteros (Streblidae y Nycteribiidae) de la zona y, por consiguiente, contribuye a mejorar el conocimiento de la diversidad de ectoparásitos de murciélagos en Ecuador.

**Palabras claves:** ectoparásitos, hospedero, murciélagos, moscas parásitas, Costa ecuatoriana.

**INTRODUCTION**
Ectoparasites are organisms that can adhere and introduce themselves to the skin or its excretions for variable periods (Hopla et al., 1994). They are mainly part of the phylum Arthropoda and are made up of different taxonomic groups, such as fleas (Siphonaptera), lice (Phthiraptera), flies (Diptera), bedbugs (Hemiptera), ticks (Ixodida), and mites (Mesostigmata) (Sánchez et al., 2020).

A characteristic of ectoparasites is the ability to establish associations in the host to protect themselves from the external environment and changes in temperature and humidity, factors that determine their life cycle (Amat-Valero et al., 2013). They use the host as a means of transport to new and suitable habitats, increasing their dispersal capacity (Baumann, 2018).

Around 6000 species of insects have been reported worldwide as external parasites of warm-blooded vertebrates; of these, 742 parasitize bats (Haelewaters et al., 2018; Marshall, 1982). In accordance with the most recent catalogues, Central and South America are inhabited by a comprehensive array of 273 ectoparasite species associated with bats, comprising 187 species of flies (141 belonging to the family Streblidae and 46 within Nycteribiidae), eight flea species, four bedbug species, and 74 mites and tick species (Frank et al., 2014).

It is noteworthy that the families Streblidae and Nycteribiidae have been the primary focus of research in the Neotropical region. As evidenced by various publications, 68 species have been documented in Peru (Minaya et al., 2021), 82 in Colombia (Dick et al., 2016; Graciolli et al., 2016; Pastrana-Montiel et al., 2019), 130 in Venezuela (Guerrero, 2019; Guimarães, 1972; Wenzel, 1976), and 119 in Brazil (Graciolli & Hrycyna, 2023; Hrycyna et al., 2019).

In Ecuador, 59 species of bat ectoparasites have been reported; among these, 54 correspond to the order Diptera (families Streblidae and Nycteribiidae), two belong to the order Prostigmata (Trombiculidae and Myobiidae),
two conform the order Mesostigmata (Macro- 
nyssidae and Spinthriuricidae), and one is mem-
ber of the order Siphonaptera (Ischnopsyllidae) 
(Camacho et al., 2014; Correa et al., 2019; Espinoza, 
2020; Guerrero, 1997; Guimarães & D’Andretta, 
1956; Liu et al., 2020; Salgado, 2019; Stamper, 
2012; Tello, 2005). Of these species, five are located 
on the Ecuadorian Coast and belong to the family Streblidae (Correa et 
al., 2019; Liu et al., 2020; Tello, 2005).

Of the studies, only Salgado (2019), Stamp-
er (2012), and Tello (2005) focused directly on 
the study of ectoparasites and bats in Ecuador. It is 
important to note that research on this topic, 
even more so those focused on the Coast, 
are scattered in time, very scarce, primarily fo-
cused on dipterous of the family Streblidae and, 
therefore, exclude information on other fami-
lies and orders presents in the country and their 
association with different species of bats. This 
is due to two essential aspects: the findings of 
Streblidae in bats are better documented and this 
is the ectoparasite family with the highest spe-
cies richness and most abundant in the Western 
Hemisphere (Calonge-Camargo & Pérez-Torres, 
2018; Reeves et al., 2016; Santos et al., 2016).

The present study consists of an extensive 
and detailed review covering a larger number 
of bat species, their parasitic bat flies, and sev-
eral coastal areas duly associated with the host 
collection site. In this sense, the objective is 
to identify the diversity of ectoparasites of the 
families Streblidae and Nycteribiidae associat-
ed with bats in some localities on the Coast of 
Ecuador.

MATERIALS AND METHODS

Sample

The study sample came from the associated col-
lection of ectoparasites of the Mammalogy Sec-
tion of the Museo de Zoología at Pontificia Uni-
versidad Católica del Ecuador (QCAZ-M) and, 
specifically, those that registered collection sites 
on the Ecuadorian Coast. The sample, being con-
formed by a collection of ectoparasites of 
bats, contained specimens of different species, 
so it was necessary to carry out a first revision 
to isolate the parasitic bat flies of the families 
Streblidae and Nycteribiidae from the rest of the 
ectoparasites.

We obtained most of the samples from the 
project “Caracterización de la Diversidad Bi-
ológica y Genética de los Mamíferos del Ecuador” carried out in 2017; a smaller proportion 
came from the project “Prevalencia y Diversi-
dad Genética de Coronavirus en Murciélagos del Ecuador” carried out in 2021, and only one 
 specimen came from a different project.

Taxonomic identification

We used a stereo microscope to identify speci-
mens to the genus level, and an optical micro-
scope to observe in detail the specific structures 
required for species identification. In this process, 
we used several morphological keys (Graciolli, 
2004; Guerrero, 1994a, 1994b, 1995a, 1995b, 
1996, 1998, 2019; Guimarães & D’Andretta, 
1956; Jobling, 1936; Peterson, 1959; Theodor, 

We took microscopic photographs based on 
distinctive taxonomic characters to compare 
more than two species of the same genus. For 
species in Streblidae, we photographed the tho-
rax, head, and wings, in addition to capturing 
images of the entire body for genera with only 
one species. For species of Nycteribiidae, we fo-
cused on taking pictures of the abdomen.

Host information, including identification to 
species level and site of capture, was obtained 
from the QCAZ-M database (https://bioweb. 
.bio/faunaweb/mammaliaweb/). We needed to 
identify some bat specimens that were only 
available at the genus level. For this, we used 
the taxonomic key of Díaz et al. (2021).

The annotated list of bat fly species is pre-
sented as family, subfamily, genus, and species. 
The details of each species are divided into three 
sections: the first includes information about the 
number of specimens reviewed, locality, col-
lection date, sex of bat flies, and host species; 
the second corresponds to diagnostic characters, 
which can be reviewed in detail in the publica-
tions of Guerrero (2019), Guimarães & D’An-
dretta (1956), Wenzel (1976) and Wenzel at al. 
(1966). The third section provides information
on host-parasite interactions according to bibliographic records, as well as relevant findings.

