

Use of microhabitats affects butterfly assemblages in a rural landscape

Elton Orlandin^{1,3}; Mônica Piovesan^{1,4}; Fernanda Maurer D'Agostini^{2,5} & Eduardo Carneiro^{1,6}

¹ Universidade Federal do Paraná (UFPR), Departamento de Zoologia (DZOO), Laboratório de Estudos de Lepidoptera Neotropical (LABLEPNEO). Curitiba, PR, Brasil.

² Universidade do Oeste de Santa Catarina (UNOESC), Departamento de Ciências Biológicas e da Saúde. Joaçaba, SC, Brasil.

³ ORCID: <http://orcid.org/0000-0002-1987-9727>. E-mail: orlandinelton@gmail.com

⁴ ORCID: <http://orcid.org/0000-0003-3367-9358>. E-mail: monica367piovesan@gmail.com

⁵ ORCID: <http://orcid.org/0000-0002-1115-6153>. E-mail: fernanda.dagostini@unoesc.edu.br

⁶ ORCID: <http://orcid.org/0000-0002-4796-0020>. E-mail: eduardo.carneiro@ufpr.br

Abstract. Landscapes composed of small rural properties may support highly heterogeneous habitat, because they often cover distinct types of land uses adjacent to surrounding forest fragments. Many butterfly species may benefit from this kind of landscape, as very distinct microhabitats can be found in a very restricted spatial scale. To better understand how different microhabitats are related to fragmentation in rural landscapes the present study collected the butterfly fauna in 18 sampling point sites, representing distinct types of forest edges and forest interiors. Although closely located, these sites showed no spatial autocorrelation. Instead, a major distinction in species richness and composition was found among forest interior and edge habitats while no significant difference was found in species composition among distinct edge types. Therefore, the high segregation of butterfly assemblages found in a very restricted geographic scale suggests the presence of two different groups of butterflies that respond independently to forest fragmentation, the forest interior assemblages and forest edge assemblages. This distinction of butterfly assemblages related to forest interior and forest edges were already reported, but our results highlights that these differences are found mostly due to species turnover between those habitats. In other words, both microhabitat types present a high number of specialized species compared to a smaller fraction of generalist species that may occurs in both microhabitats. In the case of Atlantic Forest, the species of special conservation concern are those true specialized in forest interior habitats and not those specialized in forest edges, thus the present study corroborates the importance of sampling different microhabitats when studying fragmentation processes, both inside and outside of fragments. Although forest edges may present different kinds of habitat types, species present along border tend to be as heterogeneous as species present in different locations inside the forest. This information should be considered in sampling designs of biodiversity essays that focus on a more consistent representation of local diversity.

Key-Words. Atlantic Rainforest; Landscape fragmentation; Host plants; Species list.

INTRODUCTION

The increase in land exploitation for agricultural use have been identified as one of the main causes of habitat fragmentation (Foley, 2005; Foley *et al.*, 2011). This phenomena increases the isolation and the number of small habitat patches, as well as decreases the original area size of natural habitats (Fahrig, 2003), thus affecting the organisms diversity and distribution (Prugh *et al.*, 2008; Foley *et al.*, 2011; Gibson *et al.*, 2013; Ibáñez *et al.*, 2014; Haddad *et al.*, 2015). All these effects however, are dependent of how different landscape variables change across geographical scales (Brown Jr. & Hutchings, 1997; Driscoll *et al.*, 2013; Prugh *et al.*, 2008; Verbeylen *et al.*, 2003).

Studies using butterflies as models have demonstrated that local habitat fragmentation can affect their abundance, richness, composition, and diversity (Brown Jr. & Hutchings, 1997; Bobo *et al.*, 2006; Uehara-Prado *et al.*, 2007; Ribeiro *et al.*, 2008; Uehara-Prado *et al.*, 2009; Bonebrake *et al.*, 2010; Collier *et al.*, 2010; Ribeiro *et al.*, 2012; Robinson *et al.*, 2014; Filgueiras *et al.*, 2016). Most importantly, local butterfly distribution is closely associated with habitat conditions as impacted by habitat fragmentation, such as fragment interior vs. fragment edges (Ribeiro *et al.*, 2012; Brito *et al.*, 2014; Filgueiras *et al.*, 2016). This occurs because species that feed as adults on fruits, decomposing matter or bird excrement, find these resources mainly inside the forest, while nectarivorous species find most of the food resources in the canopy,

Pap. Avulsos Zool., 2019; v.59: e20195949

<http://doi.org/10.11606/1807-0205/2019.59.49>

<http://www.revistas.usp.br/paz>

<http://www.scielo.br/paz>

Edited by: Marcelo Duarte

Received: 07/03/2019

Accepted: 20/09/2019

Published: 17/10/2019

ISSN On-Line: 1807-0205

ISSN Printed: 0031-1049

ISNI: 0000-0004-0384-1825



on the edges or in open areas (Brown Jr. & Hutchings, 1997; Devries & Walla, 2001; Hill *et al.*, 2001; Brown Jr. & Freitas, 2002). As distinct types of matrices surrounding fragments may influence the availability of food resources to butterflies, more complex landscapes may offer greater resource diversity (Tews *et al.*, 2004). Therefore, it is expected that rural landscapes under predominance of small farms can harbour more rich and complex assemblages when compared to the extensive monocultural and urban landscapes (Fahrig *et al.*, 2015; Iserhard *et al.*, 2018). This is because small rural properties tend to have different kinds of land occupations, promoting peculiar characteristics, which enable population maintenance and species interaction (Fahrig *et al.*, 2011, 2015).

In addition, the transition area between the fragment and the surrounding matrix may provide differentiated food resources for some groups of insects, relative to those found within the fragment and in the matrix (Landis *et al.*, 2000; Poggio *et al.*, 2010). These areas, the fragment edges, usually have pioneering plant species (Rigueira *et al.*, 2012) and unique micro-climates (Lawson *et al.*, 2014) that form peculiar microhabitats, attracting not only nectarivores, but also predators and other herbivorous insects (Didham *et al.*, 1996; Jokimäki *et al.*, 1998; Albrecht *et al.*, 2010). Fragments surrounded by matrices composed of different occupations (*e.g.*, abandoned areas, crop lands, or roads) present these differentiated transition areas, which form microhabitats at different levels of complexity (*e.g.*, different types of resources). Several butterfly species, for example, are recognized for inhabiting these environments, from where they extract food, both at the larval and adult stages (Brown Jr. & Hutchings, 1997; Brown Jr. & Freitas, 2002).

This study aimed to verify whether the butterfly species richness and composition in a rural fragmented landscapes is influenced by these kinds of microhabitat, thus testing the following hypotheses: (1) Despite of their close proximity, the butterfly assemblages have distinct species richness and composition in different microhabitats present in a fragmented landscape; (2) forest edges and interior have distinct butterfly richness and composition, because butterfly species usually prefer for a particular microhabitat type and (3) different edges types presents distinct butterfly richness and composition.

MATERIALS AND METHODS

Study site

The study was conducted in the municipality of Joaçaba (27°10'41.0"S, 51°30'17.0"W), in the western region of Santa Catarina State, southern Brazil (Fig. 1a). This region is broadly characterized by its rural landscape, with small urban areas (Maté *et al.*, 2015). Small farms predominate in the rural landscape, some of them raising livestock such as cattle, pigs, and poultry, while the others grow corn, beans, rice, tobacco, soy, apple, and oranges (Begnini & Almeida, 2016). The forest fragments are relicts from a transition area (ecotone) between the

Araucaria forest and Deciduous forest (Vibrans *et al.*, 2012). The climate is mesothermal humid with a hot summer (according to Köppen-Geiger climatic classification), the average annual temperature is 18°C, annual rainfall of about 2,000 mm, relative annual humidity average is 76% (Alvares *et al.*, 2013), and an altitude of range 700-830 m (Google Earth, 2016).

Sampling

Butterfly assemblages were measured in 18 sample sites representing four microhabitat types: forest interiors (n = 6); road edges: edge of the fragment closer to the road (n = 4); farmland edges: crops of soybean and corn and cattle ranching (n = 4); and abandoned edges: early-regrowth vegetation areas (n = 4) (Fig. 2). The focus of the present study was to measure distribution of these butterfly assemblages in a very fine geographical scale. Therefore, these 18 sample sites were chosen in three fragments, being some of them more closely located to each other than to others (Fig. 1b-d, Appendix I). Sample sites in the same fragment were distant from each other by a minimum of 50 m meters distance when representing distinct microhabitats, or at least 100 m distance when representing the same microhabitat. Inside the forest, butterflies were captured in a radius up to 10 m, while in forest edges the butterflies were sampled in a transect up to 30 m.

Sampling was conducted with an entomological net between 08:30 AM and 04:00 PM between January 2016 and March 2017, except in April, June, July, and August, totaling 15 replicates for each sample site. Butterfly sampling was performed at each site for 01:15 hours, following a rotation, resulting a total of 337.5 h/net per site. Therefore, all sites were equally sampled during different times of the day in the same period of the year. Only the butterfly captured and euthanized were considered in the samples. The specimens were identified based on photographs of type series available in Warren *et al.* (2013) and/or confirmed by specialists. Voucher specimens are deposited in the "Coleção Entomológica Padre Jesus Santiago Moure (DZUP)".

Statistical analyses

Considering that butterflies can easily move among the sample sites and use more closely located food resources, the samples in this study are potentially subject to spatial autocorrelation. To determine if this was the case, a Mantel test was employed using a Euclidean distance matrix to represent the geographic distances between samples and a similarity matrix based on Bray-Curtis index to represent species composition.

Later, we measured the richness and composition of butterfly assemblages at each sample site. The butterfly richness was estimated using the interpolation and extrapolation methodology proposed by Chao & Jost (2012), available in the iNEXT package (Hsieh *et al.*, 2016).

