Biota Neotropica 22(3): e20221367, 2022
www.scielo.br/bn

biotaneotropica
ISSN 1676-0611 (online edition)
Inventory

The butterflies of Cristalino Lodge, in the Brazilian southern Amazonia: An updated species list with a significant contribution from citizen science

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MOTA, L.L., BODDINGTON, S.J., BROWN JR., K.S., CALLAGHAN, C.J., CARTER, G., CARTER, W., DANTAS, S.M., DOLIBAINA, D.R., GARWOOD, K., HOYER, R.C., ROBBINS, R.K., SOH, A., WILLMOTT, K.R., FREITAS, A.V.L. **The butterflies of Cristalino Lodge, in the Brazilian southern Amazonia: An updated species list with a significant contribution from citizen science**. Biota Neotropica 22(3): e20221367. https://doi.org/10.1590/1676-0611-BN-2022-1367

Abstract: The richest butterfly communities in the world are found in the Amazon rainforest. Despite of this, and the importance of species inventories for the knowledge of diversity patterns, there are few comprehensive lists of butterflies for localities in the Brazilian Amazon. Here, we present an updated list of the butterflies of Cristalino Lodge (Alta Floresta, Mato Grosso, Brazil), in southern Amazonia, based on specimens collected by researchers and photographic records taken by ecotourists, butterfly watchers, and tour guides. With 1010 species recorded, this is currently the largest list of butterflies published for a single locality in Brazil and the first to reach (and surpass) 1000 species, with more than one third of the records coming from citizen science. The region has about 29% of the butterfly species in Brazil and one of the greatest richnesses known in the country, inferior only to areas in the western Amazon. Its fauna is mainly composed of species widely distributed in lowland Amazonia, with the addition of some species typical of the Cerrado. It has a relatively low number of species of the tribe Ithomiini (Nymphalidae: Danainae), generally considered a good indicator of the total butterfly diversity in neotropical forests, which points to the need for caution when using a single taxonomic group as a surrogate of richness of entire communities. The present work highlights the importance of citizen science and ecotourism centers for inventories and data on species distribution in diverse tropical forests.
Keywords: *Amazon Forest; arch of deforestation; butterfly watching; ecotourism; iNaturalist.*

As borboletas do Cristalino Lodge, no sul da Amazônia: Uma lista atualizada de espécies com contribuição significativa da ciência cidadã

Resumo: As comunidades de borboletas mais ricas do mundo são encontradas na Amazônia. Apesar disso, e da importância dos inventários de espécies para o conhecimento dos padrões de diversidade, existem poucas listas abrangentes de borboletas para localidades da Amazônia brasileira. Aqui, apresentamos uma lista atualizada das borboletas do Cristalino Lodge (Alta Floresta, Mato Grosso, Brasil), no sul da Amazônia, baseada em espécimes

coletados por pesquisadores e em registros fotográficos feitos por ecoturistas, observadores de borboletas e guias turísticos. Com 1010 espécies registradas, essa é atualmente a maior lista de borboletas publicada para uma localidade no Brasil e a primeira a atingir 1000 espécies, sendo mais de um terço dos registros provenientes da ciência cidadã. A região apresenta cerca de 29% das espécies de borboletas do Brasil e uma das maiores riquezas conhecidas no país, inferior apenas a áreas no oeste da Amazônia. Sua fauna é composta principalmente por espécies amplamente distribuídas na planície amazônica, com adição de algumas típicas do Cerrado. Possui um número relativamente baixo de espécies da tribo Ithomiini (Nymphalidae: Danainae), que é geralmente considerada uma boa indicadora da riqueza total de borboletas em florestas neotropicais, o que aponta para a necessidade de cautela ao se usar um grupo taxonômico como previsor da riqueza de comunidades inteiras. O presente trabalho destaca a importância da ciência cidadã e dos centros de ecoturismo para inventários e dados sobre distribuição de espécies em florestas tropicais diversas.

Palavras-chave: *Floresta Amazônica; arco do desmatamento; observação de borboletas; ecoturismo; iNaturalist.*

Introduction

The world faces a biodiversity crisis, with habitats being lost and species becoming extinct at a rate that is unprecedented in historical times (Hoekstra et al. 2005, Ceballos et al. 2015). In this context, local species inventories are especially important because they help to clarify diversity patterns and species distribution, and to identify efficient conservation strategies (Balmford & Gaston 1999, Meyer et al. 2015). However, even for a relatively well-known group of invertebrates such as the butterflies, there are areas where available occurrence data is scanty, especially in portions of tropical forests, which contain the bulk of the planet's terrestrial biodiversity, such as the Amazon Basin (Girardello et al. 2019). Historically, a great part of our knowledge of the Amazonian fauna has come from expeditions that followed rivers stopping periodically to sample, instead of focusing on single areas, and the specimens gathered by such expeditions, frequently without precise geographic data, are scattered through museum collections and in need of thorough review (Casagrande et al. 2012). As for studies that focus on local faunas, the richest butterfly communities in the world have been found in western Amazonia (Lamas 1985, Emmel & Austin 1990, Robbins et al. 1996, Brown & Freitas 2002). Yet, Santos et al. (2008) showed that there are few species lists for the Brazilian Amazon Forest, compared to most other biomes in the country. Although the number of butterfly inventories in Brazil has increased considerably since then (Shirai et al. 2019), the number of comprehensive inventories for single localities in the more than 4000000 km² of Brazilian Amazonia is still low, considering that most of the studies rely on relatively small sampling efforts (e.g., Ebert 1965, Garcia et al. 1990, Mielke & Casagrande 1991, Mielke et al. 2010, Martins et al. 2017a, Oliveira et al. 2021), do not include actual species lists (e.g., Brown 1984, 2005, Brown & Freitas 2002), or use a small subset of the butterflies, the fruit-feeding nymphalids, to answer ecological questions (e.g., Ramos 2000, Ribeiro & Freitas 2012, Graça et al. 2017a, b, Martins et al. 2017b, Montejo-Kovacevich et al. 2018, Araujo et al. 2020, Rabelo et al. 2021). Contributing reasons for this outcome include low human population densities near these sites, difficult access, and distance to most Brazilian research centers, which makes it difficult and expensive for scientists to produce long-term inventories in most of the Brazilian Amazon Forest.

In recent years, however, the growing interest in citizen science has proven to be increasingly helpful for the documentation and generation of biodiversity data, by taking advantage of new and easier ways to gather, access, produce and share this information (Dickinson et al. 2012, Mazumdar et al. 2018). Such efforts can aid in filling knowledge gaps for butterflies (Girardello et al. 2019, Mesaglio et al. 2021). One interesting case relevant to the Amazon Forest was the publication of the book "Butterflies of Southern Amazonia: A Photographic Checklist of Common Species" (Garwood & Lehman 2007), which compiled images of live butterflies representing some 2000 species, recorded by several butterfly watchers and ecotourists, especially in Amazonian lodges and ecotourism centers across Peru, Bolivia, and Brazil. This publication included several images taken at Cristalino Lodge, in Alta Floresta, Mato Grosso state, Brazil, information that has already been used in studies of the state of knowledge of butterflies in Brazil (Santos et al. 2008, Queiroz-Santos et al. 2016, Shirai et al. 2019). Photographic records have continued to be made in this location ever since; furthermore, the region has been equally attractive to researchers, and the focus of several expeditions by the authors of this paper, which have resulted in the description of a Satyrini genus (Freitas et al. 2019), a new subspecies of ithomiine (Mota et al. 2022), descriptions of immature stages (Freitas & Brown 2002, 2008, Mota et al. 2020), and research on butterfly communities and mimicry (Mota et al., in preparation). Here, we present a butterfly list for the Cristalino Lodge based on all data collected during field expeditions and the records made by butterfly watchers and ecotourists.

Materials and Methods

1. Study site

The Cristalino Lodge (centered at 9°35'51''S, 55°55'52''W) is located in northern Mato Grosso State, in the municipality of Alta Floresta, central Brazil (Figure 1). The climate in the region is warm and humid, with average annual temperature of 24°C, annual rainfall above 2400 mm, with a marked dry season lasting from 3 to 5 months (Nimer 1989). Soils are mostly red-yellow latosols and altitudes vary from 100 m to 400 m at the top of small rocky outcrops (locally known as "serras") (Sazaki & Farias 2008, Müller & Farias 2010). The region is in the southern part of the Amazon Forest, and the vegetation is heterogeneous, presenting various phytophysiognomies (Figure 2 A-D) including evergreen (Figure 2 A,B), igapó (floodplain), bamboo, semi-deciduous and deciduous forests (the latter usually associated with patches of rocky outcrops in the "serras") (Figure 2 D). Despite the proximity to the Cerrado savannas, these are not represented in the region; the open vegetation types in this area are of a different origin (Zappi et al. 2011). The region is situated in the so-called "arch

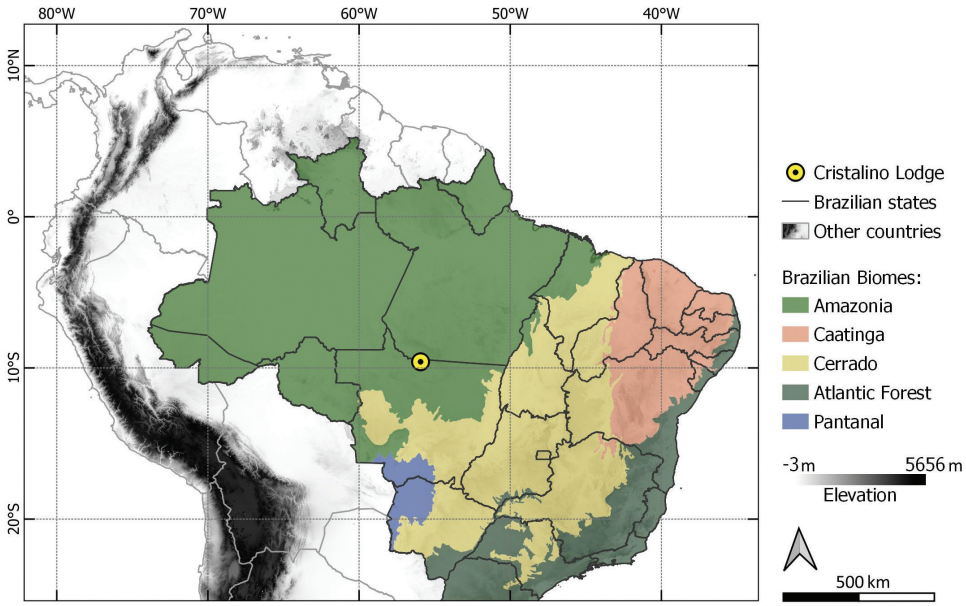

Figure 1. Map showing the location of Cristalino Lodge within the Brazilian Amazon Forest.

of deforestation" and has undergone great land-use change related to goldmining, agriculture, and cattle ranching since the foundation of Alta Floresta in 1976 (Dubreuil et al. 2012).

Cristalino Lodge was created in 1992 and has attracted ecotourists, photographers, and bird and butterfly watchers ever since. It is associated with an ecological foundation (Cristalino Ecological Foundation, CEF) and four contiguous private reserves (Reservas Particulares do Patrimônio Natural) that surround it, located in the municipalities of Alta Floresta and Novo Mundo. The lodge was named after the black waters of the Cristalino river (Figure 2 C), that crosses the area of the private reserves and is a tributary of the larger Teles Pires river, which delimits the reserves to the south. While most of the forest south of Cristalino Lodge is fragmented (Lees & Peres 2006), the 72 km² of the Cristalino private reserves are contiguous to the Cristalino State Parks I and II (1849 km²), which are also contiguous to other large conservation areas in the state of Pará. However, it is important to emphasize that Cristalino State Park II currently has its existence under legal dispute and suffers from deforestation and fires (https://g1.globo.com/mt/mato-grosso/noticia/2022/08/17/incendio-no-parque-do-cristalino-ii-em-mt-pode-ter-sido-causado-por-aeronave-diz-delegado.ghtml). Here, we consider as "Cristalino Lodge" the areas of the lodge itself, the four private reserves, the margins of the Cristalino river adjacent to the RPPNs, the Ariosto Island and the forest area located at the southern margin of the Teles Pires river, adjacent to the reserves, where visitors board the boats to access the lodge. These all form an area of forest that, apart from the rivers, is continuous and have a trail system that is explored by tourists that visit Cristalino Lodge.

2. *Field inventory*

Butterfly sampling was carried out during expeditions of 7–15 days between June and September (during the dry season, when butterflies are apparently more diverse and abundant in the region) in 2000 (twice), 2017 and 2018, and in a longer period between September 2015 and September 2016, with few temporal gaps, as part of a study that was not designed for inventorying species. Most collecting was made through active searching with entomological nets. Additionally, a few Van Someren-Rydon traps baited with banana fermented with beer and installed in the understory were used in the earlier expeditions, in addition to the Ahrenholz technique in 2018, which consists of attaching paper soaked in saliva on leaves in the understory, to attract mostly Hesperiidae (Lamas et al. 1993). Collected butterfly specimens were stored in a freezer, and at least one of each morphospecies was spread and deposited in the entomological collection of the Museu de Diversidade Biológica, Universidade Estadual de Campinas (Unicamp), Campinas, São Paulo, Brazil.

