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LISTS OF SPECIES

Butterflies (Lepidoptera: Papilionoidea and Hesperioidea) from two forest fragments in northern Rio Grande do Sul, Brazil

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Abstract: Aiming to contribute to the knowledge concerning diversity of the butterflies in the Atlantic Rainforest of the state of Rio Grande do Sul, a systematic survey was carried out in the city of Frederico Westphalen from November 2006 to June 2007, in two sampling localities. The total sampling efforts was 80 h, in which 1.785 samples were recorded, distributed in 161 species. From the latter, 51.57 % (83) belongs to the Nymphalidae family, Hesperiidae 20.49 % (33), Pieridae 8.69 % (14), Riodinidae 6.83 % (11), Papilionidae 6.21 % (10), Lycaenidae 6.21 % (10). Regarding the sampled species, 79.50 % (128) were recorded at both studied sites.

Introduction

The Lepidoptera is one of the main orders of insects, with 146.000 species in the world, spread through diverse habitats from cooler regions to tropical forests. In the Neotropical region, 31.4 % of species were described, representing the highest diversity in global biomes (Heppner 1991). It is estimated that the richness of this order could reach 500.000 species (Scoble 199), and just 7.784 species of butterflies are known (Lamas 2004).

Butterflies are organisms used in biogeography, and plant-insect interactions researches, and as environmental bioindicators, since they can indirectly assess environmental variations due to its sensitivity to climatic conditions, levels of lightness and proportion of vegetation cover (Brown Jr. 1992). In stable environments, adults can be found in any season of the year. In Brazil, Hesperiidae, Lycaenidae and Nymphalidae, respectively, are the three richest families in number of species, and some groups of Nymphalidae are commonly used as environmental indicators (Brown Jr. and Freitas 1999).

In the state of Rio Grande do Sul, there is still a lack of information about the fauna of butterflies. Several regions do not even have any list of species, or if there is one, it is incomplete, outdated or made using different or not explicit methodologies (Isehard and Romanowski 2004). Recent studies concerning the fauna of butterflies in Rio Grande do Sul characterized study locations and employed methodology more accurately, facilitating comparisons among studies and contributing to knowledge on the geographical distribution of the Neotropical butterflies (Teston and Corseuil 1998; 2000a; b; Iserhard and Romanowski 2004; Quadros et al. 2004, Marchiori and Romanowski 2006; Dessuy and Morais 2007; Giovenardi et al. 2008; Paz et al. 2008; Sack and Morais 2008).

The deciduous seasonal forest of Frederico Westphalen is heavily fragmented, due both to deforestation and agricultural activities. Nonetheless, these fragments feature great biological diversity that is still unknown. The municipality is situated in a prime location near two major areas of permanent preservation, Missiones Province in Argentina and Turvo State Forest Park in Brasil.

This survey aims to characterize the fauna of butterflies that occur in the remnants of deciduous seasonal forest in northern Rio Grande do Sul, in Frederico Westphalen, through listing, measuring richness, abundance, diversity and constancy of species, aiming a better comprehension and knowledge of lepidopteron in the region.