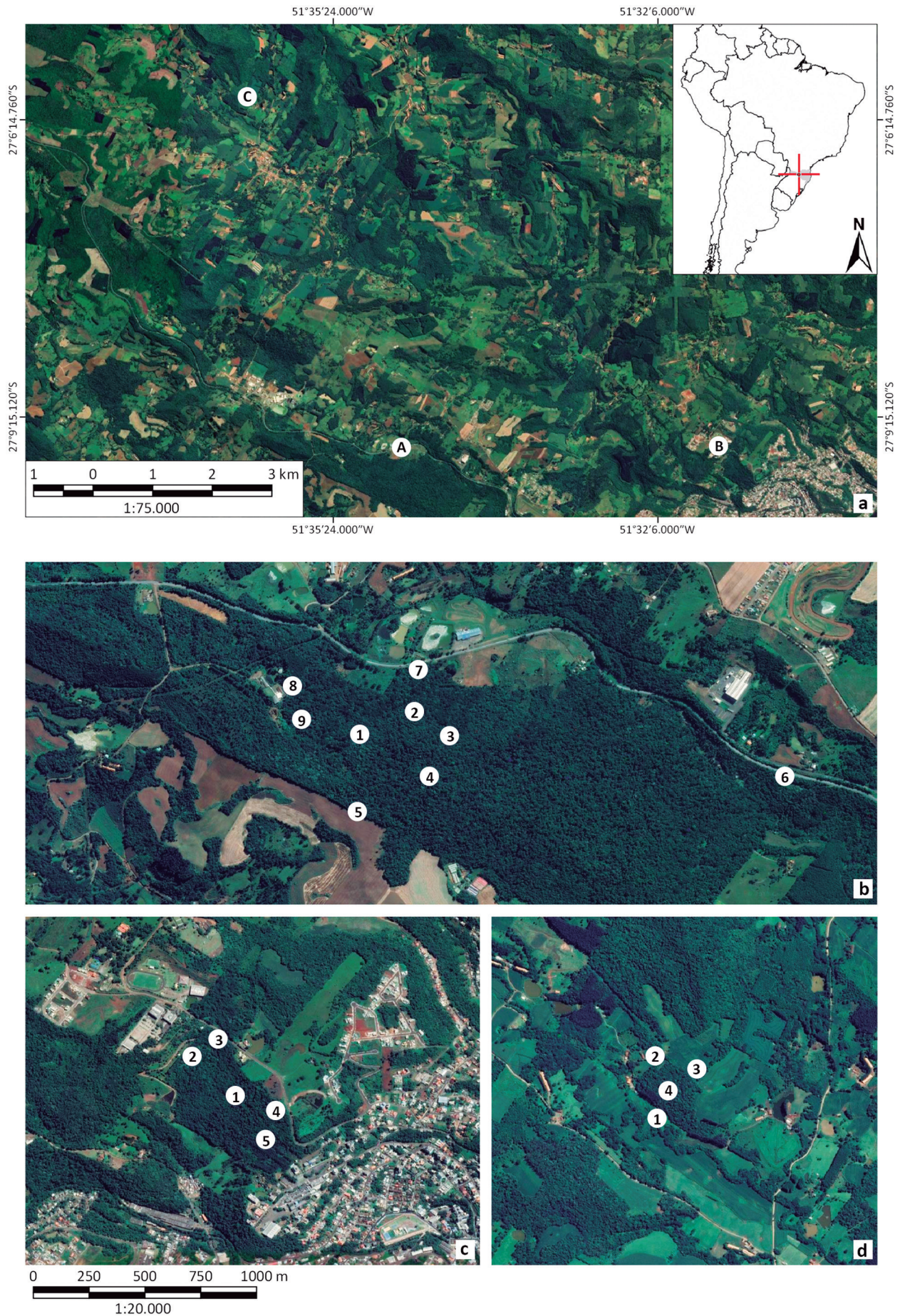


Figure 1. Location of the study area in the Joaçaba Municipality, Santa Catarina State, Brazil. (a) Fragments sampled; (b-c) Distribution of collection points of A, B and C fragments.



Figure 2. Characterization of the sampled microhabitats in a rural landscape in Southern Brazil. (a, b) forest interior; (c, d) abandoned edge; (e, f) farmland edge; (g, h) road edge.

This method is particularly efficient to estimates the differences in species richness estimated from communities with distinct structure (*e.g.*, abundances distribution). Non-metric multidimensional scaling (NMDS) based on the Bray-Curtis similarity index was used to access assemblage composition at different microhabitats. This method generates a scatter plot in which closely localized samples (*e.g.*, clustered) exhibit similar fauna composition. Thus, distances between sample sites can be used as surrogates of composition dissimilarity (Melo & Hepp, 2008). A PERMANOVA test ($n = 999$ permutations) was performed to test the significance of microhabitat type in shaping the butterfly species composition. The PERMANOVA was performed for two distinct datasets in our study, since the fragment interior showed a very distinct species composition when compared to all other microhabitat types. Therefore, after testing the whole dataset, a subsequent analysis was performed after removing the forest interior samples.

Additionally, we partitioned the Bray-Curtis coefficient into two measurements to test if any of the microhabitat types are distinct in terms of species turnover (β_{turn} -diversity) and nestedness (β_{nest} -diversity) (Baselga, 2013). These results were used to infer whether the differences in species composition are due to the segregation of different species at different microhabitats (turnover) or because one microhabitat have only a smaller amount of the same species as the other (nestedness). Therefore, if all microhabitats have a large amount of specialists butterflies a higher β_{turn} -diversity is expected. On the contrary, when most of the species in a microhabitat are generalists (*e.g.*, found across other microhabitats) a higher β_{nest} -diversity is expected. Also to complement this goal, we employed the INDVAL test to verify how many butterfly species present close ecological affinities with any microhabitat type. The INDVAL yields a maximum value when all specimens of a given species are recorded in only one type of habitat and in all samples representing this habitat, despite other species abundances (Dufrene & Legendre, 1997). Since all forest edges revealed no significant changes in the species composition, we only scored microhabitats as forest edges or forest interior. In this test, we considered only species with ≥ 10 individuals, thus totalling 190 species tested. The species that presented significant value were compared with the literature's observations regarding adult habits and larvae host plants. All analyses were performed in the R environment (R Core Team, 2015) using the package *vegan* (Oksanen *et al.*, 2017), *betapart* (Baselga, 2013) and *labdsv* (Roberts, 2016).

RESULTS

A total of 7,941 butterflies belonging to 431 species were recorded. Twenty-nine species were later recorded during occasional collects totalling 460 species; these species were attached to the species list, but not accounted in the statistical analyses (Appendix II). The Mantel test showed no correlation between species

composition and the geographical proximity of sample sites ($R = 0.07$, $p > 0.05$), indicating that sample sites are not spatial autocorrelated.

Comparisons among butterfly richness revealed that different microhabitat types do play a role on butterfly species richness patterns (Fig. 3). Assemblages are richer in forest edges than the forest interiors, with the abandoned edges being the richest, followed by the road edge and the farmland edge (Fig. 4, Appendix III). Also a major distinction in species composition is found among forest interior and edges ($R^2 = 0.36476$, $p < 0.001$, Fig. 5a), but in this case the different types of edges revealed no sig-

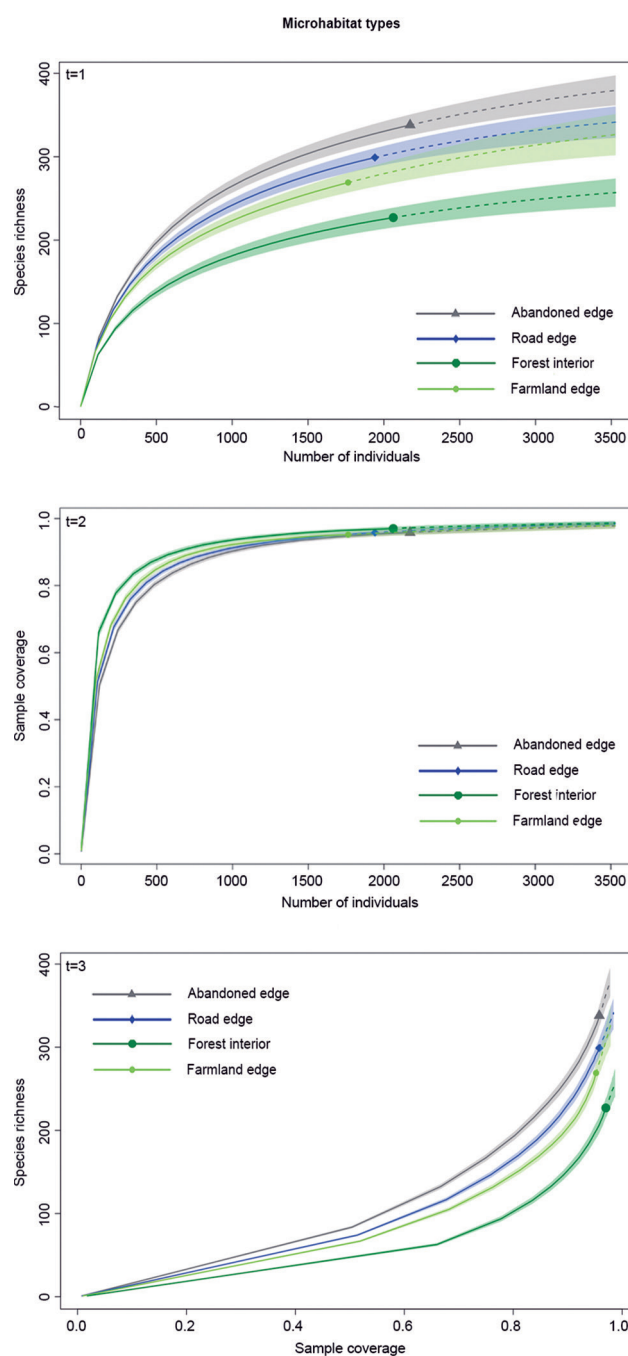


Figure 3. Results of integrated coverage-based rarefaction-extrapolation (Chao & Jost, 2012) of butterfly richness between microhabitat types in a rural landscape in Southern Brazil (confidence interval = 95%). Continuous lines (rarefaction), dotted lines (extrapolation).

