

***Culicoides* (Diptera: Ceratopogonidae) from Ceará State, northeastern Brazil: Diversity, new records and bionomic approaches**

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ABSTRACT: Introduction: little is known about the biodiversity of the genus *Culicoides* and the possible presence of vector species in Ceará State, Brazil. **Objective:** to improve the knowledge about the biodiversity and possible vectors presence in northeastern Brazil. **Methods:** with CDC light traps we surveyed *Culicoides* species in 18 municipalities from six mesoregions of Ceará State. **Results:** we collected 1 453 specimens (12 species). *Culicoides guyanensis* was the most abundant species, with 75,84% of the collected specimens. *Culicoides venezuelensis* is well distributed and is found in five Mesoregions. We recorded five species for the first time from Ceará State and seven from the surveyed municipalities; the presence of species with sanitary importance is discussed. **Conclusion:** with the addition of new species records, there are now 12 species known from Ceará State. The presence of species with medical and/or veterinary importance in the studied Mesoregions is indicative of the need of epidemiological surveillance in this state.

Key words: biting midges, insect vectors, biodiversity, bionomy.

RESUMEN: “*Culicoides* (Diptera: Ceratopogonidae) del estado de Ceará, noreste de Brasil: Diversidad, nuevos registros y enfoques bionómicos”. **Introducción:** poco se sabe sobre la biodiversidad del género *Culicoides* y la posible presencia de especies de vectores en el estado de Ceará, Brasil. **Objetivo:** mejorar el conocimiento de la biodiversidad y la posible presencia de vectores en el noreste de Brasil. **Métodos:** utilizamos trampas luminosas CDC, realizamos un levantamiento de las especies de *Culicoides* en 18 municipios pertenecientes a seis mesorregiones del estado de Ceará. **Resultados:** un total de 1 453 ejemplares (12 especies) recolectamos. *Culicoides guyanensis* fue la especie más abundante correspondiendo al 75,84% de los especímenes recolectados. *Culicoides venezuelensis* está bien distribuida en cinco de las mesorregiones investigadas. Cinco especies reportamos por primera vez para el estado de Ceará y siete especies para los municipios de las mesorregiones estudiadas; discutimos la presencia de especies de importancia sanitaria. **Conclusión:** con la adición de nuevos registros de especies, existen ahora 12 especies conocidas para el estado de Ceará. La presencia de especies con importancia médica y/o veterinaria en las mesorregiones estudiadas es indicativa de la necesidad de una vigilancia epidemiológica en el estado.

Palabras clave: jejenos, insectos vectores, biodiversidad, bionomía.

The genus *Culicoides* Latreille, 1809 includes 1 368 extant species distributed worldwide (Borkent, 2016). Santarém and Felipe-Bauer (2018) listed 299 species from the Neotropical Region and 150 from Brazil. Ceará State is included in northeastern Brazil and despite occupying an area of 148 016 km², few studies was carried out on *Culicoides* in this state. Only *Culicoides debilipalpis* Lutz,

1913, *C. guyanensis* Floch & Abonnenc, 1942, *C. insignis* Lutz, 1913, *C. leopoldoi* Ortiz, 1951, *C. maruim* Lutz, 1913, *C. paraensis* (Goeldi, 1905) and *C. phlebotomus* (Williston, 1896) have been reported from Ceará State (Santarém & Felipe-Bauer, 2018). Of these, *C. paraensis* is considered the most important species of Ceratopogonidae in the Neotropics due to its vector role in Oropouche fever and

its possible implication in the mansonelliasis transmission in Brazil and other Latin American countries. Also, *C. insignis* as well as *C. pusillus* Lutz, 1913 are incriminated as vector of Bluetongue in Central and South America.

The aim of this study is to provide a survey of *Culicoides* species in 18 municipalities of the six Mesoregions of Ceará to improving the knowledge about the biodiversity and possible vectors presence in northeastern Brazil.