3. *Image searching*

To examine butterfly images for additional species from the region, we intensively searched a number of sources, including websites and books. We focused on the images that could add new records to the list, with a search process in two phases. Firstly, we conducted an initial rapid assessment in which pictures of species that are easy to identify and that had already been recorded were ignored, and separated out other images for further examination. In the second phase, selected images were checked as to their photographer and provenance, to confirm whether they had actually been taken at Cristalino Lodge, and reviewed for potential new taxonomic records. The images selected in the second phase were subsequently sent for identification by specialists and the authors of this paper. Not all pictures could be reliably identified to species level (even if the source suggested an identification), either due to poor image quality or because the specimen belonged to a group which requires dissection or closer inspection for identification. We thus ignored any pictures which the specialists were unable to confirm as a new taxon (e.g., species group, genus or tribe) for Cristalino. We only used photographic records; trip reports and other written records were ignored if not associated with images that could be checked, even if those records were made by knowledgeable people and might be reliable.

The sources and specific searching methods, following the two-phase approach described above, were as follows: We checked every record in the books "Butterflies of Southern Amazonia" (Garwood & Lehman 2007),

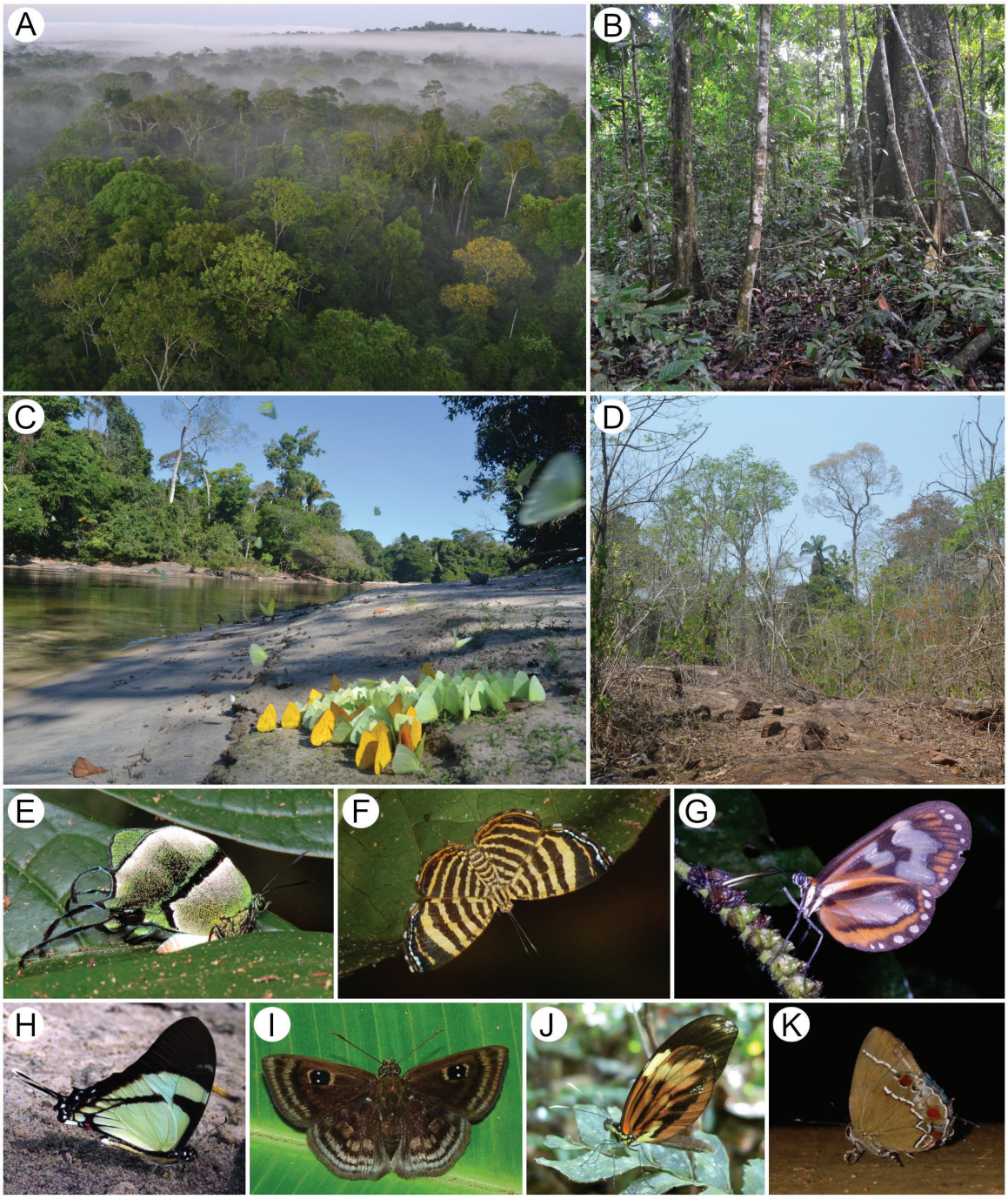

Figure 2. Environments and butterflies of Cristalino Lodge. A) View of evergreen forest from a 50 m. observation tower; B) Interior view of evergreen forest; C) *Phoebis* spp. puddling near the Cristalino River; D) View of deciduous forest during the dry season (~June-September); E-G) Examples of butterfly species that have been recorded in Cristalino Lodge through pictures only. E) *Arcas tuneta* (Lycaenidae), picture by Sidnei M. Dantas; F) *Argyrogrammana glaucopis* (Riodinidae), picture by Stephen J. Boddington; G) *Hypothyris leprieuri ninyas* (Nymphalidae), picture by Richard C. Hoyer; H) *Eurytides callias* (Papilionidae), picture by Kim Garwood; I) *Cyclosemia* sp. (Hesperiidae), picture by Will Carter; J) *Dismorphia amphione* (Pieridae), picture by Gill Carter; K) Undescribed Lycaenidae (tentatively identified as *Arumecla* sp.), picture by Sidnei M. Dantas.

"Borboletas do Brasil (three volumes)" (Palo jr. 2017) and "Lepidoptera: Borboletas e Mariposas do Brasil" (Almeida & Freitas 2012). The first contains several pictures from Cristalino Lodge, identified by the initials "CL". We used the online search platforms Google Search and Google Images, where all combinations of the keywords "butterflies", "butterfly", "borboletas", "borboleta" or "lepidoptera" with "Cristalino", "Cristalino Lodge" or "Alta Floresta" were used. At Google Search, we visited all sites and blogs in the first ten pages of results for each keyword combination; at Google Images, we checked every picture retrieved for every combination.

We also searched in specific websites and social media sites that specialize in pictures and/or butterflies where there was a reasonable likelihood of finding new records. In Flickr's search tool, we used the same combinations of keywords cited above, and checked all results

(https://www.flickr.com). At Instagram (https://www.instagram.com), we searched for images of butterflies among every public picture with the hashtag "#cristalinolodge". At Tolweb (http://tolweb.org), we used "Cristalino Lodge" in the search resource, and checked all the pages about butterfly taxa shown in the results. At Borboletas e Mariposas (http://borboletaskmariposas.blogspot.com), we used "Cristalino" in the search resource and checked all the results. At Calydna database (https://calydna.com), we manually found the Cristalino region in the map present in the site, clicked at one of the records from the area, and then clicked in the location name ("Cristalino Jungle Lodge") beyond the taxon name; this led to a page with all records made at Cristalino Lodge, and we checked each one. We searched manually among the live specimen records at Butterflies of America (Warren et al. 2016), and checked every picture at the site Neotropical Butterflies (https://www.neotropicalbutterflies.com), which includes many of the same records of Butterflies of Southern Amazonia, and the "Butterflies of the Amazon and Andes" section of the site Learn about Butterflies (https://www.learnaboutbutterflies.com). The website Butterfly Catalogs (https://www.butterflycatalogs.com) provides a useful guide and checklist of the butterflies of Cristalino Lodge (Garwood & Jaramillo V. 2021), but it was not used here because the locality of each picture is given only as country. However, it includes many pictures that are also available in other sources, with finer locality data, and could therefore be used.

We made a special effort to compile and examine records submitted to iNaturalist (www.inaturalist.org). To more easily find records of interest, we created the project "Butterflies of Cristalino Lodge" in June 2019. In this kind of project, iNaturalist automatically adds all the pictures of the selected taxa (in this case, "butterflies") from a given locality. For this, we created in iNaturalist a locality named "Cristalino Lodge" that consists of a polygon which encompasses and slightly surpasses our area of interest (to account for imprecisions in the record locations given by the users).

The search for pictures was made in June of 2020, and the statistics of iNaturalist are from January 2022, about two years and a half after the creation of the project. Additionally, we checked pictures from the Cristalino Lodge archives and the images made by the first author during fieldwork (which were not added to iNaturalist before the submission of this work, to separate them from the citizen science records).

4. Identification and taxonomy

Collected specimens and pictures of live butterflies selected in the second phase of the image search were identified by specialists and the authors of this study. Although the live specimen images are usually identified at their sources, and frequently by knowledgeable people, all the images were sent to specialists and, thus, the identifications provided in the species list might differ from those at the original source. Apart from a few records available upon request to the first author, all the photographic records are published in books or on the internet and therefore can be checked, updated, or disputed. Information on the identification, photographers and photography sources of each taxon is available as supplementary material (Table S1).

We follow Heikkilä et al. (2012) for Papilionoidea, and the taxonomy of butterflies follows mostly Lamas (2004), updated after Wahlberg et al. (2009) for higher classification of Nymphalidae, Tyler et al. (1994) for Papilionidae, the Riodinidae Species Checklist (Seraphim 2019) and Zhang et al. (2021) for Riodinidae, Robbins (2004) and subsequent publications for Lycaenidae, the Euptychiina Species Checklist (Zacca et al. 2018) for Euptychiina, Murillo-Ramos et al. (2018) for *Phoebis*, Penz et al. (2017) for *Bia*, Penz (2021) for *Cithaerias*, Paluch (2006) for *Actinote* and Núñez et al. (2021) for *Agraulis* and *Dryas*. *Eurema furtadoi* Casagrande & Mielke, 1979, synonymized with *Eurema lirina* (H. Bates, 1861) by Lamas (2004), is tentatively used for a specimen different from another that is morphologically similar to the type of *Eurema lirina*. We follow the higher classification of Hesperiidae summarized by Zhang et al. (2019a), and the taxonomy of the group follows Mielke (2005) with recent updates (Cong et al. 2019, Li et al. 2019, Medeiros et al. 2019, 2020, Zhang et al. 2019b, c, 2022, Siewert et al. 2020, 2022).

5. Species richness estimates

Beccaloni & Gaston (1995) suggest that the nymphalid tribe Ithomiini is a good surrogate of the total butterfly fauna of neotropical forests, since this group is easy to sample and represent 4.3–4.6% of the butterfly species. Brown & Freitas (2000) indicates that the Nymphalidae fauna of a well sampled site represents 25–29% of the total butterfly community. Therefore, the numbers of recorded species of Nymphalidae and Ithomiini were both used to estimate the total butterfly species richness of Cristalino Lodge.

Results

We collected approximately 2500 specimens and searched for new records among thousands of images, whose number cannot be quantified because of our searching methods and the presence of many images that were repeated in more than one source and frequently cropped, inverted or with different identifications. As an example, the search for "butterfly" plus "Cristalino" at Flickr resulted in 782 images, and there were 157 images of butterflies among 4290 images tagged with "#cristalinolodge" at Instagram. About two years and a half after being created, the project "butterflies of Cristalino Lodge" in iNaturalist reported in its statistics a total of 3398 observations (specimens recorded), 839 species, 168 identifiers, and 59 observers (photographers). These numbers have continued to grow. Although not all images were labeled with correct species names or even could lead to a precise identification, these numbers give a good estimate of the scope of the project.

Combining information from collected specimens and photographic records, a total of 1010 species (1012 taxa, including subspecies), including Hedylidae and all butterfly families, were recorded at Cristalino Lodge (Table 1). The most represented family was Hesperiidae with 314 species, followed by Nymphalidae (301), Riodinidae (221), Lycaenidae (123), Papilionidae (24), Pieridae (23) and Hedylidae (4). The two species that had more than one recorded subspecies were the nymphalids *Heliconius numata* (Cramer, 1780) and *Memphis acidalia* (Hübner, [1819]).

A total of 351 species, representing 34.7% of all species, were recorded only through photographs (examples in Figure 2 E-K). Such records contributed with at least one quarter of each family. They were particularly important to the Lycaenidae, representing more than half of its species (52,8%) and to the Hesperiidae (41,1% of the species). A total of 318 of the species with photographic records only were recorded by 5 photographers (but not necessarily only them), who are either expert butterfly watchers and/or expedition guides: SMD (155), RCH (109), GC (74), SJB (57) and WC (50).

