Natural History of Vampire Bats

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PARASITES OF VAMPIRE BATS
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I. GENERAL CONSIDERATIONS

The extraordinary characteristics of vampire bats are also reflected in the diverse and interesting parasitic fauna. These parasites are represented by unusual arthropods and other invertebrates that exploit various ecological niches offered by these bats. Significantly, a number of these parasites are specifically adapted and linked to vampire bats. They do not infest other hosts. Their existence depends entirely on these bats. The microclimate — humidity, physical, and physiological conditions — of these bats have created a host-species specific ecological niche for these parasites. The fact that vampires have a gregarious existence, sharing their habitation with other bat species, explains why some of their non-permanent parasites utilize a wide range of hosts.

It is possible that some parasites of vampires, particularly those representing unique external forms, became established on their hosts in ancient times when the hematophagous habit was being developed by these bats.

A close and exclusive dependency on bats has been established by pupiparous flies of the family Streblidae, a group that is well represented in vampire bats. The degree of host-specificity varies a great deal among these flies; however, some species are restricted to only one host species or to genera of some affiliation.

Vampire bats are not natural hosts of flies of the family Nycteribiidae, a group that is related to the Streblidae and is also exclusively found on bats. The evolution of the Nycteribiidae probably paralleled that of the Streblidae; however, the first group is perhaps older and apparently had its center of origin in the Old World.

The most diversified and perhaps the most important of bat parasites are to be found in the mite group Acari, a subdivision of the Arachnida. Members of several families of mites have successfully established themselves on vampires as well as on other bats. For instance, the families Spinturnicidae, Spelaeorhynchidae, Chiorhyncoptidae, Gastronyssidae, and Teinocoptidae, are endemic on bats and, at the same time, are permanent parasites intimately associated with their hosts. Of these only the family Spinturnicidae has representatives living on vampire bats. The other families are not known to occur on hematophagous bats.

In addition to harboring spinturnicid species, vampires are also hosts for other families of permanent and semi-permanent mites that are not restricted to bats and have forms distributed among other mammals, as well as on birds and other vertebrates. These mite families are the Myobiidae, Ixodidae, Argasidae, Trombiculidae, Macronyssidae, and Sarcopodidae.

Fur mites of the family Labidocarpidae, Suborder Astigmata, are parasites of bats and other mammals in various parts of the world, including the Western Hemisphere. Up to now, no records of these mites, sometimes placed in the family Listrophoridae, are known from vampire bats. The mite family Ereynetidae, Suborder Prostigmata, contains species found in the nasal cavities of some neotropical bats; nevertheless, they do not infest vampire bats.

An evaluation and analysis of the ecological parameters about bats and their parasitic and commensal mites has been presented by Fain.20–24

No lice occur on vampire bats or other bats. The absence of sucking lice (Anoplura) and biting lice (Mallophaga) on bats is intriguing, since some lice are known to exist on a few insects. Mammoths presumed that bats are derived.

The typical fleas of bats belong to the highly specialized family Ischnopsyllidae. In the family Pulicidae, exploiting a wide range of hosts, only the genus Rhynchopsyllus has developed a permanent association with bats. Although many neotropical bats are favored by fleas, there is no evidence of natural parasitism by fleas on vampire bats.

Within the Cimicidae, a widespread group of hematophagous hemiptera, certain species are parasites of bats, primarily of the family Vespertilionidae. Vampire bats might be
temporary hosts of *Cimex hemipterus*, *C. pilosellus*, *Lutrocimex spectans*, or other species that attack some neotropical Chiroptera; however, records of the bugs actually feeding on vampires are lacking.

The Polycenicidae are blind and viviparous hematophagous bugs that are exclusive ectoparasites of bats and have a worldwide distribution. In 1945, Ferris and Usinger described *Hesperocetes parvulus*, based on two female specimens; one taken on *Glossophaga longirostris*, the other on a "vampire bat", both from Sta. Maria de Epire, Guarico, Venezuela. Apparently the identification of the last host was in error, since Ueshima, in his work on New World Polycenicidae, remarked that *H. parvulus* is known only from *G. longirostris*. It may be also assumed that some mosquitoes and sandflies of the genus *Lutzomyia*, as well as other bloodsucking and nonpupiparous diptera living in or frequenting vampires' dwellings, may occasionally feed on these animals.