We have maintained the phylogenetic order proposed by Guerrero (2019) in one of his most current works on the family Streblidae. The species of the family Nycteribiidae are organized alphabetically.

The nomenclature for bat host species follows Tirira et al. (2022). The species of bat flies belonging to the families Streblidae and Nycteribiidae, aligns with the nomenclature of Guerrero (2019) and Guimarães & D’Andretta (1956), respectively.

Appendix 1 presents a toponymic index, with all the localities referred to in the text, as well as the species of bat flies and their geographic distribution reported in this study.

RESULTS

Diversity

We recorded 424 parasitic bat flies belonging to nine genera and 26 species of the family Streblidae, and one genus and three species of the family Nycteribiidae. The most abundant bat fly species were *Trichobius joblingi* (24%) and *Basilia ferrisi* (21%) (Table 1).

In terms of bat hosts, we obtained information from 145 individuals of two families, 13 genera and 22 species (Phyllostomidae, n = 18; Vespertilionidae, n = 4). *Carollia brevicauda* (15%), *C. perspicillata* (14%), and *C. castanea* (12%) were the most abundant species (Table 1; Figure 1).

In the context of host-parasite interactions, *Trichobius joblingi* and *Speiseria ambigua* were associated with the highest number of host species: five each (Table 1). Similarly, *Carollia brevicauda*, *C. castanea*, and *Glossophaga soricina* harbored five species of parasitic flies (Figure 1).

NEW RECORDS

Of the 29 species analyzed, five (17%) are new records for Ecuador, 19 (66%) are confirmed records from the Ecuadorian Coast, and three (10%) correspond to previous report in other regions of Ecuador (Sierra and Amazonia). In addition, we were not able to determine the species for two morphotypes from *Trichobius* (Streblidae) and *Basilia* (Nycteribiidae) (Table 1).

We report the presence of Streblidae and Nycteribiidae species in nine localities distributed in Esmeraldas, Manabi, Santo Domingo de los Tsáchilas, Los Ríos, and El Oro, provinces (Figure 2). Records in Manabi and Los Ríos correspond to new distribution data for *Strebla altmani*, *Speiseria ambigua*, and *Trichobius joblingi*.

ANNOTATED LIST OF ECTOPARASITE SPECIES

**Family Streblidae Kolenati, 1863**

**Subfamily Trichobiinae Jobling, 1936**

**Genus Trichobius Gervais, 1844**

*Trichobius uniformis* Curran, 1935

Figure 3A

Material examined [6]: **Manabi**: El Carmen, El Carmen, comunidad El Zapote; 23.XI.2021, 1♂, 1♀ ex *Glossophaga soricina*; 25.XI.2021, 1♂, 1♀ ex *Glossophaga soricina*; 26.XI.2021, 1♂ ex *Lonchophylla concava* • **Los Ríos**: Buena Fe, Patricia Pilar, Centro Científico Río Palenque; 22.VII.2017, 1♂ ex *Glossophaga soricina*.

Identification: The species was identified from the presence of setae on the basal angle of vein 6 of the wing. In addition, vein R1 is straight, and each occipital lobe has a tubercle on the posterior edge (Guerrero, 1994a).

Remarks: *Trichobius uniformis* is a characteristic species of the genus *Glossophaga*, particularly associated with *Glossophaga soricina* (Cuxim-Koyoc et al., 2018; Wenzel, 1976), which is the same host reported from Ecuador (Stamper, 2012). In this study, we found this species in association with *Lonchophylla concava*.

*Trichobius longipes* (Rudow, 1871)

Figure 3B

Material examined [1]: **Los Ríos**: Buena Fe, Patricia Pilar, Centro Científico Río Palenque; 25.VII.2017, 1♂ ex *Phyllostomus hastatus*.

Identification: This species is distinguished by short setae along the anterior margin of the prescutum and long ones along the midline. Also, those found in the lateral rows are longer compared to those found in the center (Guerrero, 1994a, 2019).
Table 1. Host taxon association and parasitic bat flies in some localities of the Ecuadorian Coast.

<table>
<thead>
<tr>
<th>Parasitic bat flies</th>
<th>Type of report</th>
<th>N</th>
<th>Host</th>
<th>N</th>
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<td></td>
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<tr>
<td>Trichobius uniformis</td>
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<td>Glossopha soricina</td>
<td>4</td>
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<tr>
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<td>5</td>
<td>Glossopha soricina</td>
<td>4</td>
</tr>
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<td>Glossopha soricina</td>
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<td><em>Artibeus lituratus</em></td>
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| **Family Nycteribiidae** |               |     |                             |     |
| **Subfamily Nycteribiinae** |             |     |                             |     |
| Basilia carteri        | a             | 7   | *Myotis albescens*          | 1   |
|                       |               |     | *Myotis nigricans*          | 1   |
| Basilia ferrisi        | b             | 88  | *Glossophaga soricina*      | 1   |
|                       |               |     | *Myotis diminutus*          | 15  |
|                       |               |     | *Myotis nigricans*          | 6   |
|                       |               |     | *Myotis riparius*           | 12  |
| Basilia sp.            | d             | 2   | *Myotis riparius*           | 1   |
| Total                 |               | 424 |                             | 145 |

N: Number of individuals.  
B: Report confirmed for the Coast region.  
C: Previous report in the Ecuadorian Sierra and Amazonia.  
D: Species not determined.

Remarks: Although *Phyllostomus hastatus* is the characteristic host of *Trichobius longipes* (Wenzel, 1976), several species of the family Phyllostomidae have been reported as hosts in Ecuador (Stamper, 2012).

*Trichobius costalimai* Guimarães, 1938

Figure 3C

Material examined [11]: **Manabí**: El Carmen, El Carmen, comunidad El Zapote; 27.XI.2021, 2♂, 2♀ ex *Phyllostomus discolor* • **Los Ríos**: Buena Fe, Patricia Pilar, Centro Científico Río Palenque; 21.VII.2017, 7♂ ex *Phyllostomus discolor*.

Identification: It is possible to differentiate between 10 to 12 setae in the anterolateral region of the prescutum and short setae between the transverse and median sutures of the mesonotum. These characteristics are exclusive to this species (Guerrero, 1994a).