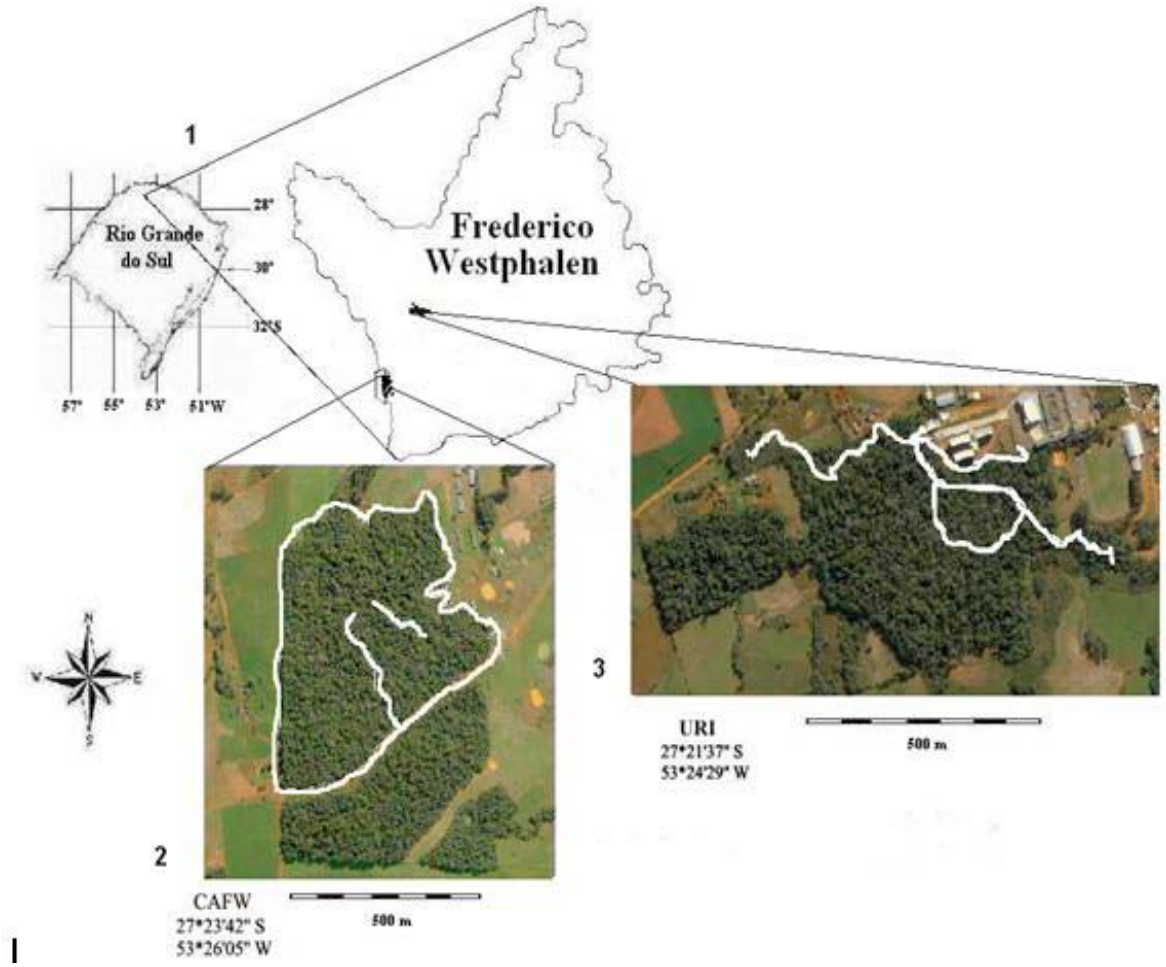
Material and methods

Study Site

Located in the Meridian Plateau, Frederico Westphalen (27°21' S and 53°23' W) has softly undulating topography with altitude between 300 and 600 m. Its river system belongs to the basin of the River Uruguay. The climate of the region is subtropical humid (Cfa), with rainfall well distributed throughout the year and average temperature of the warmer months higher than 22 °C. The annual rainfall varies between 1.800 and 2.100 mm and is distributed throughout the year (IBGE 1985).

According to the Foundation SOS Mata Atlântica (2006), the region of High Uruguay, where the municipality is located, has once been 100 % covered by Atlantic Forest, *sensu lato*, classified as deciduous seasonal forest.

Comparing the studied fragments (Figures 1-3), the Agricultural College of Frederico Westphalen (CAFW) presents the most extensive area (54 ha) with less anthropic disturbance. The interior of the forest is rarely frequented and is surrounded by fields of different crops, farming activity and management of livestock. The forest located at the Integrated Regional University of High Uruguay and Missions (URI) (47 ha), as the other fragment under study, is composed of native vegetation. In this locality, the misuse of the forest remnants is evident, considering the fact that the area is constantly assessed by the local people in search of resources.



Figures 1-3. Studied sites. 1. Location of the points of collection on northern Rio Grande do Sul; 2. Trail inside the forest fragment of the Agricultural College of Frederico Westphalen (CAFW); 3. Trail inside the forest fragment near the Integrated Regional University of High Uruguay and Missions (URI).

Data collection
Surveys were carried out from November 2006 to June 2007. In each sampling, three active nets were settled from 9:00 h to 14:00 h, totaling 5 h/net.

Butterflies were observed and caught with standard entomological net, recorded in the field book or kept in envelopes and taken to the Regional Museum of High Uruguay, in case identification in the field was not possible. One specimen of each species was sorted, identified and placed at the Collection of the Laboratory of Evolutionary Biology of the Santa Maria's Federal University.

Data analysis
Data were recorded per site of sampling, with identification of the families, subfamilies, number of individuals and species in each fragment. The determination of species was accomplished with the use of specialized bibliography (Le Moult and Real 1962; D'Abrera 1981; Ackery and Vane-Wright 1984; D'Abrera 1984; Otero 1986; D'Abrera 1987a; b; Ackery 1988; Blandin 1988; D'Abrera 1988; Brown Jr. 1992; Blandin 1993; D'Abrera 1994; Mielke 1994; Casagrande 1995; D'Abrera 1995; Canals 2003), or by comparison to those already deposited in the Collection of the Laboratory of Evolutionary Biology (Giovenardi et al. 2008).

Nomenclature was updated according to Lamas (2004) and Mielke (2005). Dates ascertained from external sources to the original publications are noted in square brackets (ICZN, Art 22 1999).

The Constancy of Occurrence was based on the ecological index proposed by Silveira Neto et al. (1976), where the species were classified as constant (present in more than 50 % of samples), accessory (present between 25 % and 50 % of samples) and accidental (present in less than 25 % of samples).

