



Taxonomy and Systematic

Butterflies (Lepidoptera: Papilionoidea) from a Fragment of Atlantic Forest in Southern Bahia, Brazil

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Abstract. The Atlantic Forest of southern Bahia comprises a zone of high levels of biodiversity and endemism of plants, vertebrates and insects. However, there are still several gaps on the knowledge of the local Lepidoptera diversity. The objective of this study was to conduct an inventory of butterflies in a fragment of the Atlantic Forest in Porto Seguro, Bahia, Brazil to provide information on species richness. Butterflies were sampled with insect net from March 2018 to March 2019, and November 2019 to February 2020, totaling 150 h of sampling effort. Additionally, we used Van Someren-Rydon traps for collecting frugivorous butterflies in September 2018 and February 2019 representing 1,080 trap-hours. A total of 228 butterfly species were recorded. Hesperiiidae (86 spp.) and Nymphalidae (77 spp.) were the most representative families, followed by Riodinidae (32 spp.), Lycaenidae (21 spp.), Pieridae (10 spp.) and Papilionidae (2 spp.). The local butterfly fauna is composed of species found in open or disturbed forest edges, and secondary vegetation. Most of the sampled species is broadly distributed in Brazil. *Morpho menelaus coeruleus* (Perry, 1810) (Nymphalidae), *Jemadia hospita hephaestos* (Plötz, 1879) (Hesperiiidae) and several species of Lycaenidae and Riodinidae represents a new record for northeastern Brazil.

Keywords: Atlantic Forest Central Biodiversity Corridor; Conservation; Inventory; Northeastern Brazil; Tabuleiro Forest.

The Atlantic Forest is a very diversified and complex biome that occupied in the past an area of approximately 150 million hectares of the Brazilian east coast. Currently the forest fragments are dispersed in 17 states, and cover approximately 32 million hectares (RIBEIRO *et al.* 2009; REZENDE *et al.* 2018; SOS MATA ATLÂNTICA 2019). The Atlantic Forest Central Biodiversity Corridor located in southern Bahia and the whole state of Espírito Santo is characterized by different types of phytophysiognomies and a rich diversity of birds and mammals species (BRASIL 2006; THOMAS *et al.* 1998). The restricted area between the north of Espírito Santo and southern Bahia is known as Hileia Baiana (Tabuleiro Forest), a region considered an endemism zone and the refuge for several species of threatened butterflies, for example, *Heraclides himeros baia* (Rothschild & Jordan, 1906) (Papilionidae), *Perrhybris pamela flava* (Oberthür, 1896) (Pieridae) and *Melinaea mnasias thera* C. Felder & R. Felder, 1865 (Nymphalidae) (FREITAS & MARINI-FILHO 2011).

In the Northeast, Sphingidae was the most represented family of Lepidoptera sampled in field inventories (in Savanna, Caatinga and Atlantic Forest biomes) conducted in all the states of the region, except Sergipe (DARRAULT & SCHLINDWEIN 2002; DUARTE-JÚNIOR & SCHLINDWEIN 2005a, 2005b, 2008; GUSMÃO & CREÃO-DUARTE 2004; MIELKE & HAXAIRE 2013; RAFAEL *et al.* 2017; VILA-VERDE & PALUCH 2019).

A pioneer study with Lepidoptera was carried out in the northeastern Atlantic Forest in the middle of the XX century (CARDOSO 1949), and the fauna of butterflies in the north of the San Francisco river is best known because of the inventories compiled in Alagoas, Pernambuco and Paraíba (CARDOSO 1949;

KESSELRING & EBERT 1982; PALUCH *et al.* 2011; MELO *et al.* 2019). In the Atlantic Forest in Bahia the inventories were drawn up only in the Recôncavo region and north coast. Another study was conducted with frugivorous butterfly species in southern Bahia (VASCONCELOS *et al.* 2009; ZACCA *et al.* 2011; NEVES & PALUCH 2016; PALUCH *et al.* 2016).

In the Caatinga, the first inventory of butterflies was compiled just over a decade ago (NOBRE *et al.* 2008), followed by other studies with different types of phytophysiognomies (KERPEL *et al.* 2014; LIMA & ZACCA 2014; RAFAEL *et al.* 2017; ZACCA & BRAVO 2012). Even though a considerable effort was expended in field surveys, the knowledge about butterfly richness in the Caatinga is still in its initial stages (KERPEL *et al.* 2014; RAFAEL *et al.* 2017). Recently inventories were drawn up in the northeastern Savanna and Amazon, covering the transition area between the two biomes (MARTINS *et al.* 2017; PEREIRA *et al.* 2018).

Due to the limited data available about Lepidoptera in the Bahian Atlantic Forest new studies are necessary regarding the biology, the ecology and the elaboration of species lists to orientate conservationist actions. These actions are necessary because, although the areas in southern Bahia are the most preserved, economic activities such as tourism and silviculture threaten the local biodiversity (FREITAS & MARINI-FILHO 2011).

