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Fleas of Small Mammals in Uruguay, with New Host and Distribution Records

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ABSTRACT: Fleas are ectoparasitic insects of many birds and mammals. More than 200 species and subspecies of fleas have been recorded from South America; however, they have been poorly studied in Uruguay. In the present study, *Polygenis* (*Neopolygenis*) *atopus*, *Polygenis* (*Neopolygenis*) *massoiai*, *Polygenis* (*Polygenis*) *axius axius*, *Craneopsylla minerva minerva*, and *Sternopsylla distincta* are reported for the first time in Uruguay. These fleas parasitize wild rodents, marsupials, and bats, and most of the ectoparasite–host associations are recorded for the first time. Results obtained are consistent with findings in nearby Argentinean and Brazilian localities.

KEY WORDS: fleas, Siphonaptera, *Polygenis* species, *Craneopsylla minerva minerva*, *Sternopsylla distincta*, ectoparasites, bats, marsupials, sigmodontine rodents, South America, Uruguay.

Fleas are ectoparasitic insects of many birds and mammals, but they are mainly associated with wild rodents (Marshall, 1981). From an epidemiological point of view, fleas are important because of their role in the maintenance of pathogens in wild reservoirs and as vectors of pathogens that cause diseases in humans and in domestic animals (Marshall, 1981; Linardi and Guimarães, 2000). Of the 3,000 flea species and subspecies known throughout the world (Lewis, 1998), 280 species belonging to 52 genera have been listed from South America (Linardi and Guimarães, 2000). In Argentina, more than 100 species and subspecies have been recorded (Autino and Lareschi, 1998; Beaucournu and Castro, 2003), and 54 have been mentioned from Brazil (Linardi and Guimarães, 2000). However, in Uruguay, fleas have been poorly studied. Fewer than 10 species have been reported from Uruguay, most of them in association with birds, domestic animals, rats (Castro and Trenchi, 1955), and bats (Claps et al., 1998, 1999; Autino et al., 2004).

The aim of the present study is to extend our knowledge of the flea fauna associated with wild rodents, marsupials, and bats from Uruguay.

MATERIALS AND METHODS

Uruguay is situated in southeastern South America (Fig. 1). The Uruguay and La Plata rivers bound the country on the southwest and separate it from the Argentinean Buenos Aires, Entre Ríos, and Corrientes provinces; to the north, Uruguay borders Rio Grande do Sul State, Brazil. The country is located between the 30° and 35° south parallels and the 53° and 58° west meridians. From a biogeographic point of view, Uruguay belongs to the Uruguayensis District of Pampean Province (Chebataroff, 1951, 1955; Cabrera and Willink, 1973), which is characterized by the dominance of subtropical prairies; an undulating topography with few localities more than 300 m above the sea level (highest peaks scarcely above 500 m); a templer subtropical subhumid climate; a median yearly temperature of 17–18°C; and 1,000 to 1,200 mm of precipitation annually. Vegetation consists mainly of diversified grasslands, with forests associated with watercourses and highlands. There are bushlands and wetland communities in some areas, the whole resembling a savanna (Evia and Gudynas, 2000). Names and coordinates for each collection locality are (Fig. 1): Parque Lecocq, Montevideo Co. (34°47′S, 56°22′W), Instituto Nacional de Investigación Agropecuaria (INIA) Las Brujas, Canelones Co. (34°40′S, 56°20′W), Arroyo Tropa Vieja, Canelones Co. (34°45′S, 55°50′W), Piriápolis, Maldonado Co. (34°48′S, 55°17′W), Cerro Pan de Azúcar, Maldonado Co. (34°37′S, 55°19′W), Barra del Arroyo Maldonado, Maldonado Co. (34°55′S, 54°50′W), Posada La Laguna, Maldonado Co. (34°20′S, 54°42′W), Forestal Compañía Oriental Forestadora Uruguaya S.A. (COFUSA), Rivera Co. (31°16′S, 55°13′W), and Kiyú, San José Co. (34°38′S, 56°45′W).