MATERIALS AND METHODS

This survey was performed using CDC light traps in two moments, in the following Mesoregions of Ceara

State: Jaguaribe, Metropolitan of Fortaleza, North, Northwest, Sertões and South (Fig. 1). During 07 to 30 January 2008, collections were made in 13 municipalities of the mesoregions: Metropolitan of Fortaleza (Fortaleza 3°56'66"S & 64°38'33"W, Aquiraz 3°90'00"S & 38°36'66"W and Horizonte 4°08'33"S & 38°48'33"W), Jaguaribe (Aracati 4°55'00"S & 37°78'33"W, Limoeiro do Norte 5°15'00"S & 38°13'33"W and Russas 4°91'66"S & 37°96'66"W), North (Redenção 4°21'66"S & 38°71'66"W, São Gonçalo do Amarante 3°60'00"S & 38°96'66"W and Itapipoca 3°48'33"S & 39°58'33"W), Northwest (Barroquinha 2°98'33"S & 41°08'33"W and Tianguá 3°73'33"S & 40°98'33"W), Sertões (Tauá 5°98'33"S & 40°28'33"W) and South (Juazeiro do Norte 7°20'00"S

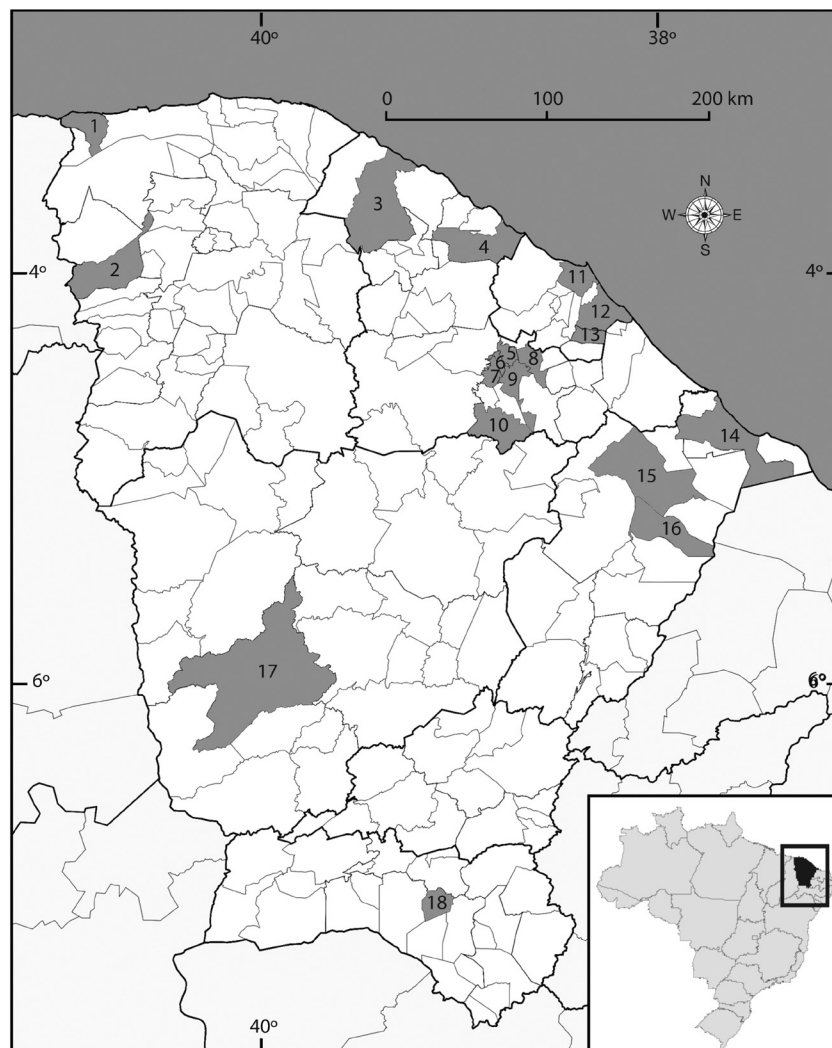


Fig.1. Map of the Ceará State with indication of the 18 surveyed municipalities during 07 to 30 January 2008 and February 2013 to January 2014. Northwest Mesoregion: 1. Barroquinha, 2. Tianguá; North Mesoregion: 3. Itapipoca, 4. São Gonçalo do Amarante, 5. Pacoti, 6. Guaramiranga, 7. Mulungu, 8. Redenção, 9. Baturité, 10. Itapiuna; Metropolitan of Fortaleza Mesoregion: 11. Fortaleza, 12. Aquiraz, 13. Horizonte; Jaguaribe Mesoregion: 14. Aracati, 15. Russas, 16. Limoeiro do Norte; Sertões Mesoregion: 17. Tauá; South Mesoregion: 18. Juazeiro do Norte.

