

Research Article / Artículo de Investigación

Ectoparasites (Diptera, Hemiptera and Siphonaptera) of bats (Chiroptera) in northeastern Argentina

Ectoparásitos (Diptera, Hemiptera y Siphonaptera) de murciélagos (Chiroptera) en el nordeste argentino

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Abstract. New information is presented regarding bats and their ectoparasite insects in the Esteros del Iberá ecoregion, Corrientes, Argentina. The aim of this study was to explore the diversity of ectoparasite species found on bats in northeastern Argentina and analyze their taxonomic features, hosts, and distribution. Bats were collected from the Molossidae, Pyllostomidae and Vespertilionidae families along with ectoparasites from the Streblidae, Nycteribiidae (Diptera), Polyctenidae (Hemiptera) and Ischnopsyllidae (Siphonaptera) families. *Aspidoptera falcata* Wenzel, 1976, *Megistopoda theodori* Wenzel, 1966, *Hesperoctenes eumops* Ferris & Usinger, 1939 and *Hesperoctenes fumarius* Westwood, 1874 were added to the ectoparasite fauna for the province of Corrientes, increasing the number of species and their geographic distribution. A rarely studied stage of a larva about to emerge from the posterior end of *Basilisa carteri* Scott, 1936 (Nycteribiidae) was recorded. Additionally, 13 parasitological associations were made for the Esteros del Iberá, four of which are new for the province of Corrientes: *B. carteri* with *Myotis riparius* Handley, 1960, *H. fumarius* and *H. giganteus* Ronderos, 1959 with *Molossus rufus* É. Geoffroy Saint-Hilaire, 1806 and *Myodopsylla wolffsohni* Rothschild, 1903 with *M. riparius* Handley, 1960; the latter being also new for Argentina. These results provide host and locality records and new parasite-host associations.

Key words: Corrientes; Ischnopsyllidae; Nycteribiidae; Polyctenidae; Streblidae.

Resumen. Se presenta nueva información sobre murciélagos y sus insectos ectoparásitos en la ecorregión de los Esteros del Iberá, Corrientes, Argentina. El objetivo de este estudio fue explorar la diversidad de especies de ectoparásitos encontradas en murciélagos del nordeste argentino y analizar sus características taxonómicas, hospedadores y distribución. Se recolectaron murciélagos de las familias Molossidae, Pyllostomidae y Vespertilionidae junto con ectoparásitos de las familias Streblidae, Nycteribiidae (Diptera), Polyctenidae (Hemiptera) e Ischnopsyllidae (Siphonaptera). *Aspidoptera falcata* Wenzel, 1976, *Megistopoda theodori* Wenzel, 1966, *Hesperoctenes eumops* Ferris y Usinger, 1939 y *Hesperoctenes fumarius* Westwood, 1874 se sumaron a la fauna de ectoparásitos para la provincia de Corrientes, aumentando el número de especies y su distribución geográfica. Se registró una etapa poco estudiada de una larva a punto de emerger del extremo posterior de *Basilisa carteri*

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Scott, 1936 (Nycteribiidae). Adicionalmente, se registraron 13 asociaciones parasitológicas para los Esteros del Iberá, de las cuales cuatro son nuevas para la provincia de Corrientes: *B. carteri* con *Myotis riparius* Handley, 1960, *H. fumarius* y *H. giganteus* Ronderos, 1959 con *Molossus rufus* É. Geoffroy Saint-Hilaire, 1806 y *Myodopsylla wolffsohni wolffsohni* Rothschild, 1903 con *M. riparius*, siendo esta última además nueva para la Argentina. Estos resultados proporcionan registros de hospedadores, localidad y nuevas asociaciones parásito-huésped.

Palabras clave: Corrientes; Ischnopsyllidae; Nycteribiidae; Polycetenidae; Streblidae.

Introduction

Bats (Mammalia: Chiroptera) display a great range of ecological variation; they can be found in most regions, inhabit a wide variety of environments, occupy natural and artificial shelters, subsist alone or in colonies and have diverse feeding habits (Walldorf & Mehlhorn 2014). Nevertheless, all are vulnerable to parasites. Ectoparasites, in Central and South American in particular, are represented by approximately 273 species (Frank *et al.* 2014). In Argentina, 49 species of bat ectoparasite insects have been recorded, 28 Diptera (22 Streblidae and six Nycteribiidae), 14 Hemiptera (10 Polycetenidae and four Cimicidae) and seven Siphonaptera (five Ischnopsyllidae, one Stephanocircidae and one Tungidae) (Autino *et al.* 2020). The registers are from investigations conducted principally in provinces in northwestern Argentina (Autino *et al.* 1999, 2005, 2009, 2014, 2016, 2020; Claps & Autino 2012; Lareschi *et al.* 2016; López Berrizbeitia *et al.* 2017; López Berrizbeitia & Diaz 2019) and in a few localities in the northeast of the country (Autino *et al.* 1998, 2000a, b, 2018, 2020; Claps *et al.* 2004; Oscherov *et al.* 2006, 2012; Claps & Autino 2012; Di Benedetto *et al.* 2017). In the province of Corrientes, 15 species have been found, including: *Basilisa carteri* Scott, 1936, *Basilisa plaumanni* Scott, 1940, *Megistopoda aranea* Coquillett, 1899, *Megistopoda proxima* Séguy, 1926, *Noctiliostrebla aikteni* Wenzel, 1966, *Noctiliostrebla dubia* Rudow, 1871, *Paradyschiria fusca* Speiser, 1900, *Paratrachobius longicrus* Miranda Ribeiro, 1907, *Xenotrachobius noctilionis* Wenzel, 1976 (Diptera); *Hesperoctenes giganteus* Ronderos, 1959, *Latrocimex spectans* Lent, 1941, *Propicimex tucmatiani* Wygodzinsky, 1951 (Hemiptera); *Myodopsylla isidori* Weyenbergh, 1881, *Myodopsylla wolffsohni wolffsohni* Rothschild, 1903, *Sternopsylla distincta distincta* Rothschild, 1903 (Siphonaptera) (Autino *et al.* 1992, 2009, 2020; Claps *et al.* 2004; Oscherov *et al.* 2006, 2012; Claps & Autino 2012; Lareschi *et al.* 2016; Di Benedetto *et al.* 2017). Recently, Di Benedetto *et al.* (2022) additionally added two species of ticks, *Ornithodoros hasei* Schulze, 1935 and *O. mimon* Kohls, Clifford & Jones, 1969 (Argasidae), as part of the ectoparasite fauna of the province.

