Diversity and Distribution of Skippers (Lepidoptera: Hesperioidea: Hesperiidae) in Michoacán, Mexico

Diversidad y Distribución de Hesperiidae (Lepidoptera: Hesperioidea: Hesperiidae) en Michoacán, México

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Abstract. A survey of butterflies of Michoacán, Mexico, found 262 species in 131 genera, four subfamilies, and one family of Hesperioidea from 123 localities. Forty-four species are reported as endemic to México. This is the first checklist of skippers for Michoacán, and 32% of the species recorded in the country are listed. The species are grouped according to distribution in biogeographical provinces and altitudinal ranges by using parsimony and similarity algorithms. The species are distributed by altitude, and this is corroborated by the analysis of the two algorithms.

Resumen. Se presenta un estudio de las mariposas de la familia Hesperiidae en Michoacán, México, se registran 262 especies, 131 géneros, 4 subfamilias y 123 localidades de recolecta. Esta es la primera lista de hespéridos para el estado, incluye el 32% de las especies registradas en el país, de las cuales 44 son endémicas a México. Con base en los algoritmos de parsimonia y similitud, las especies se agruparon con respecto a su distribución en las provincias biogeográficas y los pisos altitudinales que conforman el territorio Michoacáno. Las especies tienen un arreglo altitudinal y esto se corrobora por el análisis de ambos algoritmos.

Introduction

Inadequate information is available for insects in Mexico. The study of Lepidoptera includes research in several areas and different groups. Papilionoidea is considered a model taxon for diversity and conservation studies, as well as genetic and ecological research. Most work is on the Papilionidae, Pieridae, Nymphalidae, and Lycaenidae families, and only a few references mention or analyze the distribution and diversity of specific taxa or those difficult to study (v. gr. Hesperiidae).

Some authors (Ehrlich 1958; Ehrlich and Ehrlich 1967; Ackery 1984; Heppner 1991, 1993), consider skippers to be a family of Papilionoidea, while

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Nijhout (1991) classified the group as a superfamily. Warren et al. (2009) studied the phylogeny of skippers, based on morphological and molecular characteristics, which provided evidence to support the monophyly of Hesperiidae. He recognized seven subfamilies: Coeliadinae, Eudaminae, Euschemoninae, Hesperiinae, Heteropterinae, Pyrginae, and Trapezitinae. He mentioned Pyrginae as a paraphyletic grade with seven principal branches.

Approximately 40% of butterfly species in Mexico are skippers regardless of the season or environment in which they are collected (Warren 2000). Llorente-Bousquets et al. (1990) estimated approximately 800 species of skippers in Mexico. At present, 790 known species represent 39.8% of butterflies in Mexico (1,980 sp.), considering 1,190 registered species of Papilionoidea (Llorente-Bousquets et al. 2006). Warren (2000) reviewed work on Hesperioidea in Mexico, which included a taxonomic and synonymic list of skippers. In his review, he noted the pioneer work Biologia Centrali Americana by Godman and Salvin (1878-1901), Catálogo Sistemático y Zoogeográfico de los Lepidópteros Mexicanos by Hoffmann (1941), four catalogs by Evans, A catalogue of the American Hesperiidae indicating the classification and nomenclature adopted in the British Museum, Parts I-IV (1951, 1952, 1953, and 1955), and the work of Okano (1981, 1982). Other publications on Hesperioidea were by Díaz-Batres (1991), Brown et al. (1992), Toliver et al. (1994), Llorente-Bousquets et al. (1995), Pozo et al. (2003, 2008), Salinas-Gutiérrez (2005), Luis-Martínez et al. (2004), and Hernández-Mejía et al. (2008a,b). These and other studies listed some species of Hesperiidae. From studies in Michoacán and Mexico, Llorente-Bousquets et al. (1997) mentioned 60 species of Papilionidae and Pieridae. Llorente-Bousquets et al. (1993) indicated two localities of Michoacán among the best-known areas to find skippers in Mexico. Arteaga (1991) recorded 191 species of Papilionoidea at Chorros del Varal. Mather (1967), Balcázar (1988, 1993), Acuña (1990), Jurado (1990), Jurado and Ponce (1991, 1994), Villaseñor (1995), Ponce et al. (1996), Rosas (1998), and Maya (1999) studied the Hesperioidea superfamily in Michoacán.

Warren and González (1996) and Warren (1996) wrote papers on species of skippers. Warren studied Mexican skippers for many years, and his work is ongoing. Salinas-Gutiérrez et al. (2005) wrote the first paper about Western skippers in Mexico. Other works with data on Hesperioidea are by Warren et al. (1996, 1998) and Vargas et al. (1996, 1999).

In past decades, skippers in the State of Michoacán were studied by Lamberto González Cota and researchers from the Museo de Zoología "Alfonso L. Herrera", Facultad de Ciencias, Universidad Nacional Autónoma de México (UNAM), Mexico City. They did much field work on Hesperioidea and Papilionoidea with the goal of compiling a complete list for the state. Other Mexican institutions with records for Michoacán are the Colección Nacional de Insectos del Instituto de Biología (UNAM) and Colección Nacional de Insectos "Dr. Alfredo Barrera Marín" del Museo de Historia Natural y Cultura Ambiental de la Ciudad de México, Mexico City. The goals of our study were to increase general knowledge, create a checklist, and describe the distribution of Hesperiidae.

