

Annotated list of butterflies (Lepidoptera: Papilionoidea) of a Guatemalan dry forest, with two first records for Guatemala

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Abstract: We present a list of 151 species belonging to 109 genera, 18 subfamilies, and six families of butterflies collected at a subtropical dry forest in Guatemala from 2011 to 2012, with *Michaelus hecate* (Godman & Salvin, 1887) (Lycaenidae) and *Codatractus alcaeus alcaeus* (Hewitson, 1867) (Hesperiidae) as new records for the country.

Resumen: Se presenta una lista de 151 especies de 109 géneros, 18 subfamilias y seis familias de mariposas diurnas colectadas en un bosque seco subtropical en Guatemala de 2011 a 2012, con *Michaelus hecate* (Godman & Salvin, 1887) (Lycaenidae) y *Codatractus alcaeus alcaeus* (Hewitson, 1867) (Hesperiidae) como nuevos registros para el país.

Key Words: Central America, inventory, Neotropical, phenology, seasonal

INTRODUCTION

The Neotropics hosts the greatest diversity of butterflies of any major world biogeographic region (e.g., Heppner, 2004), and the fauna of Central America has been the subject of research for centuries (e.g., Godman & Salvin, 1879–1901). Biodiversity research on butterflies has been conducted throughout Central America, although a significant difference in surveying effort exists between the countries (e.g., Steinhauser, 1975; DeVries, 1983, 1987, 1997; Maza *et al.*, 1989, 1991; Meerman, 1999; Shuey *et al.*, 2005; Maes, 2006, 2007; Chacón, 2009; Miller *et al.*, 2012; Llorente-Bousquets *et al.*, 2014). In Guatemala, there have been relatively few studies of the butterfly fauna (Bates, 1864-1865, 1866; Boisduval, 1870; Austin *et al.*, 1998; Barrios *et al.*, 2006; Salinas-Gutiérrez *et al.*, 2009, 2012; Salinas-Gutiérrez, 2013); no comprehensive inventory of a single region has been made since Austin *et al.* (1996) listed 535 species of Papilionoidea (including Hesperidae; van Nieukerken *et al.*, 2011) from northern Guatemala. Additional field surveys are clearly needed in Guatemala to bridge a gap in our understanding of the lepidopteran fauna of the Neotropics.

Here we present a list of papilionoid species collected at a subtropical dry forest in central Guatemala, with information on phenology and seasonal patterns. At this site, we recently discovered a hairstreak species, *Atlides gaumeri* (Godman 1901) (Lycaenidae: Theclinae), which represented a new record for Guatemala (Yoshimoto & Salinas-Gutiérrez, 2015). This report, together with the fact that the Guatemalan dry forests have had few biological studies despite their unique ecosystem

(CONAP-ZOOTROPIC-CECON-TNC, 2011; Ariano-Sánchez & Salazar, 2015), highlights the importance of conducting biodiversity research in those forests.

MATERIALS AND METHODS

This study was conducted in a woodland of Los Cerritos Municipal Park in the Baja Verapaz Department in central Guatemala (90°18'W, 15°05'N, 960–1160 m, 69 ha), including a neighboring small garden in the foothills. Average annual temperature and precipitation for the last five years (2006–2010) at San Jerónimo, ca. 7 km away from the study site, are around 21 °C and 1160 mm, respectively (Ministerio de Comunicaciones Infraestructura y Vivienda -INSIVUMEH-, 2013). The period of the rainy season is from late May or early June to October (Fig. 1), which is shorter than in the Petén

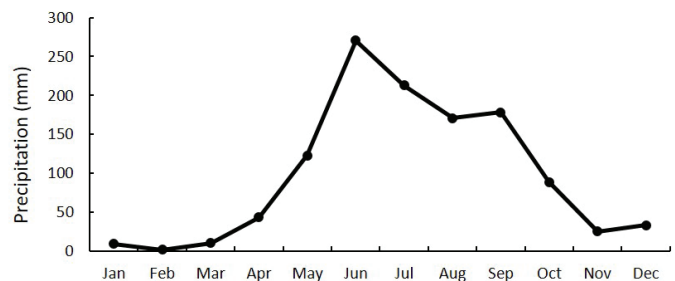


Fig. 1: Mean monthly rainfall at San Jerónimo, Baja Verapaz, Guatemala in 2006–2011, based on the data of Ministerio de Comunicaciones Infraestructura y Vivienda -INSIVUMEH- (2013).