& 39°33'33"W). The captures were made during three consecutive nights in the chosen localities. The captures were taking near the stable in the municipalities with livestock activities, and in the mangrove in costal municipalities. Captures of possible insect vectors is one of the actions of the Health Secretariat of Ceará State that does not required collection permit considering the Normative Instruction no. 141 of December 19, 2006 of the "Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis" (IBAMA).

During February 2013 to January 2014, collections were made in 11 localities of the five municipalities from North Mesoregion, as follows: Municipality of Baturité (Jordão 4°21'38"S & 38°54'73"W, Labirinto 4°17'73"S & 38°54'56"W and Tijuca 4°18'16"S & 38°54'18"W), Municipality of Guaramiranga (Álvaro 4°17'33"S & 38°57'00"W and Granja Bonfim 4°14'24"S & 38°56'08"W), Municipality of Itapiúna (Boa Água 4°34'69"S & 38°49'49"W), Municipality of Mulungu (Bagaço 4°17'92"S & 38°57'26"W, Piaba 4°17'37"S & 38°57'38"W and Trapiá 4°21'56"S & 38°59'54"W) and Municipality of Pacoti (Arvoredo 4°13'78"S & 38°55'70"W and Mulunguzinho 4°13'45"S & 38°55'90"W). The captures were taking weekly during one month for each locality.

The collected specimens were sent to Ceratopogonidae Collection of Instituto Oswaldo Cruz (CCER/FIOCRUZ) for identification. The morphotypes were separated using stereomicroscope Olympus SZ40. Part of specimens was slide-mounted in phenol-balsam as described by Wirth and Marston (1968) and the remaining specimens were kept in 70% ethanol. For analyze and identification of specimens, we used Nikon Eclipse E 200 and the atlas of the wing photographs of Neotropical species of *Culicoides* by Wirth, Dyce, and Spinelli (1988). The slide-mounted specimens from municipalities of Baturité, Guaramiranga, Itapiúna, Mulungu and Pacoti were deposited in CCER and remaining specimens preserved in 70% ethanol, were deposited in Health Secretariat of Ceará State. Data for geographical distribution of the species were collected from the *Culicoides* bibliographies and more recent literature (Borkent & Spinelli, 2007; Castellón & Felipe-Bauer, 2015; Santarém & Felipe-Bauer, 2018).

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with the final edited version of the article. A signed document has been filed in the journal archives.

RESULTS

A total of 1453 specimens of *Culicoides* were collected during the sample periods, with 97,9% female and 2,1% male specimens being captured. Twelve species were collected: *C. brasilianum* Forattini, 1956, *C. debilipalpis*, *C. guyanensis*, *C. insignis*, *C. leopoldoi*, *C. maruim*, *C. paraensis*, *C. pifanoi* Ortiz, 1951, *C. phlebotomus*, *C. poikilonotus* Macfie, 1948, *C. pusillus* and *C. venezuelensis* Ortiz & Mirsa, 1950. *Culicoides guyanensis* and *C. insignis* were the most abundant species, corresponding respectively to 75,84% and 13% of the collected specimens. *Culicoides venezuelensis* represent 1,17% of the specimens captured, but it is found in five of the six surveyed Mesoregions (Tables 1 & 2).

NEW RECORDS

Culicoides brasilianum Forattini, 1956

Known geographical distribution: Northeastern Argentina, Brazil (Amazonas, Pará, Pernambuco, Rio de Janeiro, São Paulo and Santa Catarina States).

Material examined: BRAZIL, Ceará State, Mesoregion North, Municipality of São Gonçalo do Amarante, Siupé, I-II.2008, 4 females; Mesoregion Metropolitan of Fortaleza, Municipality of Aquiraz, Tupuiu, I-II.2008, 18 females [**First record from Ceará State**].

Culicoides debilipalpis Lutz, 1913

Known geographical distribution: Widespread from southeast USA to 35°S in Buenos Aires Province, Argentina, Brazil (Acre, Amapá, Amazonas, Pará, Roraima, Ceará, Maranhão, Pernambuco, Goiás, Mato Grosso do Sul, Espírito Santo, São Paulo and Santa Catarina States).