The aim of the present study was to increase the knowledge about butterflies (Papilionoidea) in the Northeast by providing a list of species and information about their geographic distribution and richness in the Atlantic Forest.

MATERIAL AND METHODS

Study Area. *Campus Sosígenes Costa* (CSC) (16°25'22" S 39°08'11" O - PINTO *et al.* 2019) in Universidade Federal do Sul da Bahia, located in the municipality of Porto Seguro, is part of the Atlantic Forest Central Biodiversity Corridor in southern Bahia (BRASIL 2006). The climate is tropical humid without defined dry season, and the annual average temperature peaks above de 24 °C (ALVARES *et al.* 2013).

The rainfall is spread evenly throughout the year and its annual average value is 1,624 mm (CLIMATE-DATA. ORG 2019). The CSC is located at an altitude of 80 m above sea level and comprises a territorial area of 23 ha, from which 2.66 ha contain three fragments of Atlantic Forest with physiognomy typical of the Dense Ombrophylous Forest (lowland), also classified as Tabuleiro Forest (PINTO *et al.* 2019). The authors also observed that the forest has a history of intense anthropized area, although the floristic composition was predominately herbaceous with more than 193 species of plants, including native and exotic species.

Sampling and Taxonomic Classification. Sampling was done with entomological net by one person walking along the trails in a non-systematized way. Fieldwork was conducted from 10:00 AM to 2:00 PM. Butterflies were sampled between March 2018 to March 2019, totaling 26 field trips during every month. Additional sampling was conducted between November 2019 to February 2020, including 11 days more with a total sampling effort of approximately 150 hours. Three Van Someren-Rydon (VSR) type butterfly bait traps were installed at 1.5 m above ground. The traps were baited with a fermented mixture of banana and sugar cane juice placed in forest gaps. The traps were active during 15 consecutive days, between September 2018 and February 2019, and were checked every 48 hours. A 12 h daily data collection was considered, period during which the frugivorous species can be found active in the spring and summer in the northeast region of Brazil. Thus, the total sampling effort was of 1,088 trap-hours. All the collected material was stored in an entomological envelope or pinned. This research has been based on an extensive literature review, including PALO-JR (2017), and on consultation with relevant experts and the scientific collection from Laboratório de Sistemática e Conservação de Insetos (LASCI) Universidade Federal do Recôncavo da Bahia, Cruz das Almas, Bahia, where the material was deposited. The classification and nomenclature follow LAMAS (2004), modified after by WARREN *et al.* (2009) (Hesperiidae), WAHLBERG *et al.* (2009) (Nymphalidae); SERAPHIM *et al.* (2018) (Riodinidae) and later revisions (HALL 2018; ZACCA *et al.* 2018; NAKAHARA *et al.* 2019), and the inclusion of Hedyliidae in Papilionoidea (HEIKKILÄ *et al.* 2012).

Data Analyses. The species richness data were compared to other inventories compiled in the Atlantic Forest of the Northeast and also with other studies in the Central Biodiversity Corridor in the state of Espírito Santo. Those inventories occurred in the following locations: Maceió and surrounding, AL (MAC) (CARDOSO 1949), Mata do Buraquinho, João Pessoa, PB (MB) (KESSELRING & EBERT 1982), Santa Teresa, ES (ST) (BROWN-JR & FREITAS 2000), Parque Metropolitano de Pituaçu, Salvador, BA (PMP) (VASCONCELOS *et al.* 2009), Serra da Jiboia, Santa Teresinha, BA (SJ) (ZACCA *et al.* 2011), Parque Ecológico João Vasconcelos Sobrinho, Caruaru, PE (PEJVS) (PALUCH *et al.* 2011), Reserva Natural Vale, Linhares, ES (RNV) (FREITAS *et al.* 2016), Fazenda Lontra/Saudade, Itanagra, BA (FLS) (PALUCH *et al.* 2016) and Parque Dois Irmãos, Recife, PE (PDI) (MELO *et al.* 2019).

RESULTS AND DISCUSSION

A total of 228 butterfly species were recorded in the CSC. The

richest families were HesperIIDae with 86 species (37.7%) and Nymphalidae with 77 species (33.8%) corresponding to the second largest richness followed by Riodinidae (32 spp., 14%), Lycaenidae (21 spp., 9.2%), Pieridae (10 spp., 4.4%) and Papilionidae (2 sp., 0.9%) (Table 1). The Hedyliidae family which comprises an uncommon neotropical butterfly group was not collected because of the nocturnal habits of the few species known (KAWAHARA *et al.* 2018).