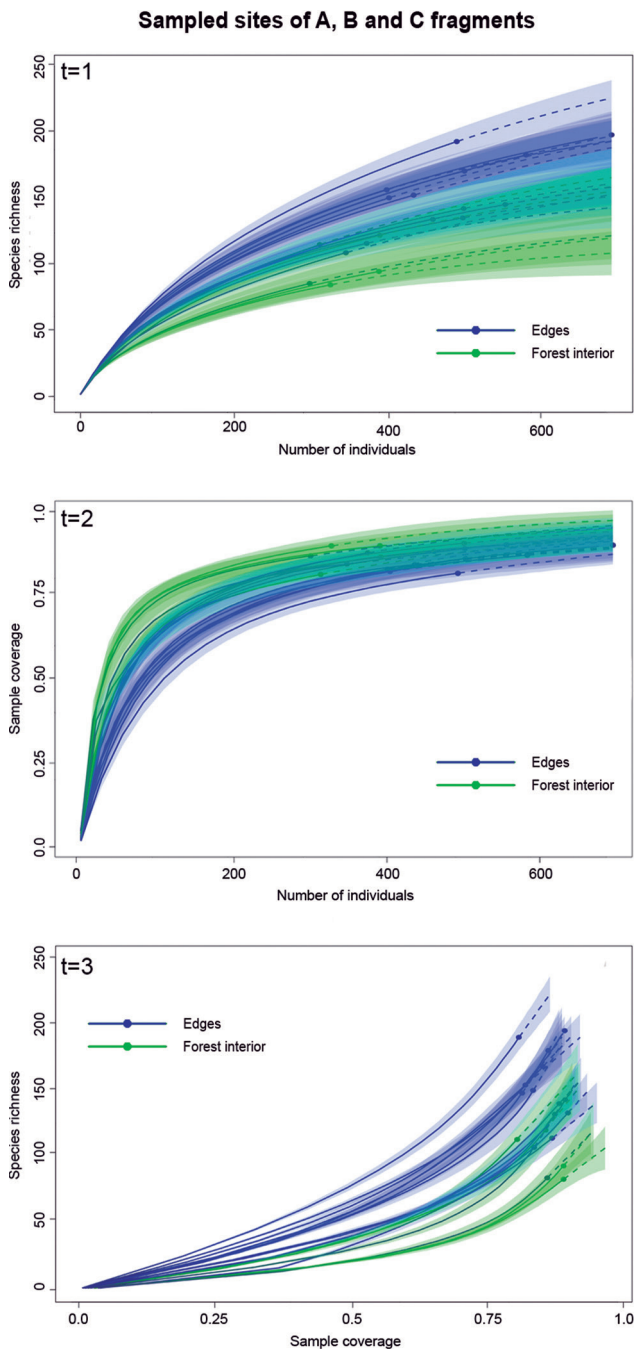


Figure 4. Results of integrated coverage-based rarefaction-extrapolation (Chao & Jost, 2012) of butterfly richness between 18 sampled points in a rural landscape in Southern Brazil (confidence interval = 95%). Continuous lines (rarefaction), dotted lines (extrapolation).

nificant differences between each other, even when the samples from the forest interior were removed from the analyses ($R^2 = 0.14894$, $p = 0.909$, Fig. 5b). In both types of microhabitats, beta-diversity is mostly represented by species turnover (Forest interior: $\beta_{\text{turn}} = 0.5$; Forest edges: $\beta_{\text{turn}} = 0.56$; $p = 0.58$) instead of nestedness (Forest interior: $\beta_{\text{nest}} = 0.03$; Forest edges: $\beta_{\text{nest}} = 0.04$; $p = 0.67$), showing that the differences between habitat types is mostly represented by specialists species instead of generalists species. By comparing microhabitat types, the fragment edges show a much larger number of indicator species ($n = 68$), than the forest interior ($n = 20$) (Appendix IV).

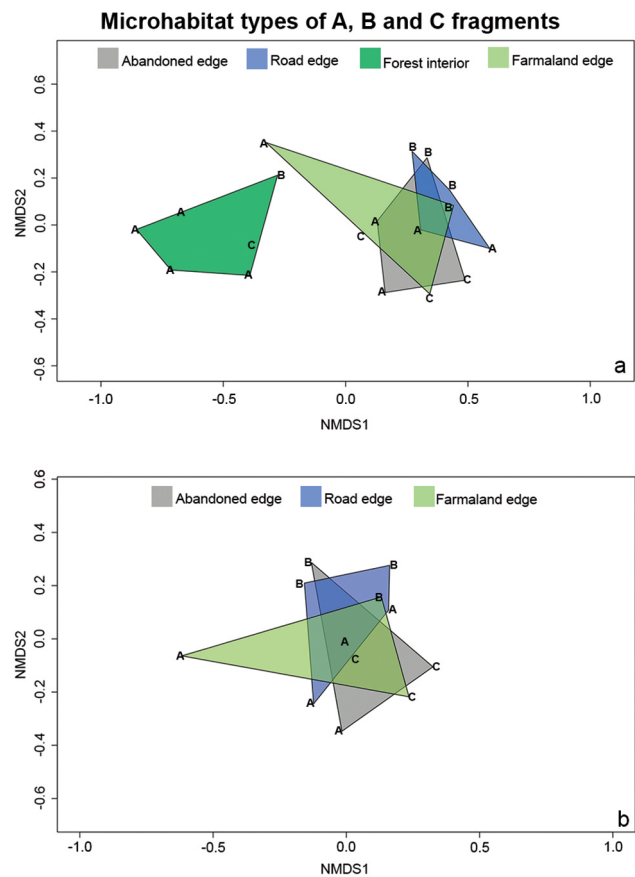


Figure 5. Non-metric multidimensional scaling (NMDS), plots representing butterfly assemblages composition measured in distinct types of microhabitats (abandoned edge, road edge, farmland edge and forest interior) in a rural landscape in Southern Brazil. a) Including forest interior sampled sites (Stress = 0.11); b) Excluding forest interior sampled sites (Stress = 0.14). Forest interior butterfly communities are distinct from all edge communities, but all edge habitats support similar butterfly communities despite microhabitat differences (even when interior samples are removed from the data analysis).

DISCUSSION

The fragmentation impacts of natural environments have been extensively studied in different animal and botanical groups (Uehara-Prado *et al.*, 2007; Buchmann *et al.*, 2013; Sancha *et al.*, 2014; Filgueiras *et al.*, 2016; Justino *et al.*, 2016). In general, several studies already demonstrated how the type of matrix surrounding a fragmented landscape may influence on species richness and composition (Gascon *et al.*, 1999; Steffan-Dewenter, 2003; Vieira *et al.*, 2009; Öckinger *et al.*, 2012; Driscoll *et al.*, 2013). The phenomena associated with these patterns are mostly related to species dispersal, colonization and extinction. However, few studies tested how the use of distinct microhabitat in a fragmented landscapes may influence on the assemblage structure of highly mobile organisms. Considering, for example, that sites inside fragments and sites along fragment border present very distinct habitats traits over a narrow geographical distance, highly mobile organisms such as winged insects could easily make use of both microhabitat types. Our study results showed, using distinct assemblage measurements, that this is not the case of butterfly assemblages.

Butterflies are widely known to have special preference for specific microhabitats (Brown Jr. & Hutchings, 1997; Devries & Walla, 2001; Hill *et al.*, 2001; Brown Jr. & Freitas, 2002; Uehara-Prado *et al.*, 2007; Ribeiro *et al.*, 2012), such as shady environments (Hill *et al.*, 2001; Brown Jr. & Freitas, 2002), hilltops (Prieto & Dahners, 2006; Carneiro *et al.*, 2014); or to fly very close to their host plants (Rutowski, 1991). Most frequently (although not always) this association with microhabitats is based on the presence and abundance of adult and/or larval food resources (Hamer *et al.*, 2006). According to our data, the assemblages sampled within microhabitats are more similar when compared among microhabitats. Therefore, the structure and distribution of butterfly assemblages in a fragment may be very heterogeneous, even when this fragment is deeply reduced in size (Ribeiro *et al.*, 2008).

This pattern cannot be explained by their geographical proximity between sample sites. Actually, even delimiting sample sites in a very narrow distance between each other (< 100 m), we could not find a spatial bias in our assemblages. In general, forest edges concentrated greater species richness than the forest interior, and consequently a higher number of significant indicator species. This difference could occur due to the higher concentration of food resources offered to butterflies at the forest borders. The abundance of flowers attractive to butterflies inside the forest is scarce when compared to the forest edges, where several pioneering plant species bloom mainly from the Asteraceae and Rubiaceae family (Silberbauer-Gottsberger & Gottsberger, 1988; Andersson *et al.*, 2002; Brown Jr. & Freitas, 2002; Ramírez, 2004). Such phanerogams are concentrated to a greater or lesser abundance around fragments, depending on which type of edge is found. For example, while abandoned edges are occupied by pioneer vegetation, farmers extend their crop fields closer to the fragment edge, thereby reducing the abundance of pioneer vegetation. Therefore, a greater richness is likely to be found in the abandoned habitat due to the greater abundance and diversity of flowers of this pioneer vegetation richness. Brown & Hutchings (1997) observed a similar pattern in the Amazon forest fragments, that is, small fragments surrounded by homogeneous areas (burned or pasture) and interiors of large fragments presenting low richness when compared with fragments that contained areas in regrowth and flowers in abundance. Similarly, Öckinger *et al.* (2012) found that butterfly species' richness is higher in fragments surrounded by matrixes whose vegetation was more similar to the forest fragment. Hence, the quality of forest edges is of great relevance in order to maximize the species richness in fragmented landscapes.

Nevertheless, it is important to highlight that butterfly species richness is not always a good descriptor of habitat quality (Shuey *et al.*, 2017). Instead, species composition has shown to be more sensitive measurement to detect differences between habitat types (Uehara-Prado *et al.*, 2007; Truxa & Fiedler, 2012; Filgueiras *et al.*, 2019). Although we could not find a significant difference in the species composition between different types

of edges, (despite of their difference in species richness), the differences between forest interior and edges are remarkable. This distinction of butterfly assemblages related to forest interior and forest edges were already reported, including those of fruit-feeding butterfly (Brown Jr. & Hutchings, 1997; Uehara-Prado *et al.*, 2007; Ribeiro *et al.*, 2012; Filgueiras *et al.*, 2016). Moreover, our results highlights that these differences are found mostly due to species turnover between those habitats. In other words, both types of microhabitat have a larger fraction of specialized species and only a smaller set of species can be found inhabiting forest interior and forest edges. This pattern is the opposite to those found in the Northern Hemisphere, in which the structure of butterfly assemblages across fine scale habitat use is mostly nested (Summerville *et al.*, 2002; Trivellini *et al.*, 2016). Most likely, the higher turnover rate observed here was produced by the behavior of butterflies. The species commonly found around the fragment hardly perch or forage inside the forest, or when they do, they should use the canopy stratum instead (Hill *et al.*, 2001). The opposite behavior is observed to forest interior species, who usually avoids flying in habitats with high luminosity rates. These species are known to be adapted to shady and humid microclimates, frequently presenting cryptic behaviours and/or coloration (Uehara-Prado & Freitas, 2009; Iserhard *et al.*, 2018).