The Esteros del Iberá ecoregion is home to 35 bat species (Argoitia & Collett 2021), though the ectoparasitic insects of these mammals are a scarcely studied field.

The aim of this study was to explore the diversity of ectoparasite species found on bats in northeastern Argentina and analyze their taxonomic features, hosts, and distribution, including new records for the departments of San Martín and Santo Tomé in the province of Corrientes.

Materials and Methods

Study Area

The samplings were taken in two areas in the province of Corrientes: i) Paraje Galarza, department of Santo Tomé (28°5'58.80 "S; 56°40'3.33" W); ii) Colonia Carlos Pellegrini, department of San Martín (28°31'59.99 "S; 57°10'0.02" W). Both sites are part of the natural heritage of Corrientes and are within the Esteros del Iberá ecoregion (Burkart *et al.* 1999).

This ecoregion is found in the center-north of the province of Corrientes and extends over approximately 12,300 km² in which three phytogeographic regions converge: Chaco Oriental, Paranaense and Espinal (Carnevali 2003). The vegetation is composed for hygrophilous forests, *Prosopis* L., 1767 (carab) forests, savannas with *Butia paraguayensis* (Barb. Rodr.) L.H. Bailey, 1936 (yatay poñí), savannas or “pastizales” and grasslands or “gramillares” with a large diversity of species (Burkart *et al.* 1999; Neiff 2004). The climate is humid subtropical, with the median minimum monthly temperature vacillating between 16 °C and 17 °C in June and July and the highest average maximum temperature between 26 °C and 27 °C in January and February (Fontana 2017).

Capture of the host bats

The capture of the bats was carried out biannually between 2015 and 2017 over the course of three consecutive nights during the warm season months in each of the two localities; a total of nine sampling at each site studied. Additional material was incorporated from previous sampling carried out in 2013 and 2014.

Eight mist-nets were used and relocated every night to cover the largest possible area. The sampling effort was determined by calculating the meters of net by the number of nights they were used by locality (Pérez-Torres & Ahumada 2004). In total, 78 meters (five 12-meter nets and three 6-meter nets) of net were left out over 27 nights in each locality implicating a sample strength of 2,106 m in each site. The nets were checked at approximately one-hour intervals, depending on the activity of the bats.

The “Dirección de Parques y Reservas” and the “Subdirección de Fauna y Flora” (N° 01426/17), corresponding to the “Dirección de Recursos Naturales” (N° 00001426) of the province of Corrientes, granted the permits for the collection of bats in the Esteros del Iberá and their transfer to the Facultad de Ciencias Naturales e Instituto Miguel Lillo (Universidad Nacional de Tucumán) where they were deposited. The bat species were identified using the guide by Barquez & Díaz (2009) and Díaz *et al.* (2016) and confirmed by specialists at the Facultad de Ciencias Naturales e Instituto Miguel Lillo, Universidad Nacional de Tucumán (San Miguel de Tucumán, Argentina) – CONICET and incorporated into the Colección Mamíferos Lillo (CML) at the same institution.

Collection and identification of the ectoparasite insects

The insects were removed from the fur of the hosts manually using fine point entomological forceps and subsequently examined under a stereoscopic microscope, while the male genitalia, in some cases, were further treated according to normal techniques for optic microscope study.

The Diptera were identified according to Wenzel *et al.* (1966), Wenzel (1976), Gracioli & Carvalho (2001a, b), Gracioli (2004) and Autino *et al.* (2014); the Hemiptera were identified according to Costa Lima (1940); Ronderos (1962a, b) and Ueshima (1972) and the fleas according to Smit (1957) and Linardi & Guimarães (2000).

The ectoparasites were deposited in the Colección de Biología de los Parásitos (UNNEPin) of the Universidad Nacional del Nordeste (UNNE), Corrientes, Argentina.

We offer detailed information of all the species analyzed; first the scientific name from the original description of the species is listed, along with the author and the year of publication, followed by the current name, authors and year of publication. In the Material Examined section the capture location is cited first, followed by the number of samples examined, sex and, in parenthesis, the collection number where they are on deposit (UNNEPin). The host bat species where they were found are also indicated along with their collection number (CML), date of collection (day / month / year) and name of collector. The hosts for each species are

listed along with their distribution in Argentina. The features most relevant for identification of the insect species are included and accompanied by details related to their distribution, hosts and species taxonomy. A photograph of a female *Basilisa carteri* is incorporated that shows a larva about to emerge from the posterior end of the bat's abdomen.