In comparison with the number of species registered by other inventories in the Atlantic Forest in the Southeast region of Brazil, the total richness in the CSC could be considered low (BROWN-JR 1992; BROWN-JR & FREITAS 2000; FRANCINI *et al.* 2011; FREITAS *et al.* 2016). On the other side, the total richness found in the CSC area is greater than those registered in the northeastern Atlantic Forest, as MAC, Maceió, AL (218 spp.), PMP, Salvador, BA (70 spp.), SJ, Santa Teresinha, BA (140 spp.) and PEJVS, Caruaru, PE (197 spp.) (CARDOSO 1949; VASCONCELOS *et al.* 2009; ZACCA *et al.* 2011; PALUCH *et al.* 2011). The number of species found are similar to recorded for the MB, João Pessoa, PB (291 spp.), FLS, BA (260 spp.) and PDI, Recife, PE (273 spp.) (KESSELRING & EBERT 1982; PALUCH *et al.* 2016; MELO *et al.* 2019). However, the forested area covers a very small proportion of the 2.66 ha in the CSC, and the richness of species registered is higher than in the remaining fragments of the Atlantic Forest in Paraíba (KESSELRING & EBERT 1982), Pernambuco (PALUCH *et al.* 2011; MELO *et al.* 2019) and Bahia (VASCONCELOS *et al.* 2009; ZACCA *et al.* 2011; PALUCH *et al.* 2016) (Table 2).

The richness of Nymphalidae (S=77) was slightly lower than HesperIIDae (S=86), but had nearly equal estimated species richness values than those observed in other inventories compiled in the Atlantic Forest of the Northeast (VASCONCELOS *et al.* 2009; ZACCA *et al.* 2011; PALUCH *et al.* 2011, 2016), although HesperIIDae was also registered with great richness of species in the forest of Pernambuco (MELO *et al.* 2019). Common species of Nymphalidae and HesperIIDae with large geographic distribution were not recorded in CSC, as for example *Anartia amathea* Linnaeus, 1758 and *Urbanus proteus* (Linnaeus, 1758).

Two taxa of Papilionidae were reported (Table 1), *Parides zacynthus zacynthus* (Fabricius, 1793) which is a new record to the Northeastern, and the widely distributed subspecies *Heraclides thoas brasiliensis* (Rothschild & Jordan, 1906).

The subspecies of *P. zacynthus* (Fabricius, 1793) previously reported for Bahia was *Parides zacynthus polymetus* (Godart, 1819) in Chapada Diamantina and on the north coast (VASCONCELOS *et al.* 2009; PALUCH *et al.* 2016). However, some very common and widespread species in Brazil, such as *Battus polydamas polydamas* (Linnaeus, 1758) and *Heraclides anchisiades capys* (Hübner, [1809]), were not observed flying around. *Heraclides himeros baia* (Rothschild & Jordan, 1906), a species under threat of extinction according to "Plano de Ação Nacional para a Conservação dos Lepidoptera Ameaçados de Extinção" (PAN Lepidoptera) and expected in the area, was not found either (FREITAS & MARINI-FILHO 2011).

Ten species of Pieridae were collected (Table 1) most of which have widely geographic distribution and were registered in published inventories in the Atlantic Forest of the Northeast region of Brazil (PALUCH *et al.* 2011; MELO *et al.* 2019). However, *Dismorphia amphinome astynome* (Dalman, 1823) is a new register for Bahia. Two species of Pieridae threatened by extinction, *Moschoneura methymna* (Godart, 1819) and *Perrhybris pamela flava* (Oberthür, 1896), were expected in the region (FREITAS & MARINI-FILHO 2011), but no specimens were observed.

Lycaenidae was represented by 21 species (Table 1), but

Table 1. List of Butterflies (Papilionoidea) from the *Campus* Sosígenes Costa, Universidade Federal do Sul da Bahia, Porto Seguro, Bahia, Brazil. Number of species are provided within parenthesis for each major taxon.