Although some information has been accumulated on internal parasites of vampire bats — e.g., certain protozoa and helminths, particularly of *Desmodus rotundus* — our knowledge on such parasites of *Diphylla ecaudata* and *Diaemus youngi* is very fragmentary.

Some vampire bat parasites, especially those having a high degree of host specificity, such as the mite families Myobiidae and Spinuricidae, and the streblid flies, have revealed clear affinities between vampires and phyllostomid bats, thus shedding light on the interpretation of their phylogeny and zoogeography. Fain observed that the presence of the myobiid genus *Eudosbabekia* on the bat families Mormoopidae and Phyllostomidae and its subfamily Desmodontinae, suggests a close relationship between these groups. Based on studies on Spinuricidae mites, Machado-Allison reported close relationship among *Periglischus herrerai*, a typical parasite of *Desmodus rotundus*, and another species of *Periglischus* that infest phyllostomid bats. While working with bat flies of the family Streblidae, Wenzel et al. observed that the relationship of some species of *Trichobius* and *Strebla* occurring on vampires suggest that they evolved from phyllostomine bats.

From the data available at present, it may be inferred that we have adequate information on the parasites associated with *Desmodus rotundus*. While knowledge has been accumulated on the systematics of the streblid flies, ticks, and mites of the families Trombiculidae, Spinuricidae and Macronyssidae, much remains to be learned about the physiology, reproduction, life cycles and pathological effects that these parasites produce on their hosts, as well as other ecological parameters related to them and to other groups of vampire bat parasites. Knowledge is more limited with regard to *Diphylla ecaudata* and *Diaemus youngi*, perhaps due to the fact that these species are rare and seldom obtained.

### II. RICKETTSIALES SP.

**A. Grahamella brumpti**

The genus *Grahamella* consists of microorganisms that live within the blood cells of various insectivores, bats, rats, and other animals. They possess a true cell wall and appear as rods of irregular contour. The species *Grahamella brumpti* was found by Rybeiro and de Aquilla in *Desmodus rufus* (now known as *D. rotundus*) in Peru in 1918. This species has been listed by Stiles and Nolan, Wenyon, and others. *Grahamella brumpti* was recovered by Lavie from the Old World bat *Rhinolophus ferrumequinum*. It was also reported by Kramps and Kleinschmidt from *Rhinolophus euryale*, *Miniopterus schreibersii*, and *Myotis bechsteinii* in Europe. Reporting the same parasite species in hosts so widely separated taxonomically and geographically is puzzling and suggests they might be treated as closely related but different.

Although *Grahamella*, formerly treated as protozoa, are now considered to be bacteria and are included in the family Bartonellaceae. Order Rickettsiales, it has been suggested that these parasites are nonpathogenic.
III. PROTOZOAN PARASITES

A. Trypanosomes

Trypanosomes are polymorphic parasites of vertebrates and are grouped in the family Trypanosomidae, Order Kinetoplastida. They live in the blood, lymph and cerebrospinal fluid and usually require an intermediate host for their transfer. They may be either harmless or somewhat detrimental to their hosts, and may cause death. However, these parasites usually are not pathogenic to their insect hosts.

Hoare lists the following species of the genus Trypanosoma as occurring in Desmodus rotundus: T. cruzi, T. vespertilionis, T. pessoai and T. megadermae. However, this last species seems to be restricted to the Old World. One or more of these species has been detected in some individual D. rotundus and not found in others.

Perhaps the most important trypanosome in vampire bats is T. cruzi (Figure 1). the causative agent of Chagas' disease in Central and South America. Marinkelle, Funayama et al., and others, have reported T. cruzi in D. rotundus. The true role of vampires and other bats in the ecology of Chagas' disease is unknown. The actual transmission of T. cruzi and other trypanosomes to bats by natural vectors is virtually unknown. The triatomine bug, Cavernicola pilosa, has been incriminated as vector of T. cruzi to bats. It is possible that other reduviid bugs, and perhaps cimicid bugs, particularly Cimex limai and Latrocimex spectans, might also play a minor role as vectors of T. cruzi.