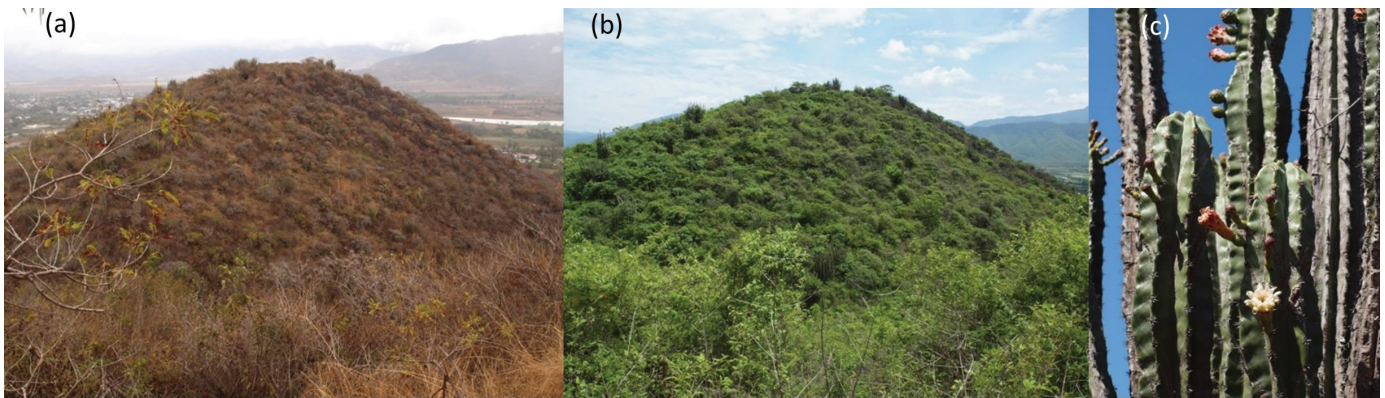


Fig. 2: Forest landscape of Los Cerritos Municipal Park in the (a) dry and (b) rainy seasons, and (c) a columnar cactus *Stenocereus pruinosus* (Cactaceae).

Department in northern Guatemala (May–January: Austin *et al.*, 1996). The landscape of Los Cerritos changes distinctively with the seasons; the whole forest turns green due to the simultaneous sprouting of leaves in the beginning of the rainy season (Fig. 2a, b). The vegetation is subtropical dry forest or subtropical thorn forest (Holdridge, 1967; Cruz, 1982), with various aculeate plants; there are more than ten species of Cactaceae at Los Cerritos, the most dominant of which is a columnar cactus *Stenocereus pruinosus* (Otto) Buxb. (Fig. 2c).

We conducted field surveys from January 2011 to November 2012 (for 76 days in 2011 and 33 days in 2012), collecting adult butterflies with an insect net along trails, on the hill summit, and in the garden. We used banana-baited traps only a few days to sample fruit-feeding butterflies. The surveys were mostly done from 09:00–13:00, because in the rainy season it often rains in the late afternoon when many adult butterflies are much less active. The individuals collected were mounted and identified at the species or subspecies level according to Warren *et al.* (2017). All the voucher specimens were deposited at the Laboratorio de Entomología Sistemática, Universidad del Valle de Guatemala in Guatemala City and at the FUNDEMABV office in Salamá, Baja Verapaz, Guatemala.

RESULTS

In total, 332 individuals of 151 species (80 subspecies) in 109 genera from 18 subfamilies were collected (Appendix). Theclinae sp.1, based on a partly damaged specimen, was excluded from our species count, since it could not be positively identified. Among the six families recorded, Nymphalidae was the richest (56 species), followed by Hesperidae, Lycaenidae, Pieridae, Riodinidae, and Papilionidae (41, 24, 14, 10, and 6 species, respectively).

