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David L. Biassi

Laboratório de Doenças Infecciosas e Parasitárias, Área de Ciências Biológicas e da Saúde, Universidade do Oeste de Santa Catarina; Rua Getúlio Vargas, 2125, Bloco B, Sala 306, CEP 89600-00, Joaçaba, Santa Catarina, Brasil.

Carlos B. Marcondes

Departamento de Microbiologia, Imunologia e Parasitologia, Centro de Ciências Biológicas, Universidade Federal de Santa Catarina, 88040-900, Florianópolis, Santa Catarina, Brasil.

Glauber Wagner

Laboratório de Doenças Infecciosas e Parasitárias, Área de Ciências Biológicas e da Saúde, Universidade do Oeste de Santa Catarina; Rua Getúlio Vargas, 2125, Bloco B, Sala 306, CEP 89600-00, Joaçaba, Santa Catarina, Brasil..

Gerson A. Muller

(B) Instituto de Educação, Ciência e Tecnologia Farroupilha, Campus Panambi, 98280-000, Panambi, Rio Grande do Sul, Brasil.

Mosquito species collected in a fragmented of the Atlantic forest bioma in the southern of Brazil

David L. Biassi, Carlos B. Marcondes, Glauber Wagner, Gerson A. Muller

Abstract

Mosquitoes are important vectors of various pathogens, such as yellow fever, dengue, Chikungunya virus and malaria. Lately, some of these diseases are emerging in the southern of Brazil due to the spread of their vectors probably by the intense forest fragmentation. Thus, the goal of this study was to survey mosquito species in a fragmented environment. Mosquitoes were collected in an area of fragmented vegetation in Atlantic forest biome in the southern of Brazil (Municipality – Paulo Lopes, Santa Catarina state). Collections were developed in the afternoon, crepuscule and night, in January and February 2013. Eight-hundred eighty-two specimens, distributed in two subfamilies, 14 genera and 33 species were obtained, among all *Ochlerotatus scapularis* was the predominant species (62%). Also, the presence of *Anopheles cruzii* and *Aedes albopictus* must be emphasized, due to their epidemiological importance. The mosquito fauna is very diversified, indicating the availability of several breeding places.

Keywords: South America; Diptera; Atlantic Forest; Vectors.

1. Introduction

Mosquitoes have been studied due to their epidemiological importance, as vectors of diseases. In Brazil, besides dengue, yellow fever and malaria, several arbovirus are transmitted by these insects ^[1].

Human interference on natural habitats may cause the fragmentation and suppression of sensitive species, besides proliferation of others, more adapted to modified habitats. For example, *Sabethes* species are adapted to preserve forest, while most species of *Psorophora* occur in degraded environments ^[2].

Among the approximately 3,700 species of mosquitoes in the world, Brazil, has around 470 species, making the most diversified fauna in the world ^[3]. The southern Brazilian state of Santa Catarina, like most other states, has suffered intense fragmentation of forests, especially the Atlantic Forest, which has probably affected the mosquito fauna. The objective of this study was to develop a survey of mosquito species in a fragmented environment in this state, to check the presence of epidemiologically important species and to evaluate the association to several vegetation types.

2. Material and methods

2.1. Study area

Collections were developed in the municipality of Paulo Lopes, in the East of state of Santa Catarina. The area was composed by five forest fragments, whose areas varied from 400 to 5,000 m² (27°56'16.85"S e 48°37'28.63"W). These fragments were classified as *Restinga Arbórea* in secondary process of regeneration (Atlantic forest biome), and were separated among them by at least 300 meters, being surrounded by pasture and rice cultivation areas.

2.2. Method of collection

Collections were performed in January and February 2013 (summer), with a sampling effort of 20 hours. In the afternoon (from 3 p.m. to 5 p.m.), they were collected while trying to bite collectors utilizing plastic suction tubes, as described by Marcondes *et al.* ^[4]. In crepuscule and at night (from 6 p.m. to 8 p.m.), they were collected with suction tubes while a Shannon trap with a lampoon light attracted them.

Correspondence:

Gerson A. Muller

(B) Instituto de Educação, Ciência e Tecnologia Farroupilha, Campus Panambi, 98280-000, Panambi, Rio Grande do Sul, Brasil.

2.3. Identification of mosquitoes

Collected mosquitoes were killed in a tube containing ethyl acetate and maintained in card boxes with soft paper. In the laboratory, They were glued to triangles fixed with entomological pins and examined in stereoscopic microscope. Mosquitoes were identified utilizing dichotomous keys from Lane [5], Correa and Ramalho [6] and Forattini [1]. *Ochlerotatus* was accepted as a genus [7] and genera were abbreviated as proposed by Reinert [8]. The material was added to the collection of Laboratory of Infectious and Parasitic Diseases at Universidade do Oeste de Santa Catarina.