In 1963, Deane and Sugay described T. pessoai, discovered in the blood of eight D. rotundus from the state of São Paulo, Brazil, previously recorded by Dias et al. Zeledon and Vito also refer to the same parasite they found in Costa Rica. Ayala and Wells found
T. pessoui in one vampire from Cali, Colombia. T. pessoui belongs in the megadermae group, which contains forms from the Old and the New World. T. pessoui is not restricted to vampires and has been reported by Esquivel and Zuñiga from the fruit bats Artibeus jamaicensis and A. lituratus in Costa Rica.

T. vespertilionis is a widespread parasite restricted to bats both in the Old World and the New World, and seems to be related to T. cruzi. Some experts consider these taxa to be morphologically inseparable. T. vespertilionis does not appear to have natural vectors; however, there is circumstantial evidence that reduviid and cimicid bugs are able to transmit this parasite to bats. Marinkelle and Dias et al. consider that Cuernicola pilosa is able to transmit T. vespertilionis.

In the laboratory D. rotundus is able to acquire and transmit mechanically Trypanosoma evansi, which is synonymous with T. equinum, T. hippocam, and T. venezuelense. This parasite is the causative agent of "Murrina" or "Derengadera", a disease with a high mortality in horses and mules, and has been reported from Panama, Colombia, Brazil, and Venezuela. Vampires transmit the trypanosomes during feeding, when the parasites reach the saliva through the broken oral mucosa or when they migrate through the intact mucosa. Although this trypanosomiasis is more prevalent in equines, various domestic and wild mammals have also been found to be susceptible. Pigs, goats, bovines, and other mammals are able to maintain the disease for a long period of time, serving as a source of infection for the vampire bats. In addition to the role played by vampires, T. evansi may also be mechanically transmitted from animal to animal by horseflies and stableflies.

IV. HELMINTH PARASITES

A. Nematodes

All the helminths that have been reported from vampire bats belong to the Class Nematoda. In 1953 Wolfgang described a new genus and species, Biacanha desmodus, from the common vampire bat in Trinidad, West Indies, which he based on five whole specimens and three odd fragments collected in 1932. This material was obtained from the intestines of 4 of 31 vampires examined; two other positive vampire bats harbored an unidentified capillarid worm. B. desmodus is a primitive member of the subfamily Strongylinae, which contains parasites of bats and edentates. This group is included in the family Trichostrongylidae, Order Trichostrongyloidea.

Chabaud and Bain described another nematode, Lukonema lukoschusi, from material obtained on D. rotundus in Cayenne, French Guyana. This parasite, a member of the family Muspiceidae, produces local tumors on the interfemoral membrane and adjacent wing area of D. rotundus and of various other bat species in Surinam, French Guyana, and perhaps other neotropical countries. In addition to parasitizing D. rotundus, L. lukoschusi has also been recovered from other bats such as Carolia perspicillata, Tonatia carrikeri, Noctilio lepida, Saccopteryx leptura, and Eptesicus melanopterus. The availability of several hosts that share the same roosting area, as well as the exploitation of an exposed habitat on these mammals may explain the poor degree of host specificity of L. lukoschusi.

In a study of bat filariasis in Colombia, Esslinger et al. reported six species of filariae after examining hundreds of bats. Although 110 specimens of D. rotundus were examined, no filarial parasites were recovered.