Remarks: *Phyllostomus discolor* is the main host of *Trichobius costalimai* (Wenzel, 1976), also occurring in Ecuador (Stamper, 2012).

*Trichobius dugesii* Townsend, 1891

Figure 3D

Material examined [5]: **Esmeraldas**: Eloy Alfaró, La Tola, Finca Cocadilla; 21.VIII.2017, 1♂, 2♀ ex *Glossophaga soricina* • Eloy Alfaró, La Tola, Centro de Interpretación Majagual; 19.VIII.2017, 1♀ ex *Glossophaga soricina*; 22.VIII.2017, 1♀ ex *Glossophaga soricina*.  

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Identification: The antescutellar setae of *Trichobius dugesii* are shorter, and the setae of the prescutum are gradually reduced towards the discal area. Also, behind the lateral lobe of tergum 1+2, no long setae are evident in females, but in males, sternum 6 is present (Guerrero, 1995a).

Remarks: *Glossophaga soricina* is considered the main host of *Trichobius dugesii* (Dick & Gettinger, 2005). However, in Ecuador, it is also found on *Artibeus fraterculus* and *Carollia brevicauda* (Stamper, 2012).

*Trichobius joblingi* Wenzel, 1966

Material examined [100]: **Esmeraldas**: Eloy Alfaro, La Tola, Finca Cocadilla; 21.VIII.2017, 2♂ ex *Carollia perspicillata* • Eloy Alfaro, La Tola, Centro de Interpretación Majagual; 21.VIII.2017, 1♂ ex *Glossophaga soricina*, 1♂ ex *Carollia perspicillata* • Eloy Alfaro, Luis Vargas Torres, Playa de Oro; 25.VIII.2017, 1♂, 3♀ ex *Carollia perspicillata* • Quinindé, Rosa Zárate, Jaboncillo, Finca La Esperanza; 09.IX.2021, 4♂, 5♀ ex *Carollia brevicauda*, 1♂ ex *Carollia castanea*, 3♀, 1♀ ex *Carollia perspicillata* • **Manabí**: El Carmen, El Carmen, comunidad El Zapote; 20.XI.2021, 2♂, 1♀ ex *Carollia brevicauda*; 25.XI.2021, 3♂,
Figure 2. Collection localities of bats and their ectoparasites in the provinces of Esmeraldas, Manabí, Santo Domingo de los Tsáchilas, Los Ríos, and El Oro.

2♀ ex Carollia brevicauda; 26.XI.2021, 4♂ ex Carollia brevicauda; 20.XI.2021, 1♀ ex Carollia castanea; 24.XI.2021, 3♂ ex Carollia castanea; 25.XI.2021, 1♂ ex Carollia castanea; 26.XI.2021, 1♂, 2♀ ex Carollia castanea; 19.XI.2021, 1♂, 1♀ ex Carollia perspicillata; 23.XI.2021, 3♂, 5♀ ex Carollia perspicillata; 24.XI.2021, 1♂, 1♀ ex Carollia perspicillata; 26.XI.2021, 1♂, 2♀ ex Carollia perspicillata; 19.XI.2021, 1♂ ex Myotis riparius • Los Ríos: Buena Fe, Patricia Pilar, Centro Científico Río Palenque; 22.VII.2017, 6♂, 6♀ ex Carollia brevicauda; 23.VII.2017, 1♂, 2♀ ex Carollia brevicauda; 25.VII.2017, 4♂, 2♀ ex Carollia brevicauda; 21.VII.2017, 2♂, 1♀ ex Carollia castanea; 24.VII.2017, 3♂, 3♀ ex Carollia castanea; 22.VII.2017, 2♂, 5♀ ex Carollia perspicillata; 23.VII.2017, 1♂ ex Carollia perspicillata; 25.VII.2017, 3♂ ex Carollia perspicillata.
Identification: It is possible to differentiate *Trichobius joblingi* by the combination of short and long setae on the antescutellar row and prescutellar setae that gradually shorten to the discal area. Behind the lateral lobe of tergum 1+2 there are two to five long setae in females, while sternum 6 is observed in the males (Guerrero, 1995a).

Remarks: According to Wenzel (1976), *Carollia perspicillata* is the characteristic host of *Trichobius joblingi*, although in Ecuador it is also reported in 10 species of the families Phyllostomidae and Vespertilionidae (Stamper, 2012; Tello, 2005). In this study, we report *Trichobius joblingi* associated with *Glossophaga soricina* and *Myotis riparius*; for the first species, there are no previous mentions of this type of association.

*Trichobius parasiticus* Gervais, 1844
Figure 3F
Material examined [2]: *El Oro*: Zaruma, Zaruma, Cerro Zaruma Urcu; 2♂ ex Platyrhinus sp. Identification: The mesonotum of *Trichobius parasiticus* has distinctive characteristics that make it easy to recognize, such as long setae on the anterolateral angles of the prescutum, short setae arranged in a row anterior to the transverse suture and the antescutellar row (Guerrero, 1995a).

Remarks: According to Wenzel (1976), the primary host of *Trichobius parasiticus* is *Desmodus rotundus*, but it has also been documented in *Glossophaga soricina* in Ecuador (Stamper, 2012).

*Trichobius dugesioides* Wenzel, 1966
Figure 3G
Material examined [25]: *Los Ríos*: Buena Fe, Patricia Pilar, Centro Científico Río Palenque; 21.VII.2017, 2♂, 2♀ ex *Trachops cirrhosus*; 25.VII.2017, 1♂, 1♀ ex *Carollia brevicauda*, 2♂ ex *Lonchorhina aurita*; 26.VII.2017, 9♂, 8♀ ex *Trachops cirrhosus*.

Identification: *Trichobius dugesioides* can be identified by the row of antescutellar setae slightly longer than those preceding it. In addition, sternite 7 has 13 to 14 setae in females, and tergite 9 has 17 to 18 setae in males (Guerrero, 1998).

Remarks: *Trachops cirrhosus* is the main host species of this parasite (Wenzel, 1976). However, in Ecuador, it was also associated with *Phyllostomus elongatus* (Stamper, 2012). In this study, we found this species in association with *Lonchorhina aurita* and *Carollia brevicauda*.