Table 1. List of the butterflies and moth-butterflies (Papilionoidea) of Cristalino Lodge. Total number: 1010 species. The number of species of each major taxa is provided within parenthesis. * Species recorded only through live specimen photographs; ** including or restricted to images made by the 5 photographers with the most records.

Papilionoidea (1010)	
Hedylidae (4)	
	Macrosoma heliconiaria (Guenée, 1858)
	Macrosoma lucivittata Walker, 1863
	Macrosoma rubedinaria Walker, 1862 **
	Macrosoma tipulata Hübner, 1818
Papilionidae (24)	
Papilioninae (24)	
Leptocircini (8)	*Eurytides callias* (Rothschild & Jordan, 1906) **
	Eurytides dolicaon (Cramer, 1775) **
	Mimoides ariarathes arianus (Staudinger, 1884)
	Mimoides pausanias pausanias (Hewitson,1852)
	Neographium agesilaus (Guérin-Méneville & Percheron, 1835)
	Neographium thyastes (Drury, 1782)
	Protesilaus glaucolaus (H. Bates, 1864)
	Protesilaus telesilaus (C. Felder & R. Felder, 1864)
Troidini (10)	*Battus belus* (Cramer, 1777)
	Battus crassus (Cramer, 1777)
	Battus lycidas (Cramer, 1777)
	Battus polydamas (Linnaeus, 1758) **
	Parides aeneas linoides K. Brown & Lamas, 1994
	Parides anchises cf. *humaita* D'Abrera, 1981
	Parides chabrias (Hewitson, 1852) **
	Parides neophilus eurybates (G. Gray, [1853])
	Parides sesostris sesostris (Cramer, 1779)
	Parides vertumnus cutora (G. Gray, [1853])
Papilionini (6)	*Heraclides anchisiades* (Esper, 1788)
	Heraclides androgeus (Cramer, 1775) **
	Heraclides astyalus (Godart, 1819)
	Heraclides hyppason (Cramer, 1775) **
	Heraclides thoas (Linnaeus, 1771) **
	Heraclides torquatus (Cramer, 1777) **
Pieridae (23)	
Dismorphiinae (5)	
	Dismorphia amphione (Cramer, 1779) **
	Enantia lina (Herbst, 1792) **
	Enantia melite vilma Lamas, 2004
	Moschoneura pinthous ssp.
	Pseudopieris nehemia limbalis Röber, 1924 **

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Coliadinae (12)	
	Anteos menippe (Hübner, [1818]) **
	Eurema albula (Cramer, 1775)
	Eurema elathea (Cramer, 1777)
	Eurema furtadoi Casagrande & Mielke, 1979
	Eurema lirina (H. Bates, 1861)
	Phoebis cf. argante (Fabricius, 1775)
	Phoebis philea (Linnaeus, 1763)
	Phoebis cf. *sennae* (Linnaeus, 1758) *
	Phoebis statira (Cramer, 1777)
	Phoebis trite (Linnaeus, 1758)
	Pyrisita nise tenella (Boisduval, 1836)
	Pyrisitia leuce (Boisduval, 1836)
Pierinae (6)	
Anthocharidini (2)	*Cunizza hirlanda* (Stoll, 1790)
	Hesperocharis nera (Hewitson, 1852) **
Pierini (4)	*Ganyra phaloe phaloe* (Godart, 1819) **
	Glutophrissa drusilla drusilla (Cramer, 1777)
	Melete lycimnia (Cramer, 1777)
	Perrhybris pamela (Stoll, 1780) **
Lycaenidae (123)	
Polyommatinae (2)	
	Hemiargus hanno (Stoll, 1790)
	Leptotes cassius (Cramer, 1775)
Theclinae (121)	
Eumaeini (121)	*Arawacus separata* (Lathy, 1926)
	Arawacus tarania (Hewitson, 1868) *
	Arcas imperialis (Cramer, 1775)
	Arcas tuneta (Hewitson, 1865) **
	Arumecla sp. **
	Atlides atys (Cramer, 1779) **
	Atlides polybe (Linnaeus, 1763) **
	Aubergina alda (Hewitson, 1868)
	Brangas getus (Fabricius, 1787) **
	Brevianta ematheon (Cramer, 1777) **
	Calycopis anastasia complex
	Calycopis anfracta complex
	Calycopis atnius (Herrich-Schäffer, [1853])
	Calycopis bellera (Hewitson, 1877)
	Calycopis caesaries (H. Druce, 1907) **
	Calycopis centoripa (Hewitson, 1868) **
	Calycopis cerata (Hewitson, 1877)
	Calycopis demonassa (Hewitson, 1868)

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Calycopis lerbela W. D. Field, 1967
Calycopis sp.1
Calycopis sp.2
Calycopis sp.3
Camissecla vesper (H. Druce, 1909)
Celmia celmus (Cramer, 1775)
Celmia color (H. Druce, 1907) **
Celmia conoveria (Schaus, 1902) **
Celmia mecrida (Hewitson, 1867) *
Chalybs janias (Cramer, 1779)
Cupathecla cupentus (Stoll, 1781)
Cyanophrys herodotus (Fabricius, 1793) **
Denivia hemon (Cramer, 1775)
Denivia lisus (Stoll, 1790)
Denivia phegeus (Hewitson, 1865)
Enos polka Lamas & Robbins, 2009 *
Erora sp.
Eumaeini sp.
Evenus batesii (Hewitson, 1865) **
Evenus satyroides (Hewitson, 1865)
Evenus sp. **
Hypostrymon asa (Hewitson, 1868)
Iaspis castinotus (K. Johnson & Le Crom, 1997) **
Iaspis sp. **
Iaspis temesa (Hewitson, 1868)
Iaspis verania (Hewitson, 1868) *
Ignata mulsus (H. Druce, 1907) **
Ipidecla crepundia (H. Druce, 1909) **
Janthecla leea Venables & Robbins, 1991
Janthecla malvina (Hewitson, 1867) **
Janthecla rocena (Hewitson, 1867)
Janthecla sista (Hewitson, 1867)
Kisutam syllis (Godman & Salvin, 1887)
Kolana cf. *buccina* (H. Druce, 1907) **
Lamprospilus orcidia (Hewitson, 1874) *
Michaelus jebus (Godart, [1824])
Michaelus joseph Robbins, 2010 **
Michaelus phoenissa (Hewitson, 1867)
Michaelus thordesa (Hewitson, 1867) **
Ministrymon azia (Hewitson, 1873) **
Ministrymon cleon (Fabricius, 1775) **

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Ministrymon cruenta (Gosse, 1880)
Ministrymon megacles (Stoll, 1780)
Ministrymon una (Hewitson, 1873)
Ministrymon zilda (Hewitson, 1873)
Mithras nautes (Cramer, 1779)
Nicolaea fabulla (Hewitson, 1868) **
Nicolaea opalia (Hewitson, 1868) **
Nicolaea petilla (Hewitson, 1868) **
Ocaria ocrisia (Hewitson, 1868)
Ocaria thales (Fabricius, 1793)
Oenomaus cf. *magnus* Faynel & Moser, 2008 **
Oenomaus minyia (Hewitson, 1867) **
Oenomaus ortygnus (Cramer, 1779) **
Oenomaus sp.1 **
Oenomaus sp.2 **
Olynthus essus (Herrich-Schäffer, [1853])
Olynthus cf. *obsoleta* (Lathy, 1926) **
Ostrinotes gentiana (H. Druce, 1907)
Ostrinotes silva (Faynel & Robbins, 2014) **
Ostrinotes sp.
Paiwarria telemus (Cramer, 1775)
Panthiades aeolus (Fabricius, 1775) **
Panthiades bitias (Cramer, 1777)
Panthiades boreas (C. Felder & R. Felder, 1865) **
Panthiades phaleros (Linnaeus, 1767) **
Paraspiculatus cf. *emma* Busby & Robbins, 2017 **
Paraspiculatus elis (Cramer, 1779) **
Parrhasius orgia (Hewitson, 1867)
Parrhasius polibetes (Stoll, 1781) **
Pseudolycaena marsyas (Linnaeus, 1758) **
Rekoa meton (Cramer, 1779) **
Rekoa palegon (Cramer, 1780) **
Rekoa stagira (Hewitson, 1867) **
Rubroserrata ecbatana (Hewitson, 1868) **
Siderus athymbra (Hewitson, 1867) **
Siderus cf. *leucophaeus* (Hübner, [1813]) **
Strephonota ambrax (Westwood, 1852)
Strephonota cyllarissus (Herbst, 1800)
Strephonota dindymus (Cramer, 1775) **
Strephonota cf. *parvipuncta* (Lathy, 1926) **

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	Strephonota cf. *strephon* (Fabricius, 1775) **
	Strephonota sp. **
	Strymon astiocha (Prittwitz, 1865) **
	Strymon megarus (Godart, [1824])
	Strymon mulucha (Hewitson, 1867) **
	Strymon yojoa (Reakirt, [1867])
	Strymon ziba (Hewitson, 1868) **
	Symbiopisis sp.
	Terenthina terentia (Hewitson, 1868)
	Theclopsis gargara (Hewitson, 1868)
	Theclopsis lydus (Hübner, [1819])
	Thereus enenia (Hewitson, 1867) **
	Thereus pedusa (Hewitson, 1867) **
	Theritas mavors Hübner, 1818
	Thestius selina (Hewitson, 1869)
	Tmolus cydrara (Hewitson, 1868) **
	Tmolus echion (Linnaeus, 1767)
	Tmolus mutina (Hewitson, 1867)
	Tmolus ufentina (Hewitson, 1868) **
	Trichonis immaculata Lathy, 1930 **
	Ziegleria ceromia (Hewitson, 1877) **
	Ziegleria hesperitis (A. Butler & H. Druce, 1872) **
Riodinidae (221)	
Nemeobiinae (35)	
Euselasiini (35)	*Erythia labdacus* (Stoll, 1780) **
	Eugelasia brevicauda (Lathy, 1926)
	Eugelasia eugeon (Hewitson, 1856)
	Eurylasia euryone (Hewitson, 1856)
	Euselasia angulata (H. Bates, 1868)
	Euselasia calligramma (H. Bates, 1868) **
	Euselasia cf. *praeclara* (Hewitson, 1869) **
	Euselasia clithra (H. Bates, 1868)
	Euselasia erilis Stichel, 1919
	Euselasia euphaes (Hewitson, [1855]) **
	Euselasia euriteus (Cramer, 1777)
	Euselasia euromus (Hewitson, 1856)
	Euselasia eurypus (Hewitson, 1856)
	Euselasia eutaea (Hewitson, [1853])
	Euselasia eutychus (Hewitson, 1856)
	Euselasia gelanor (Stoll, 1780)
	Euselasia kartopus Stichel, 1919

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	Euselasia nr. *attrita*
	Euselasia orba Stichel, 1919
	Euselasia phelina (H. Druce, 1878)
	Euselasia scotinosa Stichel, 1930 **
	Euselasia toppini Sharpe, 1915
	Euselasia uria (Hewitson, [1853])
	Euselasia uzita (Hewitson, [1853]) **
	Euselasiae euoras (Hewitson, [1855])
	Methone cecilia magnarea (Seitz, 1913)
	Methone dolichos (Staudinger, [1887]) **
	Myselasia cafusa (H. Bates, 1868) **
	Myselasia crinon (Stichel, 1919)
	Myselasia eustola (Stichel, 1919)
	Myselasia mys (Herrich-Schäffer, [1853])
	Pelolasia euboea (Hewitson, [1853])
	Pelolasia eumenes (Hewitson, [1853])
	Pelolasia melaphaea (Hübner, 1823)
	Pelolasia pellonia (Stichel, 1919)
Riodininae (186)	
Eurybiini (42)	*Alesa amesis* (Cramer, 1777)
	Alesa lipara H. Bates, 1867
	Alesa prema (Godart, [1824]) **
	Ectosemia eumene (Cramer, 1776)
	Eurybia albiseriata stellifera Stichel, 1910 **
	Eurybia caerulescens H. Druce, 1904 **
	Eurybia dardus (Fabricius, 1787) **
	Eurybia halimede halimede (Hübner, [1807])
	Eurybia molochina hyathincina Stichel, 1910
	Eurybia nicaeus (Fabricius, 1775) **
	Eurybia patrona Weymer, 1875 **
	Hyphilaria parthenis (Westwood, 1851)
	Ithomiola orpheus (Westwood, 1851) **
	Mesosemia cf. *antaerice* Hewitson, 1859 **
	Mesosemia cippus Hewitson, 1859
	Mesosemia croesus trilineata (A. Butler, 1874)
	Mesosemia esperanza Schaus, 1913
	Mesosemia evias Stichel, 1923
	Mesosemia gneris Westwood, 1851 **
	Mesosemia hesperina tenuivittata Stichel, 1910
	Mesosemia hyphea pallida (Lathy, 1932)
	Mesosemia ibycus Hewitson, 1859
	Mesosemia icare (Hübner, [1819])
	Mesosemia idotea (Westwood, 1851)