Taxa	Taxa
PAPILIONOIDEA (228)	<i>Euselasia labdacus</i> ssp.
Papilionidae (2)	Riodininae (31)
Papilioninae (2)	Eurybiini (8)
Troidini (1)	<i>Eurybia albiseriata</i> ssp.
<i>Parides zacynthus zacynthus</i> (Fabricius, 1793)	<i>Hyphilaria parthenis</i> (Westwood, 1851)
Papilionini (1)	<i>Ionotus alector</i> (Geyer, 1837)
<i>Heraclides thoas brasiliensis</i> (Rothschild & Jordan, 1906)	<i>Leucochimona icare matatha</i> (Hewitson, 1873)
Pieridae (10)	<i>Mesosemia nyctea fluminensis</i> J. Zikan, 1952
Dismorphiinae (1)	<i>Mesosemia sifia</i> (Boisduval, 1836)
<i>Dismorphia amphinome astynome</i> (Dalman, 1823)	<i>Perophtalma tullius</i> (Fabricius, 1787)
Coliadinae (8)	<i>Semomesia geminus</i> (Fabricius, 1793)
<i>Anteos clorinde</i> (Godart, [1824])	Riodinini (6)
<i>Eurema albula albula</i> (Cramer, 1775)	<i>Baeotis hisbon</i> (Cramer, 1775)
<i>Eurema elathea flavescens</i> (Chavannes, 1850)	<i>Cariomothis erythromelas erythraea</i> Stichel, 1910
<i>Leucidia elvina</i> (Godart, 1819)	<i>Detritivora gynaea</i> (Godart, [1824])
<i>Phoebis argante argante</i> (Fabricius, 1775)	<i>Exoplisia cadmeis</i> (Hewitson, 1866)
<i>Phoebis philea philea</i> (Linnaeus, 1763)	<i>Isapis agyrtus</i> (Cramer, 1777)
<i>Phoebis sennae marcellina</i> (Cramer, 1777)	<i>Themone pais pais</i> (Hübner, [1820])
<i>Pyrisitia nise tenella</i> (Boisduval, 1836)	Symmachiini (5)
Pierinae (1)	<i>Argyrogrammana physis</i> ssp.
<i>Glutophrissa drusilla drusilla</i> (Cramer, 1777)	<i>Mesene epaphus</i> ssp.
Lycaenidae (21)	<i>Mesene phareus</i> (Cramer, 1777)
Polyommatainae (2)	<i>Panaropsis inaria</i> (Westwood, 1851)
<i>Hemiargus hanno hanno</i> (Stoll, 1790)	<i>Pirascica sagaris satnius</i> (Dalman, 1823)
<i>Zizula cyna</i> (W.H. Edwards, 1881)	Helicopini (2)
Theclinae (19)	<i>Anteros acheus ampyx</i> (Drury, 1782)
<i>Calycopis caulonia</i> (Hewitson, 1877)	<i>Anteros formosus</i> (Cramer, 1777)
<i>Calycopis cerata</i> (Hewitson, 1877)	Nymphidiini (10)
<i>Calycopis cissusa</i> (Hewitson, 1877)	<i>Calospila parthaon parthaon</i> (Dalman, 1823)
<i>Calycopis</i> sp.	<i>Nymphidium acheris</i> (Boisduval, 1836)
<i>Janthecla malvina</i> (Hewitson, 1867)	<i>Nymphidium azanoides amazonensis</i> Callaghan, 1986
<i>Kisutam syllis</i> (Godman & Salvin, 1887)	<i>Nymphidium lisimon</i> (Stoll, 1790)
<i>Olynthus essus</i> (Herrich-Schäffer, [1853])	<i>Nymphidium mantus</i> (Cramer, 1775)
<i>Olynthus</i> sp.	<i>Stalactis susanna</i> (Fabricius, 1787)
<i>Ostrinotes empusa</i> (Hewitson, 1867)	<i>Synargis galena</i> (Bates, 1868)
<i>Panthiades phaleros</i> (Linnaeus, 1767)	<i>Theope eudocia</i> Westwood, 1851
<i>Rekoa palegon</i> (Cramer, 1780)	<i>Theope lycaenina</i> Bates, 1868
<i>Rekoa stagira</i> (Hewitson, 1867)	<i>Theope phaeo</i> Prittwitz, 1865
<i>Strephonota ambrax</i> (Westwood, 1852)	Nymphalidae (77)
<i>Strephonota sphinx</i> (Fabricius, 1775)	Danainae (11)
<i>Strephonota tephraeus</i> (Geyer, 1837)	Danaini (1)
<i>Symbiopsis strenua</i> (Hewitson, 1877)	<i>Lycorea halia discreta</i> Haensch, 1909
<i>Theclopsis gargara</i> (Hewitson, 1868)	Ithomiini (10)
<i>Theritas hemon</i> (Cramer, 1775)	<i>Callithomia lenea xantho</i> (C. Felder & R. Felder, 1860)
<i>Theritas lisus</i> (Stoll, 1790)	<i>Episcada doto canaria</i> (Brown & D'Almeida, 1970)
Riodinidae (32)	<i>Heterosais edessa</i> (Hewitson, [1855])
Nemeobiinae (1)	<i>Hypothyris euclea laphria</i> (Doubleday, 1847)
Euselasiini (1)	<i>Oleria aquata</i> (Weymer, 1875)

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Table 1. Continue...