Results

A total of 16 bat species were captured, of which six were associated with ectoparasite insects: two belonging to the Molossidae family: *Eumops patagonicus* Thomas, 1924 and *Molossus rufus* É. Geoffroy Saint-Hilaire, 1806; one Phyllostomidae: *Sturnira lilium* É. Geoffroy Saint-Hilaire, 1810 and three Vespertilionidae: *Eptesicus furinalis* d'Orbigny & Gervais, 1847, *Myotis albescens* É. Geoffroy Saint-Hilaire, 1806 and *Myotis riparius* Handley, 1960.

The ectoparasite insects collected included two Diptera (Streblidae family): *Aspidoptera falcata* Wenzel, 1976 and *M. theodori* Wenzel, 1966; two Diptera (Nycteribiidae family): *B. carteri* Scott, 1936, *B. plaumanni* Scott, 1940 and males from *Basilisa* sp. that couldn't be identified to a species level; three Hemiptera (Polyctenidae family): *Hesperoctenes eumpos* Ferris & Usinger, 1939, *H. fumarius* Westwood, 1874 and *H. giganteus* Ronderos, 1959 and one species of Siphonaptera (Ischnopsyllidae family): *Myodopsylla wolffsohni wolffsohni* Rothschild, 1903.

Diptera (Streblidae)

Aspidoptera falcata Wenzel, 1976

Aspidoptera falcata Wenzel, 1976: 104.

Material examined (5). Paraje Galarza, 1 female (UNNEPin-112) on *S. lilium* (CML 12436), 13/03/2016. Colonia Carlos Pellegrini, 1 male (UNNEPin-113) on *S. lilium* (CML 12430), 09/03/2016; 1 female and 2 males (UNNEPin-114) on *S. lilium* (CML 12431), 11/03/2016. Collected by Di Benedetto, I.M.D.

Hosts and distribution in Argentina. Molossidae: *Nyctinomops laticaudatus* É. Geoffroy St.-Hilaire, 1805 (Misiones). Phyllostomidae: *Artibeus fimbriatus* Gray, 1838, *A. lituratus* Olfers, 1818 and *Carollia perspicillata* Linnaeus, 1758 (Misiones); *A. planirostris* Spix, 1823 (Jujuy); *Sturnira erythromos* Tschudi, 1844 (Jujuy); *S. lilium* (Jujuy, Misiones, Salta, and Tucumán) (Autino *et al.* 2014, 2018).

Identification. The mesoepisternum, in the dorsal view, has two or three rows of setae, equal to or longer than those on the prescutum, the postgonite is sharply scythed (hence the nomenclature) and very ventrally curved.

Comments. The genus *Aspidoptera* Coquillet, 1899 is exclusive to the Neotropical region. It contains three species: *A. delatorrei* Wenzel, 1966, *A. falcata* Wenzel, 1976 and *A. phyllostomatis* (Perty, 1833) (Autino *et al.* 1999, 2009, 2014). In South America, the genus is distributed in Argentina, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Dominica, Guatemala, Mexico, Nicaragua, Paraguay, Panama, Peru, Puerto Rico, Trinidad, and Venezuela.

Only *A. phyllostomatis* Perty, 1833 and *A. falcata* are found in Argentina and tend to be taxonomically confused and found sharing the same hosts, principally with species from the Phyllostomidae and Molossidae families (Autino *et al.* 2014). In this work it is recorded for the first time in association with *S. lilium* (Phyllostomidae) in the province of Corrientes.

Megistopoda theodori Wenzel, 1966

Megistopoda theodori Wenzel, 1966, in Wenzel *et al.* 1966: 545, fig. 100B.

Material examined (23). Paraje Galarza, 1 male (UNNEPin-115) on *S. lilium* (CAG-001), 5/12/2013; 1 male (UNNEPin-116) on *S. lilium* (CML 12436), 13/03/2016; 1 male (UNNEPin-117) on *S. lilium* (CML12437), 07/02/2017; 1 male (UNNEPin-118) on *S. lilium* (CML12438), 07/02/2017; 2 females and 2 males (UNNEPin-119) on *S. lilium* (CML12440), 07/02/2017; 1 male (UNNEPin-120) on *S. lilium* (CML 12441), 08/02/2017; 1 female and 1 male (UNNEPin-121) on *S. lilium* (CML 12444), 16/03/2017; 2 males (UNNEPin-122) on *S. lilium* (CML12449), 17/03/2017; 1 female and 2 males (UNNEPin-123) on *S. lilium* (CML12450), 18/03/2017. Colonia Carlos Pellegrini, 2 females (UNNEPin-124) on *S. lilium* (CML12431), 11/03/2016; 2 females and 2 males (UNNEPin-125) on *S. lilium* (CML12432), 11/03/2016 and 1 female (UNNEPin-126) on *S. lilium* (CML12433), 09/02/2017. Collected by Di Benedetto, I.M.D.

Host and distribution in Argentina. Phyllostomidae: *S. lilium* (Misiones) (Autino *et al.* 2018).