Ninety-two mammals were captured from 1999 to 2003 in accordance with Uruguayan regulations and policies. Mammals were identified following González (2001) as *Akodon azarae* (Fischer), *Oligoryzomys* sp., *Scapteromys tumidus* (Waterhouse), *Oxymycterus nasutus* (Waterhouse), and *Necromys obscurus* (Waterhouse) (Rodentia, Cricetidae, Sigmodontinae); *Didelphis albiventris* Lund and *Monodelphis dimidiata* (Wagner) (Didelphimorphia,

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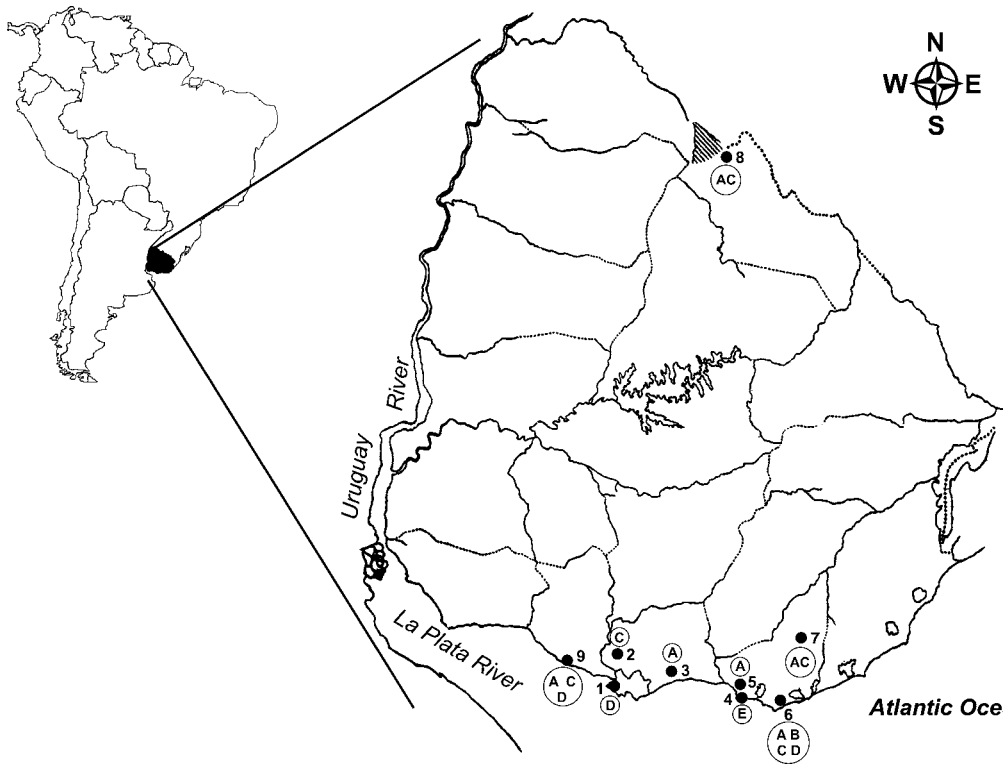

Figure 1. Collection sites and distribution of reported reported fleas within Uruguay. Localities: **1,** Parque Lecocq, Montevideo Co.; **2,** INIA Las Brujas, Canelones Co.; **3,** Arroyo Tropa Vieja, Canelones Co.; **4,** Piriápolis, Maldonado Co.; **5,** Cerro Pan de Azúcar, Maldonado Co.; **6,** Barra del Arroyo Maldonado, Maldonado Co.; **7,** Posada La Laguna, Maldonado Co.; **8,** Forestal COFUSA, Rivera Co.; **9,** Kiyú, San José Co. Flea species and subspecies: **A,** *Polygenis* (*Neopolygenis*) *atopus*; **B,** *Polygenis* (*Neopolygenis*) *massoiai*; **C,** *Polygenis* (*Polygenis*) *axius axius*; **D,** *Craneopsylla minerva minerva*; **E,** *Sternopsylla distincta*.

Didelphidae); and *Tadarida brasiliensis* (I. Geoffroy) (Chiroptera, Molossidae). Mammal names follow Wilson and Reeder (1993).