*Trichobius flagellatus* Wenzel, 1976
Figure 3H
Material examined [14]: *Manabí*: El Carmen, El Carmen, comunidad El Zapote; 19.XI.2021, 3♂, 7♀ ex *Lonchorhina aurita* • *Los Ríos*: Buena Fe, Patricia Pilar, Centro Científico Río
Palenque; 25.VII.2017, 2♂, 2♀ ex Lonchorhina aurita.
Identification: In this species, the setae of the antescutellar row are the same size as those preceding them. Also, very small setae are found behind the lateral lobes of tergum 1+2 of females and males have 22 to 25 setae on tergum 9 (Guerrero, 1995a).
Remarks: Lonchorhina aurita is the main host of Trichobius flagellatus (Wenzel, 1976).

Trichobius anducei Guerrero, 1998

Figure 3I
Material examined [14]: Esmeraldas: Eloy Alfaro, Luis Vargas Torres, Playa de Oro; 25.VIII.2017, 1♂ ex Carollia perspicillata • Manabí: El Carmen, El Carmen, comunidad El Zapote; 20.XI.2021, 1♀ ex Carollia brevicauda; 23.XI.2021, 1♀ ex Carollia perspicillata; 24.XI.2021, 1♂, 1♀ ex Carollia brevicauda, 1♀ ex Carollia castanea; 26.XI.2021, 1♂ ex Carollia perspicillata • Los Ríos: Buena Fe, Patricia Pilar, Centro Científico Río Palenque; 22.VII.2017, 1♂ ex Carollia brevicauda; 23.VII.2017, 1♀ ex Carollia brevicauda; 25.VII.2017, 1♂, 1♀ ex Carollia castanea, 3♂ ex Carollia perspicillata.
Identification: Females of Trichobius anducei differ in having a more extended band of setae on the lateral margin of the abdomen, as well as 9 to 11 setae on sternite 7. In contrast, the tergite 9 of males has 11 to 12 setae (Guerrero, 1998).
Remarks: Trichobius anducei parasitizes mainly Carollia perspicillata (Guerrero, 2019; Hiller et al., 2021); however, in Ecuador, it was also associated with Carollia brevicauda (Stamper, 2012). Furthermore, in this study, we document that Trichobius anducei parasitizes Carollia castanea.

Trichobius sp. (complex dugesii)

Figure 3J
Remarks: We were unable to identify this species; however, it has specific characteristics close to Trichobius angulatus such as the angled transverse suture, prescutellar setae shortening towards the center and setae of the antescutellar row longer than the predecessors (Guerrero, 1995a).

Genus Trichobioides Wenzel, 1966
Trichobioides perspicillatus (Pessôa & Galvao, 1937)

Figure 4
Material examined [15]: Manabí: El Carmen, El Carmen, comunidad El Zapote; 23.XI.2021, 5♂, 2♀ ex Phyllostomus discolor; 26.XI.2021, 1♂ ex Carollia castanea; 27.XI.2021, 2♂, 2♀ ex Phyllostomus discolor • Los Ríos: Buena Fe, Patricia Pilar, Centro Científico Río Palenque; 21.VII.2017, 2♂, 1♀ ex Phyllostomus discolor.
Identification: There is only one species in the genus Trichobioides. Although it is very similar to Trichobius, the difference lies in the median suture that extends to the transverse suture but does not unite. Also, a row of short and long antescutellar setae is present (Guerrero, 1994b).
Remarks: According to Wenzel (1976), Trichobioides perspicillatus is the parasite commonly associated with Phyllostomus discolor, a situation also evidenced by Stamper (2012) in Ecuador. In this study, we found an association with Carollia castanea that has not previously documented.

Figure 4. Trichobioides perspicillatus. Scale bars = 2 mm.
Genus *Speiseria* Kessel, 1925

*Speiseria ambigua* Kessel, 1925

Figure 5

Material examined [23]: *Esmeraldas*: Eloy Alfaro, La Tola, Finca Cocadilla; 21.VIII.2017, 1♂, 1♀ ex *Glossophaga soricina*, 1♀ ex *Carollia perspicillata* • Eloy Alfaro, La Tola, Centro de Interpretación Majagual; 21.VIII.2017, 1♂ ex *Carollia perspicillata* • Eloy Alfaro, Luis Vargas Torres, Playa de Oro; 25.VIII.2017, 1♀ ex *Carollia castanea*, 1♂, 1♀ ex *Carollia perspicillata* • *Manabí*: El Carmen, El Carmen, comunidad El Zapote; 19.XI.2021, 1♂ ex *Lonchorhina aurita*; 20.XI.2021, 1♂, 1♀ ex *Carollia castanea*; 23.XI.2021, 1♂ ex *Carollia castanea*; 24.XI.2021, 1♂ ex *Carollia brevicauda*, 1♀ ex *Carollia castanea*, 1♀ ex *Carollia perspicillata*; 25.XI.2021, 1♂ ex *Carollia castanea* • *Los Ríos*: Buena Fe, Patricia Pilar, Centro Científico Río Palenque; 22.VII.2017, 3♂, 2♀ ex *Carollia brevicauda*, 1♀ ex *Carollia castanea*; 25.VII.2017, 1♂, 1♀ ex *Carollia perspicillata*.

Identification: In this species, females are distinguished by having tergum 7 longer than the supra-anal plate and with parallel sides. In contrast, males exhibit strongly curved postgonites and tergum 9 between nine and ten setae (Guererro, 1994b).

Remarks: According to Wenzel (1976), *Speiseria ambigua* infests mainly *Carollia perspicillata*; but in Ecuador, it was also associated with several species of the family Phyllostomidae and with greater incidence in bats of the genus *Carollia* (Stamper, 2012; Tello, 2005). Additionally, during the research, we documented a new association with *Glossophaga soricina*.

Genus *Paratrichobius* Costa Lima, 1921

*Paratrichobius longicrus* (Miranda-Ribeiro, 1907)

Figure 6A

Material examined [2]: *Los Ríos*: Buena Fe, Patricia Pilar, Centro Científico Río Palenque; 25.VII.2017, 1♂, 1♀ ex *Artibeus lituratus*.