Identification. Has long, wide wings with six longitudinal ribs. The postgonite has a curved ventral edge in the lateral view, with a few spiniform setae on the lateral side and others on the dorsal and ventral edges of the apical region. The macroseta of the right postgonite is inserted only slightly posterior to that of the left and past the middle of the postgonite.

Comments. *Megistopoda* Macquart, 1852 is a genus exclusive to the Neotropical region. The genus is represented by three species: *M. aranea* Coquillett, 1899, *M. proxima* Seguy, 1926 and *M. theodori* (Barquez *et al.* 1989, 1991; Autino *et al.* 1992, 1998, 1999, 2000b, 2009, 2018; Autino & Claps 2000; Claps *et al.* 2000; Oscherov *et al.* 2012). In South America, *M. theodori* distribution extends through Argentina, Bolivia, Costa Rica, Paraguay, Panama and Venezuela. This species has wings like those of *M. proxima* (a characteristic the species have in common) (Wenzel *et al.* 1966). The males are differentiated by the genitalia. Some authors sustain that *M. theodori* is synonymous with *M. proxima* (Guerrero 1994; Gracioli & Carvalho 2001b) and other authors that they are different species; that the *proxima* group is represented by an assembly of species (Dick & Gettinger 2005) containing various species not yet described (Dick *et al.* 2007; Dick 2013) as is sustained by Autino *et al.* (2018) for Argentina. *Megistopoda theodori* parasitize mainly Phyllostomidae bats and this work is the first to describe it parasitizing *S. lilium* (Phyllostomidae) in the province of Corrientes.

Diptera (Nycteribiidae)

Basilina carteri Scott, 1936

Basilina carteri Scott, 1936: 498.

Material examined (22). Paraje Galarza, 2 females (UNNEPin-081) on *M. riparius* (CML12651), 15/03/2015; 1 female and 1 male (UNNEPin-082) on *M. riparius* (CML12654), 11/10/2015. Colonia Carlos Pellegrini, 1 female (UNNEPin-083) on *M. riparius* (CAG-022), 08/12/2013; 1 female (UNNEPin-084) on *M. riparius* (CAG-051), 09/12/2013; 1 female (UNNEPin-085) on *M. albescens* (CML-12510), 18/11/2014; 1 female and 1 male (UNNEPin-086) on *M. riparius* (CML12594), 07/10/2015; 1 female and 2 males (UNNEPin-087) on *M. riparius* (CML12601), 15/12/2015; 2 female and 1 larva (UNNEPin-088) on *M. riparius* (CML-12617), 10/03/2016; 1 female and 2 males (UNNEPin-089) on *M. riparius* (CML12618), 10/03/2016; 1 female (UNNEPin-090) on *M. albescens* (CML-12525), 10/02/2017; 2 females (UNNEPin-091) on *M. riparius* (CML12642), 10/02/2017; 1 female (UNNEPin-092) on *M. riparius* (CML12643), 10/02/2017 and 1 female (UNNEPin-093) on *M. riparius* (CML12646), 20/03/2017. Collected by Di Benedetto, I.M.D.

Host and distribution in Argentina. Molossidae: *Molossops temminckii* Burmeister, 1854 (Jujuy); *Tadarida brasiliensis* I. Geoffroy Saint-Hilaire, 1824 (Santiago del Estero and Tucumán). Vespertilionidae: *M. albescens* (Corrientes, Jujuy, Salta and Tucumán); *M. izecksohni* Moratelli, Peracchi, Dias & de Oliveira, 2011 (Misiones); *M. keaysi* J. A. Allen, 1914 (Tucumán); *M. levis* I. Geoffroy Saint-Hilaire, 1824 (Misiones); *M. nigricans* Schinz, 1821 (Chaco, Corrientes, Jujuy, Salta, Santiago del Estero and Tucumán); *M. riparius* (Jujuy, Salta and Tucumán); *Myotis* sp. (Jujuy) (Del Ponte 1944; Guimarães 1946; Schuurmans Stekhoven Jr. 1951; Guimarães & D'Andretta 1956; García 1959; Claps *et al.* 1992, 2004; Autino *et al.* 1999, 2000a, 2009, 2020; Oscherov *et al.* 2006, 2012).

Identification. On the abdomen of the females the tergite I, is longer than it is wide, with few setae in the middle region and the posterior edge with eight or nine long, strong setae. The tergite III presents a rounded posterior edge, with a groove down the middle but that does not form lobes and with few setae in the middle or discal region. The anal segment has convergent lateral borders. A sample female (UNNEPin-088) presented a larva about to emerge from her posterior extreme. The larva is ovoid, soft textured and whitish, strongly convex dorsally and flattened ventrally, and wider on the anterior extreme while tapering posteriorly. Two pairs of spiracles are situated close together near the posterior extreme (Figs. 1A, 1B).

The end of the male abdomen has long gonopods that are hidden in a hollow cavity and surpass the posterior edge of the sternite V.

Comments. *Basilina* Miranda-Ribeiro, 1903 is the most diverse genus in the Nycteribiidae family with more than 100 species and approximately 47 species exclusive to America (Gracioli 2004). In South America, *B. carteri* is distributed in Argentina, Bolivia, Brazil, Uruguay and Paraguay. In Argentina it has been historically recorded in the northwest (Del Ponte 1944; Claps *et al.* 1992; Autino *et al.* 1999, 2000a), though currently, their distribution extends significantly into the northeast (Autino *et al.* 2009).