The occurrence of a filarial nematode in the olfactory mucosa of the white-winged vampire bat, Diaemus youngi, in Trinidad, was demonstrated by Lichtenfels et al. It is possible that a tick, mosquito, or other blood-sucking arthropod may act as the intermediate host and vector of the undescribed filaria that was found in D. youngi.
V. ARACHNID PARASITES

A. Spinturnicid Mites

The Spinturnicidae form a highly specialized group of brown, usually flat mites with relatively long but very stout legs. They are viviparous, and the majority of them attach themselves to the wing membrane of their hosts by means of specialized claws. The genera *Spinturnix*, *Paras pinturnix*, and *Camaronieta*, are found in America; however, the first genus is also cosmopolitan. Eight species of the genus *Periglischris* have been recorded from vampire bats. Of them, it appears that *P. herrerai* is a regular parasite of *Desmodus rotundus*. The other species, *P. gameroi*, *P. acutisterius*, *P. caligus*, *P. iheringi*, *P. ojastii*, *P. tonati*, and *P. torrealbai*, are generally associated with bats of the family Phyllostomidae.

The original description of *P. herrerai* by Machado-Allison was based on one female taken on *D. rotundus* in Caripito, Venezuela, and five male and two female deutonymphs from the same host collected at Barlovento, Venezuela. This species was recorded later by Herrin and Tipton in Venezuela, who obtained 42 females, 50 males, 23 deutonymphs, and 4 protonymphs distributed in 62 *D. rotundus*. Two specimens from *Sturnira lilium*, one from *S. ludovici*, and one from *Anoura sp.*, constituted the remaining material of *P. herrerai*, and this was interpreted as contamination of collections or as specimens taken from accidental hosts. *P. desmodi* (= *P. herrerai*), was described by Furman in 1966. The type material of *P. desmodi* consisted of the holotype female and the allotype male, besides the following paratypes: 6 females, 1 deutonymph, and 3 protonymphs—all from Panama, as well as 10 females, 3 males, and one deutonymph from La Brea, Trinidad, West Indies. The above data confirms that *P. herrerai* is a normal parasite of *D. rotundus*.

B. Macronyssid Mites

The family Macronyssidae includes various genera of parasitic mites which have evolved on American bats, as well as on some rodents, birds, and reptiles. Some mites are involved with various zoonoses; however, their potential as vectors of diseases has not been investigated. Macronyssid mites live on the body or, in some cases, are confined to a particular habitat in the hosts. The protonymphs of some species of *Radfordiella* have developed the unusual adaptation of living within the mouth of certain nectar- and pollen-feeding bats.

The macronyssids feed primarily on blood or tissue secretions of their hosts; however, the larval and deutonymphal stages do not feed and are not active, sometimes remaining on a substrate of the host.

Vampire bats are natural hosts of various macronyssid mites which are distributed among six or more genera; however, some of these species have not yet been described. Among the vampire-loving macronyssids, perhaps *Radfordiella desmodi* is one that displays the highest level of host specificity and seems to be a typical parasite of *Desmodus rotundus*. *R. oudemansi* has been reported from *Desmodus rotundus* and *Diaemus youngi* in southern Brazil, Trinidad, and Venezuela.

The original description of *Nycteronyssus desmodus* was based on a single female obtained from *Diaemus youngi* in the Amazonas Federal Territory, Venezuela. The authors, Saunders and Yunker, tentatively assigned the genus *Nycteronyssus* to the family Macronyssidae, but indicated that this taxon may be a specialized endoparasite belonging to a different dermanyssoid family.

*Macronyssoides kochi* is another macronyssid mite that has been found on *Desmodus rotundus*, as well as on other bats belonging to the families Emballonuridae, Mormoopidae, and Phyllostomidae.

The species *Chiroptonyssus venezolanus* has also been recorded from *D. rotundus*, but it seems to be a typical parasite of molossid bats of the genus *Tadarida*. Saunders also lists, as associated with *D. rotundus*, one species of Macronyssus and two species of *Parichironyssus* that have not yet been described.
C. Trombiculid Mites

The larvae of trombiculid mites, known as red bugs or chiggers, are for the most part parasitic on a number of vertebrates, while only a few species prefer arthropods and other invertebrates. Among those chiggers that attack bats, several species are found on vampires. These mites pierce the hosts' skin and suck the lymph and tissue fluid resulting from the disintegrating action of a digestive substance they release. Only a single meal is required before the larvae move to the soil in order to undergo a molting process and transform themselves into nymphs. The nymphs and adults of chiggers are not parasitic and feed on small arthropods and their eggs.