Mammals were examined for fleas, which were collected from the fur of the hosts, fixed in 96% ethanol, and mounted in Canada balsam for taxonomic identification using the keys and descriptions given by Hopkins and Rothschild (1956), Smit (1987), Beaucournu and Alcover (1989), and Linardi and Guimarães (2000). Voucher specimens were deposited in the collection of the Laboratorio de Parasitología, Museo de História Natural Capão da Imbuia (MHNCI), Curitiba, Paraná, Brazil. Additional voucher specimens will be deposited in the Colecciónde Entomología del Museo de la Plata (Argentina).

Family Rhopalopsyllidae

Subfamily Rhopalopsyllinae

Polygenis (*Neopolygenis*) *atopus* (Jordan and Rothschild, 1922)

Locality and hosts: Arroyo Tropa Vieja, *S. tumidus*; Barra del Arroyo Maldonado, *D. albiventris*, *O. nasutus*, *S. tumidus*; Cerro Pan de Azúcar, *A. azarae*; Posada La Laguna, *A. azarae*; Kiyú, *A. azarae*, *S. tumidus*; Forestal COFUSA, *Oligoryzomys* sp.

Type host and type locality: Didelphis aurita Wied-Neuwied, Humboldt, Joinville, Santa Catarina, Brazil.

Other reported hosts: Marsupials, especially *Didelphis* spp. and sigmodontine rodents, mainly *Oryzomys* spp. and *Oligoryzomys* spp. (Smit, 1987; Autino and Lareschi, 1998; Linardi and Guimarães, 2000).

Other locality records: Argentina (Buenos Aires and Entre Ríos Provinces), Bolivia, Brazil (Minas Gerais, Rio de Janeiro, São Paulo, Paraná and Santa Catarina States), Panamá and Venezuela (Smit, 1987; Autino and Lareschi, 1998; Linardi and Guimarães, 2000).

Specimens deposited: MHNCI 1256, 1258, 1259, 1261, 1264, 1266, 1268, 1270B, 1274, 1275, 1276, 1277, 1281, 1284, 1285, 1286, 1288, 1289, 1290, 1291, 1292B.

Remarks: Polygenis atopus has been recorded from central and southern Brazil and eastern Argentina. In both countries, this flea was collected from the marsupial *D. albiventris* and species of *Oligoryzomys* and *Oryzomys* (Autino and Lareschi, 1998; Lareschi and Iori, 1998; Linardi and Guimarães, 2000). Machado-Allison (1962) reported *P. atopus* associated mainly with marsupials. However, Linardi (1985) recorded the preference of this flea as species of *Oryzomys*. In localities situated next to the La Plata and Paraná rivers in Argentina, *P. atopus* is very abundant, and it also has been found associated with *A. azarae*, *Oxymycterus rufus* (Fischer), and *Scapteromys aquaticus* Thomas, with a remarkable preference for *S. aquaticus* (Lareschi and Iori, 1998; Lareschi, Notarnicola et al., 2003; Nava et al., 2003). This is the first record of *P.* (*N.*) *atopus* in Uruguay and *O. nasutus* and *S. tumidus* are new host records.

Polygenis (*Neopolygenis*) *massoiai* Del Ponte, 1967

Locality and hosts: Barra del Arroyo Maldonado *O. nasutus*; Piriápolis *O. nasutus*; Posada La Laguna *O. nasutus*.

Type host and type locality: O. rufus, Miramar, Buenos Aires Province, Argentina.

Other reported hosts: Sigmodontine rodents (=Cricetidae) (Smit, 1987; Autino and Lareschi, 1998).

Other locality records: Argentina (Buenos Aires Province) (Smit, 1987; Autino and Lareschi, 1998). Beaucournu and Castro (2003) erroneously mentioned this species in the Argentinean Entre Ríos Province, in reference to Smit's citation (1987) "Delta del Paraná."

Specimens deposited: MHNCI 1259, 1296.

Remarks: Polygenis massoiai previously was reported only from eastern Argentina (Smit, 1987; Autino and Lareschi, 1998), mainly in areas next to La Plata River, where it is associated with both *S. aquaticus* and *O. rufus*, but it is more abundant on *O. rufus* (Lareschi and Iori, 1998; Lareschi, Notarnicola et al., 2003). This is the first report of *P.*(*N.*) *massoiai* in Uruguay, and *O. nasutus* is a new host record.