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	Mesosemia jucunda Stichel, 1923
	Mesosemia lacernata Stichel, 1909
	Mesosemia lagora (Herrich-Schäffer, [1853])
	Mesosemia marisa marisa (Hewitson, 1858)
	Mesosemia melaene Hewitson, 1859
	Mesosemia melpia Hewitson, 1859
	Mesosemia metope Hewitson, 1859
	Mesosemia minos modica Stichel, 1910
	Mesosemia nesti (Hewitson, 1858) **
	Mesosemia nr. *sirenia* **
	Mesosemia nyctea (Hoffmannsegg, 1818)
	Mesosemia philocles laetifica H. Bates, 1868
	Mesosemia tenella (Stichel, 1910)
	Mesosemia thetys Godman & Salvin, 1885
	Mesosemia thymetus (Cramer, 1777)
	Mesosemia tullius (Fabricius, 1787)
	Napaea eucharila (H. Bates, 1867) **
	Napaea heteroea (H. Bates, 1867)
Nymphidiini (61)	*Adelotypa* sp.
	Archaeonympha drepana (H. Bates, 1868)
	Argyraspila gyges (Stichel, 1911)
	Argyraspila pirene (Godman 1903)
	Argyraspila rhesa (Hewitson, 1858) **
	Aricoris propitia (Stichel, 1910)
	Calospila parthaon (Dalman, 1823)
	Dysmathia portia H. Bates, 1868
	Hallonympha maculosa (H. Bates, 1868)
	Juditha azan (Westwood, 1851) **
	Juditha molpe (Hübner, [1808])
	Juditha odites (Cramer, 1775)
	Lemonias zygia (Hübner, [1807])
	Livendula aristus (Stoll, 1790)
	Livendula huebneri (Butler, 1867)
	Livendula jasonhalli (Brévignon & Gallard, 1999)
	Livendula pauxilla (Stichel, 1911)
	Livendula violacea (A. Butler, 1867)
	Nymphidium acherois (Boisduval, 1836)
	Nymphidium aurum Callaghan, 1985
	Nymphidium azanoides A. Butler, 1867
	Nymphidium baeotia Hewitson, [1853]
	Nymphidium callaghani Brévignon, 1999 **

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	Nymphidium caricae (Linnaeus, 1758)
	Nymphidium carmentis Stichel, 1910
	Nymphidium chione H. Bates, 1867
	Nymphidium leucosia (Hübner, [1806])
	Nymphidium manicorensis Callaghan, 1985
	Nymphidium mantus (Cramer, 1775)
	Nymphidium minuta H. Druce, 1904
	Nymphidium robiginosum Stichel, 1929
	Nymphidium velatum Stichel, 1914
	Pachythone cf. *conspersa* Stichel, 1926 *
	Pachythone xanthe H. Bates, 1868
	Pandemos pasiphae (Cramer, 1775)
	Parvospila emylius (Cramer, 1775)
	Periplacis menander (Stoll, 1780) **
	Protonymphidia senta (Hewitson, 1853)
	Rodinia calphurnia (Saunders, 1850)
	Setabis epitus (Cramer, 1780) **
	Setabis flammula (H. Bates, 1868)
	Setabis lagus (Cramer, 1777)
	Setabis serica serica (Westwood, 1851) **
	Stalachtis calliope (Linnaeus, 1758)
	Stalachtis phaedusa (Hübner, [1813])
	Stalachtis phlegia (Cramer, 1779) *
	Synargis abaris (Cramer, 1776)
	Synargis gela (Hewitson, [1853])
	Synargis ochra (H. Bates, 1868)
	Synargis orestessa Hübner, [1819]
	Synargis regulus Hübner, [1819]
	Theope cf. *archimedes* (Fabricius, 1793) **
	Theope discus H. Bates, 1868
	Theope eurygonina H. Bates, 1868
	Theope leucanthe H. Bates, 1868
	Theope lycaenina H. Bates, 1868
	Theope nycteis (Westwood, 1851)
	Theope pedias Herrich-Schäffer, [1853]
	Theope philotes (Westwood, 1851)
	Theope thootes Hewitson, 1860
	Zelotaea phasma H. Bates, 1868
Calydnini (8)	*Calydna caieta* Hewitson, 1854
	Calydna carneia Hewitson, 1859
	Calydna catana Hewitson, 1859

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	Calydna charila Hewitson, 1854
	Calydna jeannea J. Hall, 2002 **
	Calydna nicolayi J. Hall, 2002
	Echenais thelephus (Cramer, 1775) **
	Echydna punctata (C. Felder & R. Felder, 1861)
Symmachiini (15)	*Argyrogrammana glaucopis* (H. W. Bates, 1868) **
	Argyrogrammana nr. *venilia* **
	Argyrogrammana talboti Brévignon & Gallard, 1998 *
	Argyrogrammana trochilia (Westwood, 1851)
	Mesene cf. *bigemmis* Stichel, 1925 **
	Mesene cf. *silaris* Godman & Salvin, 1878 **
	Mesene epaphus pyrrha (H. Bates, 1868)
	Mesene leucophrys (H. Bates, 1868)
	Mesene nola Herrich-Schäffer, [1853]
	Mesene phareus (Cramer, 1777)
	Phaenochitonia pyrsodes (H. Bates, 1868)
	Pterographium thyatira (Hewitson, [1853]) **
	Symmachia accusatrix Westwood, 1851
	Symmachia estellina Gallard, 2008
	Symmachia tricolor Hewitson, 1867
Helicopini (11)	*Anteros acheus* (Stoll, 1781) **
	Anteros bracteata Hewitson, 1867 **
	Anteros formosus (Cramer, 1777)
	Ourocnemis aerosus (Stichel, 1924) **
	Ourocnemis renaldus (Stoll, 1790) **
	Sarota acanthoides (Herrich-Schäffer, [1853])
	Sarota acantus (Stoll, 1781)
	Sarota chrysus (Stoll, 1781)
	Sarota gyas (Cramer, 1775)
	Sarota lasciva (Stichel, 1911) **
	Sarota miranda Brévignon, 1998
Emesidini (8)	*Emesis angularis* Hewitson, 1870 *
	Emesis cerea (Linnaeus, 1767) **
	Emesis condigna Stichel, 1925
	Emesis diogenia Prittwitz, 1865 **
	Emesis fatimella Westwood, 1851
	Emesis mandana (Cramer, 1780)
	Emesis spreta H. Bates, 1868
	Emesis temesa (Hewitson, 1870)
Riodinini (41)	*Amarynthis meneria* (Cramer, 1776)

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Ancyluris aulestes (Cramer, 1777)
Ancyluris colubra (Saunders, 1859) **
Ancyluris etias (Saunders, 1859) **
Ancyluris meliboeus (Fabricius, 1776)
Caria mantinea (C. Felder & R. Felder, 1861)
Caria sponsa (Staudinger, [1887]) *
Caria trochilus arete (C. Felder & R. Felder, 1861)
Cariomothis erythromelas (Sepp, [1841]) **
Chalodeta chitinosa J. Hall, 2002
Chalodeta theodora (C. Felder & R. Felder, 1862)
Chamaelimnas tircis C. Felder & R. Felder, 1865
Chorinea octauius (Fabricius, 1787) **
Crocozona coecias (Hewitson, 1866) **
Detritivora cuiaba (Harvey & J. Hall, 2002)
Detritivora zama (H. Bates, 1868)
Isapis agyrtus sestus (Stichel, 1909)
Ithomeis aurantiaca H. Bates, 1862
Lasaia agesilas (Latreille, [1809])
Lasaia arsis Staudinger, [1887]
Lyropteryx apollonia Westwood, 1851 **
Melanis aegates (Hewitson, 1874)
Melanis electron (Fabricius, 1793)
Melanis marathon (C. Felder & R. Felder, 1865)
Melanis smithiae (Westwood, 1851) **
Metacharis lucius (Fabricius, 1793)
Metacharis regalis A. Butler, 1867
Monethe albertus C. Felder & R. Felder, 1862
Notheme erota (Cramer, 1780)
Panara phereclus (Linnaeus, 1758) **
Parcella amarynthina (C. Felder & R. Felder, 1865) **
Pheles heliconides heliconides Herrich-Schäffer, [1853]
Pheles incerta Staudinger, [1887] **
Rhetus arcius (Linnaeus, 1763) **
Rhetus periander (Cramer, 1777)
Riodina lysippus (Linnaeus, 1758)
Riodinini sp.
Syrmatia lamia H. Bates, 1868
Themone pais (Hübner, [1820])

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	Themone poecila H. Bates, 1868
	Themone pulcherrima (Herrich-Schäffer, [1853])
Nymphalidae (301)	
Libytheinae (1)	
	Libytheana carinenta (Cramer, 1777)
Danainae (32)	
Danaini (2)	*Lycorea halia pales* C. Felder & R. Felder, 1862
	Lycorea pasinuntia (Stoll, 1780)
Ithomiini (30)	*Aeria eurimedia eurimedia* (Cramer, 1777)
	Brevioleria aelia jamariensis (R.F. d'Almeida, 1951) **
	Callithomia alexirrhoe zeuxippe H. Bates, 1862
	Callithomia lenea epidero (H. Bates, 1862)
	Ceratinia cayana giparanaensis R.F. d'Almeida, 1964
	Dircenna loreta acreana R.F. d'Almeida, 1950
	Hypoleria alema consimilis Talbot, 1928 **
	Hyposcada anchiala cynara R.F. d'Almeida, 1945 **
	Hypothyris euclea barii (H. Bates, 1862)
	Hypothyris leprieuri ninyas R.F. d'Almeida, 1945 **
	Hypothyris maenas ssp.
	Hypothyris ninonia ssp.
	Ithomia agnosia pellucida Weymer, 1875
	Mechanitis lysimnia tapajona Freitas & Mota, 2022
	Mechanitis polymnia cf. *mauensis* W. Forbes, 1948
	Melinaea marsaeus pothete R.F. d'Almeida, 1945
	Melinaea mneme cf. *mauensis* Weymer, 1891
	Melinaea ludovica ludovica (Cramer, 1780)
	Methona confusa confusa A.G. Butler, 1873 **
	Methona grandior grandior (W.T.M. Forbes, 1944)
	Napeogenes inachia pyrois H. Bates, 1862
	Napeogenes rhezia adelphe H. Bates, 1862
	Napeogenes sylphis ithra (Hewitson, 1855)
	Oleria aegle ssp.**
	Oleria antaxis ssp.
	Oleria astrea ssp.
	Sais rosalia rosalinde Weymer, 1890
	Scada reckia labyrintha Lamas, 1985
	Thyridia psidii psidii (Linnaeus, 1758)

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	Tithorea harmonia pseudonyma Staudinger, 1894
Heliconiinae (22)	
Acreini (1)	*Actinote pyrrha crucis* Jordan, 1913
Heliconiini (20)	*Agraulis maculosa* (H.F.E.J. Stichel, [1908]) **
	Dione juno (Cramer, 1779) **
	Dryas alcionea (Cramer, 1779)
	Eueides aliphera (Godart, 1819)
	Eueides isabella dissoluta Stichel, 1903
	Eueides lybia (Fabricius, 1775)
	Eueides vibilia unifasciatus A. Butler, 1873
	Heliconius antiochus antiochus (Linnaeus, 1767)
	Heliconius aoede aoede (Hübner, [1813])
	Heliconius burneyi (Hübner, [1831])
	Heliconius doris doris (Linnaeus, 1771)
	Heliconius erato amazona Staudinger, 1897
	Heliconius eratosignis (Joicey & Talbot, 1925)
	Heliconius ethilla cf. *penthesilea* Neukirchen, 1994
	Heliconius cf. *hecale* (Fabricius, 1776)
	Heliconius numata silvana (Stoll, 1781)
	Heliconius numata superioris A. Butler, 1875
	Heliconius ricini ricini (Linnaeus, 1758)
	Heliconius sara sara (Fabricius, 1793)
	Heliconius wallacei flavescens Weymer, 1891
	Philaethria dido dido (Linnaeus, 1763)
Argynnini (1)	*Euptoieta hegesia* (Cramer, 1779) *
Limenitidinae (15)	
Limenitidini (15)	*Adelpha barnesia* Schaus, 1902 **
	Adelpha boeotia (C. Felder & R. Felder, 1867) **
	Adelpha capucinus capucinus (Walch, 1775)
	Adelpha cocala cocala (Walch, 1775)
	Adelpha cytherea cytherea (Linnaeus, 1758)
	Adelpha epione agilla Fruhstorfer, 1907
	Adelpha erotia (Hewitson, 1847) **
	Adelpha iphiclus iphiclus (Linnaeus, 1758)
	Adelpha melona (Hewitson, 1847) **
	Adelpha mesentina (Cramer, 1777)
	Adelpha paraena (H. Bates, 1865) **
	Adelpha plesaure phliassa (Godart, [1824])
	Adelpha pollina Fruhstorfer, 1915 *