Materials and Methods

Area of Study. Michoacán has the following geographical extreme coordinates: north 20°24´, south 17°55´, east 100°04´, and west 103°44´. It borders the Pacific Ocean and the states of Colima, Guanajuato, Guerrero, Jalisco,

Mexico, and Querétaro. Three percent, 59,864 km², of the land of Mexico is within the state (Fig. 1). Based on structure and geological history, the state is divided into two physiographic provinces and 13 sub-provinces. Its four biogeographical provinces are Balsas Basin, Pacific Coast, Sierra Madre del Sur, and Transmexican Volcanic Belt (Fig. 2, INEGI 2000).

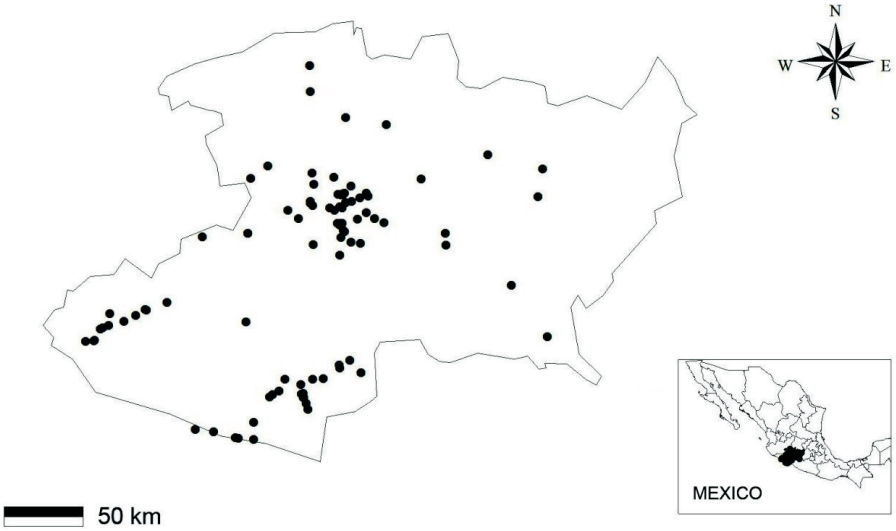

Fig. 1. Geographic localization of Michoacán, and collection localities of Hesperiidae.

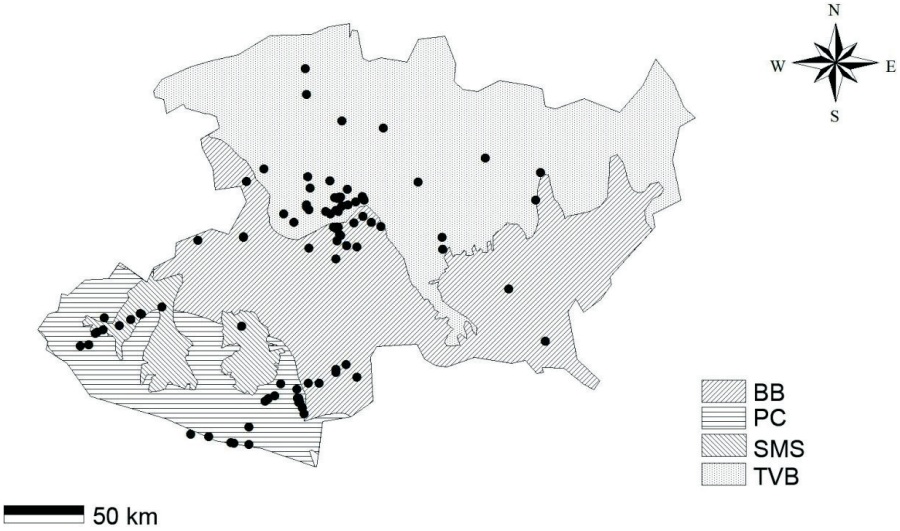

Fig. 2. Physiographical provinces of Michoacán, and collection localities of Hesperiidae. BB = Balsas Basin, PC = Pacific Coast, SMS = Sierra Madre del Sur, and TVB = Transmexican Volcanic Belt.

Among its physiographical characteristics, Michoacán has various mountain ranges, such as the Sierra de Chinicuila, Sierra de Coalcomán, Sierra de Arteaga, Sierra de Mil Cumbres, Sierra Tancítaro, Sierra Los Picachos, and Sierra San Andrés. It also has two large depressions -- Lerma in the North and Balsas in the South. The highest elevations in the state are the Tancítaro (3,840 m) and Paricutín (2,800 m) volcanoes and the hills of San Andrés (3,600 m), Patamban (3,500 m), and La Nieve (3,440 m).

Michoacán has six vegetative types: pine–oak forest, cloud forest, lowland tropical forest, semideciduous forest, grassland, and agricultural. The climates are A(w): warm subhumid with rains in summer; Acm: semi–humid with abundant summer rains; Acw: semi–warm subhumid with rains in summer; C(m): temperate humid with abundant summer rains; C(w): temperate subhumid with rains in summer; C(E)(m): wet semifreddo with abundant summer rains; BS1(h´): semi–dry very warm and warm, and BS (h): dry warm and very warm (INEGI 2000). Protected areas of the state are preserves and sanctuary sites for marine turtles, special biosphere reserves, forest zones, and national parks, one of which is the Monarch Butterfly Sanctuary.