One hairstreak species (Lycaenidae: Theclinae) and one skipper species (Hesperidae: Eudaminae) had not previously been recorded from Guatemala, constituting new records for the country:

***Michaelus hecate* (Godman & Salvin, 1887).** GUATEMALA, Baja Verapaz, Salamá, Los Cerritos (N15°05', W90°18', altitude: 960–1160 m). One specimen: 29 September 2011, M0182. Collected by Jiichiro Yoshimoto. Identified by José Luis Salinas-Gutiérrez. The specimen was deposited in the Colección de Artrópodos, Laboratorio de Entomología

Sistemática, Universidad del Valle de Guatemala, and is being cataloged (Fig. 3a). Distribution: Eastern and western Mexico to Costa Rica (Warren *et al.*, 2017).

***Codatractus alcaeus alcaeus* (Hewitson, 1867).** GUATEMALA, Baja Verapaz, Salamá, Los Cerritos (N15°05', W90°18', altitude: 960–1160 m). Two specimens: 28 March 2011, M0229; 3 May 2011, M0230. Collected by Jiichiro Yoshimoto. Identified by Mercedes Barrios. The specimens were deposited as above, and are being cataloged (Fig. 3b). Distribution: Southern Texas to Costa Rica (Warren *et al.*, 2017).

Thirty-nine species occurred in both dry (November–April) and rainy seasons (May–October); among them, *Phoebis sennae marcellina* (Cramer, 1777) (Pieridae: Fig. 4b), *Calephelis* sp.1 (Riodinidae), and *Chlosyne lacinia lacinia* (Geyer, 1837) (Nymphalidae: Fig. 4g) were collected in five or six months (Appendix), indicating that they have multiple broods throughout the year. By contrast, 17 out of 20 identified species of hairstreaks (Lycaenidae: Theclinae) were observed only in the middle of the rainy season (June–September; Appendix).

DISCUSSION

Our preliminary surveys yielded more than 150 butterfly species at Los Cerritos, demonstrating that this somewhat isolated forest hosts a relatively high lepidopteran diversity for its small area (ca. 70 ha). This is the first butterfly inventory for Guatemalan dry forests, adding to our knowledge of the Neotropical lepidopteran fauna and serving as an important baseline for future entomological research in the Guatemalan dry forests. Furthermore, the results of such studies will provide useful information for implementing conservation plans in those forests. Our species list, however, is still incomplete due to the limited sampling effort, and Los Cerritos will surely harbor many more species than those we sampled. This emphasizes the necessity of more surveys to elaborate a more comprehensive butterfly checklist of Guatemalan dry forests.

Our finding of *Codatractus alcaeus* and *Michaelus hecate* represents the first record for Guatemala of these species. Austin *et al.* (1998) listed *C. alcaeus* as a species with potential occurrence in the country, based on reports that it was sampled from the adjacent countries (Mexico, El Salvador,



Fig. 3: Butterfly species that are newly recorded for Guatemala; (a) *Michaelus hecate* (Godman & Salvin, 1887) (Lycaenidae: Theclinae) and (b) *Codatractus alcaeus alcaeus* (Hewitson, 1867) (Hesperiidae: Eudaminae). Dorsal and ventral views are respectively shown at the left and right in each photograph.

and Honduras). *Michaelus hecate* was collected from Chiapas (Luis-Martínez *et al.*, 2011), El Salvador (Warren *et al.*, 2017), and Nicaragua (Robbins *et al.*, 2012), which also implied its probable distribution in Guatemala. Our results have confirmed these predictions and thus filled a gap in our knowledge of the geographic distribution of these species.

Ninety-three species collected at Los Cerritos were also sampled at Tikal (Austin *et al.*, 1996). It is notable that more than 60% of the species recorded at our study site are also found at Tikal, a distant site (ca. 240 km away) with very different environmental conditions, although at present we cannot make quantitative comparisons of species composition between these sites, because, as previously mentioned, our sampling effort was much smaller than Austin *et al.* (1996), with the latter study involving a 3-year intensive survey in an extensive area (576 km²).