Results and discussion
Colwell & Coddington (1994) use the term "accumulation curve of species" to refer to the curves constructed with data obtained from relatively homogeneous habitats in time and space, whereas the term "species-area curve" is reserved for biogeographical patterns, which implies on the heterogeneity of the area.

The sample sufficiency examined by logarithmic curve of the species accumulation curve (Figure 4) revealed that until the second sampling, 60 % and 50% of the species were caught in CAFW and URI respectively, and 90 % of the species were caught until the sixth sampling in both locations. The analysis of the correlation between the number of species caught in both locations was significant ($r = 0.93$; $F = 127.77$, $p < 0.05$).

In 80 hours of sampling, 1.785 butterflies were caught, belonging to 161 species (Table 1): 134 of them in CAFW and 124 in URI (Table 2). Regarding families of the collected butterflies, 51.17 % belong to Nymphalidae, 22.35 % to Hesperiidae, 8.23 % to Pieridae, 6.47 % to Riodinidae, 5.88 % to Papilionidae and 5.88 % to Lycaenidae. Comparing the percentage of species by locality, 62.35 % (n = 106) were common at both sites of collection.

In this study Nymphalidae was the richest family, similar to data obtained in studies conducted in Santa Maria (Dessuy and Morais 2007; Sack and Morais 2008), Espinilho State Park and surrounding area (Marchiori and Romanowski 2006), Maquiné (Iserhard and Romanowski 2004), Minas Gerais (Silva et al. 2007) and Distrito Federal (Emery et al. 2006). The most abundant subfamilies of Nymphalidae were Nymphalinae (n = 319) and Heliconiinae (n = 300), similar to data obtained by Quadros et al. (2004) in the Coastal Plain of Rio Grande do Sul.

Hesperiidae was the second richest family, often being the largest or one of the richest families, among the inventories carried out in Brazil (Brown Jr. and Freitas 1999; 2002), and particularly in Rio Grande do Sul (Mabilde 1896; Marchiori and Romanowsky 2006; Dessuy and Morais 2007, Sack and Morais 2008, Paz et al. 2008). Biezanko and Mielke (1973) registered 294 species of Hesperiidae to the state in a survey longer than 30 years, from which, 14 species are present in this survey.

Biezanko (1959) recorded 32 species of the Family Pieridae to the southeastern zone of Rio Grande do Sul, while Teston and Corseuil (1998; 2000a; b) 42 to Rio Grande do Sul, higher than the present study which obtained, similarly to Giovenardi et al. (2008), 14 species.

Papilionidae featured ten species. Although 29 Papilionidae specie have been listed by Teston and Corseuil (1998) in Rio Grande do Sul, most previous studies in the state (Link et al. 1977; Teston and Corseuil 2000; Schwartz and Di Mare

2001; Iserhard and Romanowsky 2006; Marchiori and Romanowsky 2006; Dessuy and Morais 2007; Sack and Morais 2008), averagely registered 15 species.

In this survey Lycaenidae featured 10 species. It must be mentioned that in many studies (Brown and Freitas 1999; Iserhard and Romanowski 2004; Dessuy and Morais 2007) Riodinidae is considered as a subfamily (Riodininae) of Lycaenidae. Even adding richness of both families (Lycaenidae and Riodinidae) the diversity of the current survey is similar to the ones observed in other studies in the state (Iserhard and Romanowski 2004; Dessuy and Morais 2007). From the 11 species of Riodinidae (subfamily Riodininae) recorded in Frederico Westphalen, all of them were sampled by Biezanko et al. (1978), who achieved 49 species for the Rio Grande do Sul, during 30 years of sampling.

When the Constancy of Occurrence of species were compared (Figure 5) the accidental species are the largest group both in the URI (66.4 %) and in CAFW (62.8 %). *Biblis hyperea nectanabis* (Fruhstorfer, 1909) and *Heliconius erato phyllis* (Fabricius, 1775) (Heliconiinae) were the most abundant species in the two surveyed areas. The most abundant species in the two fragments was *H. erato phyllis*, that may have been influenced by the habitat's characteristics: according to Brown Jr. (1992) this species is common in open or disturbed forests. Therefore it is not surprising that it was abundantly registered in this study, considering the intense anthropic pressure that the two studied fragments have suffered.

Novotny and Basset (2000), define "singletons", as species represented by only one individual during the search. This can occur by several factors including: nomad species which are in the place merely to forage, rare species, or because they were sampled by unsuitable methods, especially when the population level is small, generalists that feed in the local occasionally, or specialists that feed on plants that occur only in the studied location. Of the 161 species recorded in this study 20.50 % (n = 33) were "singletons" (Table 1) and 32.92 % (n = 53) were unique species (n = 33 in CAFW in the URI n = 20) (Table 2) occuring in only one sample (Dias 2004).