Species Data. Skipper diversity was evaluated using information from the collections of the Museo de Zoología "Alfonso L. Herrera" (MZFC- UNAM), Instituto de Biología (IB-UNAM), and Colección Müller (MHNCM). We also checked the 'MARIPOSA' database of the MZFC-UNAM, and reviewed the most important journals with recent dates and records from Michoacán.

We used the ACCESS program to create a database of taxonomic, geographical, and curatorial information. A survey of butterflies is necessary to estimate diversity and richness by using non-parametric methods (Colwell and Coddington 1994). These methods were used when samples were considered "incomplete" and did not fit a given model or any distribution. We used the ICE index in the program.

Other analysis used basic diversity indices that interpreted differences in species composition between habitats or localities (in this study, biogeographical provinces and altitudinal ranges). One is the Jaccard index that does not consider the comparative abundance of species (Magurran 1989).

We analyzed different biogeographical provinces and altitudinal ranges to determine differences. We clustered all localities according to Biogeographical Provinces and Hypsometric maps, using similarity and parsimony algorithms. For the similarity algorithm, the matrices were presence-absence of the species. One matrix was 4 x 238 with four biogeographical provinces and the second matrix was 6 x 238 with six altitudinal ranges (0-500, 500-1,000, 1,000-1,500, 1,500-2,000, 2,000-2,500, and 2,500-3,000); range width was arbitrary. Each province and range was considered an Operational Taxonomic Unit. The relationship between each Operational Taxonomic Unit was evaluated through association coefficients, and the index was Jaccard's that provided a measurement of the number of species. For clustering, we used the Unweighted pair-group method using arithmetic averages. We used the PAST V2.03 program (Hammer et al. 2001).

A second method used the parsimony algorithm with Winclada V 1.00.08, and a heuristic search (Multiple TBR + TBR) (Nixon 1999). The parsimony algorithm analyzes the information contained in function of the geographical distribution of the group (Morrone et al. 1996). This method clusters areas by sharing taxa according to the most parsimonious tree.

The analysis between the four biogeographical provinces was done with a presence-absence matrix of 238 x 5, while analysis of altitudinal ranges used a matrix of 238 x 7. The analysis was: a) select a group in the areas to study, b) build a matrix r x c, where r (lines) represents the localities or areas, and c (columns) taxa. Presence is indicated by a 1 and absence by a 0. A hypothetical area coded 0 was used to determine the root of the tree, and c) apply the algorithm to obtain the tree.

Distribution Data. Maps were created with Geographical Information Systems, using the ArcView Gis 3.2 program (ESRI 1998). Thematic maps were from the CONABIO website (http://www.conabio.gob.mx). Records such as latitude and longitude without precise data were not considered in the spatial distribution analysis. The Geographic Information Systems analysis involved: 1) entering the corresponding data into the geographical coordinates to a conventional system (latitude and longitude), plus the maps in the analysis; 2) relating, gathering, and processing the information in the system; 3) analyzing information, between several geographical layers; and 4) obtaining maps and databases.

Results

Species Data. ***Diversity.*** With the information (database, collections, and papers) for Michoacán we compiled a taxonomic list of 262 species (32% from Mexico) in 131 genera, four subfamilies, and one family. We recorded 44 species endemic to Mexico (Luis-Martínez et al. 2003), and the database had 25,389 records (Appendix). Most species, 37.8%, were Hesperiinae. Heteropterinae with only 4.6% of the species is not representative of the total (Tables 1, 2).

Results with EstimateS 8.2 (Colwell 2009) for ICE and other indices are shown in Table 3. ICE and Chao^2 are based on sample incidence. MMMean works with the assumptions of a Michaelis-Menten model. MMMean index was used to

Table 1. Taxonomic Information in Three Supraspecific Levels of Skippers from Michoacán, Mexico

Family	Subfamily	Genera	Taxa	Records	%
Hesperiidae	Hesperiinae	62	99	7556	37.8
	Pyrginae	43	80	7885	30.5
	Eudaminae	23	71	8565	27.1
	Heteropterinae	3	12	601	4.6
Total	4	131	262	24607*	100%

*782 specimens not identified

Table 2. Records by Information Source for Skippers from Michoacán, Mexico

Source	Subfamilies	Taxa	Records
Literature	4	96	380
Biological collections	4	135	337
Database	4	199	24,672
Total			25,389

Table 3. Index of Species Accumulation for Skippers from Michoacán, Mexico

Index	Species
ICE	319
Chao[2]	336
MMMean	274
Observed	262

build a species-area curve (Fig. 3). The Michaelis-Menten model assumes the probability of species addition decreases with sample size, but increases during time. Our independent variable data are the collected effort (localities), and the dependent variable is the species accumulated by sample.