Taxa	Taxa
<i>Pseudoscada erruca</i> (Hewitson, 1855)	<i>Mestra hersilia hypermestra</i> Hübner, [1825]
<i>Tithorea harmonia pseudethra</i> Butler, 1873	<i>Myscelia orsis</i> (Drury, 1782)
<i>Mechanitis lysimnia lysimnia</i> (Fabricius, 1793)	<i>Nica flavilla flavilla</i> (Godart, [1824])
<i>Mechanitis lysimnia nesaea</i> Hübner, [1820]	Nymphalinae (6)
<i>Mechanitis polymnia casabranca</i> Haensch, 1905	Coeini (2)
Satyrinae (26)	<i>Colobura dirce dirce</i> (Linnaeus, 1758)
Morphini (3)	<i>Historis odius dious</i> Lamas, 1995
<i>Antirrhoea archaea</i> Hübner, [1822]	Kallimini (3)
<i>Morpho helenor achillaena</i> (Hübner [1823])	<i>Anartia jatrophae jatrophae</i> (Linnaeus, 1763)
<i>Morpho menelaus coeruleus</i> (Perry, 1810)	<i>Junonia evarete evarete</i> (Cramer, 1779)
Brassolini (6)	<i>Siproeta stelenes meridionalis</i> (Frühstorfer, 1909)
<i>Brassolis sophorae sophorae</i> (Linnaeus, 1758)	Melitaeini (1)
<i>Caligo idomeneus ariphron</i> Fruhstorfer, 1910	<i>Eresia eunice esora</i> Hewitson, 1857
<i>Caligo illioneus illioneus</i> (Cramer, 1775)	Charaxinae (7)
<i>Catoblepia amphirhoe</i> (Hubner, [1825])	Anaeini (3)
<i>Eryphanis automedon amphimedon</i> (C. Felder & R. Felder, 1867)	<i>Foutainea ryphea phidile</i> (Geyer, 1837)
<i>Opsiphanes quiteria meridionalis</i> Staudinger, 1887	<i>Memphis morus stheno</i> (Prittwitz, 1865)
Haeterini (2)	<i>Memphis acidalia victoria</i> (H. Druce, 1877)
<i>Haetera piera diaphana</i> Lucas, 1857	Preponini (4)
<i>Pierella keithbrowni</i> Siewert, Zacca & Casagrande, 2016	<i>Archaeoprepona amphimachus pseudomeander</i> (Fruhstorfer, 1906)
Satyrini (15)	<i>Archaeoprepona demophon thalpius</i> (Hübner, [1814])
<i>Amiga arnaca arnaca</i> (Fabricius, 1776)	<i>Archaeoprepona demophoon antimache</i> (Hübner, [1819])
<i>Chloreuptychia chlorimene</i> (Hübner, [1819])	<i>Prepona laertes laertes</i> (Hübner, [1811])
" <i>Cissia</i> " <i>myncea</i> (Cramer, 1780)	Limenitidinae (2)
<i>Erichthodes antonina</i> (C. Felder & R. Felder, 1867)	<i>Adelpha cytherea aea</i> (C. Felder & R. Felder, 1867)
<i>Hermeuptychia atalanta</i> (Butler, 1867)	<i>Adelpha melona melona</i> (Hewitson, 1847)
<i>Hermeuptychia hermes</i> (Fabricius, 1775)	Heliconiinae (11)
<i>Hermeuptychia</i> sp.	Argynnini (1)
<i>Magneuptychia lea</i> (Cramer, 1777)	<i>Euptoieta hegesia meridiana</i> Stichel, 1938
<i>Magneuptychia libye</i> (Linnaeus, 1767)	Heliconiini (10)
<i>Pareuptychia ocirrhoe interjecta</i> (d' Almeida, 1952)	<i>Dione juno juno</i> (Cramer, 1779)
<i>Pharneuptychia romanina</i> (Bryk, 1953)	<i>Dryas iulia alcionea</i> (Cramer, 1779)
<i>Splendeuptychia doxes</i> (Godart, [1824])	<i>Dryadula phaetusa</i> (Linnaeus, 1758)
<i>Taygetis laches marginata</i> Staudinger, [1887]	<i>Eueides aliphera aliphera</i> (Godart, 1819)
<i>Taygetis virgilia</i> (Cramer, 1776)	<i>Eueides isabella dianasa</i> (Hübner, [1806])
<i>Yphthimoides renata</i> (Stoll, 1780)	<i>Heliconius erato phyllis</i> (Fabricius, 1775)
Biblidinae (14)	<i>Heliconius ethilla narcaea</i> Godart, 1819
<i>Biblis hyperia nectanabis</i> (Fruhstorfer, 1909)	<i>Heliconius melpomene nanna</i> Stichel, 1899
<i>Catonephele acontius acontius</i> (Linnaeus, 1771)	<i>Heliconius numata ethra</i> (Hübner, [1831])
<i>Catonephele numilia penthia</i> (Hewitson, 1852)	<i>Heliconius sara apseudes</i> (Hübner, [1813])
<i>Diaethria clymena janeira</i> (C. Felder, 1862)	Hesperiidae (86)
<i>Dynamine agacles agacles</i> (Dalman, 1823)	Eudaminae (18)
<i>Dynamine artemisia artemisia</i> (Fabricius, 1793)	<i>Astraptus creteus siges</i> (Mabille, 1903)
<i>Dynamine postverta postverta</i> (Cramer, 1779)	<i>Astraptus fulgerator fulgerator</i> (Walch, 1775)
<i>Hamadryas amphinome amphinome</i> (Linnaeus, 1776)	<i>Astraptus janeira</i> (Schaus, 1902)
<i>Hamadryas chloe rhea</i> (Fruhstorfer, 1907)	<i>Astraptus talus</i> (Cramer, 1777)
<i>Hamadryas epinome</i> (C. Felder & R. Felder, 1867)	<i>Augiades criniscus</i> (Cramer, 1780)
<i>Hamadryas feronia feronia</i> (Linnaeus, 1758)	<i>Autochthon neis</i> (Geyer, 1832)

To be Continue...