Analysis of chi-square distribution of sampling, based on the geometric series (P ($\chi 2_{(0.0\ 5,\ 20\ d.f.)}$)) (Table 3), shows that the number of individuals captured per subfamily differs statistically ($p < 0.05$) from the number expected only in CAFW ($\chi^2_{(0.0\ 5,\ 20\ d.f.)} = 70.19$), but not in URI ($\chi^2_{(0.0\ 5,\ 20\ d.f.)} = 30.80$). Analyzing the number of species per subfamily, differences are not statistically significant ((CAFW) - $\chi^2_{(0.0\ 5,\ 20\ d.f.)} = 7.62$); (URI) - $\chi^2_{(0.0\ 5,\ 20\ d.f.)} = 1.38$). These results indicate that the estimates of diversity based on abundances can give an implausible ecological response, supporting the criticism about the inadequacy of estimating the diversity index based on this parameter (Dias 2004). The Shannon index based on the number of species per subfamily was 2.73 for CAFW, and 2.69 for URI, without significant differences ($t = 0.434$, $p > 0.05$).

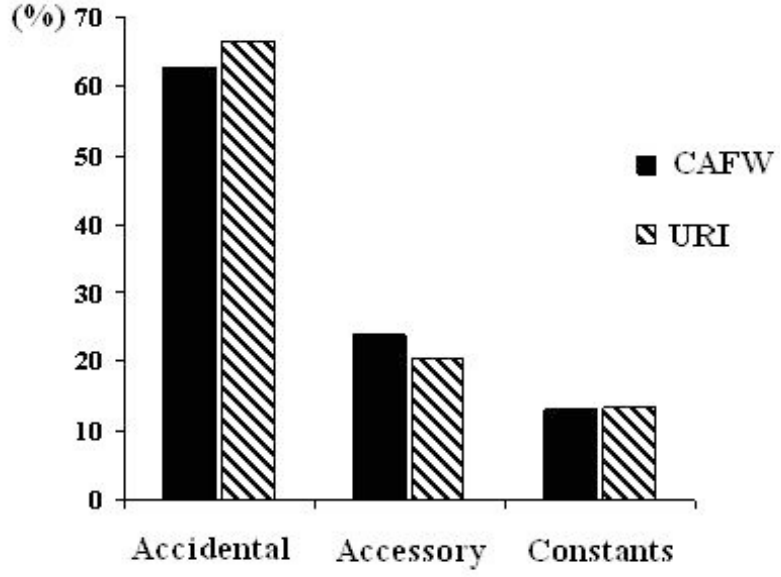


Figure 5. Proportion of species caught at each level of constancy in the studied forest fragments.

In this study, the obtained results are very similar to the ones found by Giovenardi et al. (2008) which obtained 169 species as well as the similarity between the richness of the families. However, the time of sampling was shorter in the one here presented. Fourty-nine new species were recorded in this study, implying that Frederico Westphalen has a richness of 218 species.

Table 1. List of families, subfamilies, species (N) and number of individuals (n) captured in two fragments located in the municipal district of Frederico Westphalen: the Agricultural College of Frederico Westphalen (CAFW) and the Regional Integrated University of High Uruguay (URI). An asterisk (*) indicates new record for the city of Frederico Westphalen.