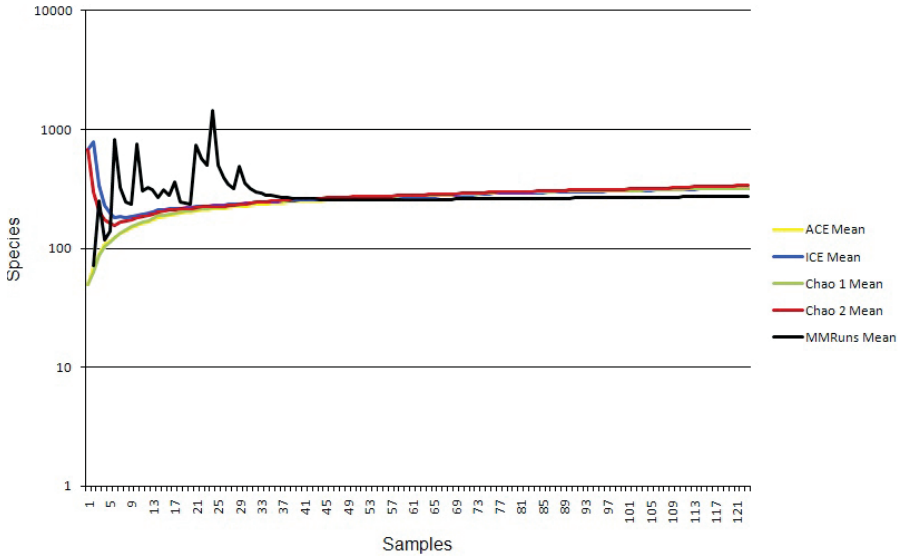

Fig. 3. Species accumulation curve for skippers from Michoacán, Mexico.

Comparison of the provinces in Fig. 4 represents the union of the Balsas Basin-Pacific Coast, corresponding to the lowland, another group is Transmexican Volcanic Belt at an altitude of 2,000-3,000 m, and Sierra Madre del Sur is the highland (1,000-2,000 m). The maximum species richness is on the Balsas Basin, which is lowland (0-1,000 m). Halffter (1987) mentioned the presence of altitudinal ranges in Mexico. He mentioned that the range between 600-1200 m has the maximum species richness, and this is congruent with our results. For the creation of this similarity tree, the range was considered for each locality; if one locality was more than 1,500 m, it was included in the Sierra Madre del Sur or Transmexican Volcanic Belt zones. The localities with a range less than 1,500 m were in the Balsas Basin or Pacific Coast (Figs. 5, 6).

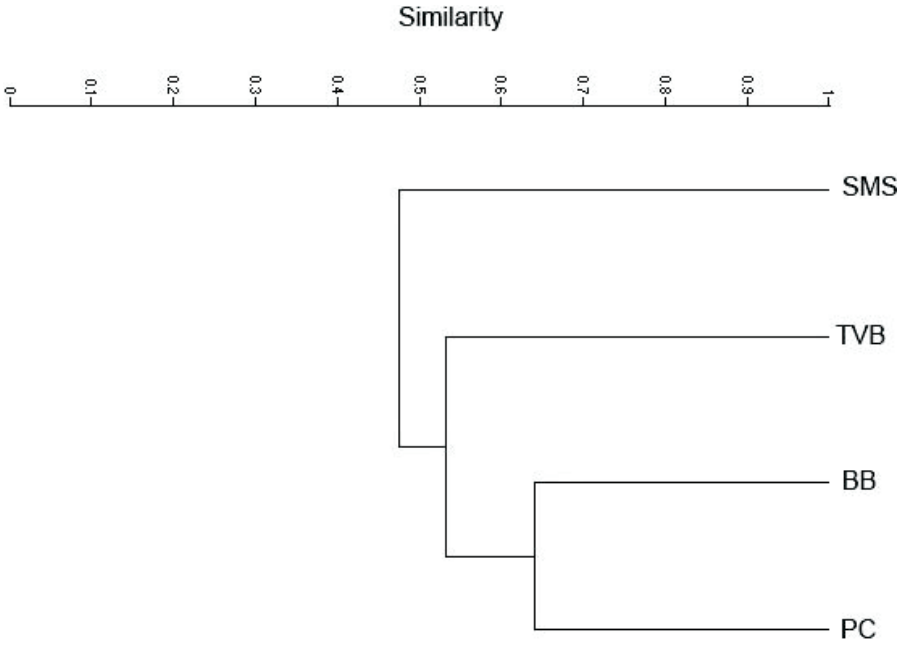

Fig. 4. Similarity tree between biogeographical provinces with Jaccard index by Unweighted pair-group method using arithmetic averages.

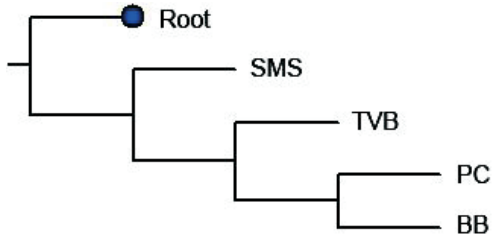

Fig. 5. Tree of biogeographical provinces with parsimony algorithm.

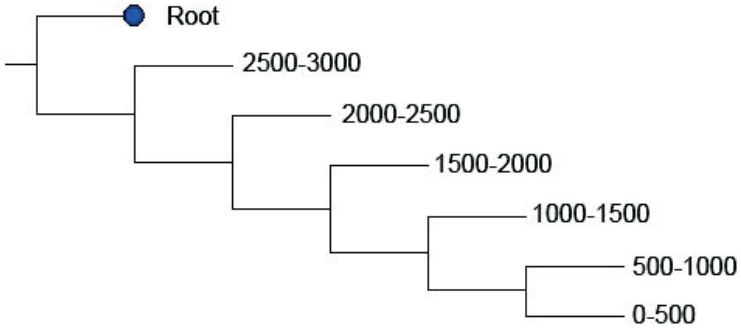

Fig. 6. Tree of the different altitudinal ranges with parsimony algorithm.