Material examined: BRAZIL, Ceará State, Mesoregion North, Municipality of Baturité, Labirinto, VI. 2013, 1 female; Municipality of Guaramiranga, Granja Bonfim, VII.2013, 1 female [**First record from Guaramiranga municipality**].

Culicoides guyanensis Floch & Abonnenc, 1942

Known geographical distribution: Honduras, Panama, Venezuela, Trinidad and Tobago, Guiana, French Guiana and Brazil (Amapá, Pará, Ceará, Maranhão, Pernambuco,

TABLE 1
List of *Culicoides* captured with CDC light trap in 13 municipalities of the Mesoregions Metropolitan of Fortaleza, Jaguaribe, North, Northwest, Sertões and South, during 07 to 30 January 2008.

Mesoregion	Metropolitan of Fortaleza	Jaguaribe	North	Northwest	Sertões	South
Microregion	Fortaleza	Litoral de Aracati	Baturité	Litoral de Camocim e Acaraú	Sertão de Inhamus	Cariari
Municipality	Fortaleza	Limoeiro do Norte	São Gonçalo do Amarante	Trianguaú	Tauaú	Juazeiro do Norte
Locality	Fortaleza	Limoeiro do Norte	Siupé	Itaguairuna	Várzea do feijão	Várzea Redonda
<i>C. brasiliannum</i> Forattini, 1956	18F		4F			22
<i>C. guyanensis</i> Ortiz & Mirsa, 1950	381F	139F	1F	5F	1F, 1M	1100
<i>C. insignis</i> Lutz, 1913	16F	6F		1F	3F	186
<i>C. leopoldoi</i> Ortiz, 1951						15
<i>C. maruim</i> Lutz, 1913	12F	1F	9F			22
<i>C. paraensis</i> (Goeldi, 1905)				2F		5
<i>C. phlebotomus</i> (Williston, 1896)		3F				3
<i>C. pusillus</i> Lutz, 1913						1
<i>C. venezuelensis</i> Ortiz & Mirsa, 1950	393	140	1F	1F	3F	13
Females (F)	688	62	15	7	7	1367
Males (M)	1			4	1	2

TABLE 2
List of *Culicoides* captured with CDC light trap in the 12 localities of the Baturité, Guaramiranga, Itapiúna, Mulungu and Pacoti municipalities, in North Mesoregion, during February 2013 to January 2014.

Mesoregion	North												Males		
	Baturité														
Microregion	Baturité														
Municipality	Baturité														
Locality	Jordão	Labirinto	Tijuca	Álvaro	Guaramiranga	Itapiuna	Bagaço	Piaba	Mulungu	Trapiá	Arvoredo	Mulunguzinho	Pacoti	Females	Males
<i>C. debilipalpis</i> Lutz, 1913		1F			1F									2	
<i>C. guyanensis</i> Floch & Abonnenc, 1942						1F								1	
<i>C. leopoldoi</i> Ortiz, 1951	1F	1F						1M				1F		3	1
<i>C. paraensis</i> (Goeldi, 1905)	2F, 1M	3F, 3M	1F	4F, 2M			2F			5F	6F, 13M	1M		20	17
<i>C. pifanoi</i> Ortiz, 1951			1F	4F		1F, 1M						9F, 1M		18	5
<i>C. poikilnotus</i> Macfie, 1948				3F, 1M						2F	1F	1M		3	1
<i>C. pusillus</i> Lutz, 1913	1M	1F	1M											4	3
<i>C. venezuelensis</i> Ortiz & Mirsa, 1950				3F				1F						4	
Females (F)	3	6	2	14	1	1	3	1	1	7	7	10		55	
Males (M)	2	3	1	3			1	1	1	13	3	3			27

Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo States).

Material examined: BRAZIL, Ceará State, Mesoregion Metropolitan of Fortaleza, Municipality of Aquiraz, Tupuiu, I-II.2008, 654 females, 1 male; Municipality of Fortaleza, Fortaleza, I-II.2008, 381 females; Municipality of Horizonte, Timbaúba, I-II.2008, 2 females; Mesoregion Jaguaribe, Municipality of Aracatí, Córrego da Inveja, I-II.2008, 56 females; Mesoregion Northwest, Municipality of Barroquinha, I-II.2008, 1 female; Mesoregion North, Municipality of São Gonçalo do Amarante, Siupé, I-II.2008, 1 female; Municipality of Itapiipoca, Vila Jardim, I-II.2008, 5 females; Municipality of Itapiuna, Boa Água, XI. 2013, 1 female [**First record from Itapiuna municipality**].