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	Adelpha thesprotia (C. Felder & R. Felder, 1867) **
	Adelpha thoasa (Hewitson, 1850) **
Apaturinae (5)	
	Doxocopa agathina (Cramer, 1777)
	Doxocopa laure (Drury, 1773) **
	Doxocopa lavinia (A. Butler, 1866)
	Doxocopa linda linda (C. Felder & R. Felder, 1862)
	Doxocopa zunilda (Godart, [1824])
Biblidinae (53)	
Biblidini (1)	*Vila emilia* (Cramer, 1779)
Catonephelini (20)	*Catonephele acontius* (Linnaeus, 1771)
	Catonephele antinoe (Godart, [1824])
	Catonephele numilia (Cramer, 1775) **
	Eunica alpais alpais (Godart, [1824])
	Eunica amelia (Cramer, 1777)
	Eunica anna (Cramer, 1780)
	Eunica bechina bechina (Hewitson, 1852)
	Eunica caelina (Godart, [1824]) **
	Eunica concordia (Hewitson, 1852) **
	Eunica eurota eurota (Cramer, 1775)
	Eunica ingens Seitz, 1915
	Eunica malvina H. Bates, 1864 **
	Eunica mygdonia (Godart, [1824]) **
	Eunica orphise (Cramer, 1775)
	Eunica phasis C. Felder & R. Felder, 1862 **
	Eunica pusilla H. Bates, 1864
	Eunica sydonia (Godart, [1824]) **
	Eunica tatila bellaria Fruhstorfer, 1908
	Eunica volumna (Godart, [1824]) **
	Nessaea obrinus (Linnaeus, 1758)
Ageroniini (9)	*Ectima iona* E. Doubleday, [1848]
	Ectima thecla (Fabricius, 1796)
	Hamadryas amphinome (Linnaeus, 1767)
	Hamadryas belladonna (H. Bates, 1865) **
	Hamadryas chloe (Stoll, 1787)
	Hamadryas februa (Hübner, [1823]) *
	Hamadryas feronia (Linnaeus, 1758)
	Hamadryas laodamia (Cramer, 1777)
	Hamadryas velutina (H. Bates, 1865) **
Epiphelini (6)	*Nica flavilla* cf. *flavilla* (Godart, [1824])

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	Peria lamis (Cramer, 1779)
	Pyrrhogyra amphiro H. Bates, 1865
	Pyrrhogyra crameri Aurivillius, 1882
	Temenis laothoe (Cramer, 1777)
	Temenis pulchra (Hewitson, 1861) **
Eubagini (8)	*Dynamine agacles* (Dalman, 1823)
	Dynamine arene Hübner, [1823]
	Dynamine artemisia (Fabricius, 1793)
	Dynamine athemon (Linnaeus, 1758)
	Dynamine myrson (E. Doubleday, 1849)
	Dynamine pebana Staudinger, [1885]
	Dynamine postverta (Cramer, 1779) **
	Dynamine racidula (Hewitson, 1852) **
Callicorini (9)	*Callicore astarte* (Cramer, 1779)
	Callicore cynosura (E. Doubleday, [1847])
	Callicore hesperis (Guérin-Méneville, [1844]) **
	Callicore texa (Hewitson, [1855])
	Catagramma hystaspes hystaspes (Fabricius, 1781)
	Diaethria clymena (Cramer, 1775)
	Diaethria kolyma pasithea (Hewitson, 1864)
	Paulogramma pygas (Godart, [1824])
	Paulogramma pyracmon (Godart, [1824]) **
Cyrestinae (10)	
Cyrestini (10)	*Marpesia berania* (Hewitson, 1852)
	Marpesia chiron (Fabricius, 1775)
	Marpesia crethon (Fabricius, 1776) **
	Marpesia egina (H. Bates, 1865) **
	Marpesia furcula (Fabricius, 1793)
	Marpesia livius (W. F. Kirby, 1871) *
	Marpesia orsilochus (Fabricius, 1776)
	Marpesia petreus (Cramer, 1776) **
	Marpesia themistocles (Fabricius, 1793)
	Marpesia tutelina (Hewitson, 1852)
Nymphalinae (26)	
Coeini (5)	*Baeotus aeilus* (Stoll, 1780) **
	Baeotus deucalion (C. Felder & R. Felder, 1860) **
	Baeotus japetus (Staudinger, [1885])
	Historis acheronta (Fabricius, 1775) **
	Historis odius (Fabricius, 1775)

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Nymphalini (5)	*Colobura annulata* Willmott, Constantino & J. Hall, 2001
	Colobura dirce (Linnaeus, 1758)
	Hypanartia lethe (Fabricius, 1793) **
	Smyrna blomfildia (Fabricius, 1781) **
	Tigridia acesta (Linnaeus, 1758)
Victorinini (3)	*Anartia amathea* (Linnaeus, 1758) **
	Napeocles jucunda (Hübner, [1808]) **
	Siproeta stelenes (Linnaeus, 1758)
Junoniini (1)	*Junonia* sp. **
Melitaeini (12)	*Anthanassa drusilla* (C. Felder & R. Felder, 1861)
	Anthanassa hermas hermas (Hewitson, 1864) *
	Chlosyne lacinia (Geyer, 1837) **
	Eresia clio (Linnaeus, 1758) **
	Eresia eunice (Hübner, [1807])
	Eresia nauplius (Linnaeus, 1758)
	*Eresia perna averyona*H. Bates, 1864
	Mazia amazonica (H. Bates, 1864)
	Ortilia gentina Higgins, 1981
	Ortilia ithra (W. F. Kirby, 1900) **
	Tegosa cf. *fragilis* (H. Bates, 1864)
	Telenassa teletusa burchelli (Moulton, 1909)
Charaxinae (20)	
Anaeini (11)	*Consul fabius* ssp.
	Fountainea ryphea (Cramer, 1775) **
	Hypna clytemnestra (Cramer, 1777)
	Memphis acidalia acidalia (Hübner, [1819])
	Memphis acidalia memphis (C. Felder & R. Felder, 1867) **
	Memphis leonida (Stoll, 1782)
	Memphis moruus moruus (Fabricius, 1775) **
	Memphis philumena philumena (E. Doubleday, [1849]) **
	Polygrapha xenocrates (Westwood, 1850)
	Siderone galanthis (Cramer, 1775) **
	Zaretis isidora (Cramer, 1779)
	Zaretis strigosus (Gmelin, [1790])
Preponini (9)	*Archaeoprepona amphimachus* (Fabricius, 1775) **
	Archaeoprepona demophon (Linnaeus, 1758) **
	Archaeoprepona demophoon (Hübner, [1814])
	Archaeoprepona licomedes (Cramer, 1777)

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	Archaeoprepona meander (Cramer, 1775) **
	Mesoprepona pheridamas (Cramer, 1777)
	Prepona claudina (Godart, [1824]) **
	Prepona eugenes H. Bates, 1865 **
	Prepona laertes (Hübner, [1811])
Satyrinae (117)	
Morphini (12)	*Antirrhea philoctetes* (Linnaeus, 1758) **
	Antirrhea taygetina (A. Butler, 1868)
	Antirrhea watkinsi Rosenberg & Talbot, 1914 **
	Caerois chorinaeus (Fabricius, 1775) **
	Morpho achilles phokylides Fruhstorfer, 1912
	Morpho cisseis C. Felder & R. Felder, 1860
	Morpho deidamia (Hübner, [1819])
	Morpho helenor helenor (Cramer, 1776)
	Morpho menelaus (Linnaeus, 1758)
	Morpho rhetenor (Cramer, 1775) **
	Morpho telemachus (Linnaeus, 1758) **
	Morpho zephirytis A. Butler, 1873 *
Brassolini (18)	*Bia rebeli* Bryk, 1953
	Brassolis sophorae (Linnaeus, 1758) **
	Caligo eurilochus (Cramer, 1775) **
	Caligo idomeneus idomeneus (Linnaeus, 1758)
	Caligo illioneus (Cramer, 1775)
	Caligo teucer (Linnaeus, 1758) **
	Caligopsis seleucida (Hewitson, 1877) **
	Catoblepia berecynthia unditaenia Fruhstorfer, 1907
	Catoblepia soranus (Westwood, 1851)
	Catoblepia xanthicles (Godman & Salvin, 1881) **
	Dynastor darius (Fabricius, 1775) *
	Eryphanis automedon (Cramer, 1775)
	Narope denticulatus Talbot, 1928
	Narope panniculus Stichel, 1904
	Opoptera hilaris Stichel, 1901
	Opsiphanes invirae (Hübner, [1808])
	Opsiphanes quiteria (Stoll, 1780)
	Selenophanes cassiope (Cramer, 1775) **
Haeterini (7)	*Cithaerias bandusia* Staudinger, 1887
	Haetera piera (Linnaeus, 1758)
	Pierella astyoche stollei Ribeiro, 1931
	Pierella chalybaea Godman, 1905
	Pierella hortona (Hewitson, 1854) **

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	Pierella hyalinus hyalinus (Gmelin, [1790])
	Pierella lena lena (Linnaeus, 1767)
Melanitini (1)	*Manataria hercyna* (Hübner, [1821])
Satyrini (79)	*Amiga arnaca* (Fabricius, 1776)
	Amphidecta calliomma (C. Felder & R. Felder, 1862)
	Amphidecta pignerator A. Butler, 1867
	Amphidecta reynoldsi Sharpe, 1890 **
	Caeruleuptychia aegrota (A. Butler, 1867)
	Caeruleuptychia cf. *coelestis* (A. Butler, 1867) **
	Caeruleuptychia glauca (Weymer, 1911)
	Caeruleuptychia cf. *penicillata* (Godman, 1905)
	Caeruleuptychia cf. *scopulata* (Godman, 1905)
	Caeruleuptychia twalela Brévignon, 2005
	Caeruleuptychia umbrosa (Butler, 1870) **
	Cepheuptychia cephus (Fabricius, 1775)
	Chloreuptychia agatha (A. Butler, 1867) *
	Chloreuptychia chlorimene (Hübner, [1819])
	Chloreuptychia herseis (Godart, [1824])
	Chloreuptychia hewitsonii (A. Butler, 1867)
	Chloreuptychia marica (Weymer, 1911) **
	Chloreuptychia rectilinea Brévignon, Rosant, Lamas & Willmott, 2019
	Chloreuptychia tolumnia (Cramer, 1777)
	Cisandina lea (Cramer, 1777)
	Cissia maripa (Brévignon, 2005)
	Cissia myncea (Cramer, 1780)
	Cissia penelope (Fabricius, 1775)
	Cissia proba (Weymer, 1911)
	Cristalinaia vitoria Mota, Zacca & Freitas, 2019
	Erichthodes antonina (C. Felder & R. Felder, 1867)
	Euptychia mollina (Hübner, [1813])
	Euptychia cf. *picea* A. Butler, 1867
	Euptychia sp.
	Euptychia westwoodi A. Butler, 1867
	Harjesia blanda (Möschler, 1877) **
	Harjesia cf. *obscura* (A. Butler, 1867)
	Hermeuptychia sp.1
	Hermeuptychia sp.2
	Macrocissia iris (C. Felder & R. Felder, 1867)
	Magneuptychia ca. *analis*

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Magneuptychia harpyia batesii (A. Butler, 1867)
Magneuptychia lethra (H.B. Möschler, 1883)
Magneuptychia ocypete (Fabricius, 1776)
Magneuptychia tricolor(Hewitson, 1850)
Malaveria affinis (A. Butler, 1867)
Megeuptychia antonoe (Cramer, 1775)
Modestia cf. *modesta* (A. Butler, 1867) **
Nubila moderata (Weymer, 1911)
Pareuptychia binocula (A. Butler, 1869)
Pareuptychia lydia (Cramer, 1777)
Pareuptychia ocirrhoe (Fabricius, 1776)
Paryphthimoides brixius (Godart, [1824])
Paryphthimoides poltys(Prittwitz, 1865)
Paryphthimoides sylvina (C. Felder & R. Felder, 1867)
Paryphthimoides terrestris muyrakytan Zacca, Casagrande & Mielke, 2020
Posttaygetis penelea (Cramer, 1777)
Pseudodebis celia (Cramer, 1779)
Pseudodebis valentina (Cramer, 1779)
Sepona punctata (Weymer, 1911)
Splendeuptychia clorimena (Stoll, 1790) **
Splendeuptychia itonis (Hewitson, 1862)
Splendeuptychia salvini (A. Butler, 1867) *
Splendeuptychia sp.1
Splendeuptychia sp.3
Splendeuptychia sp.4
Splendeuptychia sp.2
Splendeuptychia tupinamba Freitas, Huertas & Rosa, 2021
Splendeuptychia zischkai Forster, 1964
Taygetina gulnare (A. Butler, 1870)
Taygetina sp.
Taygetis angulosa Weymer, 1907
Taygetis echo (Cramer, 1775)
Taygetis laches (Fabricius, 1793)
Taygetis larua C. Felder & R. Felder, 1867
Taygetis mermeria (Cramer, 1776)
Taygetis sosis Hopffer, 1874
Taygetis sylvia H. Bates, 1866
*Taygetis tripunctata*Weymer, 1907
Taygetis cf. *virgilia* (Cramer, 1776)
Taygetis sp.
Yphthimoides eriphule (A. Butler, 1867)