Taxon	CAFW	URI	Total
	n	n	N
Nymphalidae (N= 85)			
Morphinae (N = 5)	**24**	**27**	**51**
Catoblepia amphirhoe (Hubner, [1825])*	0	1	1
Dynastor darius faenius Fruhstorfer, 1912	0	1	1
Eryphanis reevesii (Doubleday, [1849])	1	1	2
Morpho aega aega (Hübner, [1822])	10	5	15
Morpho helenor achillides C. Felder & R. Felder, 1867	13	19	32
Ithomiinae (N = 9)	**97**	**113**	**210**
Dircenna dero celtina Burmeister, 1878	12	22	34
Episcada hymenaea hymenaea (Prittwitz, 1865)*	17	18	35
Epityches eupompe (Geyer, 1832)	16	29	45
Mcclungia cymo cymo (Hubner, [1806])*	0	1	1
Mechanitis lysimnia lysimnia (Fabricius, 1793).	17	22	39
Methona themisto (Hübner, 1818)	6	7	13
Placidina euryanassa (C. Felder & R. Felder,1860)	16	2	18
Pseudoscada erruca (Hewitson, 1855)*	8	5	13
Pteronymia sylvo (Geyer,1832)	5	7	12
Heliconiinae (N = 12)	**199**	**101**	**300**
Actinote discrepans d'Almeida,1958	0	2	2
Actinote melanisans Oberthür, 1917	9	7	16
Actinote pellenea pellenea Hübner, [1821]*	0	2	2
Agraulis vanillae maculosa (Stichel, [1908])	11	3	14
Dione juno juno (Cramer, 1779)	4	7	11
Dione moneta Hübner, [1825]	0	2	2
Dryadula phaetusa (Linnaeus, 1758)	3	0	3
Dryas iulia alcionea (Cramer, 1779)	71	18	89
Euides aliphera aliphera (Godart, 1819)	24	2	26
Euptoieta claudia claudia (Cramer, 1775)	1	0	1
Heliconius erato phyllis (Fabricius, 1775)	74	54	128
Heliconius ethilla narcaea Godart, 1819	2	4	6
Nymphalinae (N = 12)	**200**	**119**	**319**
Anartia amathea roeselia (Eschscholtz, 1821)	33	29	62
Chlosyne lacinia saundersi (Doubleday, [1847])	30	19	49
Eresia lansdorfi (Godart, 1819)	0	4	4
Hypanartia bella (Fabricius, 1793)	2	4	6
Hypanartia lethe (Fabricius, 1793)	8	6	14
Junonia evarete (Cramer, 1779)	54	10	64
Ortilia ithra (Kirby, 1900)	9	6	15
Ortilia orthia (Hewitson, 1864)	9	1	10
Siproeta epaphus trayja Hübner, [1823]	11	8	19
Tegosa claudina (Eschscholtz, 1821)	40	29	69
Vanessa braziliensis (Moore, 1883)	3	3	6
Vanessa myrinna (Doubleday, 1849)	1	0	1
Biblidinae (N = 18)	**143**	**98**	**241**
Biblis hyperia nectanabis (Fruhstorfer, 1909)	89	29	118
Callicore hydaspes (Drury, 1782)	10	2	12
Callicore pygas thamyras (Ménétriés, 1857)	1	2	3

Taxon	CAFW	URI	Total
Catonephele numilia neogermanica Stichel, 1899	2	4	6
Diaethria candrena candrena (Godart, 1824)	13	3	16
Diaethria meridionalis (Bates, 1864)	6	13	19
Dynamine athemon (Linnaeus, 1758)	0	1	1
Dynamine coenus coenus (Fabricius, 1793)*	1	1	2
Dynamine myrrhina (Doubleday, 1849)	12	15	27
Dynamine tithia tithia (Hübner, [1823])	0	1	1
Epiphile orea orea (Hübner, [1823])*	0	1	1
Eunica eburnea Fruhstorfer, 1907	1	3	4
Hamadryas amphinome amphinome (Linnaeus, 1767)*	0	5	5
Hamadryas epinome (C. Felder & R. Felder, 1867)	4	13	17
Hamadryas fornax fornax (Hübner, [1823])	1	1	2
Marpesia Chiron marius (Cramer, 1779)*	1	0	1
Myscelia orsis (Drury,1782)	2	3	5
Paulogramma pyracmon pyracmon (Godart, [1824])*	0	1	1
Satyrinae (N = 16)	**121**	**59**	**180**
Eteona tisiphone (Boisduval, 1836)	17	1	18
Forsterinaria necys (Godart, [1824])	2	4	6
Forsterinaria quantius (Godart, [1824])	8	3	11
Godartiana muscosa (Butler, 1870)*	0	1	1
Hermeuptychia hermes (Fabricius, 1775)	1	0	1
Moneuptychia paeon (Godart, [1824])	0	1	1
Moneuptychia soter (Butler, 1877)	1	0	1
Pareuptychia summandosa (Gosse, 1880)	9	10	19
Paryphthimoides poltys (Prittwitz, 1865)	1	16	17
Praepedaliodes phanias (Hewitson,1862)	31	5	36
Pseudodebis euptychidia (Butler, 1868)*	26	5	31
Splendeuptychia libitina (Butler, 1870)	5	3	8
Taygetis tripunctata Weymer, 1907*	1	1	2
Taygetis ypthima Hübner, [1821]	3	2	5
Yphthimoides celmis (Godart, [1824])	8	3	11
Yphthimoides straminae (Butler, 1867)*	8	4	12
Apaturinae (N = 3)	**14**	**16**	**30**
Doxocopa kallina (Staudinger,1886)	5	4	9
Doxocopa laurentia laurentia (Godart, [1824])	8	12	20
Doxocopa zunilda zunilda (Godart,1824)	1	0	1
Charaxinae (N = 2)	**2**	**2**	**4**
Hypna clytemnestra huebneri Butler, 1866	0	1	1
Memphis moruus stheno (Prittwitz,1865)	2	1	3
Limenitidinae (N = 6)	**15**	**7**	**22**
Adelpha falcipennis Fruhstorfer, 1915*	0	1	1
Adelpha malea goyama Schaus,1902	4	1	5
Adelpha mythra (Godart, [1824])	2	0	2
Adelpha syma (Godart, [1824])	8	1	9
Adelpha thessalia indefecta Fruhstorfer, 1913*	0	3	3
Adelpha zea (Hewitson, 1850)	1	1	2
Libytheinae (N = 1)	**1**	**2**	**3**
Libytheana carinenta carinenta (Cramer, 1777)	1	2	3
Danainae (N = 1)	**3**	**6**	**9**
Danaus erippus (Cramer, 1775)	3	6	9
Papilionidae (N = 10)			
Papilioninae (N = 10)	**55**	**46**	**101**
Battus polydamas polydamas (Linnaeus, 1758)	8	1	9
Battus polystictus polystictus (Butler, 1874)	6	3	9
Heraclides anchisiades capys (Hübner, [1809])	1	2	3
Heraclides astyalus astyalus (Godart, 1819)	3	1	4
Heraclides hectorides (Esper, 1794)	4	1	5
Heraclides thoas brasiliensis (Rothschild & Jordan, 1906)	3	0	3
Mimoides lysithous rurik (Eschscholtz, 1821)	2	1	3