Evidently, in the case of Atlantic Forest the species of special conservation concern are those specialized in forest interior habitats and not those specialized in forest edges (Brown Jr. & Hutchings, 1997; Ribeiro *et al.*, 2012; Filgueiras *et al.*, 2016). However, not all of them are reliable indicators of habitat quality. The abundance of some Ithomiini species for example, respond only to the presence of small pockets of humidity generated inside the fragments, instead of habitat quality (Brown Jr. & Freitas, 2002). The same could occur with some Satyrinae species whose larvae feed on grasses that invades the understory of strongly modified fragments. On the contrary, species such as *Celaenorrhinus eligius punctiger* (Burmeister, 1878) may indicate habitat quality because both larvae and adults feed on typical understory food resources (De Jong, 1982; Brown, 1992). Although our results pointed to a relevant number of interior forest indicators, we believe it is possible that several forest specialists are no longer present in the region due to their sensitiveness to disturbances (Hill *et al.*, 2001; Cleary & Genner, 2004; Filgueiras *et al.*, 2019). This hypothesis would also explain the lower number of species found in forest interiors when compared to forest edges.

The present study corroborates the importance of sampling different microhabitats when studying fragmentation processes, both inside and outside of fragments. Although forest edges may present different kinds of habitat types, species present along border tend to be as heterogeneous as species present in different locations inside the forest. This information should be considered in sampling designs of biodiversity essays that focus on a more consistent representation of local diversity.

ACKNOWLEDGEMENTS

We would like to thank Diego Rodrigo Dolibaina, Fernando Maia Silva Dias, Marlon Paluch, Mirna Martins Casagrande, Olaf Hermann Hendrik Mielke, Thamara Zacca Bispo Taumaturgo and Wildio Ikaro da Graça Santos for help with species identification.

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APPENDIX I

Geographic coordinates of sampled sites in the studied area.
F = Fragments (A, B, C); T = Microhabitat types (I = forest interior,
F = farmland edge, R = road edge, Ab = abandoned edge)

F/T	Latitude	Longitude	F/T	Latitude	Longitude
A1/I	-27.163431	-51.584744	B1/I	-27.162906	-51.521150
A2/I	-27.162514	-51.582222	B2/F	-27.160906	-51.523441
A3/I	-27.163406	-51.580575	B3/R	-27.160169	-51.521833
A4/I	-27.165284	-51.581486	B4/R	-27.163364	-51.519058
A5/F	-27.166906	-51.584844	B5/Ab	-27.165044	-51.520150
A6/R	-27.16569	-51.565428	C1/Ab	-27.101853	-51.607444
A7/R	-27.160314	-51.582244	C2/F	-27.099936	-51.607708
A8/Ab	-27.161467	-51.587906	C3/F	-27.100242	-51.606400
A9/Ab	-27.163155	-51.587621	C4/I	-27.100831	-51.607111

APPENDIX II

List of butterflies (Papilionoidea) sampled in the sites studied, Joaçaba, Santa Catarina, Brazil.
Fragments (A, B, C). * Indicates species sampled by chance

FAMILY/Subfamily/Tribe/Specie	A1	A2	A3	A4	A5	A6	A7	A8	A9	B1	B2	B3	B4	B5	C1	C2	C3	C4	Total
HESPERIIDAE																			
Eudaminae																			
Eudamini																			
1 <i>Aguna asander asander</i> (Hewitson, 1867)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	2
2 * <i>Aguna glaphyrus</i> (Mabille, 1888)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3 <i>Astraptes aulus</i> (Plötz, 1881)	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	3
4 <i>Astraptes enotrus</i> (Stoll, [1781])	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	2
5 <i>Astraptes erycina</i> (Plötz, 1881)	0	0	0	1	0	0	0	0	2	0	0	0	0	0	1	0	0	0	4
6 <i>Cecropterus dorantes dorantes</i> (Stoll, [1790])	0	0	2	0	0	1	3	2	0	0	1	1	2	0	1	0	3	1	17
7 <i>Cecropterus doryssus albicuspis</i> (Herrich-Schäffer, 1869)	0	0	0	0	2	2	0	0	0	1	0	0	0	0	0	0	0	0	5
8 <i>Cecropterus rica</i> (Evans, 1952)	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	2
9 <i>Cecropterus zarex</i> (Hübner, 1818)	1	0	0	0	1	0	0	0	5	0	0	0	0	0	1	0	1	0	9
10 <i>Oechydrys evelinda</i> (Butler, 1870)	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	3
11 <i>Polygonus leo leo</i> (Gmelin, [1790])	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
12 <i>Polygonus savigny savigny</i> (Latreille, [1824])	1	0	0	0	0	0	1	1	1	0	0	1	0	0	1	0	0	1	7
13 <i>Proteides mercurius mercurius</i> (Fabricius, 1787)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
14 <i>Spicauda procne</i> (Plötz, 1880)	0	1	1	0	0	1	4	1	1	0	5	2	3	2	2	1	0	1	25
15 <i>Spicauda simplicius</i> (Stoll, [1790])	1	0	0	0	0	2	2	1	0	0	1	1	7	0	5	3	0	0	23
16 <i>Spicauda teleus</i> (Hübner, 1821)	2	0	0	0	2	2	10	4	5	0	7	4	4	9	9	3	6	0	67
17 <i>Spicauda zagorus</i> (Plötz, 1880)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
18 * <i>Telegonus alardus alardus</i> (Stoll, 1790)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19 <i>Telegonus cretatus adoba</i> (Evans, 1952)	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0	0	5
20 <i>Telegonus creteus siges</i> (Mabille, 1903)	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	4
21 <i>Telegonus elorus</i> (Hewitson, 1867)	2	1	1	0	0	3	0	0	0	0	0	0	1	0	0	0	1	0	9
22 <i>Telegonus fulgerator fulgerator</i> (Walch, 1775)	5	0	1	2	1	1	0	2	1	1	0	0	0	0	0	1	2	3	20
23 <i>Urbanus esta</i> Evans, 1952	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	2	0	5
24 <i>Urbanus pronta</i> Evans, 1952	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	3
25 <i>Urbanus proteus</i> (Linnaeus, 1758)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Phocidini																			
26 <i>Nascus phocus</i> (Cramer, [1777])	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
27 <i>Phocides charon</i> (C. & R. Felder, 1859)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
28 * <i>Phocides pialia pialia</i> (Hewitson, 1857)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Heteropterinae																			
29 <i>Dardarina aspila</i> Mielke, 1966	0	0	0	0	0	0	1	2	4	0	0	0	0	0	6	0	1	0	14
30 <i>Dardarina rana</i> Evans, 1955	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	4
Hesperiinae																			
Hesperiini																			
31 <i>Anthoptus epictetus</i> (Fabricius, 1793)	6	0	4	0	1	1	32	16	29	1	5	10	2	1	12	15	2	2	139
32 <i>Arita arita</i> (Schaus, 1902)	0	1	2	1	2	1	1	1	0	1	0	0	1	0	0	0	0	0	11
33 <i>Arita mubevensis</i> (Bell, 1932)	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
34 <i>Artines satyr</i> Evans, 1955	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3
35 <i>Callimormus interpunctata</i> (Plötz, 1884)	22	12	13	1	9	0	5	9	13	13	1	7	0	1	4	2	18	10	140
36 <i>Callimormus rivera</i> (Plötz, 1882)	0	0	0	0	0	6	11	10	7	0	15	8	3	4	11	9	7	0	91
37 * <i>Calpodus ethlius</i> (Stoll, [1782])	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
38 <i>Chalcone briquenydan australis</i> Mielke, 1980	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
39 <i>Cobalopsis hazarma</i> (Hewitson, 1877)	0	0	0	0	1	2	0	1	1	1	2	0	2	0	2	0	3	0	15
40 <i>Cobalopsis miaba</i> (Schaus, 1902)	6	5	6	3	6	0	0	3	1	3	0	0	1	0	0	0	2	5	41
41 <i>Cobalopsis nero</i> (Herrich-Schäffer, 1869)	0	0	0	0	0	2	0	4	0	3	0	4	7	6	1	0	1	1	29
42 <i>Cobalopsis vorgia</i> (Schaus, 1902)	0	2	2	0	4	0	2	2	2	2	0	1	2	0	0	0	3	1	23
43 <i>Conga chydrea</i> (Butler, 1877)	3	0	0	0	1	7	2	2	3	4	2	1	0	2	1	3	4	0	35
44 <i>Conga iheringii</i> (Mabille, 1891)	0	0	0	0	0	4	4	2	1	0	4	3	0	1	9	1	0	0	29
45 <i>Conga immaculata</i> (Bell, 1930)	4	1	1	2	3	5	1	3	12	0	2	3	1	2	10	1	4	4	59
46 <i>Conga urqua</i> (Schaus, 1902)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
47 <i>Corticea corticea</i> (Plötz, 1883)	1	0	0	0	0	0	7	1	1	0	1	1	0	1	2	0	0	0	15
48 <i>Corticea lysias potex</i> Evans, 1955	2	0	0	1	0	10	3	14	24	2	14	31	8	7	19	7	6	1	149