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	Yphthimoides renata (Stoll, 1780)
	Zischkaia baku Zacca, Dolibaina & Dias, 2019
Hesperiidae (314)	
Eudaminae (89)	
Entheini (15)	*Augiades crinisus* (Cramer, 1780)
	Augiades vespasius bicolor (Mabille & Boullet, 1919)
	Drephalys alcmon (Cramer, 1780) **
	Drephalys dumeril (Latreille, [1824])
	Drephalys eous (Hewitson, 1867)
	Drephalys oriander (Hewitson, 1867)
	Entheus priassus priassus (Linnaeus, 1758) **
	Hyalothyrus infernalis (Möschler, 1877) *
	Hyalothyrus leucomelas (Geyer, 1832)
	Hyalothyrus neleus neleus (Linnaeus, 1758)
	Phanus marshalli (W. F. Kirby, 1880)
	Phanus vitreus (Stoll, 1781)
	Tarsoctenus corytus corba Evans, 1952 **
	Tarsoctenus praecia plutia (Hewitson, 1857) **
	Udranomia kikkawai (Weeks, 1906) **
Eudamini (51)	*Astraptes enotrus* (Stoll, 1781) **
	Autochton bipunctatus (Gmelin, [1790]) **
	Autochton neis (Geyer, 1832) **
	Aguna asander asander (Hewitson, 1867)
	Aguna squamalba Austin & O. Mielke, 1998
	Cephise maculatus Austin & Mielke, 2000 **
	Cecropterus sp. **
	Cecropterus zarex (Hübner, 1818)
	Cecropterus albimargo (Mabille, 1875) *
	Cecropterus doryssus doryssus (Swainson, 1831)
	Cecropterus reductus (Riley, 1919) **
	Cecropterus dorantes dorantes (Stoll, 1790) **
	Cecropterus virescens (Mabille, 1877)
	Ectomis auginus (Hewitson, 1867)
	Ectomis caunus (Herrich-Schäffer, 1869)
	Ectomis labriaris (Butler, 1877) **
	Ectomis metallescens (Mabille, 1888) **
	Ectomis octomaculata (Sepp, [1844]) **
	Ectomis orpheus (Plötz, 1881)
	Ectomis otriades (Hewitson, 1867)
	Ectomis perniciosus (Herrich-Schäffer, 1869) **

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	Ectomis pervivax (Hübner, [1819]) **
	Ectomis teutas (Hewitson, 1876) *
	Epargyreus clavicornis clavicornis (Herrich-Schäffer, 1869)
	Epargyreus exadeus (Cramer, 1779)
	Narcosius narcosius (Stoll, 1790)
	Polygonus leo pallida Röber, 1925 **
	Proteides mercurius mercurius (Fabricius, 1787) **
	Spicauda cindra (Evans, 1952)
	Spicauda simplicius (Stoll, 1790)
	Spicauda tanna (Evans, 1952) **
	Spicauda teleus (Hübner, 1821)
	Spicauda sp.
	Telegonus alector hopfferi (Plötz, 1881)
	Telegonus anaphus anaphus (Cramer, 1777)
	Telegonus cretatus cretatus Hayward, 1939
	Telegonus apastus apaustus (Cramer, 1777) **
	Telegonus chalco (Hübner, 1823) *
	Telegonus fulgerator (Walch, 1775)
	Telegonus talus (Cramer, 1777)
	Telemiades amphion (Geyer, 1832)
	Telemiades antiope (Plötz, 1882) **
	Telemiades avitus (Stoll, 1781)
	Telemiades delalande (Latreille, [1824])
	Telemiades epicalus Hübner, [1819]
	Telemiades penidas (Hewitson, 1867)
	Urbanus esma Evans, 1952 **
	Urbanus esmeraldus (Butler, 1877)
	Urbanus pronta Evans, 1952
	Urbanus proteus proteus (Linnaeus, 1758)
	Urbanus velinus (Plötz, 1880)
Oileidini (6)	*Cogia calchas* (Herrich-Schäffer, 1869) **
	Cogia crameri (McHenry, 1960) **
	Cogia galbula (Plötz, 1880) **
	Cogia undulatus (Hewitson, 1867) **
	Marela tamyris Mabille, 1903 **
	Marela tamyroides (C. Felder & R. Felder, 1867) *
Phocidini (17)	*Aurina azines* (Hewitson, 1867)
	Bungalotis astylos (Cramer, 1780) **
	Bungalotis midas (Cramer, 1775)
	Dyscophellus porcius porcius (C. Felder & R. Felder, 1862) **

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	Dyscophellus ramusis ramusis (Stoll, 1781)
	Dyscophellus sebaldus (Stoll, 1781) **
	Euriphellus euribates (Stoll, 1782)
	Nascus broteas (Cramer, 1780)
	Nascus paulliniae (Sepp, [1842]) **
	Nascus phocus (Cramer, 1777)
	Nascus solon solon (Plötz, 1882) *
	Nicephellus nicephorus (Hewitson, 1876)
	Phareas coeleste Westwood, 1852
	Phocides pigmalion pigmalion (Cramer, 1779)
	Porphyrogenes sororcula (Mabille & Boullet, 1912)
	Salatis salatis (Stoll, 1872) **
	Sarmientoia sp. **
Pyrginae (65)	
Achlyodini (21)	*Achlyodes busirus busirus* (Cramer, 1779)
	Aethilla echina echina Hewitson, 1870
	Cabirus procas procas (Cramer, 1777)
	Charidia lucaria ssp. **
	Eantis thraso (Hübner, [1807])
	Grais stigmaticus stigmaticus (Mabille, 1883)
	Livida assecla (Mabille, 1883) **
	Milanion sp.
	Morvina morvus cyclopa Evans, 1953
	Myrinia catua O. Mielke, 1968 **
	Ouleus friderichus friderichus (Geyer, 1832) **
	Ouleus juxta dampa Evans, 1953 **
	Pseudodrephalys sohni Burns, 1999 **
	Pythonides homer Evans, 1953
	Pythonides jovianus crameri (Mabille & Boullet, 1917)
	Pythonides lerina (Hewitson, 1868)
	Quadrus cerialis (Stoll, 1782)
	Quadrus contubernalis contubernalis (Mabille, 1883) **
	Quadrus fanda Evans, 1953
	Quadrus sp.
	Spioniades artemides (Stoll, 1782) *
Carcharodini (10)	*Conognathus platon*C. Felder & R. Felder, 1862 **
	Cornuphallus onoribo (Möschler, 1883)
	Cyclosemia sp. **
	Nisoniades brunneata (Williams & Bell, 1939) **

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	Nisoniades macarius (Herrich-Schäffer, 1870) **
	Nisoniades mimas (Cramer, 1775)
	Pachyneuria sp. **
	Pellicia sp.
	Polyctor polyctor polyctor (Prittwitz, 1868)
	Sophista aristoteles (Westwood, 1852) **
Erynnini (24)	*Anastrus neaeris narva* Evans, 1953
	Anastrus virens virens Austin, 1999 *
	Anaxas petius petius (Möschler, 1877)
	Camptopleura auxo (Möschler, 1879)
	Camptopleura impressus (Mabille, 1889) *
	Chiomara mithrax (Möschler, 1879) **
	Cycloglypha sp. **
	Cycloglypha thrasibulus thrasibulus (Fabricius, 1793)
	Cycloglypha tisias (Godman & Salvin, 1896)
	Ebrietas anacreon anacreon (Staudinger, 1876)
	Ebrietas elaudia livius Mabille, 1898
	Ebrietas infanda (Butler, 1877)
	Echelatus sempiternus simplicior (Möschler, 1877) **
	Festivia festiva (Erichson, [1849])
	Gorgythion begga pyralina (Möschler, 1877)
	Gorgythion plautia (Möschler, 1877)
	Helias phalaenoides palpalis (Latreille, [1824])
	Hoodus exstincta (Mabille & Boullet, 1917) **
	Hoodus pelopidas (Fabricius, 1793)
	Hoodus simplex (Austin, 2000) **
	Mylon maimon (Fabricius, 1775)
	Sostrata bifasciata bifasciata (Ménétriés, 1829) **
	Sostrata pusilla pusilla Godman & Salvin, 1895
	Tolius tolimus robigus(Plötz, 1884)
Pyrgini (10)	*Burnsius orcus* (Stoll, 1780)
	Carrhenes chaeremon (Mabille, 1891)
	Heliopetes arsalte (Linnaeus, 1758)
	Heliopetes orbigera (Mabille, 1888) **
	Heliopetes petrus (Hübner, [1819])
	Paches exosa (Butler, 1877) **
	Paches liborius liborius Plötz, 1884 **
	Plumbago plumbago (Plötz, 1884) *
	Santa santes (Bell, 1940) **
	Xenophanes tryxus (Stoll, 1780)

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Pyrrhopyginae (22)	
Passovini (5)	*Agara assaricus assaricus* (Cramer, 1779)
	Aspitha agenoria agenoria (Hewitson, 1876) **
	Myscelus nobilis (Cramer, 1777) **
	Passova glacia Evans, 1951 **
	Passova passova passova (Hewitson, 1866)
Pyrrhopygini (17)	*Croniades pieria pieria* (Hewitson, 1857)
	Gunayan rubricollis (Sepp, [1841]) *
	Jemadia hospita hospita (Butler, 1877) **
	Jemadia hewitsonii hewitsonii (Mabille, 1878)
	Jemadia gnetus gnetus (Fabricius, 1781) **
	Jemadia sp. **
	Microceris azeta azeta (Hewitson, 1866) **
	Microceris blanda (Evans, 1951) **
	Microceris rondonia (Mielke, 1995)
	Microceris intersecta intersecta (Herrich-Schäffer, 1869)
	Mimoniades fallax fida (Evans, 1951) **
	Mysoria sejanus stolli O. Mielke, 2002
	Parelbella sp. **
	Pyrrhopyge sergius semana Evans, 1951
	Pyrrhopyge sp.1 **
	Pyrrhopyge sp.2 **
	Yanguna thelersa (Hewitson, 1866) **
Tagiadinae (3)	
Celaenorrhinini (3)	*Celaenorrhinus astrigera* (Butler, 1877)
	Celaenorrhinus autochton Steinhauser & Austin, 1996
	Celaenorrhinus jao (Mabille, 1889)
Hesperiinae (135)	
Hesperiini (130)	*Adlerodea mineira* O. Mielke, 1968
	Adlerodea sp.
	Aides aegita (Hewitson, 1866)
	Aides brino (Stoll, 1781) **
	Aides duma duma Evans, 1955
	Anthoptus epictetus (Fabricius, 1793)
	Anthoptus insignis (Plötz, 1882)
	Artines bamba Medeiros & O. Mielke, 2019
	Callimormus alsimo (Möschler, 1883)
	Callimormus corades (C. Felder, [1863]) **
	Callimormus saturnus (Herrich-Schäffer, 1869) **

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Calpodes antoninus (Latreille, [1824])
Calpodes esperi esperi (Evans, 1955)
Calpodes ethlius (Stoll, 1782) **
Calpodes longirostris (Sepp, [1840])
Calpodes nigel (Evans, 1955) **
Calpodes salius (Cramer, 1775)
Calvetta calvina (Hewitson, 1866)
Cantha calva Evans, 1955
Carystoides basoches (Latreille, [1824]) **
Carystoides cathaea (Hewitson, 1866)
Carystoides noseda (Hewitson, 1866) **
Carystoides yenna Evans, 1955 **
Carystus hocus Evans, 1955
Carystus lota (Hewitson, 1877) **
Carystus moeros (Möschler, 1877) **
Chloeria psittacina (C. Felder & R. Felder, 1867) **
Cobalopsis nero (Herrich-Schäffer, 1869) **
Cobalopsis valerius (Möschler, 1879)
Cobalus virbius virbius (Cramer, 1777)
Conga chydaea (Butler, 1877)
Cyclosma altama (Schaus, 1902) **
Cymaenes alumna (Butler, 1877)
Cynea popla Evans, 1955
Damas clavus (Herrich-Schäffer, 1869)
Decinea sp. **
Dion uza (Hewitson, 1877) **
Dubia dubia (Bell, 1932)
Dubiella dubius (Stoll, 1781)
Ebusus ebusus ebusus (Cramer, 1780) *
Eprius veleda veleda (Godman, 1901) **
Eutocus vetulus vinda Evans, 1955
Eutus mubevensis (Bell, 1932)
Evansiella cordela (Plötz, 1882) **
Flaccilla aecas (Stoll, 1781)
Gallio seriatus (Mabille, 1891)
Justinia justinianus justinianus (Latreille, [1824]) **
Justinia maculata (Bell, 1930)
Lento apta Evans, 1955
Lento lento (Mabille, 1878)
Lento lora Evans, 1955