An apparent seasonal pattern was seen in Theclinae, where almost all the species occurred uniquely in the rainy season, which would be an interesting phenomenon to investigate further. Although we cannot discuss the seasonality in detail because the sampling effort differed across months, it should be noted that more species were observed in the wettest months (June–September; Fig. 1) than in the other months in both years (79 and 76 species, respectively, in 2011, and 50 and 25 species, respectively, in 2012), despite the former period having fewer observation dates than the latter (33 and 43 days, respectively, in 2011, and 16 and 17 days, respectively, in 2012). Quantitative monthly monitoring of butterflies, ideally in relation to abiotic and biotic factors, is necessary to examine such seasonal patterns, which in turn may elucidate the phenology of each species.

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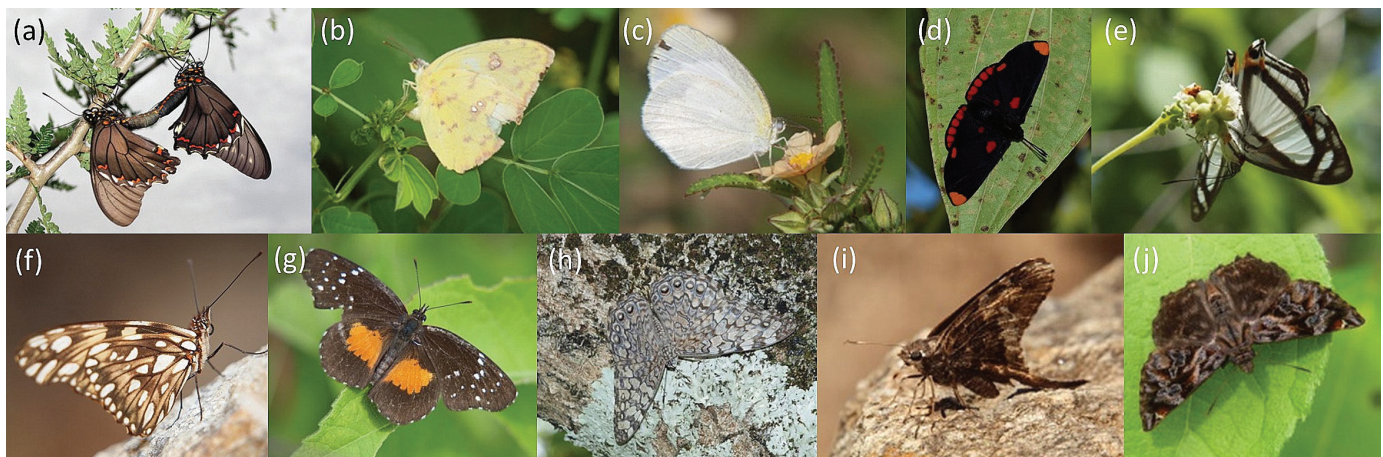


Fig. 4: Butterfly species that were commonly observed at Los Cerritos Municipal Park: (a) a copulating pair of *Battus polydamas* (Papilionidae), (b) an ovipositing female of *Phoebis sennae*, (c) *Eurema daira* (both Pieridae), (d) *Melanis pixe*, (e) *Thisbe lycorias* (both Riodinidae), (f) *Dione juno*, (g) *Chlosyne lacinia*, (h) *Hamadryas februa* (all Nymphalidae), (i) *Typhedanus undulatus*, (j) *Noctuana stator* (both Hesperidae).

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APPENDIX: Butterfly species collected at Los Cerritos Municipal Park, Guatemala in 2011–2012. The numbers of individuals sampled and the months when they were collected are also given; the number of individuals does not represent relative abundance because exhaustive collecting of all observed individuals was not done. The species that were newly recorded for Guatemala are shown in bold. Identifications were made using Warren *et al.* (2017).