Identification: The relevant characteristics of this species are the rounded anterior angles on the pronotum and the internal face of the proemurs covered only by small setae accompanied by a row of six thick spines (Guerrero, 1994b).

Remarks: *Artibeus lituratus* is the characteristic host of *Paratrichobius longicrus* (Dick &
Gettinger, 2005; Wenzel, 1976), and the same host has been reported in Ecuador (Stamper, 2012).

*Paratrichobius dunni* (Curran, 1935)

Figure 6B
Material examined [4]: **Manabí**: Manta, San Lorenzo, Refugio de Vida Silvestre Marino Costera Pacoche; 09.IX.2017, 1♂, 3♀ ex *Urodema convexum*.

Identification: *Paratrichobius dunni* was identified by the straight anterior angles of the pronotum and its profemurs, with two to three short spines extending parallel to a line of six thick spines on the inner side (Guerrero, 1994b).

Remarks: It is mainly found in species of the genus *Uroderma*, especially in *Uroderma bilobatum* (Guerrero, 2019; Hiller et al., 2021).

Genus *Megistopoda* Macquart, 1852

*Megistopoda aranea* (Coquillett, 1899)

Figure 7A
Material examined [8]: **Manabí**: Manta, San Lorenzo, Refugio de Vida Silvestre Marino Costera Pacoche; 09.IX.2017, 1♂, 1♀ ex *Artibeus fraterculus* • **El Carmen**: El Carmen, El Carmen, comunidad El Zapote; 19.XI.2021, 1♀ ex *Platyrhinus umbratus* • **Los Ríos**: Buena Fe, Patricia Pilar, Centro Científico Río Palenque; 22.VII.2017, 3♂, 1♀ ex *Artibeus lituratus*.

Identification: This species has narrow wings with four longitudinal veins, long hind legs, and a scutellum with two macrosetae (Guerrero, 1994b).

Remarks: Dick & Gettinger (2005) state that *Artibeus fimbriatus* and *A. jamaicensis* are the primary hosts of *Megistopoda aranea*. However, Stamper (2012) indicates that in Ecuador, it has been reported in association with several species of the family Phyllostomidae. In addition, in the study, we document the association with *Platyrhinus umbratus*.

*Megistopoda proxima* (Seguy, 1926)

Figure 7B
Material examined [9]: **Esmeraldas**: Quinindé, Rosa Zárate, Jaboncillo, Finca La Esperanza; 09.IX.2021, 1♂ ex *Sturnira bakeri* • **Manabí**: El Carmen, El Carmen, comunidad El Zapote; 25.XI.2021, 3♀ ex *Sturnira bakeri*; 26.XI.2021, 1♀ ex *Sturnira bakeri*; 26.XI.2021, 1♀ ex *Sturnira bakeri* • **El Carmen**: El Carmen, El Carmen, comunidad El Zapote; 19.XI.2021, 3♀, 1♂ ex *Artibeus fraterculus* • **Los Ríos**: Buena Fe, Patricia Pilar, Centro Científico Río Palenque; 22.VII.2017, 1♂ ex *Sturnira bakeri*; 25.VII.2017, 1♀ ex *Sturnira bakeri*; 27.VII.2017, 1♀ ex *Sturnira bakeri*.

Identification: *Megistopoda proxima* is distinguished by its broad wings with six longitudinal veins and the scutellum with four macrosetae (Guerrero, 1994b).

Remarks: Dick and Gettinger (2005) mention that *Sturnira lilium* is the main host of *Megistopoda proxima*. However, in Ecuador, it is also found in different species of the genus *Sturnira* (Stamper, 2012).

Genus *Aspidoptera* Coquillett, 1899

*Aspidoptera phyllostomatis* (Perty, 1833)

Figure 8A
Material examined [5]: **Manabí**: Manta, San Lorenzo, Refugio de Vida Silvestre Marino Costera Pacoche; 09.IX.2017, 2♂, 2♀ ex *Artibeus fraterculus* • 11.IX.2017, 1♀ ex *Artibeus fraterculus*.

Identification: Unlike *Aspidoptera falcata*, the mesepisternum of this species exhibits long setae on the dorsal side and shorter on the periphery. Likewise, the supra-anal plate of females has a short seta; in males, the postgonites are slightly curved (Guerrero, 1995b).
Remarks: *Aspidoptera phyllostomatis* is mainly found in *Artibeus jamaicensis* (Wenzel, 1976). However, in Ecuador, we reported in other species of the genus *Artibeus* (Stamper, 2012).

*Aspidoptera falcata* Wenzel, 1976  
Figure 8B  
Material examined [2]: Manabí: El Carmen, El Carmen, comunidad El Zapote; 26.XI.2021, 1♂, 1♀ ex *Sturnira ludovici*.  
Identification: In contrast to *Aspidoptera phyllostomatis*, this species has a more setose appearance and the setae on the dorsal surface of the mesepisternum are long. In addition, in females, the supra-anal plate includes six apical macrosetae and a short seta on each side of the anterior ones; on the other hand, males have very curved postgonites (Wenzel et al., 1966; Wenzel, 1976).

Remarks: Although *Sturnira lilium* is the primary host of *Aspidoptera falcata* (Dick & Gettinger, 2005), most of the parasitized species in Ecuador belong to the genus *Sturnira* (Stamper, 2012).

Genus *Exastinion* Wenzel, 1966  
*Exastinion clovisi* (Pessôa & Guimarães, 1936)  
Figure 9  
Material examined [1]: Manabí: El Carmen, El Carmen, comunidad El Zapote; 19.XI.2021, 1♀ ex *Carollia castanea*.  
Identification: This species is characterized by the presence of eight setae on the scutum, and a very setose area on sternum 2 that extends anteriorly to the middle. In addition, females have a group of five setae on the abdominal connexivum that are longer than the following ones (Wenzel, 1976).  
Remarks: In this study, we document that *Exastinion clovisi* parasitizes *Carollia castanea*; Stamper (2012) also evidenced its association with *Glossophaga soricina* in Ecuador. The characteristic host is *Anoura geoffroyi* (Guerrero, 2019).