Chiggers infesting vampire bats show no marked host-specificity. The species Loomisia desmodus and Perissopalla precaria were described from specimens first removed from Desmodus rotundus.4 They have also been reported from nonhematophagous bats. According to several authors,1,3,7-49,55 other chiggers known to occur on D. rotundus are Baemerella acuascua, Colicus exhumatus, Euchoengastia colombiae, E. (s.1.) megasyrAX, Nyceri-nastes primus, Microtrombicula bonei, M. carmenae, Hooperella saccopertyx, H. vesperuginis, Perissopalla nr. barticorycterus, Speleocola secunda, Trombicula longicalcar, T. pecari, and Whartonia nudosetosa.

The only known chigger species that has been encountered on Diphlla ecaudata is Whartonia angulascua Reed and Brennan.43 The original description is based on specimens obtained on D. ecaudata, Carolia brevicauda, C. perspicillata, and Chroteopterus auritus from Monagas, Venezuela.47

Diaemus youngi has been found infested with Perissopalla exhumatus33 and Euchoengastia colombiae,1 species that are not primarily associated with this bat.

D. Myobiid Mites

The family Myobiidae contains highly specialized tiny mites found on rodents, insectivores, marsupials, and bats. They lack a body sclerotization, and their anterior pair of legs is transformed into a hair-clasping organ. Myobiids show a high degree of specificity and live attached to the host's hairs, feeding on dermal liquids; however, some species are capable of ingesting blood. The species Eudusbabekia arganoi is the only myobiid mite thus far reported from a vampire bat. It was described as Jamesonia arganoi by Vomero34 in 1972 from a large series of specimens taken on the fur of a single Desmodus rotundus at Cueva de los Sabinos, Ciudad Valles, San Luis Potosí, Mexico. Later, this species was reported by Dusbábek and Lukoschus17 from the same host collected in Surinam and French Guiana. In his paper describing J. arganoi ( = E. arganoi), Vomero pointed out that the strong affinities between this species and other species of the genus found on phyllostomid bats, indicates the close phylogenetic relationship among the hosts of these mites. He further indicated that the strong affinity between J. arganoi and J. samsinakí, a parasite of Phyllostominae, suggests an origin of the vampires from this subfamily of Phyllostomidae.

E. Sarcop sid Mites

The mites comprising the family Sarcopidae are very similar in their appearance. They live on the skin of mammals and have a soft, globose body provided with stout legs. In Chirynsoides, as well as in some other genera of the family, the cuticle is, for the most part, finely striated. Chirynsoides caparti is the only species of this family that has been found infesting Desmodus rotundus. This taxon was described by Fain29 from Panamanian material collected from this host. The parasite, however, displays a poor host specificity and also has been collected from the following Panamanian bats: Artibeus jamaicensis, A. toltecus, A. cinereus, Vampyrrhodes major, V. vitatus, Vampyressa minuta, and Chiroderma salvini, all members of the family Phyllostomidae.
FIGURE 2. Ornithodoros azteci: dorsal view; ventral view.

F. Ticks

Ticks are semi-permanent parasites that are presently grouped by some authors in the Suborder Metastigmata of the Order Parasitiformes. They were formerly known as members of the Suborder Ixodides, and this designation is still used by many authors. These arthropods are parasitic on mammals, birds, reptiles, and amphibians, being blood feeders at each stage. In addition to causing skin injuries, many of them are directly or indirectly responsible for health problems of their victims. A short, proboscis-like anterior structure (hypostome), armed with retrorse teeth, allows these creatures to attach themselves tightly to the skin of their hosts.

Bats are not regular hosts of hard ticks of the family Ixodidae, and the presence of these parasites on them may be considered fortuitous. The majority of the ticks that are harbored by bats belong to the genus Ornithodoros, one of the groups that conforms to the Argasidae or soft ticks. Ornithodoros species do not exhibit a strong degree of specificity and generally remain in the host's nesting area where they have easy access to their food source. Of the various species of Ornithodoros that have been recovered from vampire bats, O. azteci and O. peruvianus perhaps show a stronger degree of association to these hosts.