Taxon	CAFW	URI	Total
Parides agavus (Drury, 1782)	15	12	27
Parides anchises nephalion (Godart, 1819)	13	24	37
Protesilaus stenodesmus (Rothschild & Jordan , 1906)*	0	1	1
Pieridae (N = 13)			
Coliadinae (N = 7)	**39**	**40**	**79**
Aphrissa statira statira (Cramer, 1777)	2	4	6
Eurema deva deva (Doubleday, 1847)	1	2	3
Phoebis argante argante (Fabricius, 1775)	11	6	17
Phoebis neocypris neocypris (Hübner, 1823)	3	8	11
Phoebis philea philea (Linnaeus, 1763)	5	5	10
Phoebis sennae marcellina (Cramer, 1777)	9	11	20
Rhabdodryas trite banski (Breyer, 1939)	8	4	12
Dismorphiinae (N = 3)	**7**	**6**	**13**
Dismorphia astyocha Hübner, [1831]*	1	1	2
Enantia lina psamathe (Fabricius, 1793)*	1	0	1
Pseudopieris nehemia prasina Hayward, 1949	5	5	10
Pierinae (N = 3)	**16**	**15**	**31**
Ascia monuste orseis (Godart, 1819)	15	14	29
Glutophrissa drusilla drusilla (Cramer, 1777)	1	0	1
Tatochila autodice autodice (Hübner, 1818)	0	1	1
Riodinidae (N = 10)			
Riodininae (N = 9)	**10**	**3**	**12**
Adelotypa bolena (Butler, 1867)*	1	0	1
Barbicornis basilis mona Westwood, 1851	0	1	1
Emesis diogenia Prittwitz, 1865*	0	1	1
Emesis russula Stichel, 1910	2	1	3
Eurybia pergaea (Geyer , 1832)	1	0	1
Melanis smithiae (Westwood, 1851)	2	0	2
Melanis xenia (Hewitson, [1853])*	2	0	2
Riodina lycisca (Hewitson, [1853]) *	1	0	1
Synargis calyce (C. Felder & R. Felder, 1864)	1	0	0
Euselasiinae (N = 1)	**6**	**4**	**10**
Euselasia hygenius occulta Stichel, 1919*	6	4	10
Lycaenidae (N = 10)			
Theclinae (N = 10)	**50**	**22**	**72**
Arawacus meliboeus (Fabricius, 1793)	3	1	4
Arawacus separata (Lathy, 1926)*	1	3	4
Calycopis caulonia (Hewitson, 1877)*	3	7	10
Contrafacia imma (Prittwitz, 1865)*	2	0	2
Cyanophrys remus (Hewitson, 1868)*	1	0	1
Laothus phydela (Hewitson, 1867)	2	0	2
Parrhasius orgia (Hewitson, 1867)	1	0	1
Pseudolycaena marsyas (Linnaeus, 1758)*	1	2	3
Strymon eurytulus (Hübner, [1819])*	35	9	44
Tmolus echion (Linnaeus, 1767)*	1	0	1
Hesperiidae (N = 33)			
Pyrginae (N = 21)	**43**	**34**	**77**
Achlyodes busirus rioja Evans, 1953	2	3	5
Achlyodes mithridates thraso (Hübner, [1807]) *	1	1	2
Astraptes anaphus anaphus (Cramer, 1777)	11	1	12
Astraptes fulgerator fulgerator (Walch, 1775)*	0	2	2
Codatractus aminias (Hewitson, 1867)*	1	1	2
Ebrietas anacreon anacreon (Staudinger, 1876)*	1	0	1
Heliopetes alana (Reakirt, 1868)	7	5	12
Heliopetes arsalte (Linnaeus, 1758)	7	1	8
Heliopetes omrina (Butler, 1870)	1	2	3
Pellicia vecina Schaus, 1902*	0	1	1
Polygonus leo leo (Gmelin, [1790])	1	1	2
Pyrgus orcus (Stoll, 1780)*	3	3	6
Staphylus sp.	1	0	1