Table 1. Continue...

Taxa	Taxa
<i>Autochton zarex</i> (Hübner, 1818)	<i>Callimormus corades</i> (C. Felder, 1862)
<i>Chioides catillus catillus</i> (Cramer, 1779)	<i>Callimormus corus</i> Bell, 1941
<i>Dyscophellus porcius doriscus</i> (Hewitson, 1867)	<i>Carystus phorcus claudianus</i> (Latreille, [1824])
<i>Dyscophellus ramusis damias</i> (Plötz, 1882)	<i>Cobalopsis miaba</i> (Schaus, 1902)
<i>Entheus priassus pralina</i> Evans, 1952	<i>Cobalopsis nero</i> (Herrich-Schäffer, 1869)
<i>Epargyreus</i> sp.	<i>Conga chydaea</i> (Butler, 1877)
<i>Nicephellus nicephorus</i> (Hewitson, 1876)	<i>Conga iheringii</i> (Mabille, 1891)
<i>Phanus australis</i> Miller, 1965	<i>Corticea corticea</i> (Plötz, 1883)
<i>Urbanus dorantes dorantes</i> (Stoll, 1790)	<i>Damas clavus</i> (Herrich-Schäffer, 1869)
<i>Urbanus esta</i> Evans, 1952	<i>Flaccilla aecas</i> (Stoll, 1781)
<i>Urbanus procne</i> (Plötz, 1880)	<i>Hylephila phyleus phyleus</i> (Drury, 1773)
<i>Urbanus simplicius</i> (Stoll, 1790)	<i>Justinia justinianus justinianus</i> (Latreille, [1824])
Pyrginae (25)	<i>Molo mango</i> (Guenée, 1865)
<i>Achlyodes busirus rioja</i> Evans, 1953	<i>Naevolus orius orius</i> (Mabille, 1883)
<i>Anastrus neaeris narva</i> Evans, 1953	<i>Niconiades nikko</i> Hayward, 1948
<i>Anastrus sempiternus simplicior</i> (Möschler, 1877)	<i>Niconiades xanthaphes</i> Hübner, [1821]
<i>Anastrus tolimus robigus</i> (Plotz, 1884)	<i>Onophas columbaria distigma</i> Bell, 1830
<i>Eantis mithridates thraso</i> (Hubner, [1807])	<i>Orses cynisca</i> (Swainson, 1821)
<i>Ebrietas anacreon anacreon</i> (Staudinger, 1876)	<i>Panoquina fusina viola</i> Evans, 1955
<i>Eracon paulinus</i> (Stoll, 1782)	<i>Panoquina hecebolus</i> (Scudder, 1872)
<i>Gorgythion begga begga</i> (Prittwitz, 1868)	<i>Panoquina lucas</i> (Fabricius, 1793)
<i>Gorgythion beggina beggina</i> Mabille, 1898	<i>Paracarystus menestries menestries</i> (Latreille, [1824])
<i>Helias phalaenoides palpalis</i> (Latreille, [1824])	<i>Perichares philetes adela</i> (Hewitson, 1867)
<i>Heliopetes arsalte</i> (Linnaeus, 1758)	<i>Phanes aletes</i> (Geyer, 1832)
<i>Jemadia hospita hephaestos</i> (Plötz, 1879)	<i>Polites vibex catilina</i> (Plotz, 1886)
<i>Myscelus santhilarius</i> (Latreille, [1824])	<i>Pompeius pompeius</i> (Latreille, [1824])
<i>Ouleus accedens accedens</i> (Mabille, 1895)	<i>Saliana longirostris</i> (Sepp, [1840])
<i>Ouleus fridericus riona</i> Evans, 1953	<i>Sodalia coler</i> (Schaus, 1902)
<i>Pyrgus orcus</i> (Stoll, 1780)	<i>Sodalia sodalis</i> (A. Butler, 1877)
<i>Pyrrhopyge thericles rileyi</i> Bell, 1931	<i>Talides riosa</i> Evans, 1955
<i>Pythonides herennius lusorius</i> Mabille, 1891	<i>Thargella caura</i> (Plötz, 1882)
<i>Pythonides jovianus fabricii</i> W.F. Kirby, 1871	<i>Thargella evansi</i> Biezanko & O. Mielke, 1973
<i>Quadrus cerialis</i> (Stoll, 1782)	<i>Thoon</i> sp.
<i>Sostrata bifasciata bifasciata</i> (Ménétriés, 1829)	<i>Vacerra bonfilius</i> (Latreille, [1824])
<i>Sostrata festiva</i> (Erichson, [1849])	<i>Vehilius inca</i> (Scudder, 1872)
<i>Telemiades epicalus</i> Hübner, [1819]	<i>Vehilius stictomenes stictomenes</i> (Butler, 1877)
<i>Viola violella</i> (Mabille, 1898)	<i>Vettius diversa diversa</i> (Herrich-Schäffer, 1869)
<i>Zera tetrastigma erisichthon</i> (Plötz, 1884)	<i>Vettius fantasos</i> (Cramer, 1780)
Hesperinae (43)	<i>Vettius lafrenaye lafrenaye</i> (Latreille, [1824])
<i>Arotis kayei</i> (Bell, 1932)	<i>Vettius marcus</i> (Fabricius, 1787)
<i>Callimormus</i> sp. (Moschler, 1883)	<i>Zariaspes mys</i> (Hübner, [1808])