Skippers have maximum diversity in the "lowlands", with the most diverse range at 1,000-1,500 m (164 species). The maximum exchange of species (122) is between the ranges of 500-1,000 and 1,000-1,500 m.

Distribution. The species of skippers were distributed at 123 localities. Most were recorded at Santa Rosa (3,512), 43 localities had less than 10 records, and Rancho el Zorrillo was the locality with the greatest number of species (118).

With 25,389 records, distribution maps were constructed for all but 24 species that did not have minimum necessary information for geographical localization. Figs. 7 and 8 show areas of distribution of the four subfamilies. Hesperiinae (99 species) was better collected and had a distribution in the characterized by pine-oak forests, and had the most species (80). Eudaminae (71 species) were located in pine-oak forests and lowland tropical forests in the center and north of the state. They were distributed in the altitudinal range of 500 to 1,500 m. Fig. 9 shows the general distribution of skippers in Michoacán.

Three species were widely distributed. *Urbanus dorantes dorantes* (Stoll, [1970]) and *Pyrgus oileus* (Linnaeus, 1767) were widely distributed in Mexico and Michoacán. The third, *Lerema accius* (J.E. Smith, 1797) was found in both low and highlands. These three species, plus *Pompeius pompeius* (Latreille, [1824]), *Chioides catillus albofasciatus* (Hewitson, 1867), and *Urbanus teleus* (Hübner, 1821) were the six taxa found at more than 50 localities. Thirty-six species were found at one locality, and 135 species were found at fewer than 10 localities. Distribution of species varied for ecological (dispersion capacity, quantity and quality of resources) or historical (biogeographical history) reasons.

Conclusions

Michoacán has 262 species records of skippers (32% of those in Mexico). Both similarity and parsimony algorithms indicated altitudinal distribution of species. Hesperioidea had maximum diversity in the altitudinal range of 500 to 1,500 m. Balsas Basin and Pacific Coast had the most diversity, 154 and 153 species, respectively. More collecting effort is required for Michoacán. Balsas Basin has localities that need more study, and the indices indicated the same (ICE 319, Chao2 336, MMMean 274, and Observed 262).

We analyzed skippers from 119 localities of which Santa Rosa, Uruapan, had the greatest collection effort, and Rancho El Zorrillo, Cañada Húmeda, had the greatest number of species, 118. At all localities, *Urbanus dorantes dorantes* (Stoll, [1790]) was the most widely distributed species.

The Balsas Basin and Pacific Coast provinces had the most diversity (155 and 153 species, respectively), and analysis indicated the two provinces were similar. The provinces are at lower altitude. Skippers are thought to have maximum diversity in the altitudinal range between 500-1,500 m. The Hesperiinae is the most widely distributed group (99 species) in Michoacán, and their distribution suggests tolerance to different ecological conditions.

More collection effort is needed in the state of Michoacán. Uruapan is the only area with intense collection. An area that should be further explored is the Balsas Basin, because it has the greatest number of species in comparison to other provinces, but it has been only incipiently studied.

Fig. 7. Map of Michoacán, Mexico, showing collection localities of Hesperiidae. A. Eudaminae, B. Pyrginae.

Fig. 8. Map of Michoacán, Mexico, showing collection localities of Hesperiidae. A. Heteropterinae, B. Hesperiinae.

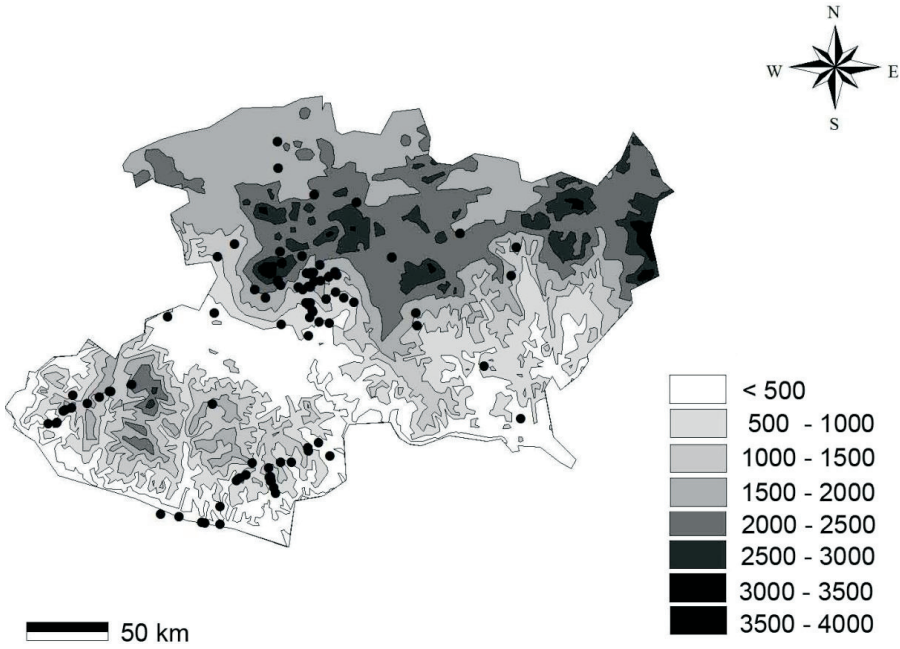

Fig. 9. Map of Michoacán, Mexico, showing collection localities of Hesperiidae.