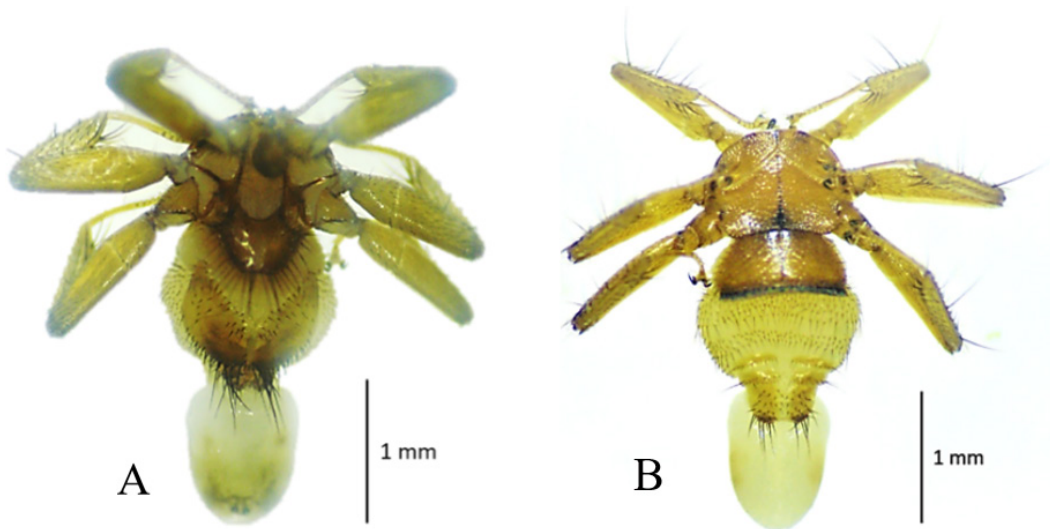


Figure 1. *Basilina carteri* (Diptera: Streblidae) female carrying a larva about to emerge on its posterior end, captured on a specimen of *Myotis riparius* (Chiroptera: Vespertilionidae) in Colonia Carlos Pellegrini (Esteros del Iberá), Corrientes, Argentina. **A.** Dorsal general view. **B.** Ventral general view. / *Basilina carteri* (Diptera: Streblidae) hembra portando una larva a punto de emerger en su extremo posterior, capturada sobre un ejemplar de *Myotis riparius* (Chiroptera: Vespertilionidae) en Colonia Carlos Pellegrini (Esteros del Iberá), Corrientes, Argentina. **A.** Vista general dorsal. **B.** Vista general ventral.

Information about the life cycle phases of *Basilia* is scarce or null (Scott 1936). The mature larva recently expelled from the female has a form like that of a pupa, with a convex dorsal surface and a flattened ventral one. The female then adheres the flattened ventral surface of the pupa to the substrate (Peterson and Wenzel 1987). This paper registers on *M. albescens* and *M. riparius* (Vespertilionidae).

***Basilia plaumanni* Scott, 1940**

Basilia plaumanni Scott, 1940: 58, figs. 1-2. Schuurmans Stekhoven, Jr. 1951a: 112; Maa 1965: 380 (subgenus *Basilia*).

Basilia mexicana plaumanni: Guimarães 1946: 38, figs. 31, 39, 40, 44.

Material examined (21). Paraje Galarza, 5 females and 1 male (UNNEPin-094) on *E. furinalis* (CAG-010), 06/12/2013; 1 female (UNNEPin-095) on *E. furinalis* (CAG-131), 07/12/2014; 3 females and 1 male (UNNEPin-096) on *E. furinalis* (CML12504), 19/12/2015. Colonia Carlos Pellegrini, 4 females and 3 males (UNNEPin-097) on *E. furinalis* (CML12496), 14/12/2015; 1 female (UNNEPin-098) on *E. furinalis* (CML12497), 14/12/2015; 1 female (UNNEPin-099) on *E. furinalis* (CML12502), 19/03/2017 and 1 female (UNNEPin-100) on *E. furinalis* (CML12501), 19/03/2017. Collected by Di Benedetto, I.M.D.

Host and distribution in Argentina. Vespertilionidae: *Eptesicus furinalis* (Corrientes and Santiago del Estero); *Histiopus laeophotis* Thomas, 1916 (Córdoba and Jujuy); *Histiopus macrotus* Poeppig, 1835 (Salta) (Del Ponte 1944; García 1959; Claps *et al.* 1992; Autino *et al.* 1999, 2009, 2016; Oscherov *et al.* 2012).

Identification. The posterior portion of the mesnotum is elevated (though this is not the case in all the samples), ventrally the thorax has a suture in the form of an inverted “V” with straight sides. The first visible tergite is somewhat angled and marked on the posterior edge, and the lobes on the second visible tergite have two or three long setae and other shorter ones.

Comments. In South America, it has distribution in Argentina, Brazil, Paraguay, and Uruguay. In Argentina, the first records of *B. plaumanni* come from Santiago del Estero on *E. furinalis* and from Córdoba on *H. laeophotis* (Del Ponte 1944; García 1959). The latter host is dubious, as it could be *H. montanus* Philippi & Landbeck, 1861, *H. macrotus* (Autino *et al.* 1999). *Basilia plaumanni* was also cited in Salta on *H. macrotus* (Autino *et al.* 2009) and in Jujuy on *H. laeophotis* (Autino *et al.* 1999, 2016). In the province of Corrientes, Oscherov *et al.* (2012) cites it on *E. furinalis* on the Isla Apipé Grande, and in this work, it is mentioned for Paraje Galarza and Colonia Carlos Pellegrini (Esteros del Iberá).