Matheson’s based his original description of O. azteci (Figure 2) on Panamanian specimens collected from D. rotundus and Hemiderma perspicillatum aztecum (now known as Carollia perspicillata azteca), as well as on material obtained from cracks and crevices of caves and culverts where the bats roosted. Goodwin and Greenhall listed this species from Trinidad.
Fairchild et al.\textsuperscript{26} Hoffman,\textsuperscript{79} and Jones et al.\textsuperscript{17} report the finding of \textit{O. azieci} on \textit{D. rotundus} in Panama, Mexico, and Venezuela, respectively. Marinkelle and Grose\textsuperscript{44} found 63 specimens of this tick among 300 Colombian \textit{D. rotundus}. \textit{O. azieci} has also been reported from \textit{Peropertyx macrotis}, \textit{Lonchorhina aurita}, \textit{Glossiphaga soricina}, and other bats.

\textit{O. brodski} seems to be a regular parasite of \textit{Carollia perspicillata}, and secondarily infests other bats. Fairchild et al.\textsuperscript{26} record only one larva of this species taken from \textit{D. rotundus} in Cerro Hoya, Los Santos Province, Panama.

\textit{O. hasei} has been recorded from a wide spectrum of bat species, distributed primarily among the families Notilionidae and Phyllostomidae. The few records of \textit{D. rotundus} harboring \textit{O. hasei} in Venezuela, listed by Jones et al.,\textsuperscript{37} reveal a poor preference for this host.

\textit{O. peruvianus}\textsuperscript{26} is known from five larvae collected among \textit{D. rotundus}. \textit{Glossiphaga} species, and \textit{Molossus obscurus} in Peru. Apparently, no other record of this tick has been published.

The species \textit{O. rossi} is known only from the larval stage which has been obtained from various bat species. Jones et al.\textsuperscript{37} reported a few larval specimens of \textit{O. yumatensis} taken on \textit{D. rotundus} in the Venezuelan states of Monagas, Nueva Esparta, Zulia, and possibly the Federal Territory of Amazonas. The finding of 14 larvae of \textit{O. yumatensis} on two \textit{Diphylla ecaudata} in Monagas, Venezuela, suggests that this bat is the commonest host for this tick. Also, \textit{O. yumatensis} has been found on \textit{Peropertyx kappleri}, \textit{Carollia perspicillata}, and other bats. The range of \textit{O. yumatensis} is wide, and probably extends from the southwestern U.S., throughout Mexico, Central America, and the northern part of South America.

The parasitic role of the odd neotropical ticks of the genus \textit{Antricola}, which live primarily on bat guano, is not well known. They have mouth parts adapted for quick feeding, and the possibility that they may attack vampires should not be discarded.

VI. INSECT PARASITES

A. Triatomid Bugs (\textit{Cavernicola pilosa})

\textit{C. pilosa} (Figure 3) is a dark brownish and bristly bug which reaches a length of 11 to 13.5 mm. It belongs to the subfamily \textit{Triatominae}, a widely distributed group of bloodsucking hemiptera belonging to the family \textit{Reduviidae}. This triatomine occurs in Panama, Colombia, Brazil, Venezuela, and Ecuador, and is associated with certain habitats used by bats, such as caves and tree holes. It has been found naturally infected with \textit{Trypanosoma cruzi}, the causative agent of Chagas' disease.\textsuperscript{13,15,27} \textit{C. pilosa} is known to transmit this parasite to vampires and other bats.\textsuperscript{27} These mammals become infected if the trypanosomes present in the bugs' feces accidentally reach the oral mucosa or are introduced into the blood or into tissues through a wound or skin abrasions. \textit{T. cruzi} is not pathogenic to these reservoirs; however, in humans this parasite may cause serious cardiac, gastrointestinal, and central nervous system pathology. \textit{C. pilosa} has been incriminated as vector of \textit{T. vespertilionis} to bats.\textsuperscript{13,15}