Subfamily Streblinae Jobling, 1936

Genus *Strebla* Wiedemann, 1824  
*Strebla mirabilis* (Waterhouse, 1879)  
Figure 10A  
Material examined [21]: Los Ríos: Buena Fe, Patricia Pilar, Centro Científico Río Palenque; 21.VII.2017, 1♂ ex *Trachops cirrhosus*;
26.VII.2017, 8♂, 12♀ ex Trachops cirrhosus. Identification: Unlike other species, Strebla mirabilis has eyes with several facets, a pointed anterior end of the postvertex that forms an angle close to 90 degrees and, finally, all setae are strong. In addition, the metatibia has two to three macrosetae; and on the mesonotum, between the transverse and pigmented suture, three rows of setae are located (Guerrero, 2019; Wenzel et al., 1966).

Remarks: Although Strebla mirabilis is commonly associated with Trachops cirrhosus (Wenzel, 1976), hosts in Ecuador include several species of the family Phyllostomidae (Stampfer, 2012).

Strebla guajiro (Garcia & Casal, 1965)
Figure 10B
Material examined [16]: Esmeraldas: Quinindé, Rosa Zárate, Jaboncillo, Finca La Esperanza; 09.IX.2021, 1♂ ex Carollia brevicauda • Eloy Alfaro, La Tola, Finca Cocadilla; 21.VIII.2017, 1♂ ex Carollia perspicillata • Eloy Alfaro, La Tola, Centro de Interpretación Majagual; 21.VIII.2017, 1♀ ex Carollia perspicillata • Eloy Alfaro, Luis Vargas Torres, Playa de Oro; 25.VIII.2017, 1♀ ex Carollia perspicillata • Manabí: El Carmen, El Carmen, comunidad El Zapote; 25.XI.2021, 1♂, 1♀ ex Carollia brevicauda; 26.XI.2021, 1♀ ex Carollia perspicillata • Los Ríos: Buena Fe, Patricia Pilar, Centro Científico Rio Palenque; 22.VII.2017, 5♂, 4♀ ex Carollia brevicauda.

Identification: The anterior end of the postvertex of Strebla guajiro is more rounded than in other species and forms an angle of fewer than 90 degrees. All its setae are strong, and two to three rows are found between the transverse and pigmented suture, as well as two or three mac-
rosetae on the metatibia (Guerrero, 1996; Wenzel et al., 1966).
Remarks: *Strebla guajiro* is mainly associated with *Carollia perspicillata* (Dick & Gettinger, 2005; Wenzel, 1976). In the case of Ecuador, it usually also parasitizes several species of the family Phyllostomidae, especially bats of the genus *Carollia* (Stamper, 2012; Tello, 2005).

*Strebla hertigi* Wenzel, 1966
Figure 10C
Material examined [2]: Manabí: El Carmen, El Carmen, comunidad El Zapote; 23.XI.2021, 1♀ ex *Phyllostomus hastatus*; 27.XI.2021, 1♂ ex *Phyllostomus discolor*.
Identification: *Strebla hertigi* has a distinctive subquadrate postvertex, the anterior end of which forms an angle greater than 120 degrees; in addition, the internal setae of the occipital plates are short; there are three rows of setae located between the transverse and pigmented sutures on the mesonotum; finally, the metatibia has two to three macrosetae (Guerrero, 1996; Wenzel et al., 1966).
Remarks: *Strebla hertigi* is a characteristic parasite of *Phyllostomus discolor* (Wenzel, 1976). According to Stamper (2012), this species is associated with *Phyllostomus discolor* and *Phyllostomus hastatus* in Ecuador.

*Strebla galindoi* Wenzel, 1966
Figure 10D
Identification: It is possible to recognize this species by several characteristics: it has eight facets on the eyes; the anterior end of the postvertex forms an angle greater than 120 degrees; its setae are thin and elongated; before the pigmented suture on the mesonotum, a row of longer setae stands out; finally, it has three large setae on the metatibia (Guerrero, 1996).
Remarks: *Tonatia bidens* is the characteristic host of *Strebla galindoi* (Wenzel, 1976). In Ecuador, this species parasitizes those of the genus *Tonatia* (Stamper, 2012).

*Strebla machadoi* Wenzel, 1966
Figure 10E
Material examined [2]: Santo Domingo de los Tsáchilas: Santo Domingo de los Colorado, Alluriquin, La Unión del Toachi; 09.IX.2017, 2♂ ex *Micronycteris simmonsae*.
Identification: *Strebla machadoi* has eyes with a single facet, a postvertex with a pointed anterior end forming an angle of fewer than 45 degrees, and two dorsal rows containing six to eight setae longer than the rest on the metatibia (Guerrero, 1996; Wenzel et al., 1966).
Remarks: *Strebla machadoi* parasitizes some species of *Micronycteris* (Guerrero, 2019).

*Strebla altmani* Wenzel, 1966
Figure 10F
Material examined [5]: Manabí: El Carmen, El Carmen, comunidad El Zapote; 19.IX.2021, 2♂, 1♀ ex *Lonchorhina aurita*; Los Ríos: Buena Fe, Patricia Pilar, Centro Científico Río Palenque; 25.VII.2017, 1♂, 1♀ ex *Lonchorhina aurita*.
Identification: This species is distinguished by the following characteristics: six facets are identified on the eyes; the anterior end of the postvertex is pointed and forms an angle close to 90 degrees; the internal setae of the occipital plates are very short and thin; between the transverse and pigmented suture of the mesonotum there are two to three rows of setae; finally, two of the setae of the metatibia are noticeably longer (Guerrero, 1996).
Remarks: *Lonchorhina aurita* is the characteristic host of *Strebla altmani* (Guerrero, 2019).

Genus Metelasmus Coquillett, 1907
*Metelasmus pseudopterus* Coquillett, 1907
Figure 11
Material examined [1]: Manabí: El Carmen, El Carmen, comunidad El Zapote; 23.IX.2021, 1♀ ex *Artibeus lituratus*.
Identification: According to Guerrero (2019), only one species of the genus *Metelasmus* has been determined so far. Its characteristics include the following: well-developed frontocylops; large postvertex, with triangular anterior margin and flattened posterior margin and two strong setae; it also has a hook-shaped postgena with a remiform seta; complete ctenidium;
small wings with reduced venation; posterior tibiae with very small setae and, finally, setae that completely covering the dorsal connexivum (Guerrero, 2019; Jobling, 1936).