The samples of *B. plaumanni* from NOA (Salta and Jujuy) display the first visible tergite bordered with long and short setae (Autino *et al.* 1999), while the examined material from Corrientes shows the first visible tergite with only short setae, as described by Gracioli (2004), demonstrating variations between samples of this species.

***Basilia* sp.**

Material examined (12). Paraje Galarza, 1 male (UNNEPin-101) on *M. riparius* (CML12656), 19/12/2015; 1 male (UNNEPin-102) on *M. riparius* (CML12657), 12/03/2016; 1 male (UNNEPin-103) on *M. riparius* (CML12658), 14/03/2016 and 1 male (UNNEPin-104) on *E. furinalis* (CML12508), 17/03/2017. Colonia Carlos Pellegrini, 1 male (UNNEPin-105) on *M. albescens* (CML12513), 15/12/2015; 1 male (UNNEPin-106) on *M. albescens* (CML12515), 15/12/2015; 1 male (UNNEPin-107) on *M. albescens* (CML12521), 15/12/2015; 1 male

(UNNEPin-108) on *E. furinalis* (CML12499), 09/02/2017; 2 males (UNNEPin-109) on *M. riparius* (CAG-12641), 10/02/2017; 1 male (UNNEPin-110) on *M. albescens* (CML12526), 10/02/2017; 1 male (UNNEPin-111) on *E. furinalis* (CML12500), 10/02/2017. Collected by Di Benedetto, I.M.D.

Comments. The sample male *Basilia* collected with corresponding females were established to be *Basilia* sp. due to the difficulty in determining the species, as there are few taxonomic keys that describe them. The samples were found on two bat species from the Vespertilionidae family.

Hemiptera (Polyctenidae)

Hesperoctenes eumops Ferris & Usinger, 1939

Heperoctenes eumpos Ferris & Usinger, 1939: 19, figs. 14, 17, 18.

Material examined (5). Paraje Galarza, 2 females (UNNEPin-127) on *E. patagonicus* (CML12735), 16/3/2015. Colonia Carlos Pellegrini, 1 nymph, 1 female and 1 male (UNNEPin-128) on *E. patagonicus* (CML12726), 10/03/2016. Collected by Di Benedetto, I.M.D.

Host and distribution in Argentina. Molossidae: *E. patagonicus* (Tucumán) (Autino *et al.* 1999).

Identification. The pronotum is much wider than it is long with semi convergent edges and covered with irregularly distributed thin setae leaving many glabrous areas on the discal region. The mesonotal lobes are shorter than the pronotum and the edges are subcuadrangular, with each lobe being slightly longer than wide and densely covered with thin setae, except in the ante-inner area that is glabrous. The prosternum is triangular, longer than it is wide and with an anterior marginal row of strong setae, followed by two more rows of weaker setae; the posterior area is glabrous except two longitudinal rows of small slightly convergent setae. The femur I is strongly curved in the middle of the posterior edge. The nymph corresponds to the second to last nymphal stage.

Comments. This species was cited only on *E. perotis californicus* Merriam, 1890 in California (Ferris & Usinger 1939; Ueshima 1972) and *E. perotis perotis* Schinz, 1821 in Brazil (Ronderos 1959). In Argentina Autino *et al.* (1999) cited *H. eumops* in the Yungas, in the Reserva Provincial La Florida (Tucumán) on *E. patagonicus*, the same host found in this work, increasing its distribution to the northeast of the country.

Hesperoctenes fumarius (Westwood, 1874)

Polyctenes fumarius Westwood, 1874: 198, pl. 38. Waterhouse 1880: 319; Speiser 1904: 376.

Hesperoctenes fumarius: Kirkaldy 1906: 375. Costa Lima 1920: 69. Ueshima 1972: 17.

Material examined (1). Paraje Galarza, 1 male (UNNEPin-129) on *M. rufus* (CML12823), 14/03/2016. Collected by Di Benedetto, I.M.D.

Host and distribution in Argentina. Molossidae: *Eumpos bonariensis* Peters, 1874 (Buenos Aires and Tucumán); *Eumops glaucinus* Wagner, 1843 (Jujuy); *M. molossus crassicaudatus* É. Geoffroy Saint-Hilaire, 1805 (Salta); *M. molossus* Pallas, 1766 (Entre Ríos); *Promops nasutus* Spix, 1823 (Salta) (Ronderos 1962b; Autino *et al.* 1999, 2009; Claps *et al.* 2004); unidentified host (Jujuy) (Ronderos 1962b).

Identification. The antennae have four segments; the first antennomere is much shorter than the rest, which are of equal length; the fourth segment is club shaped. The thorax has a pronotum that is wider than it is long and covered with irregularly distributed setae, leaving small glabrous areas on the middle and lateral posterior regions; the mesonotal lobes are slightly shorter than the pronotum, with each lobe slightly wider than long. The prosternum has a triangular form, longer than it is wide, with an anterior marginal row of 14 strong setae that are more robust towards the edges, followed by two irregular rows of somewhat weaker setae. The posterior part of the prosternum has two longitudinal convergent rows of around eight small setae each, the rest is glabrous.