The species \textit{Eratyrus cuspidatus} and \textit{E. micromatus} are also neotropical triatomines that sometimes inhabit bat dwellings. Both species have been found infected with \textit{Trypanosoma cruzi} and may be able to transmit this parasite to vampires and other bats.\textsuperscript{40}

B. Streblid Flies

The family \textit{Streblidae} represents a numerous, diversified, and highly specialized group of slightly flattened bat flies. They are obligate hematophagous ectoparasites and therefore entirely dependent on their hosts. A number have their wings well developed, whereas others show these structures as moderately or greatly reduced, and in some species the wings are absent. The presence or absence of one or more combs of spines is another remarkable
feature typical of some of these flies. In this group, as well as in the family Nycteribiidae and other related flies, the female retains the egg and the larva inside the body; in this situation, the larva develops until fully grown and ready to pupate.

Vampire bats are parasitized by a number of streblid flies, although the majority of them are not very host-specific. According to Jobling and Wenzel et al., Trichobius parasiticus (Figure 4), a widespread species, is a frequent parasite of D. rotundus; however, material collected in Venezuela shows that this fly also uses a variety of phyllostomid hosts. The species Streblo wiedemanni (Figure 5) seems to be specific on the common vampire bat. The following taxa also have been found on Desmodus rotundus but are not regular parasites of this host: T. caecus, T. costalimai, T. dugesioides, T. furmani, T. joblingi, T. longipes, T. liptoni, Mastoptera sp. minutai complex, Megistopoda aranea, Paradisciria curvata, Para-trichobius dinni, P. sp. longicerus complex, Streblo consocius, and S. guajiro.

One specimen of a probable new species of Nycterophilus taken on D. rotundus in Colombia, is listed by Marinkelle and Grose however, the same taxon was found on other bat species. Diaemus youngi is a strictly specific host of Streblo diaemii, a species known from Panama and Venezuela. Trichobius dugesi, T. parasiticus, as well as an undescribed species of Trichobius occurring in Trinidad, have also been recorded from D. youngi.

Streblo diphylla seems to be restricted Diphylla ecaudata, and is known to occur in Guatemala, Mexico, Brazil, and Colombia. Streblo mirabilis, the other species that has been recorded from Diphylla, also infests several phyllostomid hosts.

C. Nycteribiid Flies

Flies of the family Nycteribiidae superficially resemble spiders in that they have a compact body devoid of wings and are provided with long legs armed with claws. They are hematophagous, and the majority of them are restricted to Old World bats. A number of species
infest American bats and have been classified in the subfamily Nycteribiinae. which is restricted to bats of the Suborder Microchiroptera. The other known subfamily, Ciclopodiniinae, is limited to bats of the Suborder Megachiroptera. Some of the nycteribiids exhibit a strong degree of host-specificity while others do not show much host preference.

So far the only species of nycteribiid fly that has been found on a vampire bat is *Basilia ferrisi*, of which a female fly taken in Monagas, Venezuela, was reported by Gimeraes. According to that author, the finding of *B. ferrisi* on *D. rotundus* is accidental. This fly is commonly associated with bats of the genus *Myotis*, particularly with *M. nigriceps*, *M. albescens*, and *M. riparium*.

**VII. HOST-PARASITE LIST**

The following list includes parasitic forms found associated with vampire bats. Those marked with an asterisk are very specific parasites of these hosts. The rest are not-specific, incidental, or temporary parasites.