Family		Number of individuals	Months when collected
	Subfamily		
	Species and subspecies		
Papilionidae			
Papilioninae			
1	<i>Battus polydamas polydamas</i> (Linnaeus, 1758) ^A	4	Mar, Jul, Sep
2	<i>Heraclides erostratus erostratus</i> (Westwood, 1847) ^A	3	May, Oct
3	<i>Heraclides thoas autocles</i> (Rothschild & Jordan, 1906) ^A	2	Feb, Apr
4	<i>Papilio polyxenes asterius</i> Stoll, 1782	3	Mar, Apr, May
5	<i>Neographium epidaus epidaus</i> (Doubleday, 1846) ^A	3	Apr, May
6	<i>Neographium philolaus philolaus</i> (Boisduval, 1836) ^A	3	Jun, Sep
Pieridae			
Coliadinae			
7	<i>Anteos clorinde</i> (Godart, [1824]) ^A	2	Apr, Jun
8	<i>Anteos maerula</i> (Fabricius, 1775) ^A	2	Jun, Nov
9	<i>Aphrissa statira statira</i> (Cramer, 1777) ^A	1	Oct
10	<i>Eurema boisduvaliana</i> (C. Felder & R. Felder, 1865) ^A	3	Feb, Oct, Nov
11	<i>Eurema दौरा eugenia</i> (Wallengren, 1860) ^A	5	Jan, Feb, Aug, Nov
12	<i>Kricogonia lyside</i> (Godart, 1819) ^A	1	Mar
13	<i>Phoebis argante</i> ssp. n. ^A	1	May
14	<i>Phoebis philea philea</i> (Linnaeus, 1763) ^A	1	May
15	<i>Phoebis sennae marcellina</i> (Cramer, 1777) ^A	5	Feb, Apr, Jun, Jul, Nov
16	<i>Pyrisitia proterpia</i> (Fabricius, 1775) ^A	4	May, Jun, Jul, Oct
17	<i>Zerene cesonia cesonia</i> (Stoll, 1790)	3	Jun, Aug
Pierinae			
18	<i>Ascia monuste monuste</i> (Linnaeus, 1764) ^A	3	Feb, Jun
19	<i>Hesperocharis crocea crocea</i> H.W. Bates, 1866	1	Mar
20	<i>Leptophobia aripa elodia</i> (Boisduval, 1836)	1	Jan
Lycaenidae			
Theclinae			
21	<i>Arawacus jada</i> (Hewitson, 1867) ^A	1	Jul
22	<i>Arawacus sito</i> (Boisduval, 1836) ^A	1	Aug
23	<i>Atlides carpasia</i> (Hewitson, 1868) ^A	1	Aug
24	<i>Atlides gaumeri</i> (Godman 1901)	1	Aug
25	<i>Calycopis isobeon</i> (Butler & H. Druce, 1872)	2	Aug, Sep
26	<i>Chalybs hassan</i> (Stoll 1790)	4	Aug, Sep, Nov
27	<i>Cyanophrys herodotus</i> (Fabricius, 1793) ^A	1	Aug
28	<i>Erora gabina</i> (Godman & Salvin, 1887)	4	May, Jun, Aug, Oct
29	<i>Evenus regalis</i> (Cramer, 1775) ^A	1	Sep
30	<i>Kolana lyde</i> (Godman & Salvin, 1887) ^A	1	Sep
31	<i>Michaelus hecate</i> (Godman & Salvin, 1887)	1	Sep
32	<i>Panthiades bitias</i> (Cramer, 1777) ^A	1	Jun
33	<i>Rekoa stagira</i> (Hewitson, 1867) ^A	1	Aug
34	<i>Strymon bazochii</i> (Godart, [1824]) ^A	1	Jul
35	<i>Strymon bebrycia</i> (Hewitson, 1868)	1	Aug
36	<i>Strymon cestri</i> (Reakirt, [1867]) ^A	2	Aug
37	<i>Strymon istapa istapa</i> (Reakirt, [1867])	1	Aug
38	<i>Strymon melinus franki</i> W. D. Field, 1938	2	Aug, Sep
39	<i>Strymon rufofusca</i> (Hewitson, 1877)	1	Nov
40	<i>Strymon ziba</i> (Hewitson, 1868)	1	Jul
-	Theclinae sp.1*	1	Aug

APPENDIX cont.