Comments. This species is found in Bolivia, Brazil, Colombia, Peru, and Venezuela (Maa 1961; Autino *et al.* 1999). In Argentina, Ronderos (1962b) cites for the first time *H. fumarius* on *M. molossus crassicaudatus* in Santa Victoria Este, Toldería La Merced (Salta) and in Jujuy on an unidentified host. Autino *et al.* (2009) record *H. fumarius* on *Molossus molossus* in Entre Ríos. There are also records of *E. glaucinus* in Jujuy (Autino *et al.* 2009). In Corrientes it is recorded for the first time on *M. rufus* (Molossidae) constituting a new parasitological association.

Morphologically *H. fumarius* is distinguished from *H. eumops* and *H. giganteus* by a head that is notably wider than it is long and a pronotum that is also much wider than it is long (Ronderos 1962b).

***Hesperoctenes giganteus* Ronderos, 1959**

Hesperoctenes giganteus Ronderos, 1959: 176.

Material examined (7). Paraje Galarza, 1 nymph, 2 females and 1 male (UNNEPin-130) on *M. rufus* (CML12813), 14/3/2015; 1 male (UNNEPin-131) on *M. rufus* (CML12816), 14/3/2015 and 2 females (UNNEPin-132) on *M. rufus* (CML12818), 16/3/2015. Collected by Di Benedetto, I.M.D.

Host and distribution in Argentina. Molossidae: *E. perotis* (Santiago del Estero); *Eumops patagonicus* (Corrientes) (Ronderos 1959; Claps *et al.* 2004).

Identification. The pronotum has subparallel lateral edges. The mesonotal lobes are subrectangular. Ventrally the gular region is glabrous and the prosternum in triangular with a row of thick setae on the anterior marginal edge followed by a row of irregularly dispersed setae. The central area is glabrous, and the posterior edge has some visible setae. The femur I has a uniformly curved posterior edge. The nymph corresponds to the second to last nymphal stage.

Comments. *Hesperoctenes giganteus* is similar to *H. eumops*, though both species are differentiated by the form of the lateral edges of the pronotum and of the mesonotal lobes, and the femur I (Ronderos 1962b). In South America, this species is found exclusively in Argentina where there are two records; the first was found in Santiago del Estero and is the base for the original description of the species (Ronderos 1959), associated with *E. perotis perotis* and the second from la Estancia San Juan Poriahú, Loreto, province of Corrientes (Claps *et al.* 2004) associated with *E. patagonicus*. *Hesperoctenes giganteus* represents the second discovery for the province of Corrientes and the third for Argentina. Also, the association between *H. giganteus* and *M. rufus* (Molossidae) indicates a new host for Corrientes.

Siphonaptera (Ischnopsyllidae)

Myodopsylla wolffsohni wolffsohni (Rothschild, 1903)

Ceratopsylla wolffsohni Rothschild, 1903: 321, figs. 14-16.

Myodopsylla wolffsohni wolffsohni: Jordan 1931: 366; Guimarães 1940: 220, fig. 1; Hopkins & Rothschild 1956: 240; Del Ponte 1977:134.

Material examined (26). Colonia Carlos Pellegrini, 2 females (UNNEPin-133) on *M. albescens* (CML12510), 18/11/2014; 1 male (UNNEPin-134) on *M. albescens* (CML12511), 15/12/2015; 1 male (UNNEPin-135) on *M. albescens* (CML12512), 15/12/2015; 1 female (UNNEPin-136) on *M. albescens* (CML12514), 15/12/2015; 1 female (UNNEPin-137) on *M. albescens* (CML12515), 15/12/2015; 2 females and 1 male (UNNEPin-138) on *M. albescens* (CML12516), 15/12/2015; 1 female (UNNEPin-139) on *M. albescens* (CML12520), 15/12/2015; 10 females and 2 males (UNNEPin-140) on *M. albescens* (CML12521), 15/12/2015; 3 females and 1 male (UNNEPin-141) on *M. riparius* (CML12594), 06/10/2015. Collected by Di Benedetto, I.M.D.

Host and distribution in Argentina. Molossidae: *E. perotis* (Corrientes, Entre Ríos, Salta and Tucumán). Vespertilionidae: *M. albescens* (Corrientes and Salta); *M. chiloensis* Waterhouse, 1840 (Entre Ríos); *M. nigricans* (Salta) (Schreiter & Shannon 1927; Del Ponte 1977; Claps & Autino 2012; Autino *et al.* 2016).

Identification. Have false ctenidium on the abdominal tergites I and II that have four or five thick, pigmented setae. These are absent on the abdominal tergites III and IV.

Comments. This species of flea is distributed in Argentina, Brazil, Paraguay, and Uruguay. *Myodopsylla w. wolffsohni* has false ctenidium on the abdominal tergites I and II, different from *M. isidori* Weyenbergh, 1881 that is also present in Argentina and has false ctenidium on the abdominal tergites I and III (Claps & Autino 2012). *Myodopsylla w. wolffsohni* have been cited in Tucumán, on *E. perotis* (Schreiter & Shannon 1927), in Corrientes (Estancia San Juan Poriahú, Loreto, department of San Miguel) and Salta, on *M. albescens* and *M. nigricans* (Claps & Autino 2012; Autino *et al.* 2016). In Entre Ríos, there is an old citation on *M. chiloensis* (Del Ponte 1977), though the identification of the host could be dubious if we consider that *M. chiloensis* is only present in the provinces of southern Argentina (Barquez 2006). In Uruguay, it is found on *M. riparius* (Claps & Autino 2012).