Remarks: *Metelasmus pseudopterus* was reported by Wenzel (1976) as a characteristic parasite of *Artibeus jamaicensis*. In Ecuador, it also parasitizes some species of *Artibeus* (Stamper, 2012).

Figure 12A
Material examined [7]: **Esmeraldas**: Quinindé, Rosa Zárate, Jaboncillo, Finca La Esperanza; 09.IX.2021, 1♂, 1♀ ex *Myotis nigricans* • **Manabí**: El Carmen, El Carmen, comunidad El Zapote; 24.XI.2021, 2♂, 3♀ ex *Myotis albescens*. Identification: Females of *Basilia carteri* are differentiated by tergite 1 having eight to nine long setae on the posterior margin, while tergite 2 has a subcodiform shape with very few disc-like setae. Conversely, males exhibit a sternite V with two asymmetrical rows of setae (Graciolli, 2004).

Remarks: *Basilia carteri* has been documented in association with *Myotis albescens*, *M. levis*, *M. nigricans*, and *M. riparius*; also, with *Tadarida brasiliensis* (Autino et al., 2009).

Figure 12B
Material examined [88]: **Esmeraldas**: Eloy Alfaro, La Tola, Finca Cocadilla; 20.XII.2017, 1♂ ex *Glossophaga soricina* • Eloy Alfaro, La Tola, Centro de Interpretación Majagual; 23.VIII.2017, 1♀ ex *Myotis nigricans* • Eloy Alfaro, Luis Vargas Torres, Playa de Oro; 23. VIII.2017, 1♀ ex
Myotis riparius; 25.VIII.2017, 8♂, 26♀ ex Myotis riparius • Manabí: El Carmen, El Carmen, comunidad El Zapote; 26.XI.2021, 2♂, 1♀ ex Myotis riparius • Los Ríos: Buena Fe, Patricia Pilar, Centro Científico Río Palenque; 20.VII.2017, 6♂, 15♀ ex Myotis diminutus; 24.VII.2017, 5♂, 6♀ ex Myotis diminutus; 27.VII.2017, 1♂, 7♀ ex Myotis diminutus; 27.VII.2017, 3♂, 5♀ ex Myotis nigricans.

Identification: Tergite 1 of females is very long in this species and has six to nine bristles on the posterior margin. In contrast, the sternite V of males is slightly rounded and with a small notch in the middle (Guimarães & D’Andretta, 1956; Peterson, 1959).

Remarks: 

Basilia ferrisi is associated with Carollia brevicauda, Histiotus montanus, Myotis nigricans, and M. keaysi (Raigosa et al., 2020); however, in Ecuador, it was also associated with bats of the genus Myotis and Platyrhinus mata-palensis (Stamper, 2012). In addition, we report the association with Myotis diminutus and Glossophaga soricina.

Basilia sp. (group ferruginea)

Figure 12C

Material examined [2]: Los Ríos: Buena Fe, Patricia Pilar, Centro Científico Río Palenque; 21.VII.2017, 2♀ ex Myotis riparius.

Remarks: We were unable to identify this species; however, the bilobed tergite 2 is a characteristic of the ferruginea group (Theodor, 1967).

DISCUSSION

Ecuador, known for its remarkable biodiversity (Mittermeier et al., 2011), lacks comprehensive information about specific taxonomic groups such as the parasitic bat flies from the families Streblidae and Nycteribiidae. Most of the known records come from localities in Amazonia, and only five species have been documented in the few studies conducted on the Coast (Camacho et al., 2014; Correa et al., 2019; Guerrero, 1997; Guimarães & D’Andretta, 1956; Liu et al., 2020; Stamper, 2012; Tello, 2005). This study aims to address this knowledge gap by providing valuable insights. Our findings contribute to the knowledge of bat flies of the families Streblidae and Nycteribiidae, as we have documented new records for Ecuador (Trichobius flagellatus, Paratrichobius durnii, Strebula machadoi, S. altmani, and Basilia carteri), bringing the species richness to 61. In addition, their geographic range has expanded, as they had previously only been documented in countries such as Argentina, Panama, Mexico, and Venezuela (Cuxim-Koyoc et al., 2018; Guerrero, 2019; Hiller et al., 2021; Oscherov et al., 2012). Notably, in the coastal region, the species count has shown a substantial increase from 5 to 31.

Stamper (2012), documented 42 species of bat flies in Ecuador, 19 of which we report in this study. However, Stamper’s study provided only general locality descriptions without additional information that could establish a direct association between each specimen and its collection site. This lack of specific data has raised concerns regarding the accurate distribution patterns of these species. Our research considers these findings as confirmed records specifically within the Ecuadorian coastal region, offering more precise insights into their distribution. Trichobius joblingi, Speiseria ambiguia, and Strebla guajiro had already been documented in Morona Santiago, Orellana, Pastaza, Cotopaxi, Pichincha, Esmeraldas, and Santo Domingo de los Tsáchilas (Tello, 2005). This study extends the records to Manabí and Los Ríos.

The most abundant fly parasite was Trichobius joblingi, and some of the factors influencing these results are probably due to the fact that it is a generalist species (Barbier & Bernard, 2017; Tlapaya-Romero et al., 2015), which has been reported parasitizing several bat species (de Groot et al., 2020; Santos et al., 2016; Soares et al., 2017). Additionally, previous research mentions that parasite abundance is related to host abundance (Ascuntar-Osnas et al., 2020; Cuxim-Koyoc et al., 2015). Carollia perspicillata is the main host (Wenzel, 1976), and in the present investigation, it is documented among the most abundant bat species, along with Carollia brevicauda and C. castanea, all widely distributed on the Ecuadorian Coast (Tirira, 2017).