Taxon	CAFW	URI	Total
Telemiades sp.	2	0	2
Urbanus doryssus albicuspis (Herrich-Schäffer, 1869)	2	2	4
Urbanus proteus proteus (Linnaeus, 1758)	1	1	2
Urbanus simplicius (Stoll, 1790)	2	5	7
Urbanus teleus (Hübner, 1821)	0	3	3
Xenophanes tryxus (Stoll, 1780)*	0	1	0
Zera hyacinthinus servius (Plötz, 1884)	0	2	2
Hesperiinae (N = 11)	**15**	**5**	**20**
Anthoptus epictetus (Fabricius, 1793)*	0	1	1
Carystoides basoches basoches (Latreille, [1824])	4	0	4
Cymaenes tripunctus theogenis (Capronnier, 1874)*	1	0	1
Hylephila phyleus phyleus (Drury, 1773)*	2	2	4
Lento krexoides (Hayward, 1940)*	1	0	1
Lychnuchoides ozias ozias (Hewitson, 1878)	1	0	1
Niconiades merenda (Mabille, 1878)*	0	1	1
Perichares lotus (Butler, 1870)*	1	0	1
Quinta cannae (Herrich - Schäffer, 1869)	1	0	1
Saliana saladin catha Evans, 1955*	1	0	1
Vehilius stictomenes stictomenes (Butler, 1877)*	1	0	1
Zariaspes mys (Hübner, [1808])	2	0	2
Pyrrhopyginae (N = 1)	**0**	**1**	**1**
Mysoria barcastus barta Evans, 1951*	0	1	1

Table 2. Number and percentage of individuals, species and unique species per family and subfamily in two localities of the municipality of Frederico Westphalen (CFW = College of Agricultural Frederico Westphalen; URI = Regional Integrated University of High Uruguay and Missions), Rio Grande do Sul, November 2006 to June 2007.

	Number of indviduals						Number of species						Exclusive species			
	CFW	%	URI	%	Total	%	CFW	%	URI	%	Total	%	CFW	%	URI	%
Hesperiidae	58	5.47	39	5.38	97	5.43	25	18.66	20	16.13	33	20.5	13	39.39	8	40
Hesperiinae	14	1.32	4	0.55	18	1.01	9	6.72	3	2.42	15	9.32	8	24.24	3	15
Pyrginae	44	4.15	34	4.69	78	4.37	16	11.94	16	12.9	23	14.29	5	15.15	4	20
Pyrrhopyginae	0	0	1	0.14	1	0.06	0	0	1	0.81	1	0.62	0	0	1	5
Lycaenidae	50	4.72	22	3.03	72	4.03	10	7.46	5	4.03	10	6.21	5	15.15	2	10
Theclinae	50	4.72	22	3.03	72	4.03	10	7.46	5	4.03	10	6.21	5	15.15	2	10
Nymphalidae	819	77.3	550	75.9	1369	76.69	69	51.49	74	59.68	85	52.8	6	18.18	8	40
Apaturinae	14	1.32	16	2.21	30	1.68	3	2.24	2	1.61	3	1.86	1	3.03	6	30
Biblidinae	143	13.5	98	13.5	241	13.5	13	9.7	17	13.71	18	11.18	1	3.03	5	25
Charaxinae	2	0.19	2	0.28	4	0.22	1	0.75	2	1.61	2	1.24	0	0	1	5
Danainae	3	0.28	6	0.83	9	0.5	1	0.75	1	0.81	1	0.62	0	0	0	0
Heliconiinae	199	18.8	101	13.9	300	16.81	10	7.46	10	8.06	12	7.45	2	6.06	3	15
Ithomiinae	97	9.15	113	15.6	210	11.76	8	5.97	8	6.45	9	5.59	0	0	1	5
Libytheinae	1	0.09	2	0.28	3	0.17	1	0.75	1	0.81	1	0.62	0	0	0	0
Limenitidinae	15	1.42	7	0.97	22	1.23	4	2.99	5	4.03	6	3.73	1	3.03	2	10
Morphinae	24	2.26	27	3.72	51	2.86	3	2.24	3	2.42	5	3.11	0	0	2	10
Nymphalinae	200	18.9	119	16.4	319	17.87	11	8.21	11	8.87	12	7.45	1	3.03	1	5
Satyrinae	121	11.4	59	8.14	180	10.08	14	10.45	14	11.29	16	9.94	1	3.03	2	10
Papilionidae	55	5.19	46	6.34	101	5.66	9	6.72	9	7.26	10	6.21	1	3.03	1	5
Papilioninae	55	5.19	46	6.34	101	5.66	9	6.72	9	7.26	10	6.21	1	3.03	1	5
Pieridae	62	5.85	61	8.41	123	6.89	12	8.96	11	8.87	13	8.7	2	6.06	1	5
Coliadinae	39	3.68	40	5.52	79	4.43	7	5.22	7	5.65	7	4.97	0	0	0	0
Dismorphiinae	7	0.66	6	0.83	13	0.73	3	2.24	2	1.61	3	1.86	1	3.03	0	0