Polygenis (*Polygenis*) *axius axius* (Jordan and Rothschild, 1923)

Locality and hosts: INIA, Las Brujas, *A. azarae*, *N. obscurus*; Posada La Laguna, *A. azarae*; Barra del Arroyo Maldonado, *O. nasutus*, *S. tumidus*; Piriápolis, *O. nasutus*; Forestal COFUSA, *Oligoryzomys* sp.; Kiyú, *S. tumidus*, *A. azarae*; Parque Lecocq, *M. dimidiata*.

Type host and type locality: O. rufus, Noetinger, Córdoba Province, Argentina.

Other reported hosts: Rodents and marsupials (Smit, 1987; Autino and Lareschi, 1998; Linardi and Guimarães, 2000).

Other locality records: Argentina (Buenos Aires, Córdoba, Santa Fé and San Juan Provinces) (Autino and Lareschi, 1998; Beaucournu and Castro, 2003), and Brazil (Minas Gerais, São Paulo and Paraná States) (Linardi and Guimarães, 2000).

Specimens deposited: MHNCI 1258, 1262, 1263, 1264, 1265, 1266, 1267B, 1269, 1278, 1279, 1280, 1282, 1287, 1292-A, 1295, 1296, 1657, 1659, 1660, 1661, 1662.

Remarks: In Buenos Aires Province, *P. a. axius* has been collected on *N. obscurus*, *A. azarae*, *S. aquaticus*, and *O. rufus*, mainly in localities next to the La Plata River (Lareschi and Iori, 1998). *Polygenis a. axius* has also been reported from central and southern Brazil, associated with rodents and marsupials; species of *Akodon* and *Oxymycterus* have been reported associated with this flea (Linardi and Guimarães, 2000). This is the first report of *P. a. axius* in Uruguay; and *O. nasutus*, *S. tumidus*, and *M. dimidiata* are new host records.

Family Stephanocircidae

Craneopsylla minerva minerva (Rothschild, 1903)

Locality and hosts: Parque Lecocq, *A. azarae;* Barra del Arroyo Maldonado, *S. tumidus*, *O. nasutus*; Kiyú, *A. azarae*.

Type host and type locality: Didelphys azarae Temminck, Sapucay, Paraguay.

Other reported hosts: Rodents and marsupials (Hopkins and Rothschild, 1956; Autino and Lareschi, 1998; Linardi and Guimarães, 2000).

Other locality records: Argentina (Jujuy, Catamarca, Tucumán, Buenos Aires, Salta, Mendoza and

Río Negro Provinces), Brazil (Alagoas, Ceará, Minas Gerais, Paraná, Pernambuco, Rio de Janeiro, Santa Catarina and São Paulo States), Paraguay, Peru and Venezuela (Hopkins and Rothschild, 1956; Autino and Lareschi, 1998; Linardi and Guimarães, 2000; Beaucournu and Castro, 2003).

Specimens deposited: MHNCI 1257, 1260, 1267, 1269, 1270, 1271, 1272, 1273, 1279, 1283, 1285, 1287, 1291, 1292A, 1293.

Remarks: In Argentina, *C. m. minerva* has been found mainly associated with wild rodents in Buenos Aires Province. Next to Uruguay, in the Argentinean margin of the Paraná River, it has been found associated with *O. flavescens*, *A. azarae*, *S. aquaticus*, and *O. rufus* (Lareschi and Linardi, 2000). Although *C. m. minerva* has been also reported from localities situated in central and northwestern Argentina (Lareschi, Autino et al., 2003), in most of the country, the allied subspecies *Craneopsylla minerva wolffhuegeli* (Rothschild, 1909) is more abundant (Hopkins and Rothschild, 1956; Lareschi et al., 2004). In Brazil, only the subspecies *C. m. minerva* has been reported. Species of *Akodon* and *Oxymycterus* have been listed among the hosts of this subspecies (Linardi and Guimarães, 2000). This is the first record of *C. m. minerva* in Uruguay, and *O. nasutus* and *S. tumidus* are new host records.