FAMILY/Subfamily/Tribe/Specie	A1	A2	A3	A4	A5	A6	A7	A8	A9	B1	B2	B3	B4	B5	C1	C2	C3	C4	Total
25 <i>Erora gabina</i> (Godman & Salvin, [1887])	0	0	0	0	0	2	0	0	0	0	0	0	1	1	0	1	0	0	5
26 <i>Erora aff campa</i>	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
27 <i>Kolana ligurina</i> (Hewitson, 1874)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
28 <i>Kolana</i> sp. n.	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	3
29 <i>Laothus phydela</i> (Hewitson, 1867)	0	0	0	2	0	1	1	0	2	0	2	0	1	0	4	4	2	2	21
30 <i>Magnastigma hirsuta</i> (Prittwitz, 1865)	0	0	0	0	0	1	0	0	1	0	1	0	0	1	0	0	0	0	4
31 <i>Ministrymon cruenta</i> (Gosse, 1880)	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	1	0	0	4
32 <i>Ministrymon azia</i> (Hewitson, 1873)	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	2	6
33 <i>Mithras catrea</i> (Hewitson, 1874)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
34 <i>Nicolaea cupa</i> (Druce, 1907)	0	0	0	0	1	0	0	2	1	0	0	0	0	0	0	0	0	1	5
35 <i>Ocaria ocrisia</i> (Hewitson, 1868)	0	0	0	0	0	1	1	0	2	0	0	0	0	0	2	1	0	0	7
36 * <i>Ocaria</i> sp. n.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
37 <i>Ocaria thales</i> (Fabricius, 1793)	2	2	0	1	0	0	0	1	7	0	1	0	0	0	1	0	0	0	15
38 <i>Ostrinotes sophocles</i> (Fabricius, 1793)	2	0	0	0	0	1	0	1	0	0	0	0	1	2	0	1	1	1	10
39 <i>Panthiades hebraeus</i> (Hewitson, 1867)	0	0	0	0	0	2	0	0	0	0	2	1	0	1	0	0	0	0	6
40 <i>Parrhasius orgia</i> (Hewitson, 1867)	0	0	0	0	1	0	0	0	2	0	0	0	0	1	5	0	1	0	10
41 <i>Parrhasius polibetes</i> (Stoll, [1781])	0	0	0	0	0	3	0	0	0	0	1	1	0	0	2	0	0	0	7
42 <i>Parrhasius selika</i> (Hewitson, 1874)	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	9
43 <i>Pseudolycaena marsyas</i> (Linnaeus, 1758)	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	2
44 <i>Rekoa malina</i> (Hewitson, 1867)	0	0	0	0	0	7	0	0	2	0	0	1	0	0	3	2	0	0	15
45 <i>Rekoa palegon</i> (Cramer, [1780])	0	0	0	0	0	1	0	0	1	1	0	0	0	0	2	0	0	0	5
46 <i>Siderus eliatha</i> (Hewitson, 1867)	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	1	0	5
47 <i>Strephonota elika</i> (Hewitson, 1867)	0	1	2	1	0	0	0	0	0	6	0	1	0	0	2	2	0	10	25
48 <i>Strymon bazochii</i> (Godart, [1824])	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	3
49 <i>Strymon eurytulus</i> (Hübner, [1819])	0	0	0	1	0	1	0	1	4	0	0	2	1	0	1	0	0	0	11
50 <i>Strymon oreala</i> (Hewitson, 1868)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
51 <i>Thereus cithonius</i> (Godart, [1824])	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	2
52 <i>Theritas chaluma</i> (Schaus, 1902)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
53 <i>Theritas deniva</i> (Hewitson, 1874)	3	1	0	0	1	9	0	0	3	2	0	0	0	0	4	2	2	0	27
54 <i>Theritas triquetra</i> (Hewitson, 1865)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
55 <i>Tmolus echion</i> (Linnaeus, 1767)	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	3
NYMPHALIDAE																			
Apaturinae																			
1 <i>Doxocopa kallina</i> (Staudinger, 1886)	0	0	0	0	0	0	1	1	4	0	0	2	0	1	1	3	1	1	15
2 <i>Doxocopa laurentia laurentia</i> (Godart, [1824])	0	0	2	1	1	2	2	5	7	1	1	1	1	1	6	13	4	3	51
3 <i>Doxocopa zunilda zunilda</i> (Godart, [1824])	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	1	0	4
Danainae																			
Danaini																			
4 <i>Lycorea ilione ilione</i> (Cramer, [1775])	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2
5 <i>Danaus erippus</i> (Cramer, [1775])	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
6 <i>Danaus gilippus gilippus</i> (Cramer, [1775])	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Ithomiini																			
7 <i>Aeria olena olena</i> Weymer, 1875	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
8 <i>Dircenna dero dero</i> (Hübner, [1823])	0	1	0	2	1	4	1	2	2	6	2	0	0	1	3	5	1	11	42
9 <i>Episcada carcinia</i> Schaus, 1902	2	7	11	6	2	0	0	0	1	2	2	0	1	0	1	5	0	19	59
10 <i>Episcada hymenaea hymenaea</i> (Prittwitz, 1865)	1	1	2	1	1	1	0	0	0	1	0	0	0	0	2	4	3	7	24
11 <i>Epityches eupompe</i> (Geyer, 1832)	8	9	12	8	4	8	2	7	1	9	5	1	1	5	3	13	4	19	119
12 <i>Hypoleria adasa adasa</i> (Hewitson, 1855)	6	13	11	10	0	0	1	2	0	15	1	0	1	3	2	0	4	20	89
13 <i>Hypothyris euclaea laphria</i> (Doubleday, [1847])	0	2	4	2	0	0	0	0	0	1	0	0	0	0	5	1	1	8	24
14 <i>Ithomia agnosia zikani</i> d'Almeida, 1940	1	1	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	2	7
15 <i>Ithomia drymo</i> Hübner, 1816	1	0	0	0	0	0	0	2	0	3	0	0	1	2	0	1	0	3	13
16 <i>Mechanitis lysimnia lysimnia</i> (Fabricius, 1793)	6	1	1	1	1	0	5	1	1	2	2	0	1	3	5	2	3	11	46
17 <i>Methona themisto</i> (Hübner, 1818)	0	0	2	1	0	0	0	0	0	1	0	0	2	0	0	0	0	0	6
18 <i>Placidina euryanassa</i> (C. Felder & R. Felder, 1860)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	2
19 <i>Pseudoscada erruca</i> (Hewitson, 1855)	3	12	24	7	2	0	2	1	0	10	1	1	1	0	4	2	2	20	92
20 <i>Pteronymia sylvo</i> (Geyer, 1832)	2	3	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	10
21 <i>Thyridia psidii cetoides</i> (Rosenberg & Talbot, 1914)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	2
Biblidinae																			
Ageroniini																			
22 <i>Ectima thecla thecla</i> (Fabricius, 1796)	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2

FAMILY/Subfamily/Tribe/Specie	A1	A2	A3	A4	A5	A6	A7	A8	A9	B1	B2	B3	B4	B5	C1	C2	C3	C4	Total
23 <i>Hamadryas amphinome amphinome</i> (Linnaeus, 1767)	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
24 <i>Hamadryas epinome</i> (C. & R. Felder, 1867)	1	2	0	0	4	4	0	6	1	3	1	0	13	1	1	1	0	1	39
25 <i>Hamadryas februa februa</i> (Hübner, [1823])	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
26 <i>Hamadryas fornax fornax</i> (Hübner, [1823])	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	3
Biblidini																			
27 <i>Biblis hyperia nectanabis</i> (Fruhstorfer, 1909)	5	0	2	1	1	6	6	7	4	4	10	4	5	3	2	1	7	1	69
Callicorini																			
28 <i>Callicore pygas eucale</i> (Fruhstorfer, 1916)	3	2	0	0	0	1	1	0	0	0	0	0	0	0	2	1	0	0	10
29 <i>Diaethria candrena candrena</i> (Godart, [1824])	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	2	2	2	10
30 <i>Diaethria clymena meridionalis</i> (Bates, 1864)	0	0	0	0	2	0	0	0	0	0	0	1	2	0	4	7	0	0	16
31 <i>Haematera pyrame pyrame</i> (Hübner, [1819])	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	4
Catonephelini																			
32 <i>Cybdelis phaesyia</i> (Hübner, [1831])	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
33 <i>Eunica caelina caelina</i> (Godart, [1824])	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
34 <i>Eunica eburnea</i> Fruhstorfer, 1907	0	0	0	0	0	0	5	1	0	0	4	6	2	0	3	2	3	0	26
35 <i>Eunica tatila bellaria</i> Fruhstorfer, 1908	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	4
36 <i>Myscelia orsis</i> (Drury, [1782])	0	0	0	0	0	0	0	1	0	2	1	1	2	1	0	0	0	0	8
Eubagini																			
37 <i>Dynamine agacles agacles</i> (Dalman, 1823)	0	0	0	0	1	7	2	0	0	0	0	1	2	5	0	0	0	0	18
38 <i>Dynamine artemisia artemisia</i> (Fabricius, 1793)	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	5
39 <i>Dynamine athemon athemaena</i> (Hübner, [1824])	0	0	1	0	0	0	0	0	0	0	1	3	2	3	0	0	0	0	10
40 <i>Dynamine coenus</i> (Fabricius, 1793)	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0	5
41 <i>Dynamine myrrhina</i> (Doubleday, 1849)	10	0	0	0	7	2	6	12	6	9	10	4	2	3	7	15	15	8	116
42 <i>Dynamine postverta postverta</i> (Cramer, [1780])	0	0	0	0	0	2	1	2	0	0	0	1	0	1	0	0	0	0	7
43 <i>Dynamine tithia tithia</i> (Hübner, [1823])	0	1	0	0	0	1	1	0	1	0	1	2	1	4	0	0	0	0	12
Epiphelini																			
44 <i>Epiphile hubneri</i> Hewitson, 1861	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	6	1	2	12
45 <i>Epiphile orea orea</i> (Hübner, [1823])	0	0	1	0	0	0	1	0	0	1	0	0	0	0	2	0	1	1	7
46 <i>Temenis laothoe meridionalis</i> Ebert, 1965	0	0	0	0	0	0	2	0	1	0	0	3	0	0	0	1	0	0	7
Charaxinae																			
Anaeini																			
47 <i>Hypna clytemnestra huebneri</i> Butler, 1866	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
48 <i>Memphis acidalia victoria</i> (Druce, 1877)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
49 <i>Memphis moruus stheno</i> (Prittwitz, 1865)	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	3
50 <i>Memphis otrere</i> (Hübner, 1825)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
51 <i>Zaretis strigosus</i> (Gmelin, [1790])	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	2
Preponini																			
52 * <i>Archaeoprepona amphinome pseudomeander</i> (Fruhstorfer, 1906)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
53 <i>Archaeoprepona chalciope</i> (Hübner, [1823])	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
54 * <i>Archaeoprepona demophon thalpius</i> (Hübner, [1814])	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
55 * <i>Archaeoprepona demophoon antimache</i> (Hübner, [1819])	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
56 <i>Prepona pylene</i> Hewitson, 1854	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cyrestinae																			
Cyrestini																			
57 * <i>Marpesia petreus</i> (Cramer, [1776])	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Heliconiinae																			
Acraeini																			
58 <i>Actinote carycina</i> Jordan, 1913	0	0	0	0	7	13	2	1	13	4	12	9	12	25	15	8	13	0	134
59 <i>Actinote dalmeidai</i> Francini, 1996	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	1	0	4
60 <i>Actinote genitrix</i> R.F. d'Almeida, 1922	1	0	0	0	3	1	0	1	0	0	0	1	0	4	0	2	0	0	13
61 <i>Actinote melanisans</i> Oberthür, 1917	1	0	0	0	2	3	2	2	3	1	1	1	6	0	1	4	2	0	29
62 <i>Actinote surima surima</i> (Schaus, 1902)	0	0	0	0	2	0	0	0	0	0	5	0	0	3	2	0	0	0	12
Argynnini																			
63 <i>Euptoieta hortensia</i> (Blanchard, 1852)	0	0	0	0	3	0	0	0	0	0	1	0	0	0	3	0	0	0	7
Heliconiini																			
64 <i>Agraulis vanillae maculosa</i> (Stichel, [1908])	0	0	0	0	0	0	2	1	0	0	1	2	3	2	0	0	0	0	11
65 <i>Dione junio junio</i> (Cramer, [1779])	0	0	0	0	0	0	0	0	1	0	0	2	1	0	0	0	0	0	4
66 <i>Dione moneta moneta</i> Hübner, [1825]	0	0	0	0	1	0	0	1	0	0	1	1	0	2	4	4	0	0	14
67 <i>Dryas iulia alcionea</i> (Cramer, 1779)	0	0	0	0	1	0	0	0	0	0	2	0	7	2	2	1	5	2	22
68 <i>Eueides aliphera aliphera</i> (Godart, 1819)	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2	1	1	0	6