Family		Number of individuals	Months when collected
	Subfamily		
	Species and subspecies		
	Polyommatainae		
41	<i>Celastrina echo gozora</i> (Boisduval, 1870)	1	Nov
42	<i>Cupido comyntas texana</i> (F. Chermock, 1945) ^A	1	Nov
43	<i>Echinargus isola</i> (Reakirt, [1867])	1	Feb
44	<i>Hemiargus ceraunus astenidas</i> (Lucas, 1857) ^A	1	Mar
	Riodinidae		
	Riodininae		
45	<i>Anteros carausius carausius</i> Westwood, 1851 ^A	2	Aug, Nov
46	<i>Calephelis</i> sp.1	6	Jan, May, Jul, Aug, Oct
47	<i>Calydna sturnula</i> (Geyer, 1837)	3	Aug, Oct
48	<i>Emesis lupina lupina</i> Godman & Salvin, 1886	1	Oct
49	<i>Emesis mandana furor</i> Butler & H. Druce, 1872 ^A	1	Aug
50	<i>Emesis tenedia</i> C. Felder & R. Felder, 1861 ^A	1	Jul
51	<i>Melanis pixe pixe</i> (Boisduval, 1836) ^A	4	Feb, Sep, Nov, Dec
52	<i>Rhetus arcus thia</i> (Morisse, 1838) ^A	1	Sep
53	<i>Synargis mycone</i> (Hewitson, 1865) ^A	5	Mar, Jun, Jul
54	<i>Thisbe lycorias</i> (Hewitson, [1853]) ^A	4	Jun, Jul, Oct, Nov
	Nymphalidae		
	Libytheinae		
55	<i>Libytheana carinenta mexicana</i> Michener, 1943 ^A	1	Jul
	Biblidinae		
56	<i>Biblis hyperia aganisa</i> Boisduval, 1836 ^A	1	Jul
57	<i>Bolboneura sylphis sylphis</i> (H.W. Bates, 1864)	4	Jul, Aug, Sep
58	<i>Catonephele mexicana</i> Jenkins & R.G. Maza, 1985 ^A	3	Sep, Oct, Nov
59	<i>Diaethria astala astala</i> (Guérin-Ménéville, [1844]) ^A	5	May, Jul, Oct, Nov
60	<i>Dynamine dyonis</i> Geyer, 1837 ^A	6	Jul, Aug, Oct, Nov
61	<i>Dynamine postverta mexicana</i> d'Almeida, 1952 ^A	4	Jun, Jul, Oct
62	<i>Dynamine theseus</i> (C. Felder & R. Felder, 1861) ^A	2	Sep, Oct
63	<i>Epiphile adrasta adrasta</i> Hewitson, 1861	4	Aug, Oct
64	<i>Eunica monima</i> (Stoll, 1782)	2	Jun
65	<i>Eunica tatila tatila</i> (Herrich-Schäffer, [1855]) ^A	1	Jun
66	<i>Hamadryas atlantis atlantis</i> (H.W. Bates, 1864)	1	Sep
67	<i>Hamadryas februa ferentina</i> (Godart, [1824]) ^A	2	Apr, May
68	<i>Hamadryas glauconome glauconome</i> (H.W. Bates, 1864)	3	Jan, Oct, Dec
69	<i>Hamadryas guatemalena guatemalena</i> (H.W. Bates, 1864) ^A	3	May, Jun, Jul
70	<i>Mestra amymone</i> (Ménétriés, 1857) ^A	3	May, Jun, Jul
	Cyrestinae		
71	<i>Marpesia petreus</i> ssp. n. ^A	2	Jul, Sep
	Charaxinae		
72	<i>Anaea aidea</i> (Guérin-Ménéville, [1844]) ^A	3	May, Nov
73	<i>Fountainea glycerium glycerium</i> (Doubleday, [1849])	4	Aug, Sep, Oct
74	<i>Zaretis ellops</i> (Ménétriés, 1855) ^A	5	Jul, Sep, Nov
	Danainae		
75	<i>Danaus eresimus montezuma</i> Talbot, 1943 ^A	2	Aug
76	<i>Dircenna klugii klugii</i> (Geyer, 1837)	3	Sep, Oct, Nov
77	<i>Mechanitis polymnia lycidice</i> H.W. Bates, 1864 ^A	1	Sep
	Heliconiinae		
78	<i>Agraulis vanillae incarnata</i> (Riley, 1926) ^A	4	Jun, Jul
79	<i>Dione junio huascuma</i> (Reakirt, 1866) ^A	4	Feb, Mar
80	<i>Dione moneta poeyii</i> Butler, 1873	2	Jun, Nov
81	<i>Dryas iulia moderata</i> (Riley, 1926) ^A	1	Aug
82	<i>Eueides isabella eva</i> (Fabricius, 1793) ^A	2	Nov
83	<i>Euptoieta hegesia meridiania</i> Stichel, 1938 ^A	3	Jun, Jul, Sep

APPENDIX cont.