Culicoides insignis Lutz, 1913

Known geographical distribution: Widespread from USA (Alabama, Georgia and Florida) to 35°S in Argentina, Brazil (Amazonas, Pará, Maranhão, Rondônia, Bahia, Ceará, Paraíba, Pernambuco, Maranhão, Goiás, Mato Grosso, Mato Grosso do Sul, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Rio Grande do Sul and Santa Catarina States).

Material examined: BRAZIL, Ceará State, Mesoregion Metropolitan of Fortaleza, Municipality of Aquiraz, Tupuiu, I-II.2008, 16 females; Municipality of Horizonte, Timbaúba, I-II.2008, 3 females; Mesoregion Sertões, Municipality of Tauá, Várzea do Feijão, I-II.2008, 1 female, 1 male; Mesoregion Jaguaribe, Municipality of Limoeiro do Norte, Limoeiro, I-II.2008, 139 females; Municipality of Russas, I-II.2008, 4 females; Mesoregion Northwest, Municipality of Tianguá, Itaguaruna, I-II.2008, 5 females; Mesoregion South, Municipality of Juazeiro do Norte, Várzea Redonda, 18 females, 2 males [**First record from Aquiraz, Horizonte and Tauá municipalities and from Sertões, Jaguaribe, Northwest and South Mesoregions**].

Culicoides leopoldoi Ortiz, 1951

Known geographical distribution: Widespread from Mexico (Oaxaca) to northeastern Argentina, Trinidad, Brazil (Amapá, Amazonas, Pará, Rondônia, Roraima, Bahia, Ceará, Maranhão, Pernambuco, Espírito Santo, Minas Gerais and Rio de Janeiro States).

Material examined: BRAZIL, Ceará State, Mesoregion North, Municipality of Baturité, Jordão, II.2013, 1 female; Labirinto, VI.2013, 1 female; Municipality of Mulungu, Piaba, IX.2013, 1 male; Municipality of Pacoti, Mulunguzinho, VIII.2013, 1 female; Municipality of Itapiipoca, Vila Jardim, I-II.2008, 1 female; Mesoregion

Jaguaribe, Municipality of Russas, I-II.2008, 6 females; Mesoregion Sertões, Municipality of Tauá, Várzea do Feijão, I-II.2008, 3 females; Mesoregion South, Municipality of Juazeiro do Norte, Várzea Redonda, I-II.2008, 5 females [**First record from North, Jaguaribe, Sertões and South Mesoregions**].

Culicoides maruim Lutz, 1913

Known geographical distribution: Venezuela, Guiana, Guiana Francesa, Carriacou, Trinidad, Brasil (Pará, Maranhão, Bahia, Ceará, Pernambuco, Espírito Santo, Rio de Janeiro and São Paulo States).

Material examined: BRAZIL, Ceará State, Mesoregion Metropolitan of Fortaleza, Municipality of Fortaleza, Fortaleza, I-II.2008, 12 females; Mesoregion North, Municipality of São Gonçalo do Amarante, Siupé, I-II.2008, 9 females; Mesoregion Jaguaribe, Municipality of Aracati, Córrego da Inveja, I-II.2008, 1 female [**First record from Fortaleza municipality and from North and Jaguaribe Mesoregions**].

Culicoides paraensis (Goeldi, 1905)

Known geographical distribution: Widespread from southeastern USA (Pennsylvania and Wisconsin) and south through Central and South America to Uruguay (Salto). Brazil records: Acre, Amazonas, Pará, Rondônia, Roraima, Bahia, Ceará, Maranhão, Pernambuco, Mato Grosso do Sul, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo and Santa Catarina States.

Material examined: BRAZIL, Ceará State, Mesoregion North, Municipality of Baturité, Jordão, II.2013, 2 females, 1 male; Tijuca, X.2013, 1 female; Municipality of Guaramiranga, Álvaro, III, 2013, 4 females, 2 males; Municipality of Mulungu, Bagaço, V.2013, 2 females; Trapiá, I.2014, 5 females; Municipality of Pacoti, Arvoredo, XII.2013, 6 females, 13 males; Mulunguzinho, VIII.2013, 1 male; Municipality of Redenção, I-II.2008, 2 females; Mesoregion Jaguaribe, Municipality of Russas, I-II.2008, 1 female; Mesoregion Northwest, Municipality of Barroquinha, I-II.2008, 2 females [**First record from Guaramiranga, Mulungu, Pacoti and Redenção municipalities, and from Jaguaribe and Northwest Mesoregions**].