	Number of indviduals						Number of species						Exclusive species			
	CFW	**%**	**URI**	**%**	**Total**	**%**	**CFW**	**%**	**URI**	**%**	**Total**	**%**	**CFW**	**%**	**URI**	**%**
Pierinae	16	1.51	15	2.07	31	1.74	2	1.49	2	1.61	3	1.86	1	3.03	1	5
Riodinidae	16	1.51	7	0.97	23	1.29	8	5.97	4	3.23	11	6.83	6	18.18	2	10
Euselasiinae	6	0.57	4	0.55	10	0.56	1	0.75	1	0.81	1	0.62	0	0	0	0
Riodininae	10	0.94	3	0.41	12	0.67	7	5.22	3	2.42	10	6.21	6	18.18	2	10
Total	1,060		725		1,785		134		124		161		33		20	

Table 3. Chi-square (χ^2), number of individuals, number of species observed (O) and expected (E) by subfamily, of the two studied locations in the municipality of Frederico Westphalen (CAFW = College of Agricultural Frederico Westphalen; URI = Regional Integrated University of High Uruguay and Missions), Rio Grande do Sul, November 2006 to June 2007.(ns= non significant, *= $p < 0.05$).

	Number of individuals						Number of species					
	CAFW1			URI			CAFW1			URI		
Species Names	**O**	**E**	χ^2	**O**	**E**	χ^2	**O**	**E**	χ^2	**O**	**E**	χ^2
Apaturinae	14	7.88	4.75 *	16	12.80	0.80 ns	3	2.21	0.28 ns	2	2.70	0.18 ns
Biblidinae	143	150.52	0.38 ns	98	76.30	6.17 *	13	14.83	0.22 ns	17	17.17	0.00 ns
Charaxinae	2	1.34	0.32 ns	2	1.29	0.39 ns	1	1.00	0.00 ns	2	1.77	0.03 ns
Coliadinae	39	25.65	6.95 *	40	35.51	0.57 ns	7	4.17	1.92 ns	7	6.35	0.07 ns
Danainae	3	1.80	0.79 ns	6	5.96	0.00 ns	1	1.61	0.23 ns	1	1.15	0.02 ns
Dismorphiinae	7	3.25	4.31 *	6	4.62	0.41 ns	3	2.59	0.06 ns	2	2.35	0.05 ns
Euselasiinae	6	2.42	5.28 *	4	3.58	0.05 ns	1	1.17	0.03 ns	1	1.33	0.08 ns
Heliconiinae	199	202.15	0.05 ns	101	98.45	0.07 ns	10	10.80	0.06 ns	10	9.72	0.01 ns
Hesperiinae	14	5.87	11.27 *	4	2.77	0.54 ns	9	7.86	0.16 ns	3	3.59	0.10 ns
Ithomiinae	97	83.44	2.20 ns	113	127.05	1.55 ns	8	5.72	0.90 ns	8	7.32	0.06 ns
Libytheinae	1	1.00	0.00 ns	2	1.67	0.07 ns	1	1.37	0.10 ns	1	1.00	0.00ns
Limenitidinae	15	10.59	1.84 ns	7	7.69	0.06 ns	4	3.56	0.06 ns	5	5.51	0.05 ns
Morphinae	24	19.10	1.26 ns	27	21.32	1.51 ns	3	3.04	0.00 ns	3	3.12	0.00 ns
Nymphalinae	200	271.50	18.83 *	119	163.95	12.32 *	11	12.65	0.22 ns	11	11.21	0.00 ns
Papilioninae	55	62.13	0.82 ns	46	45.82	0.00 ns	9	6.71	0.78 ns	9	8.43	0.04 ns
Pierinae	16	14.22	0.22 ns	15	9.92	2.60 ns	2	1.89	0.01 ns	2	2.04	0.00 ns
Pyrginae	44	34.44	2.65 ns	34	27.51	1.53 ns	16	20.36	0.93 ns	16	14.89	0.08 ns
Pyrrhopyginae	0	0.00	0.00 ns	1	1.00	0.00 ns	0	0.00	0.00 ns	1	1.53	0.18 ns
Riodininae	10	4.37	7.25*	3	2.15	0.34 ns	7	4.88	0.92 ns	3	4.14	0.32 ns
Satyrinae	121	112.07	0.71 ns	59	59.12	0.00 ns	14	17.37	0.66 ns	14	12.92	0.09 ns
Theclinae	50	46.26	0.30 ns	22	16.52	1.82 ns	10	9.21	0.07 ns	5	4.78	0.01 ns
$\sum\chi^2$	1060	060	70.19 *	725	725	30.80 ns	133	133	7.62 ns	123	123	1.38 ns

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