Family		Number of individuals	Months when collected
	Subfamily		
	Species and subspecies		
84	<i>Heliconius charithonia vazquezae</i> W.P. Comstock & F.M. Brown, 1950 ^A	1	Jul
	Limnitiidae		
85	<i>Adelpha iphicleola iphicleola</i> (H.W. Bates, 1864)	2	Aug
86	<i>Adelpha melanthe</i> (H.W. Bates, 1864) ^A	3	Aug, Sep
87	<i>Adelpha paroeca paroeca</i> (H.W. Bates, 1864)	2	Oct, Nov
	Nymphalinae		
88	<i>Anartia fatima fatima</i> (Fabricius, 1793) ^A	1	May
89	<i>Anthanassa dracaena phlegias</i> (Godman, 1901)	1	May
90	<i>Anthanassa ptolyca ptolyca</i> (H.W. Bates, 1864)	1	Aug
91	<i>Chlosyne janais janais</i> (Drury, 1782) ^A	1	Jun
92	<i>Chlosyne lacinia lacinia</i> (Geyer, 1837) ^A	7	Mar, Jul, Aug, Sep, Oct, Nov
93	<i>Chlosyne theona theona</i> (Ménétriés, 1855)	4	Apr, Jun, Sep
94	<i>Historis odius dious</i> Lamas, 1995 ^A	2	Aug, Sep
95	<i>Junonia evarete</i> (Cramer, 1779) ^A	4	Jun, Jul, Aug
96	<i>Microtia elva horni</i> Rebel, 1906	4	Jun, Jul, Aug, Nov
97	<i>Siproeta epaphus epaphus</i> (Latreille, [1813]) ^A	2	Sep
98	<i>Siproeta stelenes biplagiata</i> (Fruhstorfer, 1907) ^A	2	Jul, Sep
99	<i>Smyrna blomfieldia datis</i> Fruhstorfer, 1908 ^A	1	Jul
100	<i>Tegosa guatemalena</i> (H.W. Bates, 1864) ^A	3	Feb, Nov
	Satyrinae		
101	<i>Cissia pompilia</i> (C.Felder & R. Felder, 1867)	3	May, Jun, Aug
102	<i>Cissia similis</i> (Butler, 1867) ^A	2	Oct, Nov
103	<i>Cissia themis</i> (Butler, 1867)	1	Jul
104	<i>Cyllopsis gemma freemani</i> (Stallings & J.R. Turner, 1947)	3	Sep, Nov
105	<i>Cyllopsis hedemanni hedemanni</i> R. Felder, 1869	1	Feb
106	<i>Cyllopsis hilaria</i> (Godman, 1901)	2	Sep, Nov
107	<i>Cyllopsis pephredo</i> (Godman, 1901)	2	Nov
108	<i>Euptychia fetna</i> Butler, 1870	2	Aug, Sep
109	<i>Hermeuptychia hermes</i> (Fabricius, 1775) ^A	1	Jul
110	<i>Taygetis thamyra</i> (Cramer, 1779)	1	Nov
	Hesperiidae		
	Eudaminae		
111	<i>Achalarus albociliatus albociliatus</i> (Mabille, 1877) ^A	3	Feb, Mar
112	<i>Astrartes alector hopfferi</i> (Plötz, 1881) ^A	1	Sep
113	<i>Astrartes anaphus annetta</i> Evans, 1952 ^A	2	Jun, Oct
114	<i>Astrartes fulgurator azul</i> (Reakirt, [1867])**	2	Oct, Nov
115	<i>Chioides albofasciatus</i> (Hewitson, 1867) ^A	1	Jun
116	<i>Chioides zilpa</i> (Butler, 1872) ^A	2	Jan, Mar
117	<i>Codatractus alcaeus alcaeus</i> (Hewitson, 1867)	2	Mar, May
118	<i>Cogia cajeta eluina</i> Godman & Salvin, 1894	2	May
119	<i>Epargyreus exadeus cruza</i> Evans, 1952 ^A	6	Feb, Mar, Apr, Jun
120	<i>Phocides urania urania</i> (Westwood, 1852)	1	Aug
121	<i>Polygonus leo arizonensis</i> (Skinner, 1911)	1	Jul
122	<i>Proteides mercurius mercurius</i> (Fabricius, 1787) ^A	1	Jun
123	<i>Typhedanus undulatus</i> (Hewitson, 1867) ^A	3	Feb, Mar, May
124	<i>Urbanus dorantes dorantes</i> (Stoll, 1790) ^A	1	May
125	<i>Urbanus doryssus doryssus</i> (Swainson, 1831) ^A	1	Jul
126	<i>Urbanus esmeraldus</i> (Butler, 1877) ^A	3	Aug, Sep
127	<i>Urbanus procne</i> (Plötz, 1880) ^A	2	May, Jul
128	<i>Urbanus proteus proteus</i> (Linnaeus, 1758) ^A	1	Nov
129	<i>Urbanus viterboana</i> (Ehrmann, 1907) ^A	2	Sep