revealed low richness when compared to KESSELRING & EBERT (1982) research in MB who found the richest fauna of this family in the Northeast region so far. However, in CSC seven species was registered for the first time in the region: *Calycopis cerata* (Hewitson, 1877); *Janthecla malvina* (Hewitson, 1867), *Ostrinotes empusa* (Hewitson, 1867), *Rekoa stagira* (Hewitson, 1867), *Strephonota sphinx* (Fabricius, 1775) and *Symbiopsis strenua* (Hewitson, 1877), already observed in previous research in Atlantic Rainforest southeast (DUARTE *et al.* 2009; FRANZINI *et al.* 2011), and *Olynthus essus* (Herrich-Schäffer, [1853]), a species widely distributed in Savanna and Amazon

Brazilian biomes (PINHEIRO & EMERY 2006; MIELKE *et al.* 2010).

The Riodinidae richness in CSC was very similar to the number of species found by MELO *et al.* (2019) in the state of Pernambuco (Table 1). Nevertheless, the great richness of species in the Northeast region of Brazil was published in inventories of the Atlantic Forest of Paraíba and in the north coast of Bahia (KESSELRING & EBERT 1982; PALUCH *et al.* 2016). Most of the taxa registered in CSC have a broad distribution in Brazilian biomes, and these common species are also found in the Caatinga, Savanna and Amazon (EMMEL & AUSTIN 1990;

Table 2. Inventories of butterflies realized in northeastern Atlantic Forest and in Atlantic Forest Central Biodiversity Corridor.

Location- Municipality, State	TR	SE (hours)		S
		EN	VSR	
Mata do Buraquinho - João Pessoa, PB ¹	471 ha	-	-	291
Parque João Vasconcelos Sobrinho - Caruaru, PE ²	359 ha	216	-	197
Parque Dois Irmãos - Recife, PE ³	384.7 ha	455	-	288
Maceió and surrounding - Maceió, AL ⁴	-	-	-	218
Parque Metropolitan de Pituacú- Salvador, BA ⁵	440 ha	144	180	70
Serra da Jiboia- Santa Teresinha, BA ⁶	22,000 ha	-	-	140
Fazenda Lontra/Saudade- Itanagra, BA ⁷	1,377.33 ha	288	-	260
Campus Sosígenes Costa - Porto Seguro, BA⁸	2.66 ha	150	1,080	228
Santa Teresa, ES ⁹	-	-	-	769
Reserva Natural Vale - Linhares, ES ¹⁰	23,000 ha	180	-	512

Legend:¹KESSELING & EBERT (1982); ²PALUCH *et al.* (2011); ³MELO *et al.* (2019); ⁴CARDOSO (1949); ⁵VASCONCELOS *et al.* (2009); ⁶ZACCA *et al.* (2011); ⁷PALUCH *et al.* (2016); ⁸present study; ⁹BROWN-JR & FREITAS (2000); ¹⁰FREITAS *et al.* (2016); TR: territorial extension; SE: sampling effort; EN: entomological net; VSR: Van Someren-Rydon trap; S: richness of species.

MURRAY 2000; EMERY *et al.* 2006; PINHEIRO & EMERY 2006; MIELKE *et al.* 2010; CASAGRANDE *et al.* 2012; KERPEL *et al.* 2014). From the known species in the Amazon region four taxa were identified in CSS, which may represent new subspecies for the Atlantic Forest: *Euselasia labdacus* (Stoll, 1780), *Eurybia albiseriata* Weymer, 1890, *Argyrogrammana physis* (Stichel, 1911) and *Mesene epaphus* (Stoll, 1780) (HALL & WILLMOTT 1995; MURRAY 2000; NIELSEN & SALAZAR-E 2014, DOLIBAINA *et al.* 2015, 2016; SALAZAR-E *et al.* 2019). Another taxa considered rare by FREITAS *et al.* (2016), as *Calospila parthaon parthaon* (Dalman, 1823), *Cariomothis erythromelas erythraea* Stichel, 1910 and *Panaropsis inaria* (Westwood, 1851), were also found in CSC area.

Nymphalidae was represented by 77 species, the majority of which is widely distributed in the Atlantic Forest. The richest subfamily was Satyrinae (26 spp.) followed by Biblidinae (14 spp.), Danainae (11 spp.), Heliconiinae (11 spp.), Charaxinae (7 spp.), Nymphalinae (6 spp.) and Limenitidinae (2 spp.). The subfamilies Libytheinae, Apaturinae and Cyrestinae were not found.