3. Results and discussion

In the present study, 882 specimens of mosquitoes, distributed in 14 genera and 33 species were obtained (Table 1). According to Marcondes *et al.* [9], Müller *et al.* [10] and Reis *et al.* [11], 75 species had been reported in the state of Santa Catarina, mostly in the East, and the present fragmented area has at least 45% of the known fauna in the state, indicating a great diversity.

Table 1: Species of Culicidae obtained in Atlantic forest fragments in the East of Santa Catarina state in January and February 2013.

Species	N (%)
<i>Anopheles lanei</i>	27 (3,1)
<i>Anopheles cruzii</i>	12 (1,4)
<i>Aedes albopictus</i>	2 (0,2)
<i>Coquillettidia chrysonotum</i> *	1 (0,1)
<i>Coquillettidia hermanni</i> *	1 (0,1)
<i>Coquillettidia shannoni</i>	2 (0,2)
<i>Coquillettidia venezuelensis</i>	1 (0,1)
<i>Culex</i> spp.	10 (1,1)
<i>Isostomyia espinii</i>	12 (1,4)
<i>Limatus durhamii</i>	5 (0,6)
<i>Mansonia titillans</i>	1 (0,1)
<i>Mansonia wilsoni</i>	1 (0,1)
<i>Ochlerotatus crinifer</i>	4 (0,4)
<i>Ochlerotatus jacobinae</i> *	3 (0,3)
<i>Ochlerotatus rhyacophilus</i>	63 (7,1)
<i>Ochlerotatus scapularis</i>	547 (62,0)
<i>Ochlerotatus serratus</i> s.l.	11 (1,2)
<i>Onirion personatum</i>	1 (0,1)
<i>Psorophora ferox</i>	21 (2,4)
<i>Psorophora lanei</i>	1 (0,1)
<i>Psorophora lutzii</i>	1 (0,1)
<i>Runchomyia cerqueirai</i>	2 (0,2)
<i>Runchomyia humboldti</i>	2 (0,2)
<i>Runchomyia theobaldi</i>	3 (0,3)
<i>Sabethes purpureus</i>	1 (0,1)
<i>Trichoprosopon pallidiventer</i>	2 (0,2)
<i>Wyeomyia davisii</i>	2 (0,2)
<i>Wyeomyia incaudata</i>	62 (7,0)
<i>Wyeomyia lassalli</i>	6 (0,7)
<i>Wyeomyia longirostris</i>	2 (0,2)
<i>Wyeomyia pallidiventer</i>	7 (0,8)
<i>Wyeomyia palmata</i>	1 (0,1)
<i>Wyeomyia pilicauda</i>	37 (4,2)
<i>Wyeomyia theobaldi</i>	28 (3,2)
Total	882 (100,0)

*First report for Santa Catarina state.

Ochlerotatus scapularis was the predominant specie identified, accounting for 62% of the obtained specimens, being dominant in degraded environments. Females of this

species lay eggs in soil areas subject to be flooded, and some days after rainfall great populations can occur. It is a potential vector of several arboviruses [1, 12] and *Dirofilaria immitis* [13] and dirofilariasis was found in 15% of dogs examined (by low sensitivity parasitological tests) in Florianopolis [14], which is close to the study area.

The presence of *An. cruzii* and *Ae. albopictus*, potential vectors respectively, of malaria and several arboviruses, must be emphasized. *An. cruzii* was considered the most important vector of malaria in the eastern part of state of Santa Catarina, due to the abundance of bromeliads [15]. And *Ae. albopictus* is widely distributed in the South America and is a potential vector of dengue and Chikungunya viruses [16].

A similar study developed in two localities in the city of Itapema, São Paulinho (27°6'26.98''S 48°38'37.86''W) and Praia Grossa (27°53'47''S 48°35'51.16''W), respectively forested and of *Restinga*, at 70 km to the North found 16 species [17] (Marchi *et al.*, 2010), of which only six were present in the present study, probably a indicating strong influence of latitude and other conditions.

All species of *Runchomyia* found in UCAD forest in the Santa Catarina Island [11], were also collected in Paulo Lopes, except to *Ru. reversa* and *Ru. frontosa*, but additional collections may show the presence of these species in the study area.

The great diversity of *Wyeomyia (Phoniomyia)* spp. in the eastern region of Santa Catarina is remarkable. In fact, from the 22 known species [6, 18], eight were found in the present study and 15 were found in a forested area in the Santa Catarina Island (UCAD), where more thoroughly studies have been developed [11].

A study developed in a nearby area of *Restinga* (Southern Brazilian Coastal Vegetation) indicated the presence of *An. deaneorum* [19] and several other *Anopheles* species, totaling 25 species of mosquitoes, most of them were not reported in this state so far (V. F. Freitas – pers. commun.), reinforcing the need of additional studies on the mosquito fauna of this state.

4. Conclusion

The fauna of mosquitoes in the studied forest fragments is diversified and the environment may represent an important habitat for potential vectors of diseases. The influence of latitude and vegetation on the mosquito fauna needs to be more thoroughly studied.

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