APPENDIX cont.

Family	Subfamily	Species and subspecies	Number of individuals	Months when collected
	Pyrginae			
130		<i>Antigonus erosus</i> (Hübner, [1812]) ^A	1	Oct
131		<i>Atarnes sallei</i> (C. Felder & R. Felder, 1867) ^A	1	Jul
132		<i>Bolla evippe</i> (Godman & Salvin, 1896)	1	Mar
133		<i>Celaenorrhinus fritzgaertneri</i> (Bailey, 1880)	3	Feb, Aug
134		<i>Chiomara georgina georgina</i> (Reakirt, 1868)	2	Jan, Sep
135		<i>Eantis tamenund</i> (W. H. Edwards, 1871)	7	Feb, Jul, Aug, Dec
136		<i>Heliopetes alana</i> (Reakirt, 1868) ^A	1	Jul
137		<i>Heliopyrgus domicella domicella</i> (Erichson, [1849])	2	Jul, Sep
138		<i>Noctuana stator</i> (Godman, 1899) ^A	4	Feb, Mar, May, Sep
139		<i>Pyrgus oileus</i> (Linnaeus, 1767) ^A	1	Apr
140		<i>Staphylus ascalaphus</i> (Staudinger, 1876)	1	May
141		<i>Zopyrion sandace</i> Godman & Salvin, 1896	1	Aug
	Hesperiinae			
142		<i>Amblyscirtes toteca toteca</i> Scudder, 1872 ^A	1	Jul
143		<i>Ancyloxypha arene</i> (W. H. Edwards, 1871)	1	Mar
144		<i>Atrytonopsis ovinia</i> (Hewitson, 1866)	4	Jan, Feb, Mar, Apr
145		<i>Cymaenes trebius</i> (Mabille, 1891)	1	Aug
146		<i>Hylephila phyleus phyleus</i> (Drury, 1773) ^A	1	Aug
147		<i>Perichares adela</i> (Hewitson, 1867) ^A	2	Aug, Sep
148		<i>Polites vibex praeceps</i> (Scudder, 1872) ^A	2	Mar, Apr
149		<i>Synapte shiva</i> (Evans, 1955)	1	Aug
150		<i>Vettius fantasos</i> (Cramer, 1780) ^A	3	Aug, Sep, Oct
151		<i>Zenis jebus hemizona</i> (Dyar, 1918)	1	Jan

^A Species shared with those collected by Austin *et al.* (1996).

*Excluded from the count of the number of species.

**This is a species complex, which includes several species in Costa Rica (Hebert *et al.*, 2004; Brower, 2006, 2010). We were not able to identify our samples to species due to lack of DNA barcoding analyses. The two individuals collected might also represent two different species.