Culicoides pifanoi Ortiz, 1951

Known geographical distribution: Belize to Colombia, Venezuela, Trinidad, Brazil (Pará, Bahia and Rio de Janeiro States), Argentina and Paraguay.

Material examined: BRAZIL, Ceará State, Mesoregion North, Municipality of Baturité, Labirinto, VI.2013, 3 females, 3 males; Tijuca, X.2013, 1 female; Municipality of Guaramiranga, Álvaro, III, 2013, 4 females; Municipality of Mulungu, Bagaço, V.2013, 1 female, 1 male; Municipality of Pacoti, Mulunguzinho, VIII.2013, 9 females, 1 male [**First record from Ceará State**].

Culicoides phlebotomus (Williston, 1896)

Known geographical distribution: Distributed from coastal Mexico to Ecuador, Caribe Islands, Guiana, Brazil (Pará, Maranhão, Ceará, Pernambuco and Goiás States).

Material examined: BRAZIL, Ceará State, Mesoregion Jaguaribe, Municipality of Aracati, Córrego da Inveja, I-II.2008, 3 females [**First record from Jaguaribe Mesoregion**].

Culicoides poikilonotus Macfie, 1948

Known geographical distribution: Distributed from Mexico, Central America, Venezuela, Colombia, Trinidad to Brazil (Bahia and Rio de Janeiro States).

Material examined: BRAZIL, Ceará State, Mesoregion North, Municipality of Guaramiranga, Álvaro, III.2013, 3 females, 1 male [**First record from Ceará State**].

Culicoides pusillus Lutz, 1913

Known geographical distribution: Widespread from USA (Florida), Mexico and south through Central and South America to northeastern Argentina. Brazil records: Acre, Amapá, Amazonas, Pará, Rondônia, Bahia, Minas Gerais, Rio de Janeiro, São Paulo and Santa Catarina States).

Material examined: BRAZIL, Ceará State, Mesoregion North, Municipality of Baturité, Jordão, II.2013, 1 male; Labirinto, VI.2013, 1 female; Tijuca, X. 2013, 1 male; Municipality of Mulungu, Trapiá, I.2014, 2 females; Municipality of Pacoti, Arvoredo, XII.2013, 1 female; Mulunguzinho, VIII.2013, 1 male; Mesoregion South, Municipality of Juazeiro do Norte, Várzea Redonda, I-II.2008, 1 female [**First record from Ceará State**].

Culicoides venezuelensis Ortiz & Mirsa, 1950

Known geographical distribution: Costa Rica to Chile and Central Argentina, Brazil (Pernambuco, Minas Gerais, São Paulo, Rio Grande do Sul and Santa Catarina States).

Material examined: BRAZIL, Ceará State, Mesoregion North, Municipality of Guaramiranga, Álvaro, III.2013, 3 females; Municipality of Mulungu, Piaba, IX. 2013,

1 female; Municipality of Redenção, I-II.2008, 1 female; Municipality of São Gonçalo do Amarante, Suipé, I-II.2008, 1 female; Municipality of Itapipoca, Vila Jardim, I-II.2008, 1 female; Mesoregion Metropolitan of Fortaleza, Municipality of Horizonte, Timbaúba, I-II.2008, 1 female; Mesoregion Jaguaribe, Municipality of Aracati, Córrego da Inveja, I-II.2008, 2 females; Municipality of Limoeiro do Norte, Limoeiro, I-II.2008, 1 female; Municipality of Russas, I-II.2008, 2 females; Mesoregion Northwest, Municipality of Barroquinha, I-II.2008, 1 female; Mesoregion Sertões, Municipality of Tauá, Várzea do Feijão, I-II.2008, 3 females [First record from Ceará State].