Family Ischnopsyllidae

Sternopsylla distincta (Rothschild, 1903)

Locality and hosts: Piriápolis, *T. brasiliensis*.

Type host and type locality: "Bat," unknown species, Villa Rica, Departamento Guairá, Paraguay.

Other reported hosts: Bats (Hopkins and Rothschild, 1956).

Other locality records: Argentina (Mendoza, Tucumán, Buenos Aires, Catamarca and Salta Provinces), Brazil (Minas Gerais, Paraná and Rio Grande do Sul States), Paraguay, Peru, Chile and Ecuador (Hopkins and Rothschild, 1956; Autino and Lareschi, 1998; Linardi and Guimarães, 2000).

Specimens deposited: MHNCI 1294.

Remarks: In Argentina, *S. distincta* has been reported associated with species of *Myotis* and *Tadarida* (Autino and Lareschi, 1998); in Buenos Aires Province, it was reported from *T. brasiliensis*. In Brazil, it has been reported from species of *Molossus* and *Tadarida*. Because subspecies are differentiated on the basis of the morphology of male genitalia (Linardi and Guimarães, 2000), and in the present study only 7 females were collected, we were only able to identify them to species level. This is the first report of *S. distincta* in Uruguay.

DISCUSSION

Previous reports of fleas associated with wild small mammals in Uruguay are limited to *Ctenocephalides felis* from captive-born individuals of the marsupial *Didelphis paraguayensis* Oken (Vogelsang, 1926), *Myodopsylla isidori* (Weyenbergh, 1881) (Ischnopsyllidae) associated with bats of the genus *Myotis* (Claps et al., 1998, 1999; Autino et al., 2004), and *Polygenis* (*Polygenis*) *platensis* (Jordan and Rothschild, 1908) on the rodent *Ctenomys brasiliensis* Blainville from Montevideo (Jordan and Rothschild, 1923; Smit, 1987). Therefore, the results presented in this study constitute an important contribution to the knowledge of the flea fauna associated with wild small mammals in Uruguay.

All species and subspecies of fleas collected in this study are reported for the first time in Uruguay, extending their known distribution. All species except *P. massoiai* have been previously collected in areas of Argentina and Brazil adjacent to Uruguay (Lareschi and Iori, 1998; Linardi and Guimarães, 2000; Lareschi, Notarnicola et al., 2003.; Nava et al., 2003).

Most of the fleas collected in this study were associated with sigmodontine rodents. However, *S. distincta* was collected from bats, and *P. atopus* and *P. a. axius* were also collected from marsupials. Before this study, the only flea reported from *M. dimidiata* in South America was *Adoratopsylla* (*Adoratopsylla*) *antiquorum antiquorum* (Rothschild, 1904) (Ctenophthalmidae), collected in Brazil (Linardi and Guimarães, 2000). Our report of *P. a. axius* from this marsupial is thus noteworthy. In addition, these results demonstrate that although in some cases a host species is associated with the same flea species or subspecies in different countries (e.g., *S. distincta* on *T. brasiliensis*, and *C. m. minerva* on *A. azarae*), in other cases, a certain flea species parasitizes allied host species in each country (e.g., *O. nasutus* and *O. rufus*, as well as *S. tumidus* and *S. aquaticus*).

The flea fauna of Uruguay, as reported in this study, is similar to that in nearby South American localities. Because Uruguay, as well as east-central

Argentina and the southern area of Rio Grande do Sul in Brazil, belongs to the Pampean Biogeographic Province (Cabrera and Willink, 1973), this similarity was not unexpected. However, for the genus *Polygenis* in Brazil, species in the subgenus *Polygenis* are more abundant (Linardi and Guimarães, 2000), whereas in Uruguay (this study) and the Argentinean Buenos Aires Province (Lareschi and Iori, 1998), species in the subgenus *Neopolyenis* are more abundant.

Because fleas act as vectors of diseases—particularly species of *Polygenis*, which are known to transmit sylvatic plague among wild rodents (Linardi and Guimarães, 2000)—the extension of their known geographic range, as well as the new host records reported in this study, are important from an epidemiological viewpoint.

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