*Desmodus rotundus* (É. Geoffroy-Saint-Hilaire)
- Family Bartonellaceae
  - *Grahamella brumpti* Rybeiro and del Aquilla
- Family Trypanosomiidae
  - *Trypanosoma cruzi* Chagas
  - *Trypanosoma evansi* Steel
  - *Trypanosoma megaderma* Wenyon
  - *Trypanosoma pessoai* Deane and Sugay
  - *Trypanosoma vespertilionis* Battaglia
- Family Trichostongylidae
  - *Bicantha desmodus* Wolgang
- Family Muspiceidae
  - *Lukonema lukoischusi* Chabaud and Bain
- Family Trichuridae
  - Unnamed capillaroid nematode
- Family Spinturnicidae
  - *Periglischrus acutisternus* Machado-Allison
  - *Periglischrus caligus* Kolenati
  - *Periglischrus gameroi* Machado-Allison and Antequera
  - *Periglischrus herrerai* Machado-Allison
  - *Periglischrus iheringi* Oudemans
  - *Periglischrus ojastii* Machado-Allison
  - *Periglischrus ionatti* Herrin and Tipton
  - *Periglischrus torrealbai* Machado-Allison
- Family Macronyssidae
  - *Chiroptonyssus venezolanus* (Vitzthum)
  - *Macronyssoides kochi* (Fonseca)
  - *Macronyssus* sp.
  - *Parichoronyssus* sp.
  - *Parichoronyssus* sp. *not sclerus*
  - *Radfordiella desmodi* Radovsky
  - *Radfordiella* sp.
- Family Argasidae
  - *Ornithodoros azteci* Matheson
  - *Ornithodoros brodyi* Matheson
Ornithodoros hasei (Schulze)
Ornithodoros rossi Kohls, Sonenshine and Clifford
Ornithodoros yumatensis Cooley and Kohls
Ornithodoros sp.

Family Ixodidae
Amblyomma sp.
Ixodes sp.

Family Myobiidae
*Eudesbabekia arganoi (Vomera)

Family Trombiculidae
Beamereilla acutascuta Brennan
Colicus exhumatus Brennan
Euschoengastia colombiae (Boshell and Kerr)
Euschoengastia (s.l.) megastyrax Brennan and Jones
Euschoengastia desmodus Brennan and Dalmat
Hooperella saccopertyx Brennan and Jones
Loomisista desmodus (Brennan and Dalmat)
Microtrombicula boneti (Hoffmann)
Nycterinastes primus Brennan and Reed
Perissopalla barticonvicteris Brennan
Perissopalla precaria Brennan and Dalmat
Speleocola secunda Brennan and Jones
Trombicula pecari Brennan and Jones
Wharthonia nudosetosa (Wharton)

Family Sarcoptidae
Chirnyssoides caparti Fain

Family Reduviidae
Cavernicola pilosa Barber

Family Streblidae
Mastoptera sp. minuta complex
Megistopoda aranea Coquillett
Paradyschiria curvata Wenzel
Paratrichobius dunni (Curran)
Strebla consocius Wenzel
Strebla guajiro (Garcia and Casal)
*Strebla wiedemanni Kolenati
Trichobius caecus Edwards
Trichobius costalimai Guimaraes
Trichobius dugesioides Wenzel
Trichobius furmani Wenzel and Tipton
Trichobius joblingi Wenzel
Trichobius longipes (Rudow)
*Trichobius parasiticus (Gervais)
Trichobius tiftoni Wenzel
Nycterophilia n. sp. (?)

Family Nycteribiidae
Basilia ferrisi Schuurmans-Stikhoven

Diaemus youngi (Jeantink)

Family Filariidae
Unnamed filarial nematode
Family Macronyssidae

*Nycteronyssus desmodus* Saunders and Yunker
*Radfordiella desmodi* Radovsky
*Radfordiella oudemansi* Fonseca

Family Trombiculidae

*Euschoengastia colombiae* (Boshell and Kerr)
*Perissopella exhumatus* (Brennan)

Family Streblidae

*Strebla diaemi* Wenzel
*Trichobius dugesi* Townsend
*Trichobius parasiticus* Gervais
*Trichobius sp.*

*Diphylla ecaudata* (Spix)

Family Argasidae

*Ornithodoros yumatensis* Cooley and Kohls
*Ornithodoros sp.*

Family Trombiculidae

*Whartonia angulascuta* Reed and Brennan

Family Streblidae

*Strebla mirabilis* (Waterhouse)
*Strebla diphylla* Wenzel

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REFERENCES