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Appendix 1. Hesperioidea from Michoacán. The checklist is listed in the order by Warren (2000).

Id	Taxon	Literature								Biological collection			Database
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**a**	**b**	**c**	**α**
	EUDAMINAE												
1	*Phocides polybius lilea* (Reakirt, [1867])	**1**								**a**			**α**
2	*Phocides belus* Godman and Salvin, 1890									**a**			**α**
3	*Phocides pigmalion pigmalion* (Cramer, 1779)									**a**			
4	*Phocides urania urania* (Westwood, 1852)					**5**			**8**		**b**		**α**
5	*Phanus albiapicalis* Austin, 1993									**a**			
6	*Proteides mercurius mercurius* (Fabricius, 1787)	**1**			**4**								**α**
7	*Epargyreus socus orizaba* Scudder, 1872									**a**			
8	***Epargyreus windi* H. A. Freeman, 1969**									**a**			
9	*Epargyreus aspina* Evans, 1952									**a**			
10	*Epargyreus spina spina* Evans, 1952									**a**			
11	*Epargyreus spinosa* Evans, 1952									**a**			
12	*Polygonus leo arizonensis* (Skinner, 1911)	**1**			**4**	**5**							**α**
13	*Polygonus savigny savigny* (Latreille, [1824])												**α**
14	*Chioides albofasciatus* (Hewitson, 1867)	**1**	**2**	**3**	**4**	**5**			**8**			**c**	**α**
15	*Chioides zilpa* (Butler, 1872)								**8**			**c**	**α**
16	*Aguna asander asander* (Hewitson, 1867)										**b**		**α**
17	*Aguna metophis* (Latreille, [1824])												**α**
18	*Typhedanus undulatus* (Hewitson, 1867)												**α**

19	*Typhedanus ampyx* (Godman and Salvin, 1893)		**2**		**4**							α
20	*Polythrix octomaculata* (Sepp, [1844])											α
21	*Polythrix asine* (Hewitson, 1867)							**a**				
22	*Polythrix mexicanus* H. A. Freeman, 1969											α
23	*Cephise aelius* (Plötz, 1880)							**a**				
24	*Zestusa dorus* (W. H. Edwards, 1882)							**a**				
25	***Zestusa elwesi* (Godman and Salvin, 1893)**							**a**				
26	*Codatractus carlos carlos* Evans, 1952											α
27	*Codatractus alcaeus alcaeus* (Hewitson, 1867)											α
28	*Codatractus arizonensis* (Skinner, 1905)							**a**				
29	*Codatractus sallyae* A. D. Warren, 1995							**a**				
30	*Codatractus melon* (Godman and Salvin, 1893)	**1**	**2**		**4**		**8**					α
31	*Codatractus bryaxis* (Hewitson, 1867)		**2**		**4**							
32	***Codatractus uvydixa* (Dyar, 1914)**											α
33	*"Codatractus" hyster* (Dyar, 1916)								**b**			α
34	*Urbanus proteus proteus* (Linnaeus, 1758)		**2**	**3**	**4**	**5**	**8**		**b**	**c**		α
35	*Urbanus viterboana* (Ehrmann, 1907)											α
36	*Urbanus belli* (Hayward, 1935)							**a**				α
37	*Urbanus pronta* Evans, 1952							**a**				α
38	*Urbanus esmeraldus* (Butler, 1877)	**1**				**5**						α
39	*Urbanus evona* Evans, 1952											α
40	*Urbanus esta* Evans, 1952											α
41	*Urbanus prodicus* Bell, 1956											α

42	*Urbanus dorantes dorantes* (Stoll, 1790)	**1**	**2**	**3**	**4**	**5**		**7**	**8**		**b**	**c**	α
43	*Urbanus teleus* (Hübner, 1821)	**1**	**2**		**4**	**5**			**8**		**b**	**c**	α
44	*Urbanus simplicius* (Stoll, 1790)	**1**	**2**		**4**	**5**			**8**			**c**	α
45	*Urbanus procne* (Plötz, 1881)					**5**			**8**		**b**		α
46	***Urbanus doryssus chales* (Godman and Salvin, 1893)**	**1**											α
47	*Astraptes "fulgerator azul"* (Reakirt, [1867])	**1**	**2**		**4**	**5**			**8**		**b**	**c**	α
48	*Astraptes egregius egregius* (Butler, 1870)												α
49	*Astraptes enotrus* (Stoll, 1781)									**a**			
50	*Astraptes megalurus* (Mabille, 1877)							**7**		**a**			α
51	*Astraptes alector hopfferi* (Plötz, 1881)					**5**			**8**				α
52	*Astraptes anaphus annetta* Evans, 1952	**1**	**2**		**4**	**5**					**b**		α
53	*Narcosius parisi helen* (Evans, 1952)									**a**			
54	*Autochton cellus* (Boisduval and LeConte, [1837])			**3**	**4**			**7**	**8**		**b**	**c**	α
55	*Autochton pseudocellus* (Coolidge and Clemence, [1910])									**a**			α
56	*Autochton cincta* (Plötz, 1882)								**8**		**b**		α
57	*Autochton neis* (Geyer, 1832)		**2**		**4**						**b**		α
58	*Achalarus casica* (Herrich-Schäffer, 1869)												α
59	*Achalarus albociliatus albociliatus* (Mabille, 1877)	**1**	**2**		**4**	**5**						**c**	α
60	*Achalarus toxeus* (Plötz, 1882)					**5**			**8**				α
61	*Thorybes drusius* (W. H. Edwards, [1884])												α
62	*Thorybes pylades* (Scudder, 1870)									**a**			
63	***Thorybes mexicana mexicana* (Herrich-Schäffer, 1869)**												α
64	*Cabares potrillo potrillo* (Lucas, 1857)	**1**	**2**		**4**						**b**		α