FAMILY/Subfamily/Tribe/Specie	A1	A2	A3	A4	A5	A6	A7	A8	A9	B1	B2	B3	B4	B5	C1	C2	C3	C4	Total
69 <i>Eueides isabella dianasa</i> (Hübner, [1806])	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
70 <i>Heliconius erato phyllis</i> (Fabricius, 1775)	15	4	3	2	7	4	2	3	3	21	10	4	6	15	4	2	9	4	118
71 <i>Heliconius ethilla narcaea</i> Godart, 1819	1	0	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	1	8
Libytheinae																			
72 <i>Libytheana carinenta</i> (Cramer, [1777])	0	0	0	0	0	1	0	0	1	0	0	0	1	1	1	6	2	0	13
Limnitiidae																			
Limnitiidini																			
73 <i>Adelpha falcipennis</i> Fruhstorfer, 1915	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	4
74 <i>Adelpha hyas hyas</i> (Doyère, [1840])	0	0	0	0	0	1	0	2	1	0	0	1	0	1	0	0	0	0	6
75 <i>Adelpha iphicles ephesa</i> (Ménétriés, 1857)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
76 <i>Adelpha mythra</i> (Godart, [1824])	6	0	1	0	0	1	0	2	3	1	0	1	0	0	2	0	4	1	22
77 <i>Adelpha serpa serpa</i> (Boisduval, [1836])	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	5
78 <i>Adelpha syma</i> (Godart, [1824])	15	2	1	1	2	6	15	6	24	4	20	16	4	5	15	7	7	2	152
79 <i>Adelpha thessalia indefecta</i> Fruhstorfer, 1913	6	0	1	1	0	7	0	4	15	0	0	0	0	1	2	6	4	1	48
80 <i>Adelpha zea</i> (Hewitson, 1850)	1	0	0	0	0	2	0	1	5	0	0	0	0	2	1	0	0	0	12
Nymphalinae																			
Melitaeini																			
81 <i>Chlosyne lacinia saundersi</i> (Doubleday, [1847])	0	0	0	0	0	3	0	3	3	0	1	6	1	0	0	5	0	0	22
82 <i>Eresia lansdorfi</i> (Godart, 1819)	2	2	0	2	0	2	1	0	0	0	1	2	1	4	0	1	1	1	20
83 <i>Ortilia dicoma</i> (Hewitson, 1864)	0	0	1	0	2	1	0	1	0	9	2	1	0	5	0	3	2	0	27
84 <i>Ortilia ithra</i> (Kirby, 1900)	0	0	0	0	0	3	4	4	2	0	2	10	1	1	10	9	1	1	48
85 <i>Ortilia orthia</i> (Hewitson, 1864)	3	0	1	0	1	3	3	11	12	5	8	29	7	3	9	10	11	0	116
86 <i>Ortilia velica durnfordi</i> (Godman & Salvin, 1878)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
87 <i>Tegosa claudina</i> (Eschscholtz, 1821)	1	0	0	0	0	1	5	23	14	5	16	29	7	7	13	18	17	0	156
88 <i>Telenassa teletusa teletusa</i> (Godart, [1824])	3	2	3	5	4	1	1	6	1	2	1	3	1	0	0	2	1	3	39
Nymphalini																			
89 <i>Hypanartia bella</i> (Fabricius, 1793)	0	0	3	0	1	2	2	2	2	7	12	1	4	4	2	2	0	0	46
90 <i>Hypanartia lethe lethe</i> (Fabricius, 1793)	0	0	1	0	2	4	2	5	2	0	1	0	6	0	1	7	6	1	38
91 <i>Smyrna blomfieldia blomfieldia</i> (Fabricius, 1781)	2	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	5
92 <i>Vanessa braziliensis</i> (Moore, 1883)	0	0	0	0	0	5	2	2	0	0	6	2	2	3	10	2	1	0	35
93 <i>Vanessa carye</i> (Hübner, [1812])	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
94 <i>Vanessa myrinna</i> (Doubleday, 1849)	0	0	0	0	0	2	2	1	0	0	0	0	1	1	0	0	0	0	7
Junoniini																			
95 <i>Junonia evarete evarete</i> (Cramer, [1779])	0	0	0	0	0	3	0	1	0	0	1	0	0	0	7	1	0	0	13
Victorinini																			
96 <i>Anartia amathea roeselia</i> (Eschscholtz, 1821)	3	0	7	0	0	6	9	3	2	0	8	26	4	1	25	14	4	0	112
97 <i>Siproeta epaphus trayja</i> Hübner, [1823]	0	0	1	0	0	0	1	1	1	1	0	0	1	0	3	1	0	0	10
Satyrinae																			
Brasolini																			
98 <i>Blepolenis bassus</i> (C. & R. Felder, [1867])	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	6
99 <i>Blepolenis batea batea</i> (Hübner, [1821])	0	0	0	0	0	0	1	2	1	0	6	0	0	2	4	0	1	0	17
100 * <i>Caligo illioneus pampeiro</i> Fruhstorfer, 1904	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
101 <i>Caligo martia</i> (Godart, [1824])	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
102 <i>Eryphanis reevesii</i> (Doubleday, [1849])	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2
103 <i>Opoptera sulcius</i> (Staudinger, 1887)	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
104 * <i>Opsiphanes cassiae crameri</i> C. Felder & R. Felder, 1862	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
105 * <i>Opsiphanes quiteria meridionalis</i> Staudinger, 1887	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
106 <i>Opsiphanes invirae amplificatus</i> Stichel, 1904	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
Morphini																			
107 <i>Morpho aega aega</i> (Hübner, [1822])	0	0	0	0	5	0	0	0	0	3	0	0	1	1	0	0	0	1	11
108 <i>Morphoanaxibia</i> (Esper, 1801)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
109 <i>Morpho epistrophus catenaria</i> (Perry, 1811)	1	2	1	0	0	0	0	1	3	1	0	0	0	1	4	7	1	2	24
110 <i>Morpho helenor violaceus</i> Fruhstorfer, 1912	0	2	2	1	0	0	1	3	4	2	2	0	0	0	1	1	4	4	27
Satyrini																			
111 <i>Capronnieria galesus</i> (Godart, [1824])	0	0	0	0	0	1	0	0	2	0	4	0	0	0	4	1	0	0	12
112 <i>Carminda griseldis</i> (Weymer, 1911)	2	0	0	0	1	0	0	1	1	0	0	0	2	1	0	0	0	0	8
113 <i>Carminda paeon</i> (Godart, [1824])	3	5	2	1	2	0	0	1	0	1	1	0	1	1	1	0	1	9	29
114 <i>Cissia eous</i> (Butler, 1867)	0	0	0	0	0	0	0	2	0	2	0	0	0	2	0	0	1	0	7
115 <i>Cissia phronius</i> (Godart, [1824])	0	0	0	0	2	1	2	1	0	2	2	0	2	2	2	5	3	2	26
116 <i>Eteona tisiphone</i> (Boisduval, [1836])	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	7