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Lento ludo Evans, 1955 **
Lerema geisa geisa (Möschler, 1879)
Lindra sp.
Lychnuchus demon (Evans, 1955)
Methionopsis ina (Plötz, 1882)
Metrocles cotundo (Nicolay, 1980)
Metrocles sp. **
Metron chrysogastra chrysogastra (Butler, 1870)
Misius misius (Mabille, 1891) **
Mnasicles hicetaon Godman, 1901
Mnasicles sp.
Mnasitheus forma Evans, 1955
Mnasitheus sp.
Naevolus orius (Mabille, 1883) **
Neoxeniades cincia (Hewitson, 1867) **
Niconiades peri (Evans, 1955) **
Niconiades yoka Evans, 1955
Nyctelius nyctelius nyctelius (Latreille, [1824]) **
Onophas columbaria columbaria (Herrich-Schäffer, 1870) **
Orthos orthos minka Evans, 1955
Oxynthes corusca (Herrich-Schäffer, 1869) **
Panca trogon (Evans, 1955)
Panoquina fusina viola Evans, 1955
Panoquina hecebolus (Scudder, 1872)
Panoquina lucas lucas (Fabricius, 1793)
Panoquina pauper grapte (H. Druce, 1908) **
Paracarystus menestries rona (Hewitson, 1866)
Pares pares (Bell, 1959)
Parphorus decora (Herrich-Schäffer, 1869)
Parphorus sp.
Peba verames (Schaus, 1902)
Phanes almoda (Hewitson, 1866)
Phemiades pohli pohli (Bell, 1932) **
Pheraeus honta Evans, 1955
Pheraeus maria Steinhauser, 1991
Pheraeus sp.
Phlebodes buriti O. Mielke, 1968
Phlebodes fuldai (Bell, 1930) **
Pompeius pompeius (Latreille, [1824])

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Propapias sipariana (Kaye, 1925)
Psoralis arva (Evans, 1955)
Psoralis visendus (Bell, 1942) **
Pyrrhopygopsis socrates crates Mabille & Boullet, 1912 **
Quasimellana angra (Evans, 1955)
Quasimellana eulogius (Plötz, 1882) **
Saturnus reticulata meton (Mabille, 1891)
Saturnus saturnus saturnus (Fabricius, 1787)
Sodalia sodalis (Butler, 1877)
Synapte malitiosa pericles (Möschler, 1879)
Synapte silius (Latreille, [1824])
Talides sp. **
Thargella caura caura (Plötz, 1882)
Thargella volasus (Godman, 1901)
Thespieus dalman (Latreille, [1824])
Thoon modius (Mabille, 1889)
Thracides cleanthes telmela (Hewitson, 1866)
Thracides phidon (Cramer, 1779) **
Thracides thrasea (Hewitson, 1866)
Tirynthoides lotana (Butler, 1870) **
Tirynthoides virilis (Riley, 1929) **
Tisias sp. 1 **
Tisias sp. 2
Tricrista taxes (Godman, 1900)
Troyus marcus (Fabricius, 1787)
Turesis basta Evans, 1955
Turesis complanula (Herrich-Schäffer, 1869)
Vacerra evansi Hayward, 1938
Vehilius inca (Scudder, 1872)
Vehilius stictomenes stictomenes (Butler, 1877)
Vehilius vetula (Mabille, 1878)
Venas caerulans (Mabille, 1878) **
Vertica verticalis grandipuncta (Mabille, 1883)
Vettius lafrenaye pica (Herrich-Schäffer, 1869) **
Vettius phylus phylus (Cramer, 1777)
Vettius triangularis (Hübner, [1831])
Vinius exilis phellus (Mabille, 1883)
Xeniades orchamus (Cramer, 1777) **
Xeniades putumayo (Constantino & Salazar, 2013) **

Continue...

...Continuation

	Zenis minos (Latreille, [1824])
Pericharini (5)	*Orphe gerasa* (Hewitson, 1867) *
	Orphe vatinius Godman, 1901 **
	Orses cynisca (Swainson, 1821) **
	Perichares adela (Hewitson, 1867)
	Perichares butus (Möschler, 1877) **

The total richness of butterflies in the region was estimated to be from 1038 to 1204 species when the number of recorded Nymphalidae was used as a predictor, and from 652 to 698 species when the group used was Ithomiini.

Discussion

This study is one of the few to provide an extensive list of the butterflies of a Brazilian Amazon Forest locality, and the first in Brazil to surpass 1000 species. This results from the combined efforts of many researchers and citizen scientists, over more than two decades, to document the butterfly fauna of a diverse region. The 1010 recorded species and the estimates for the total number of species present in the area (see below) represent between one quarter and one third of the 3522 butterfly species (including 23 Hedylidae) known to occur in Brazil (Casagrande 2022), a proportion similar to that of the well-known avifauna of the region (Lees et al. 2013). The species recorded also surpass the total diversity of butterflies of the State of Mato Grosso in the thorough assessment by Queiroz-Santos et al. (2016), which found a total of 901 species recorded in the State, and confirms their suggestion of the need for intensive inventories of its northernmost, Amazonian portion. For two families, Hesperiidae and Lycaenidae, we recorded more species than were represented in the previous list from the whole of Mato Grosso, with a remarkable 314 species at Cristalino compared with 148 species from Mato Grosso for Hesperiidae, and 123 versus 77 for Lycaenidae. These two families were precisely the ones that Queiroz-Santos et al. (2016) expected to be the most underrepresented in their study. A quick and conservative look through their database, considering unknown subspecies or other ambiguities in both lists as representing the same taxa, reveals that the Cristalino Lodge list adds more than 360 species to the previously reported State total. As expected, the present list is responsible for an important extension in the known distribution of several species (examples in Figure 3).

Amazonian butterfly communities are known to have high turnover rates and a high proportion of species that are rare and hard to detect; therefore, high sampling effort and long-term sampling, spanning several years, are required to produce representative inventories (Brown & Hutchings 1997, Mielke et al. 2010, Lamas et al. 2021). Considering that the sampling effort at Cristalino Lodge has been relatively high and includes not only collected specimens but also images made through more than fifteen years by several citizen scientists, covering different trails, vegetation types and in both dry and wet seasons, this list can be regarded as relatively complete for an Amazonian butterfly fauna. However, for the reasons already mentioned, we still expect many future additions to the list, especially among the Hesperiidae, Riodinidae and Lycaenidae, and that is supported by the fact that several new photographic species records have been made after the first assessment through the iNaturalist project, mostly of rare, small riodinids and lycaenids. Also, in Neotropical forests, the family Hesperiidae is typically found to be the richest at every site with nearly complete lists, while the Nymphalidae is usually the richest in sites with less complete lists because the latter are easier to collect and identify (Brown & Freitas 2002, Francini et al. 2011). In our study, these two families have a rather equivalent richness, which indicates that there are still likely a number of Hesperiidae species in the region that have gone undetected, probably mostly among the fast-flying canopy species. Future collecting in the region should therefore focus on Hesperiidae and the use of the Ahrenholz method.

The total species richness estimates were substantially different according to the taxonomic group used as a predictor. The number of recorded Nymphalidae suggested that there are from 1038 to 1204 butterfly species at Cristalino Lodge, and that we should still expect something between 30 to 200 additional species. However, using the number of Ithomiini, the total species richness would be from 652 to 698 species, which is considerably lower than the actual number of species already recorded. This result does not seem to be linked to undersampling of this group, which is well-known for being locally abundant and easy to detect, collect and photograph. As an example, with a lower sampling effort, Mielke et al. (2010) found 35 Ithomiini species at Chandless State Park, Acre, Brazil and KSB and AVLF recorded more than 70 species of Ithomiini in a two day census in a locality in the upper Juruá river, Acre, Brazil (unpublished data). Instead, the Cristalino fauna seems to be particularly poor in its proportion of ithomiines, with only 30 species known, a mere 3% of the total recorded butterfly richness. This is in accordance with Brown & Freitas (2000), who indicated that the proportion of Ithomiini presents a great variance, ranging from 2% to 6% of the total butterfly species richness in the Atlantic Forest, and reaching a maximum of 8% in the east Andean slopes. This result suggests that the tribe Ithomiini is not necessarily a good surrogate of butterfly species richness in neotropical forests, and calls attention to the importance of considering the characteristics of each region's fauna in terms of using a taxon or guild for this kind of estimate. Since the Ithomiini is a tribe of Nymphalidae it is possible that other nymphalid groups are under-represented in comparison with other regions, but it seems clear that using Nymphalidae to estimate overall diversity is likely to be more precise. It may thus be assumed that we have recorded at least 80% of the butterfly species of Cristalino. Although this estimate should be used carefully, we believe it is safe to consider this list as a good illustration of the diversity and distribution patterns of this region (the small representation of Ithomiini being an example), and to compare it to other areas.

Relative to the other tropical forest biome in Brazil, the Atlantic Forest, Cristalino Lodge presents a higher number of species than the richest localities (Brown & Freitas 2000, Dolibaina et al. 2010, Francini et al. 2011). As for the Amazon Forest, it is not as rich as areas in western Amazonia, such as Tambopata and Pakitza in Peru or Cacaulândia and Marechal Thaumaturgo in the Brazilian states of Rondônia and Acre (Lamas 1985, Robbins et al. 1996, Brown & Freitas 2002, respectively, see also Brown 2005 for other equally rich localities in western Amazonia). Therefore, although the present butterfly inventory is currently the richest for a locality in Brazil, it is expected that it will be surpassed when lists of sufficiently sampled

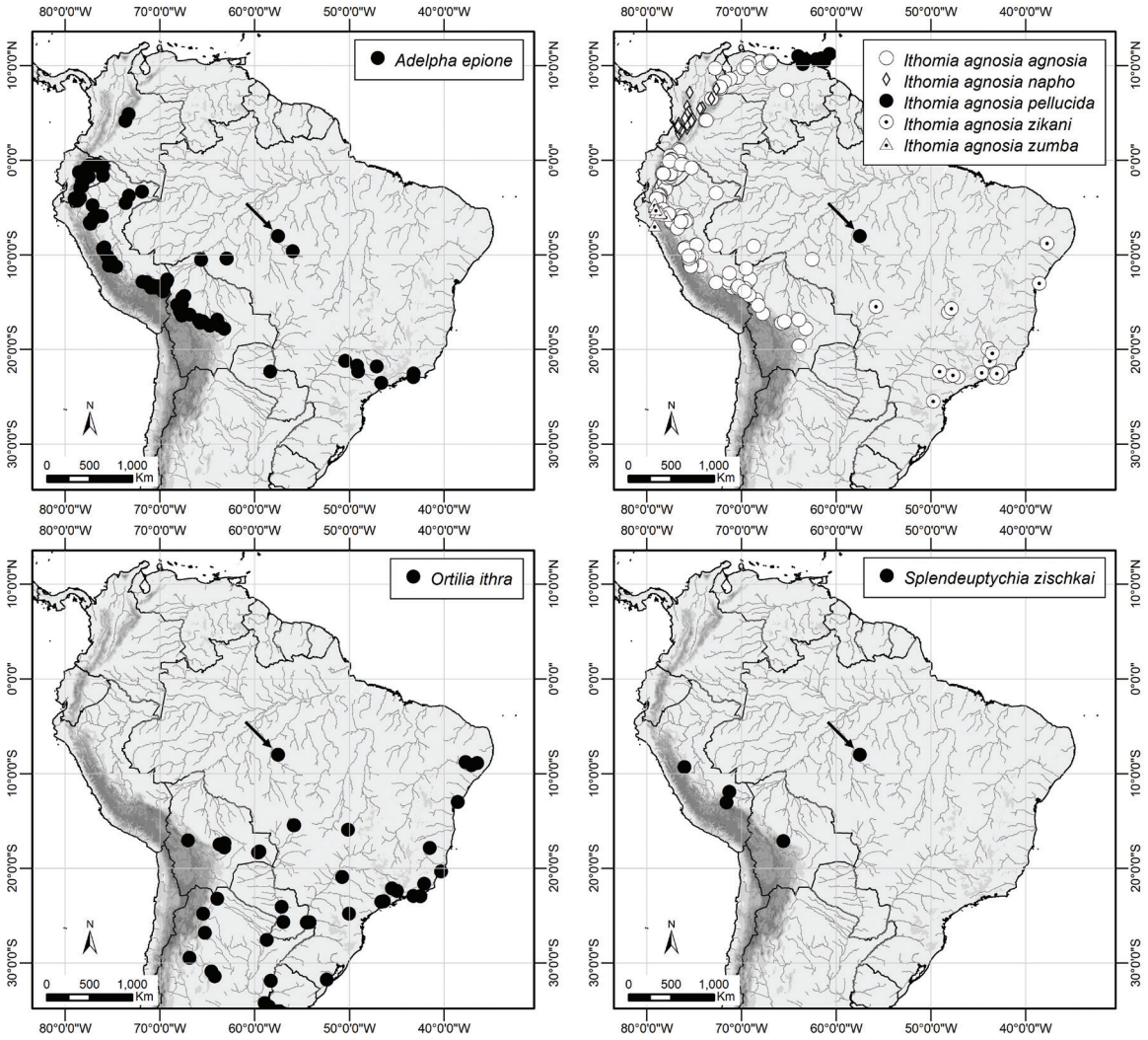

Figure 3. Distribution map for some butterfly species with notable range extensions documented at Cristalino Lodge (arrows).

regions in the Brazilian western Amazonia are published. At the same time, the region of Manaus, in central Amazonia, is known to be less rich, with about 800 estimated species (Brown 1984). Factors such as soil richness, proximity to the Andes and environmental heterogeneity have been proposed as important to determine the butterfly richness of Amazonian localities (Brown 1984). The Cristalino region has poorer soils than rich areas in Acre and Rondônia, and is much more distant to the Andes than Tambopata and even the aforementioned Brazilian states, thus being less under the influence of the diverse Andean fauna. The latter factor could be especially important for the Ithomiini, since the Andes is the area where this tribe is the richest and many of its groups originated and diversified (Chazot et al. 2016, 2018). Such an influence, however, is not completely absent: interestingly, the Andean *Morpho zephyritis* A. Butler, 1873, cited by Brown (1984) as an occasional visitor in Jaru, Rondônia, has also been recorded at Cristalino. At the same time, the great environmental heterogeneity and different vegetation types found in Cristalino could explain in part why it is a richer site than Manaus for butterflies.