65	*Spathilepia clonius* (Cramer, 1775)		**2**	**4**	**5**		**8**		**b**		α
66	*Cogia cajeta eluina* Godman and Salvin, 1894										α
67	*Cogia calchas* (Herrich-Schäffer, 1869)						**8**			**c**	α
68	*Cogia hippalus hippalus* (W. H. Edwards, 1882)				**5**						α
69	***Cogia aventinus* (Godman and Salvin, 1894)**										α
70	*Nascus phocus* (Cramer, 1777)		**2**	**4**				**a**			
71	*Ocyba calathana calanus* (Godman and Salvin, 1894)										α
	PYRGINAE										
	Tribu Pyrrhopygini Mabille, 1877										
72	***Chalypyge chalybea chalybea* (Scudder, 1872)**	**1**	**2**	**4**	**5**		**8**		**b**		
73	*Chalypyge chalybea chloris* Evans, 1951								**b**		α
74	***Apyrrothrix araxes* (Hewitson, 1867)**								**b**		α
75	*Elbella scylla* (Ménétriés, 1855)										α
76	*Mysoria amra* (Hewitson, 1871)										α
77	*Mysoria affinis* (Herrich-Schäffer, 1869)			**4**	**5**		**8**				α
	Tribu Celaenorrhinini Swinhoe, 1902										
78	*Celaenorrhinus fritzgaertneri* (Bailey, 1880)				**5**		**8**		**b**		α
79	*Celaenorrhinus stola* Evans, 1952										α
	Tribu Carcharodini Verity, 1940										
80	*Arteurotia tractipennis tractipennis* Butler and H. Druce, 1872							**a**			α
81	*Polyctor cleta* Evans, 1953							**a**			α
82	*Nisoniades rubescens* (Möschler, 1877)		**2**	**4**					**b**		α
83	*Nisoniades ephora* (Herrich-Schäffer, 1870)		**2**	**4**							α

84	*Pachyneuria licisca* (Plötz, 1882)								**a**				
85	*Pellicia arina* Evans, 1953												α
86	*Pellicia dimidiata dimidiata* Herrich-Schäffer, 1870												α
87	*Noctuana stator* (Godman and Salvin, 1899)												α
88	*Noctuana lactifera bipuncta* (Plötz, 1884)								**a**				α
89	*Windia windi* H. A. Freeman, 1969								**a**				α
90	*Bolla subapicatus* (Schaus, 1902)								**a**				
91	*Bolla orsines* (Godman and Salvin, 1896)								**a**				
92	*Bolla evippe* (Godman and Salvin, 1896)								**a**				
93	*Bolla guerra* Evans, 1953												α
94	*Bolla eusebius* (Plötz, 1884)								**a**	**b**			
95	*Bolla clytius* (Godman and Salvin, 1897)								**a**				α
96	***Bolla litus* (Dyar, 1912)**												α
97	*Staphylus vulgata* (Möschler, 1879)								**a**				
98	*Staphylus tierra* Evans, 1953	**1**	**2**	**3**	**4**			**8**			**c**		α
99	*Staphylus mazans* (Reakirt, [1867])									**b**			
100	*Staphylus azteca* (Scudder, 1872)		**2**		**4**					**b**			α
101	*Staphylus vincula* (Plötz, 1886)								**a**				
102	***Staphylus iguala* (R. C. Williams and Bell, 1940)**												α
103	*Pholisora mejicanus* (Reakirt, [1867])		**2**	**3**	**4**	**5**		**8**		**b**			α
	Tribu Erynnini Brues and F. Carpenter, 1932												
104	*Gorgythion begga pyralina* (Möschler, 1877)												α
105	*Sostrata nordica* Evans, 1953												α