FAMILY/Subfamily/Tribe/Specie	A1	A2	A3	A4	A5	A6	A7	A8	A9	B1	B2	B3	B4	B5	C1	C2	C3	C4	Total
16 <i>Phoebis sennae marcellina</i> (Cramer, [1779])	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	4
17 <i>Phoebis trite banksi</i> (Breyer, 1939)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
18 <i>Pyrristia leuce leuce</i> (Boisduval, 1836)	0	0	0	0	0	0	1	1	1	0	0	0	0	0	8	4	1	0	16
19 <i>Pyrristia nise tenella</i> (Boisduval, 1836)	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	4
Pierinae																			
Anthocharidini																			
20 <i>*Hesperocharis erota</i> (Lucas, 1852)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
21 <i>Hesperocharis paranensis paranensis</i> Schaus, 1898	0	0	0	0	1	4	0	0	0	0	1	0	1	0	0	0	0	0	7
Pierini																			
22 <i>Leptophobia aripa balidia</i> (Boisduval, 1836)	0	0	0	0	0	1	2	1	0	2	7	2	4	3	0	0	2	0	24
23 <i>Pereute antodyca</i> (Boisduval, 1836)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
24 <i>Pereute swainsonii</i> (Gray, 1832)	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	4
25 <i>Tatochila autodice autodice</i> (Hübner, 1818)	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	3
26 <i>Theochila maenacte maenacte</i> (Boisduval, 1836)	0	0	0	0	1	1	1	1	0	0	3	0	0	6	7	1	1	0	22
RIODINIDAE																			
Nemeobiinae																			
Euselasiini																			
1 <i>Euselasia eucerus</i> (Hewitson, 1872)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	7
2 <i>Euselasia hygenius occulta</i> Stichel, 1919	0	0	0	1	0	0	0	3	2	2	4	0	0	1	1	0	0	0	14
3 <i>*Euselasia zara</i> (Westwood, 1851)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Riodininae																			
Emesidini																			
4 <i>Emesis fatimella fatimella</i> Westwood, 1851	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
5 <i>Emesis mandana mandana</i> (Cramer, [1780])	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	3
6 <i>Emesis ocyptore zelotes</i> Hewitson, 1872	0	0	0	0	2	0	1	0	0	3	0	2	2	0	3	9	0	1	23
7 <i>Emesis russula</i> Stichel, 1910	0	0	0	0	0	5	1	1	2	0	1	0	1	0	0	1	0	0	12
8 <i>Emesis satema</i> (Schaus, 1902)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Eurybiini																			
9 <i>Ionotos alector</i> (Geyer, 1837)	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
10 <i>Ithomiola orpheus</i> (Westwood, 1851)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
11 <i>Mesoemia odice</i> (Godart, [1824])	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
12 <i>Mesoemia rhodia</i> (Godart, [1824])	5	1	3	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
Nymphidiini																			
13 <i>Adelotypa bolena</i> (Butler, 1867)	0	0	0	0	1	1	0	0	1	0	0	0	0	0	1	0	0	0	4
14 <i>Catoclyotis sejuncta</i> (Stichel, 1910)	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	3
15 <i>Mycastor leucarpis</i> (Stichel, 1925)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
16 <i>Synargis paulistina</i> (Stichel, 1910)	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3
17 <i>Theope thestias</i> Hewitson, 1860	0	0	0	0	0	1	1	0	4	0	0	0	0	2	0	0	0	0	8
Riodinini																			
18 <i>Barbicornis basilis mona</i> Westwood, 1851	0	0	0	0	0	1	0	1	2	0	1	0	1	0	1	3	0	0	10
19 <i>Calephelis braziliensis</i> McAlpine, 1971	0	0	0	0	0	6	10	0	1	0	12	2	2	1	2	0	1	0	37
20 <i>Chalodeta theodora</i> (C. & R. Felder, 1862)	0	0	1	0	0	5	2	1	1	1	1	1	1	2	1	5	0	1	23
21 <i>Chamaelimnas briola doryphora</i> Stichel, 1910	1	2	0	0	0	0	1	0	0	2	1	1	0	0	1	1	1	4	15
22 <i>Charis cadytis</i> Hewitson, 1866	0	2	0	0	1	0	3	2	3	1	2	0	0	0	0	0	0	0	14
23 <i>*Chorinea licursis</i> (Fabricius, 1775)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24 <i>Lasaia agesilas agesilas</i> (Latreille, [1809])	0	0	0	0	0	4	0	1	2	0	0	0	0	0	0	0	0	0	7
25 <i>Lasaia incoides</i> (Schaus, 1902)	0	0	0	0	0	6	0	0	1	0	0	0	0	0	0	0	0	0	7
26 <i>Melanis smithiae smithiae</i> (Westwood, 1851)	1	0	0	6	1	0	0	0	1	2	0	2	0	1	1	0	3	1	19
27 <i>Melanis xenia xenia</i> (Hewitson, 1853)	0	0	0	1	0	0	0	0	2	1	1	3	1	0	0	0	0	1	10
28 <i>Parcella amarynthina</i> (C. & R. Felder, [1865])	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
29 <i>Rhetus perianther eleusinus</i> Stichel, 1910	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	3
30 <i>Riodina lycisca</i> (Hewitson, 1853)	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	3
31 <i>Syrmatia nyx</i> (Hübner, [1817])	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Symmachiini																			
32 <i>Mesene pyrippe sanguilenta</i> Stichel, 1910	0	0	0	0	0	0	0	0	0	0	4	0	0	0	1	0	0	0	5
33 <i>Mesene</i> sp. n.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
34 <i>Stichelia bocchoris suavis</i> (Stichel, 1911)	8	1	0	0	0	5	2	0	1	2	5	0	0	0	1	2	0	0	27
35 <i>Symmachia arion</i> (C. & R. Felder, 1865)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
460	390	326	389	299	374	490	499	500	580	312	459	553	399	402	691	498	434	346	7941

APPENDIX III

Butterflies richness and abundance in the studied site

F = Fragments (A, B, C)

T = Microhabitat types (I = Forest interior, F = Farmland edge, R = Road edge, Ab = Abandoned edge)

F	Abundance	Richness	Estimated richness (95%)	Singletons	Doubletons
A	3846	363	303.676	79	50
B	2125	284	261.73	63	52
C	1969	284	273.867	86	39
T	Abundance	Richness	Estimated richness (95%)	Singletons	Doubletons
I	2062	227	201.673	61	34
F	1764	269	264.176	84	34
R	1941	299	289.163	82	50
Ab	2173	338	327.172	91	48
Site sampled	Abundance	Richness	Estimated richness (90%)	Singletons	Doubletons
A1/I	390	120	142.325	56	21
A2/I	326	83	86.648	36	19
A3/I	389	93	99.432	43	17
A4/I	299	84	100.889	42	15
A5/F	373	114	125.102	49	28
A6/R	490	190	243.988	94	40
A7/R	499	140	148.573	59	32
A8/Ab	500	168	190.231	74	42
A9/Ab	580	180	208.411	80	33
B1/I	312	113	157.015	61	21
B2/F	459	132	148.106	58	24
B3/R	553	143	149.036	59	23
B4/R	399	154	182.644	72	40
B5/Ab	402	148	197.868	75	26
C1/Ab	691	195	202.487	75	40
C2/F	498	133	135.681	51	28
C3/F	434	150	194.529	72	23
C4/I	346	107	146.982	57	16

APPENDIX IV

Butterflies species indicators in the studied area (only species with n ≥ 10 were included) H: Habitat = E: edge, I: forest interior Habits and Host plants information were obtained from literature cited below this table

Family/Subfamily/Specie	H	P		Habits	Host plants
Hesperiidae/Eudaminae					
<i>Spicauda teelus</i>	E	0.001	***	Open areas ¹	Cyperaceae; Poaceae: <i>Coelorachis</i> sp., <i>Cynodon dactylon</i> , <i>Oryza latifolia</i> , <i>Panicum maximum</i> , <i>Sorghum halepense</i> ; Fabaceae: <i>Schrankia</i> sp., <i>Glycine max</i> , <i>Phaseolus vulgaris</i> , <i>Pisum sativum</i> ⁵ .
Hesperiinae					
<i>Anthoptus epictetus</i>	E	0.016	*	Disturbed forest ³ , Open areas ¹	Poaceae ⁵
<i>Callimormus rivera</i>	E	0.002	**		
<i>Cobalopsis miaba</i>	I	0.001	***		
<i>Conga iheringii</i>	E	0.014	*	Clearings ¹	
<i>Corticea lysias potex</i>	E	0.006	**	Open areas ³	
<i>Corticea mendica</i> ssp. n.	E	0.039	*		
<i>Corticea oblinita</i>	E	0.004	**		
<i>Cymaenes tripunctata tripunctata</i>	E	0.001	***	Open areas ^{1,3}	
<i>Lucida lucia lucia</i>	I	0.015	*		
<i>Polites vibex catilina</i>	E	0.018	*	Open areas ^{1,3}	Poaceae ³ ; Smilacaceae: <i>Smilax</i> spp.; Solanaceae: <i>Solanum variabile</i> ⁵
<i>Pompeius pompeius</i>	E	0.011	*	Open areas ^{1,3}	Poaceae ⁵
<i>Synapte silius</i>	I	0.017	*	Forest ³ , Clearings ¹	Arecaceae: <i>Syagrus romanzoffiana</i> ⁵
<i>Thargella evansi</i>	I	0.014	*	Forest ³	
<i>Thespisus jora</i>	E	0.003	**	Clearings ¹	
<i>Vehilius inca</i>	E	0.03	*	Disturbed areas ³ , Open areas ¹	Poaceae: <i>Panicum maximum</i> , <i>Rottboellia cochinchinensis</i> ⁵
<i>Vehilius stictomenes stictomenes</i>	E	0.002	**	Open areas ³	Poaceae: <i>Paspalum</i> spp. ⁵
<i>Vinius letis</i>	I	0.002	**	Open areas ¹	
<i>Wallengrenia premnas</i>	E	0.037	*	Open areas ¹	Poaceae: <i>Echinochloa crus-galli</i> , <i>Leersia hexandra</i> , <i>Oryza sativa</i> , <i>Stenotaphrum secundatum</i> ⁵
Pyrginae					
<i>Achlyodes mithridates thraso</i>	E	0.001	***		Rutaceae: <i>Citrus</i> spp., <i>Zanthoxylum</i> spp. ⁵
<i>Burnsius orcus</i>	E	0.001	***	Open areas ¹	Malvaceae: <i>Abelmoschus esculentus</i> , <i>Alcea rosea</i> , <i>Althaea</i> sp., <i>Hibiscus</i> sp., <i>Malva</i> spp., <i>Malvastrum</i> sp., <i>Sida</i> spp. ⁵
<i>Helias phalaenoides palpalis</i>	E	0.038	*	Disturbed forest ³	Verbenaceae: <i>Citharexylum montevidense</i> ⁵
<i>Heliopetes alana</i>	E	0.011	*	Open areas ^{1,3}	Malvaceae: <i>Sida</i> sp. ³
<i>Heliopetes omrina</i>	E	0.01	**	Open areas ^{1,3}	Convolvulaceae: <i>Convolvulus arvensis</i> , <i>Ipomoea</i> spp.; Malvaceae: <i>Abutilon</i> spp., <i>Pavonia spinifex</i> , <i>Sida</i> sp. ⁵
<i>Staphylus musculus</i>	E	0.023	*	Clearings ¹	Amaranthaceae: <i>Gomphrena</i> spp. ⁵
<i>Trina geometrina geometrina</i>	E	0.001	***	Disturbed forest ³	Malvaceae: <i>Sida rhombifolia</i> ⁵
<i>Xenophanes tryxus</i>	E	0.048	*	Open areas ³	Fabaceae: <i>Glycine max</i> ; Malvaceae: <i>Hibiscus</i> sp., <i>Malachra</i> spp., <i>Pavonia</i> spp. ⁵
Tagiadinae					
<i>Celaenorrhinus eligius punctiger</i>	I	0.003	**	Humid forest ³	Acanthaceae: <i>Justicia carnea</i> ¹¹
Lycaenidae/Theclinae					
<i>Arawacus meliboeus</i>	E	0.002	**		Solanaceae: <i>Solanum</i> spp. ^{5,11}
<i>Calycopis caulonia</i>	E	0.022	*		Cannabaceae: <i>Celtis iguanaea</i> ⁵ , leaf detritus ⁴
<i>Cyanophrys remus</i>	E	0.016	*		Fabaceae: <i>Calliandra parvifolia</i> ⁵
<i>Strephonota elika</i>	I	0.016	*		
Nymphalidae/Apaturinae					
<i>Doxocopa laurentia laurentia</i>	E	0.031	*		Cannabaceae: <i>Celtis</i> sp. ^{5,11}
Biblidinae					
<i>Biblis hyperia nectanabis</i>	E	0.036	*		Euphorbiaceae: <i>Tragia</i> spp. ⁵
<i>Eunica eburnea</i>	E	0.026	*		Euphorbiaceae: <i>Sebastiania commersoniana</i> ⁵
Danainae					
<i>Episcada carcinia</i>	I	0.004	**	Dense forest ³	Solanaceae: <i>Solanum</i> spp. ³
<i>Episcada hymenaea hymenaea</i>	I	0.025	*		Solanaceae: <i>Cestrum</i> spp., <i>Solanum</i> spp. ⁵
<i>Epityches eupompe</i>	I	0.018	*	Fragments ⁶	Solanaceae: <i>Acnistus arborescens</i> , <i>Athenaea picta</i> , <i>Aureliana lucida</i> , <i>Brunfelsia australis</i> , <i>Cestrum</i> spp., <i>Physalis neesiana</i> , <i>Solanum</i> spp., <i>Vassobia breviflora</i> , <i>Witheringia</i> ⁵
<i>Hypoleria adasa adasa</i>	I	0.001	***	Fragments ⁶	Solanaceae: <i>Cestrum</i> spp. ⁵
<i>Hypothesis eueca laphria</i>	I	0.013	*		Solanaceae: <i>Solanum</i> spp. ⁵
<i>Pseudoscada erruca</i>	I	0.003	**	Fragments ⁶	Solanaceae: <i>Brunfelsia</i> spp., <i>Cestrum</i> spp., <i>Seslea</i> spp. ⁵