DISCUSSION

Culicoides debilipalpis was reported from Baturité Mountains and Uruburetama municipality from North Mesoregion (Barbosa, 1953). In the present work, this species is found in Baturité and Guaramiranga, municipalities. *Culicoides pifanoi* was exclusively observed on Baturité, Guaramiranga, Mulungu and Pacoti municipalities in North Mesoregion, while *C. poikilonotus* was captured only in Guaramiranga (Table 2). All these municipalities encompass the cities from Baturité Mountains influenced by humid climate from Rain forest prevailing in this region.

Despite its wide distribution in Brazil, *C. guyanensis* was only registered recently from Ceará State to the municipalities of Jaguaribe, Metropolitan of Fortaleza, Northwest and North Mesoregions (Santarém, Farias, & Felipe-Bauer, 2015). It is cited for the first time in this work from Itapiuna municipality in North Mesoregion (Table 2). *C. insignis*, anteriorly reported from Metropolitan of Fortaleza and North Mesoregions (Barbosa, 1953; Forattini, 1957), is founded here in Sertões, Jaguaribe, Northwest and South Mesoregions (Table 1). *Culicoides guyanensis* and *C. insignis* can be reared in fresh and brackish water, open to sky (Forattini, Rabello, & Pattoli, 1958; Williams, 1964) and in mangrove (Forattini, Rabello, & Pattoli, 1957), which explains its wide distribution in the studied mesoregions in coastal cities as well as within the Ceará State. Felipe-Bauer and Sternheim (2008) also associate the presence of *C. insignis* with the irrigated rice plantation in Santa Catarina State, Brazil.

Culicoides insignis and *C. pusillus* are incriminated as possible vector of bluetongue in South America (Mellor, 2004). *C. pusillus* is recorded for the first time in Ceará State, where goats and sheep positive serology for bluetongue virus was demonstrate (Pinheiro, Chagas,

Andrioli, & Alves, 2003). In the present work, it was captured in Juazeiro do Norte in South Mesoregion and in the municipalities of Baturité, Mulungu and Pacoti in North Mesoregion (Table 1 & 2). It can be reared in decaying parts of several plants as banana, cocoa, calabash, coconut, flowers and also in humid cow and horse manure, mangrove mud (Williams, 1964).

Culicoides leopoldoi was mentioned from Pacatuba municipality of Metropolitan of Fortaleza Mesoregion (Forattini, 1957) and is cited for the first time in this survey from North, Jaguaribe, Sertões, and South Mesoregions (Table 1 & 2). This species can be reared from margins of ditches and small streams of various sorts (Williams, 1964; Aitken, Wirth, Williams, Davies, & Tikasingh, 1975). It is widespread in Central and South America and seems don't have epidemiological importance in the transmission of disease to man and other animals.

Culicoides maruim and *C. phlebotomus* are considered as coastal species (Borkent & Spinelli, 2007). *C. maruim* was cited from Caucaia (Barbosa, 1953) and *C. phlebotomus* from Cascavel (Forattini, 1957), costal municipalities of the Metropolitan of Fortaleza Mesoregion. In this study, few specimens of *C. maruim* were captured in coastal localities from municipalities of Aracati (Córrego da Inveja), Fortaleza (Fortaleza) and São Gonçalo do Amarante (Siupé). *C. phlebotomus* was only captured in Córrego da Inveja (Table 1).

Culicoides venezuelensis was present in five of the six Mesoregions studied, being recorded in coastal and within municipalities of the Ceará State (Table 1 & 2). Diaz, Ronderos, and Spinelli (2005) cited this species reared in muddy area near a stream margin and Ronderos, Marino, Díaz and Estévez (2011) collected imatures stages in inland aquatic habitat near river margins produced by river overflows and rainfall.

Culicoides paraensis was recorded from Serra do Baturité and Uruburetama in North Mesoregion (Barbosa, 1953) and from Quixadá in Sertões Mesoregion (Forattini, 1957). In this survey, it is also collected in Jaguaribe and Northwest Mesoregions (Table 1). This species is present in natural environments, but it is considered pest species in areas of banana monoculture, which is enabling environments on large scale for the development of immature stages (Felipe-Bauer & Sternheim, 2008). *C. paraensis* transmits the Oropouche virus between humans in urban areas of the Brazilian Amazon and other Latin American countries where more than 30 epidemics were reported (Vasconcelos et al., 2009, 2011). Its presence in the neighboring state to the Amazon region is indicative of the possible spread of this arbovirosis to other regions.

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