The butterfly fauna found in Cristalino is mostly composed of species widely distributed in the lowland Amazon Forest, with some notable absences: for example, the widespread Amazonian genera *Asterope* Hübner, [1819], *Panacea* Godman & Salvin, 1883 and *Batesia* C. Felder & R. Felder, 1862 (Nymphalidae) have never been observed in the region. Conversely, the Cristalino region also harbors several species that are typical of southern biomes such as the Cerrado and the Atlantic Forest. That is the case with *Arawacus tarania* (Hewitson, 1868) (Lycaenidae), a species of open Cerrado vegetation, and of the newly described *Splendeuptychia tupinamba* Freitas, Huertas & Rosa, 2021 (Nymphalidae), found primarily in the Cerrado but also in the Atlantic Forest and some localities in southwest Amazonia (Rosa et al. 2021). Another good example is the presence of *Ortilia ithra* (W. F. Kirby, 1900) (Nymphalidae); this species is widespread through the Atlantic Forest and in riparian forest in the Cerrado domain and the present record is the northernmost and the first in the Amazon Forest (Figure 3). In addition, the Hesperiidae *Pythonides homer* Evans, 1953 and *Lento apta* Evans, 1955 were both considered endemics of the Cerrado, usually found in riparian forests (Mielke et al. 2008). However, it is unknown if these elements from the southern biomes are part of an original mixed fauna or recent invaders following the open areas created with the advance of agriculture and cattle ranching. It is likely that the presence of these

species is due to the region being relatively close to the southern border of Amazonia and having patches of deciduous and semi-deciduous vegetation with influence from the Cerrado flora (Zappi et al. 2011). Several other butterflies from open vegetation are widely distributed species, such as *Junonia* sp. and *Euptoieta hegesia* (Cramer, 1779), both found in the deciduous forest fragments, while many common Neotropical pierids follow the river margins, where they puddle (figure 1c). The bamboo forests have an important community of Euptychiina associated with them, probably due the use of bamboo as hostplants by many species (See et al. 2018, Freitas et al. 2019). The Ithomiini and their mimics reveal that the region is heavily influenced by the Tapajós center of endemism and a little by the Rondônia center, with some undescribed subspecies (Brown 1979, 1982). The list presents two cases of species with more than one recorded subspecies, the nymphalids *Heliconius numata* and *Memphis acidalia*. The first is a polymorphic species that participates in several mimicry rings and is known to have as many as seven forms in a single locality (Brown & Benson 1974). Therefore, even though the forms found at Cristalino Lodge are currently treated as subspecies, they represent the expected polymorphism found in *H. numata.* In contrast, the reason why two subspecies of *M. acidalia* have been recorded is not known, but it is possible, for instance, that the region is close to the distribution limits between them.

None of the butterflies recorded at the site is listed as endangered, which is unsurprising since the only butterfly species in the Brazilian Amazon Forest considered to be threatened is *Parides klagesi* (Ehrmann, 1904), which is found in a small area very distant to Cristalino (Freitas et al. 2018). However, it is important to emphasize that, as noted by Freitas & Marini-Filho (2011), the low numbers of Amazonian butterfly species regarded as threatened could partly result from poor knowledge about the distribution of Amazonian species. In particular, the degree to which rarer species, such as *Splendeuptychia tupinamba*, occupy sites within their extent of occurrence, is critical for estimating global range and population size and threat status. In addition, Silva et al. (2005) showed that habitat loss is not homogeneous among terrestrial vertebrate centers of endemism, which somewhat correspond to those of butterflies (Brown 1979, Tyler et al. 1994, Hall & Harvey 2002). This fact, combined with the large total area of long-term degraded forests (Matricardi et al. 2020), the recent increase in deforestation of the Amazon Forest in Brazil (INPE, 2020), and the perspective of future savannization of forest areas if certain temperature and deforestation "tipping-points" are achieved (Nobre et al. 2016, Sales et al. 2020), means that Amazonian butterfly species and subspecies could already be or become endangered in the future. This is especially true if there are any butterflies endemic to the region of the arch of deforestation, which encompasses the southern Amazon border. It is clear that more inventories and distribution data on the Amazonian butterfly fauna are needed not only to better understand its diversity patterns and the factors that determine them, but also how it is responding and will respond to anthropogenic changes in the region.

Images of live butterflies available on the internet contributed an impressive proportion of the present species list (virtually one third), and were especially important for a representative inventory of Hesperiidae and Lycaenidae. Photographic records include rare and undescribed taxa, which reinforces the value of photographic data for tropical butterflies (Mesaglio et al. 2021). It is important to note that the use of photographic records for butterfly species lists has limitations, since not all species can be identified based on images only, and, even for those that can, a precise identification depends also on the image quality and aspects such as the butterfly's position. Such limitations and the necessities for the identification of each taxon are often unknown to the general public, which is probably the reason behind the presence of a great number of images labeled with wrong or uncertain identifications on the internet. It also seems possible that the identification of some key pictures (i.e., shared in many sources or in a few relevant ones) is frequently copied for records of similar looking specimens, leading to a cascade of misidentified images that could be confusing for citizen scientists. However, as noticed by Mesaglio et al. (2021), the iNaturalist platform is used by many knowledgeable, professional and amateur taxonomists, who contribute with hundreds or even thousands of identifications on their groups of interest. Therefore, identifications of images available on this platform are often corrected, justified, discussed, or have comments regarding their uncertainty. For these reasons, it is extremely important that the use of photographic records for butterfly inventories, as well as other areas of research, is made with caution and the aid of specialists (which might include the ones that use iNaturalist), and that the identification methods are made clear to readers. The source of the images used should also be explicit, so identifications can be disputed or corrected in the future, in the same way as with collected specimens deposited in collections. Overall, our study shows that images can be invaluable for butterfly species lists, and, even if many of them are not identified to species-level, they at least give an idea of the characteristics of the fauna found in a certain region, and even serve as a guideline for what researchers should look for in further visits to the location. Future studies should help clarify the extent to which live-specimen images are informative for different taxonomic groups and localities.

Although ecotourists not focusing on butterfly watching generated hundreds of pictures of butterflies at Cristalino, providing important data that can be used in future studies in fields such as ecology and behavior, this huge amount of information contributed few new records (not present among the collected specimens) of butterfly species for the region. One possible reason is that tourists typically focus on big, colorful, and easy-to-photograph specimens, thus tending to record the same common or flashy species. We found that the majority of new records come from expert butterfly watchers and tour guides, who together contributed more than 300 species for the total list. This is similar to what was found by Mesaglio et al. (2021), and many of the iNaturalist users (including both photographers and identifiers) cited there also participated in the project "Butterflies of Cristalino Lodge" in this platform. Butterfly watchers and tour guides: a) are interested in high numbers of records, with an emphasis on the new and rare species; b) are familiar with specific scientific knowledge, searching for information about behavior and taxonomy in the literature, and often (but not necessarily) having a degree in environment-related areas; c) are enthusiastic about sharing their records and knowledge, including in online platforms, and communicating with researchers and other interested people; and d) accumulate thousands of hours of field experience in either one or several localities. We believe that there is huge potential for greater communication between scientists and taxon-oriented ecotourists (such as butterfly watchers) and tour guides, with their knowledge and experience being both backed up by and supporting research in creative ways. In particular, photographers

are able to visit and document butterflies in many areas that are not open to researchers wishing to collect specimens because of the time or complexities in obtaining the necessary research permits, and potentially the expense to access field sites. Fortunately, butterfly taxonomy is sufficiently advanced in most groups for many images to be identified, and photographic contributions have extended even to the discovery of new species (e.g., Willmott et al. 2020).

Finally, this study lists the butterflies known from the private reserves associated with an ecolodge and an environmental foundation. Without the existence of these institutions, it is unlikely that the butterfly fauna of this region would have been the subject of so many photographers and visiting researchers. Ecotourism facilities thus can provide access to and infrastructure in areas that would be otherwise remote, giving support for citizen scientists (and, in cases such as that presented here, formal scientific researchers) to reach these areas. Responsible ecotourism initiatives therefore can link themes such as environmental education, conservation, and science, and become a basis for unusually complete and long-term occurrence data, especially for charismatic groups such as butterflies.

Supplementary Material

The following online material is available for this article:

Table S1 - Butterflies and moth-butterflies (Papilionoidea) of Cristalino Lodge recorded only through pictures. Indicates the photographers, picture sources (including links, when available), and species identifiers.

Acknowledgements

We thank Cristalino Lodge, Fundação Ecológica Cristalino, Vitoria da Riva, Alex da Riva and the lodge's staff for logistical support and the excellent conservation efforts. We thank everyone who has shared pictures of butterflies of Cristalino Lodge in public platforms or published them in books. Diego Ferreira da Silva and Julia Leme Pablos helped in fieldwork. We thank the invaluable help of many researchers who provided identifications: Carla Penz (*Eryphanis*), Cristophe Faynel (*Oenomaus*), Fernando Dias (Charaxinae), James Mallet (*Heliconius*), Jason Hall (Riodinidae), Jorge Bizarro (*Doxocopa linda*), Lucas Kaminski (Riodinidae), Mario Marín (*Pareuptychia*), Mirna Casagrande (*Narope*), Neil Rosser (*Heliconius*), Noemy Seraphim Pereira (Riodinidae and also fieldwork), Renato Ramos (Heliconiini), Simeão Moraes (Hedylidae) and Thamara Zacca (Satyrinae). Lucas Kaminski also shared important information about his personal records. Blanca Huertas kindly shared data on the distribution of *Ortilia ithra* from the Tropical Andean Butterfly Diversity Project and the Natural History Museum. LLM thanks CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil) for a PhD scholarship (Finance Code 001) and Santander for a mobility scholarship (DERI nº 031/2018). DRD thanks CNPq (process 152362/2020-7) for post-doctoral fellowship. AVLF thanks CNPq (process 304291/2020-0), National Science Foundation (DEB-1256742), and USAID/U.S. National Academy of Sciences (NAS) (grant number AID-OAA-A-11-00012). This publication is part of the RedeLep 'Rede Nacional de Pesquisa e Conservação de Lepidópteros' SISBIOTABrasil/ CNPq (563332/2010-7), and of the BIOTA-FAPESP Program (grants 2011/50225-3 and 2012/50260-6). The present study is registered at the SISGEN (ADF9450).

Associate Editor

Gustavo Graciolli

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Keith S. Brown Jr.: Contribution to data collection, contribution to data analysis and interpretation.

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Keith R. Willmott: Substantial contribution in the concept and design of the study, contribution to data collection, contribution to data analysis and interpretation, contribution to manuscript preparation.

André V. L. Freitas: Substantial contribution in the concept and design of the study, contribution to data collection, contribution to data analysis and interpretation, contribution to manuscript preparation.

Conflicts of Interest

The authors declare that they have no conflict of interest related to the publication of this manuscript.

Ethics

This study did not involve human beings and/or clinical trials that should be approved by one Institutional Committee.

Data Availability

A MS Excel file containing information on the species recorded only through pictures including each species' photographers, picture sources and links is available at: https://doi.org/10.48331/scielodata.SDBURK.

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Received: 17/05/2022
Accepted: 26/09/2022
Published online: 04/11/2022