Bat flies are highly host-specific, that is, they parasitize a single bat species (Dick & Gettinger, 2005; Wenzel et al., 1966; Wenzel, 1976).
However, we report some novel interactions, such as the association of one bat fly species with multiple host species, as well as the presence of several bat fly species on the same host, which have also been documented in previous research (Barbier & Graciolli, 2016; da Silva et al., 2023; Durán et al., 2017; França et al., 2013; Lira-Olguin et al., 2020; Menezes et al., 2021). Factors such as sample contamination, transfers due to disturbance at the time of capture (Dick, 2007; Fritz, 1983), and accidental transfers when bat hosts share roosts with other species (Aguiar & Antonini, 2016; Barbier & Bernard, 2017; Hernández-Martínez et al., 2019; ter Hofstede et al., 2004), could explain these findings. It is important to clarify that the aim of the present study did not include at any time to assess specificity or factors influencing host-parasite associations. Therefore, these aspects were not explored to avoid misinterpretations, but relevant association findings that may be the subject of future research were documented.

It is important to point out that during the taxonomic identification process there were certain limitations since it was not possible to determine the species level in three individuals, due to taxonomical publications with ambiguous descriptions and outdated illustrations. The taxonomic keys used for the family Streblidae are the result of very complete works that include the description of a large number of species. On the other hand, the information on the family Nycteribiidae is scattered; in fact, most of the available works describe mainly females and relegate the identification of males to the background. Several of these problems coincide with those described by Lira-Olguin et al. (2020) and Trujillo-Pahua & Ibáñez-Bernal (2019, 2020), demonstrating the need for further research on this taxon.

According to studies by Barbier & Bernard (2017) and Dick & Gettinger (2005), the great variety of bat fly species is correlated with host diversity. Under this premise, we consider that the current species richness of the families Streblidae and Nycteribiidae is still underestimated, since 179 species of bats have been reported in Ecuador (Tirira et al., 2022), 120 of them in the Coast (Brito et al., 2023; Carrera et al., 2010). Along the same lines, in countries of the region with a similar number of bat species, there are even twice as many records of flies that parasitize them, in contrast to those documented at the national level. A notable example is Brazil, which has 181 species of bats (Garbinho et al., 2022) and 119 species of the family Streblidae and Nycteribiidae (Graciolli & Hrycyna, 2023; Hrycyna et al., 2019); it also ranks among the nations with the highest number of publications on the taxonomic group under discussion (Urbieta et al., 2022). This shows that there are several species to be identified and, therefore, it is relevant to propose more studies such as the one carried out throughout this research.

The natural history collections reflect the planet’s biota over time (Bradley et al., 2014). Therefore, the results of this research, obtained based on museum specimens and associated data, provide valuable information on this taxonomic group in the country, which evidences the importance of the collections and the need to continue collecting more specimens as possible.

Future research should include the analysis of specimens in other regions and from different families, as well as the use of molecular techniques that facilitate species identification and validate the findings of host-parasite interaction reported in this study. Undoubtedly, works such as this one contributes to expanding the knowledge of the diversity of parasitic bat flies in the country and consolidate the basis for future research to address ecological and evolutionary questions due to the close relationship of bat flies with their hosts (Brown et al., 2022; Hiller et al., 2020). They are also important in the public health area since bat flies are reservoirs of viruses and bacteria and could act as vectors of zoonotic pathogens (Lee et al., 2021; Morse et al., 2012; Ramirez-Martinez et al., 2021).

CONCLUSION

The study contributed to increasing the knowledge of the diversity of parasitic bat flies as well as broadening their distribution. The document also consolidates baseline information on host-parasite associations and establishes the
first collection with the largest number of identified bat fly species of the families Streblidae and Nycteribiidae in the Ecuadorian coastal region.

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Author contributions: KP: design of the research plan, analysis of the information, taking photographs, and drafting of the manuscript. KP and ALP: elaboration of the database, peer review, and identification of bat fly species and bat species. MAC: design of the research plan, logistical support, and manuscript review.

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APPENDIX 1
Toponymic index

El Oro
Zaruma Urcu, Cerro (03°41’01.6” S, 79°37’21.4” W; 1126 m a.s.l.). Trichobius parasiticus.

Esmeraldas
Cocadilla, Finca (01°11’29.2” N, 79°03’07.7” W; 5 m a.s.l.). Trichobius dugesii, T. joblingi, Speiseria ambigua, Strebla guaijrio, Basilia ferrisi.
La Esperanza, Finca (00°12’54.3” N, 79°35’54.9” W; 100 m a.s.l.). Trichobius joblingi, Strebla guaijrio, Megistopoda proxima, Basilia carteri.
Majagual, Centro de Interpretación (01°10’23.0” N, 79°04’45.8” W; 11 m a.s.l.). Trichobius dugesii, T. joblingi, Speiseria ambigua, Strebla guaijrio, Basilia ferrisi.
Playa de Oro (00°52’33.0” N, 78°47’40.7” W; 113 m a.s.l.). Trichobius joblingi, T. anducei, Speiseria ambigua, Strebla guaijrio, S. galindoii, Basilia ferrisi.

Los Ríos
Río Palenque, Centro Científico (00°35’19.8” S, 79°21’39.8” W; 150 m a.s.l.). Trichobius uniformis, T. longipes, T. costalimai, T. joblingi, T. dugesiioides, T. flagellatus, T. anducei, Trichobiioides perspicillatus, Speiseria ambigua, Paratrichobius longicus, Megistopoda aranea, M. proxima, Strebla mirabilis, S. guaijrio, S. altmani, Basilia ferrisi, Basilia sp.
Manabí
El Zapote, comunidad (00°22'31.4'' S, 79°36' 16.3'' W; 200 m a.s.l.). *Trichobius uniformis*,
*T. costalimai*, *T. joblingi*, *T. flagellatus*, *T. anducei*, *Trichobius* sp., *Trichobioides perspicillatus*,
*Speiseria ambigua*, *Megistopoda aranea*, *M. proxima*, *Aspidoptera falcata*, *Exastinion clovisi*,
*Strebla guajiro*, *S. hertigi*, *S. altmani*, *Metelasmus pseudopterus*, *Basilia carteri*, *B. ferrisi*.
Pacoche, Refugio de Vida Silvestre Marino Costera (01°04'00.91'' S, 80°53’20.00’’ W; 118 m a.s.l.)
*Paratrichobius dunni*, *Megistopoda aranea*, *Aspidoptera phyllostomatis*.

Santo Domingo de los Tsáchilas
La Unión del Toachi (00°19’14.2”S, 78°57’08.8” W; 811 m a.s.l.). *Strebla machadoi*.