In this work we identified specimens of *M. w. wolffsohni* on *M. albescens* and *M. riparius*. The latter species constitutes a new host for *M. w. wolffsohni* in Argentina.

Discussion

These results contribute to the understanding of the ectoparasite insect fauna of Corrientes, a province with little investigation regarding its bat ectoparasites: the last paper published by Claps & Autino (2012) and Oscherov *et al.* (2012) reported a flea and Diptera species, respectively.

The current paper provides information regarding eight species of ectoparasite insects from two localities in the province of Corrientes: two species of Streblidae (*A. falcata* and *M. theodori*), two species of Nycteribiidae (*B. carteri* and *B. plaumanni*), three Polycytenidae (*H. eumops*, *H. fumarius* and *H. giganteus*) and one Siphonaptera (*M. w. wolffsohni*), collected from 57 infested bats, constituting the first detailed report about bat ectoparasites in the Esteros del Iberá ecoregion.

The most relevant contributions of this work include the record of four species, not previously mentioned for the province of Corrientes, which entails an expansion of the

distribution of the species, the presence of a larva about to emerge from a Diptera female and the register of four new ectoparasite-host associations.

Regarding the incorporation of new species, four species were cited in Corrientes for the first time: *A. falcata*, *M. theodori* (Streblidae), *H. eumops* and *H. fumarius* (Polycstenidae). These records increase the number of known bat ectoparasite insects in the province to 18 and amplifies the distribution for most of them. Recently, Di Benedetto *et al.* (2022) found *O. hasei* and *O. mimon* in Corrientes, two species of soft tick that raise the total number of bat ectoparasites.

The previous records for *A. falcata* and *M. theodori* come from the province of Misiones (Autino *et al.* 2014, 2018), meaning that their distribution extends approximately 500 km and 250 km, respectively, to the southern most recorded locality. With respect to the Hemiptera, *H. eumops*, had only been cited in the province of Tucumán (Autino *et al.* 1999), in comparison with *H. fumarius* which has a wider distribution in northwestern (Jujuy, Salta, Tucumán) and central Argentina (Buenos Aires, Entre Ríos) (Ronderos 1962 b; Autino *et al.* 1999, 2009; Claps *et al.* 2004). The discovery of these species allows new localities to be added to the departments of Santo Tomé and San Martín. Regarding the rest of the studied species, *B. carteri* has been previously cited in three localities in Corrientes: Estancia San Juan Poriahú, Loreto (Departament of San Miguel), Colonia Carlos Pellegrini (Departament of San Martín) and Isla Apipé Grande (Departament of Ituzaingó) (Claps *et al.* 2004; Oscherov *et al.* 2006, 2012). *Basilia plaumanni* was cited in Isla Apipé Grande (Departament of Ituzaingó) (Oscherov *et al.* 2012) and *H. giganteus* and *M. w. wolffsohni* in Estancia San Juan Poriahú, Loreto (Departament of San Miguel) (Claps *et al.* 2004; Claps & Autino 2012).

In Argentina, the principal hosts for the Diptera species belong to the Phyllostomidae, Vespertilionidae and, to a lesser extent, Molossidae, families. The principal hosts for the Hemiptera correspond to species from Molossidae and the Siphonaptera are found on Molossidae y Vespertilionidae, as demonstrated in the literature and within this work.

With respect the ectoparasite-host associations, *B. carteri* with *M. riparius*; *H. fumarius* and *H. giganteus* with *M. rufus*, represent new records for the province of Corrientes. Also, *M. w. wolffsohni* with *M. riparius* not only represents a new association for Corrientes but also for Argentina.

The discovery of a female of *B. carteri* carrying a larva at the extreme end of her abdomen is exceptional, as it is extremely rare to find this stage during field work. The Diptera from the Nycteribiidae family inhabit their hosts continually during their adult life, except when the female abandons the host to deposit a mature larva (Dick & Pospischil 2015). As the understanding of the different life cycle phases of *Basilia* almost non-existent (Scott 1936), it is necessary to continue investigation to expand the description.

The geographic position of the province of Corrientes, located between the tropical and temperate regions, and the transition between various phytogeographic provinces including the Paranaense, the Chaqueña and Espinal give rise to a great faunistic and floristic richness inside the Argentine territory (Burkart *et al.* 1999; Pavé & Giraudó 2014). The high biogeographic interest is the result of the vegetational corridors originating in Brazil and Paraguay that are potential providers of fauna (Barquez 2004). There are very few studies regarding the diversity of ectoparasites in the Esteros del Iberá, including only the records by Oscherov *et al.* (2006, 2012) and Debarbora *et al.* (2012), who form part of the group Biología de Vectores y Parásitos (BIOVyP), Fa.CENA-UNNE. Nevertheless, in the past few years, interest in ectoparasites and their relationship with their hosts has increased in other parts of the province, associated with anthropic areas and not only related to bats (Di Benedetto *et al.* 2017), but also rodents and marsupials (Benitez-Ibalo *et al.* 2020).

For the stated reasons and due to the complexity of the biotopes and interrelations that characterize the province of Corrientes, it is extremely important to continue studying the

ectoparasites, as they are not only an understudied group in the northeast region, but they also are an important group at an ecosystemic level and for their influence on animal health.

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