Family/Subfamily/Specie	H	P		Habits	Host plants
<i>Pteronymia sylvo</i>	I	0.001	***		Solanaceae: <i>Brunfelsia australis</i> , <i>Cestrum</i> spp., <i>Solanum</i> spp. ⁵
Heliconiinae					
<i>Actinote carycina</i>	E	0.001	***	Disturbed areas ³	Asteraceae: <i>Eupatorium</i> spp., <i>Mikania micranta</i> , <i>Symphopappus reticulatus</i> , <i>Trichogonia gardneri</i> ⁵
<i>Actinote melanisans</i>	E	0.007	**	Disturbed areas ⁴	Asteraceae: <i>Mikania</i> spp. ⁵
<i>Dione moneta moneta</i>	E	0.046	*		Passifloraceae: <i>Passiflora</i> spp. ⁵
Limnitiidae					
<i>Adelpha syma</i>	E	0.047	*	Disturbed areas ³	Rosaceae: <i>Rubus</i> spp.; Rubiaceae: <i>Cephalanthus glabratus</i> ⁵
Libytheinae					
<i>Libytheana carinenta</i>	E	0.03	*		Cannabaceae: <i>Celtis</i> spp. ^{2,5}
Nymphalinae					
<i>Anartia amathea roeselia</i>	E	0.03	*	Disturbed areas ³	Acanthaceae: <i>Acanthus</i> spp., <i>Dicliptera</i> spp., <i>Justicia</i> spp., <i>Ruellia</i> spp. ⁵
<i>Chlosyne lacinia saundersi</i>	E	0.036	*	Open areas ³	Amaranthaceae: <i>Amaranthus hybridus</i> ; Asteraceae: <i>Acanthospermum</i> spp., <i>Ambrosia</i> spp., <i>Bidens pilosa</i> , <i>Emilia sonchifolia</i> , <i>Eupatorium</i> sp., <i>Galinsoga parviflora</i> , <i>Helianthus</i> spp., <i>Parthenium hysterophorus</i> , <i>Senecio brasiliensis</i> , <i>Sonchus oleraceus</i> , <i>Sphagnetocola trilobata</i> , <i>Synedrella nodiflora</i> , <i>Verbesina</i> spp., <i>Vernonia</i> sp., <i>Viguiera</i> sp., <i>Wedelia glauca</i> , <i>Xanthium strumarium</i> ; Fabaceae: <i>Glycine max</i> ; Rubiaceae: <i>Richardia brasiliensis</i> ⁵
<i>Hypanartia bella</i>	E	0.01	**	Mountain forest ³	Cannabaceae: <i>Celtis</i> spp., <i>Trema micranta</i> ; Urticaceae: <i>Boehmeria</i> spp., <i>Parietaria debilis</i> , <i>Phenax laevigatus</i> , <i>Urtica spathulata</i> ⁵
<i>Hypanartia lethe</i>	E	0.015	*	Clearings ³	Cannabaceae: <i>Celtis</i> spp., <i>Trema micranta</i> ; Urticaceae: <i>Boehmeria</i> spp., <i>Phenax</i> sp., <i>Urera baccifera</i> ⁵
<i>Ortilia ithra</i>	E	0.001	***	Disturbed forest ³	Acanthaceae: <i>Acanthus</i> spp., <i>Asystasia gangetica</i> , <i>Dicliptera sericea</i> , <i>Fittonia</i> spp., <i>Justicia</i> spp., <i>Ruellia</i> spp. ⁵
<i>Ortilia orthia</i>	E	0.004	**	Disturbed forest ³	Acanthaceae: <i>Ruellia coerulea</i> ; Asteraceae: <i>Aster</i> spp., <i>Calistephus chinensis</i> , <i>Noticastrum diffusum</i> ⁵
<i>Tegosa claudina</i>	E	0.002	**	Disturbed areas ³	Acanthaceae: <i>Ruellia</i> sp.; Asteraceae: <i>Mikania</i> spp.; Scrophulariaceae: <i>Verbascum</i> spp.; Verbenaceae: <i>Glandularia</i> spp., <i>Verbena</i> spp. ⁵
<i>Vanessa braziliensis</i>	E	0.004	**	Open areas ³	Asteraceae: <i>Achyrocline</i> spp., <i>Antennaria</i> spp., <i>Gamochoeta</i> spp., <i>Gnaphalium</i> spp., <i>Pseudognaphalium obtusifolium</i> ⁵
Satyrinae					
<i>Blepolenis batea</i>	E	0.035	*	Matrix specialist ⁹	Cyperaceae; Poaceae; Arecaceae: <i>Butia capitata</i> , <i>Syagrus romanzoffiana</i> ⁵
<i>Carminda paeon</i>	I	0.004	**	Forest ³	Poaceae: Bambusoideae ⁵
<i>Euptychoides castrensis</i>	I	0.017	*	Clearings ³	Cyperaceae ³
<i>Godartiana muscosa</i>	I	0.001	***	Forest ¹⁰	Cyperaceae; Poaceae: <i>Setaria poiretiana</i> ^{5,10}
<i>Paryphthimoides poltys</i>	I	0.008	**	Early-regrowth forest ⁸	Poaceae ³
<i>Taygetis ypthima</i>	I	0.025	*	Forest specialist ⁹	Poaceae: Bambusoideae ⁵
<i>Ypthimoides ordinaria</i>	E	0.042	*	Open areas ⁷	Poaceae: <i>Axonopus compressus</i> , <i>Panicum maximum</i> ⁷
Pieridae/Coliadinae					
Dismorphiinae					
<i>Pseudopieris nehemia nehemia</i>	E	0.026	*		Fabaceae: <i>Acacia</i> spp., <i>Calliandra</i> spp., <i>Senegalia</i> sp. ¹¹
Pierinae					
<i>Theochila maenacte maenacte</i>	E	0.019	*		Cruciferae ⁵
Riodinidae/Riodininae					
<i>Barbicornis basilis mona</i>	E	0.026	*		Sapotaceae: <i>Pouteria gardneriana</i> ; Cannabaceae: <i>Celtis</i> sp. ⁵
<i>Calephelis braziliensis</i>	E	0.016	*		
<i>Emesis russula</i>	E	0.035	*		Apocynaceae: <i>Aspidosperma tomentosum</i> ; Aquifoliaceae: <i>Ilex paraguariensis</i> ; Burceraceae: <i>Protium ovatum</i> ; Connaraceae: <i>Rourea induta</i> ; Erythroxylaceae: <i>Erythroxylum</i> spp.; Euphorbiaceae: <i>Maprounea guianensis</i> , <i>Ricinus communis</i> ; Malpighiaceae: <i>Byrsonima</i> spp.; Moraceae: <i>Ficus carica</i> ; Myrtaceae: <i>Eugenia</i> spp.; Salicaceae: <i>Casearia sylvestris</i> ; Sapotaceae: <i>Pouteria ramiflora</i> ⁵
<i>Mesosemia rhodia</i>	I	0.004	**		

¹ Biezanko & Mielke (1973)² Biezanko et al. (1974)³ Brown (1992)⁴ Duarte et al. (2005)⁵ Becalloni et al. (2008)⁶ Uehara-Prado & Freitas (2009)⁷ Freitas et al. (2012)⁸ Ribeiro et al. (2012)⁹ Brito et al. (2014)¹⁰ Zacca et al. (2017)¹¹ Orlandin et al. (in prep.).Significance level: ***, $P < 0.001$; **, $P < 0.01$; *, $P < 0.05$