Danainae (Nymphalidae) was represented by 11 taxa (Table 1) with similar number of species reported in other Atlantic Forest areas in the Northeast region (ZACCA *et al.* 2011; PALUCH *et al.* 2016; MELO *et al.* 2019). In the tribe Ithomiini the presence of two sympatric subspecies, *Mechanitis lysimnia lysimnia* (Fabricius, 1793) and *Mechanitis lysimnia nesaea* Hübner, [1820] reveals an unusual taxonomic situation. The two subspecies were observed flying at the same time. A few similar cases were also observed in other locations, as is the case of the subspecies *Melete lycimnia* (Cramer, 1777) (Pieridae) in PEJVS, Pernambuco State (PALUCH *et al.* 2011); and the subspecies of *Stalactis phlegia* (Cramer, 1779) (Riodinidae) in FLS, northern coastal region of Bahia (PALUCH *et al.* 2016). To elucidate the situation, a new research involving immature stages and adult specimens of *Mechanitis lysimnia* (Fabricius, 1793), collected in Caatinga, Atlantic Forest (north, south and Recôncavo) of Bahia is being undertaken. The study intends to review the taxonomic status of these subspecies. According to PAN Lepidoptera (FREITAS & MARINI-FILHO 2011), two subspecies of Ithomiini threatened by extinction, *Melinaea mnasis thera* C. Felder & R. Felder, 1865, and *Napeogenes rhezia rhezia* (Geyer, [1834]), may occur in the region but were not reported in this study.

The frugivorous butterflies Satyrinae in the CSC area accounted for 34% of the Nymphalidae recorded (Table 1). These include *Haetera piera diaphana* Lucas, 1857 (Haeterini) and *Magneptychia libye* (Linnaeus, 1767) (Satyrini), examples of disjunctive butterfly populations in the Amazon Biome,

including endemic taxa which find their geographical limits in Hileia Baiana (FREITAS & MARINI-FILHO 2011). Six species of the tribe Brassolini were recorded, the same richness was revealed by PALUCH *et al.* (2011) in PEJVS area. Was registered three taxa of Morphini: *Antirrhoea archaia* Hübner, [1822] widely dispersed in the Atlantic Forest, *Morpho helenor achillaena* (Hübner [1823]) and *Morpho menelaus coeruleus* (Perry, 1810). The last one was registered for the first time in the Atlantic Forest of northeast Brazil, although it was expected in the region, because it was previously cited in RNV, Linhares, Espírito Santo (FREITAS *et al.* 2016).

Only one subspecies of Melitaeini tribe (Nymphalinae: Nymphalidae) was recorded *Eresia eunice esora* Hewitson, 1857. According to PAN Lepidoptera, the threatened subspecies *Eresia erysice erysice* (Geyer, 1832) must also occur in the region, but was not observed in the present study.

Heliconiinae (Nymphalidae) is represented by eleven widespread taxa in the Atlantic Forest. The presence of *Heliconius nattereri* C. Felder & R. Felder, 1865, also threatened with extinction, was expected in the region. The last registry known for *H. nattereri*'s north limit distribution corresponds to Amargosa municipality, Bahia, according to CARDOSO *et al.* (2017).

The Hesperiiidae subspecies *Jemadia hospita hephaestos* (Plötz, 1879) (Pyrginae) is known only in Suriname, its type locality (MIELKE 2005). The record in CSC expanded its geographic distribution to the Hileia Baiana, representing a new record in the Atlantic Forest. The presence of *Nicephellus nicephorus* (Hewitson, 1876) (Eudaminae) in CSC extends the distribution of this species to the south, since it had already been recorded in Alagoas, Paraíba, Rondônia and Pará (CARDOSO 1949; DARRAULT & SCHLINDWEIN 2005; AUSTIN 2008; MIELKE *et al.* 2012).

Considering the small size of the forested territory the significant richness of butterfly species registered in CSC could be favored by its great botanical diversity (PINTO *et al.* 2019). The CSC is located approximately 4km away from important Protected Conservation Units (PCU), such as Parque Nacional do Pau Brasil and Private Reserva Particular do Patrimônio Natural Estação Veracel. These PCUs might have contributed to the dispersion and gene flow of several species through ecological corridors or trampolines (ARANA & ALMIRANTE 2007). The species dispersion between CSC and the PCUs may also be facilitated by the Tabuleiro Forest phytophysiognomy, a type of vegetation that occurs in the coastal plains. The presence of endemic and threatened species in the region, beyond the Amazonian flora and fauna (FREITAS & MARINI-FILHO 2011; PINTO *et al.* 2019), emphasize the importance of the CSC

area. Therefore, studies and actions for the conservation and reforestation with native species to provide Ecological connectivity among PCUs should be encouraged.

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