106	*Mylon lassia* (Hewitson, 1868)							**a**		α
107	*Mylon maimon* (Fabricius, 1775)				**5**					
108	*Mylon pelopidas* (Fabricius, 1793)						**8**		**b**	α
109	*Grais stigmaticus stigmaticus* (Mabille, 1883)					**6**		**a**		
110	*Timochares trifasciata trifasciata* (Hewitson, 1868)									α
111	*Timochares ruptifasciatus* (Plötz, 1884)							**a**		
112	*Anastrus sempiternus sempiternus* (Butler and H. Druce, 1872)									α
113	***Anastrus luctuosus* (Godman and Salvin, 1894)**									α
114	*Ebrietas anacreon anacreon* (Staudinger, 1876)	**2**		**4**						α
115	*Cycloglypha thrasibulus thrasibulus* (Fabricius, 1793)						**8**		**b**	α
116	*Theagenes aegides* (Herrich-Schäffer, 1869)							**a**		
117	*Chiomara georgina georgina* (Reakirt, 1868)						**8**		**b**	α
118	*Chiomara mithrax* (Möschler, 1879)	**2**		**4**					**b**	α
119	*Gesta invisus* (Butler and H. Druce, 1872)	**2**		**4**			**8**			α
120	***Erynnis meridianus fieldi* Burns, 1964**							**a**		
121	*Erynnis scudderi* (Skinner, 1914)							**a**		
122	*Erynnis tristis tatius* (W. H. Edwards, 1883)						**8**			α
123	*Erynnis funeralis* (Scudder and Burgess, 1870)	**2**		**4**					**b**	α
	Tribu Achlyodidini Burmeister, 1878									
124	*Achlyodes busirus heros* Ehrmann, 1909							**a**		α
125	*Achlyodes pallida* (R. Felder, 1869)	**2**	**3**	**4**		**7**			**b**	α
126	*Eantis tamenund* (W. H. Edwards, 1871)									α
127	*Zera hyacinthinus hyacinthinus* (Mabille, 1877)								**b**	α

128	*Quadrus lugubris lugubris* (R. Felder, 1869)													α
129	*Gindanes brontinus brontinus* Godman and Salvin, 1895									**a**				α
130	*Atarnes sallei* (C. Felder and R. Felder, 1867)	**1**	**2**		**4**			**7**			**b**	**c**		α
	Tribu Pyrgini Burmeister, 1878													
131	*Clito aberrans* (Draudt, 1924)													α
132	*Paches polla* (Mabille, 1888)									**a**				α
133	*Carrhenes fuscescens fuscescens* (Mabille, 1891)													α
134	*Carrhenes canescens canescens* (R. Felder, 1869)													α
135	*Xenophanes tryxus* (Stoll, 1780)							**8**						α
136	*Antigonus nearchus* (Latreille, [1817])									**a**				
137	*Antigonus erosus* (Hübner, [1812])	**1**	**2**		**4**			**8**			**b**	**c**		α
138	*Antigonus emorsa* (R. Felder, 1869)	**1**	**2**		**4**						**b**	**c**		α
139	***Antigonus funebris* (R. Felder, 1869)**		**2**		**4**						**b**	**c**		α
140	*Systasea pulverulenta* (R. Felder, 1869)		**2**		**4**						**b**	**c**		α
141	*Zopyrion sandace* Godman and Salvin, 1896	**1**	**2**		**4**	**5**		**8**						α
142	*Pyrgus communis communis* (Grote, 1872)	**1**	**2**	**3**	**4**	**5**	**7**	**8**			**b**			
143	*Pyrgus albescens* Plötz, 1884						**6**							
144	*Pyrgus adepta* Plötz, 1884									**a**				
145	*Pyrgus philetas* W. H. Edwards, 1881					**5**		**8**			**b**			α
146	*Pyrgus oileus* (Linnaeus, 1767)	**1**	**2**		**4**	**5**		**8**			**b**			α
147	*Heliopyrgus domicella domicella* (Erichson, [1849])													α
148	*Heliopetes laviana laviana* (Hewitson, 1868)				**4**			**8**			**b**			α
149	*Heliopetes macaira* (Reakirt, [1867])	**1**	**2**		**4**	**5**		**8**			**b**	**c**		α

150	*Heliopetes arsalte* (Linnaeus, 1758)	**1**		**4**	**5**		**8**			α
151	*Heliopetes alana* (Reakirt, 1868)									α
	HETEROPTERINAE									
152	***Dalla bubobon* (Dyar, 1921)**		**2**	**4**				**a**		
153	***Dalla dividuum* (Dyar, 1913)**									α
154	***Dalla faula* (Godman, 1900)**		**2**	**4**					**b**	α
155	*Piruna aea aea* (Dyar, 1912)									α
156	*Piruna brunnea* (Scudder, 1872)		**2**	**4**					**b**	α
157	***Piruna dampfi* (Bell, 1942)**									α
158	***Piruna gyrans* (Plötz, 1884)**									α
159	***Piruna microsticta* (Godman, 1900)**							**a**		
160	***Piruna penaea* (Dyar, 1918)**									α
161	*Piruna polingii* (Barnes, 1900)									α
162	***Piruna purepecha* A. Warren and González, 1999**									α
163	*Dardarina dardaris* (Hewitson, 1877)						**8**			α
	HESPERIINAE									
	Tribu Insertae sedis									
164	*Perichares adela* (Hewitson, 1867)		**2**	**4**			**8**		**b**	α
165	*Orses cynisca* (Swainson, 1821)	**1**		**4**						
	Tribu Megathymini J. H. Comstock and A. Comstock, 1895									
166	***Stallingsia smithi* (H. H. Druce, 1896)**									α
167	***Aegiale hesperiaris* (Walker, 1856)**								**c**	
168	*Agathymus rethon* (Dyar, 1913)									α

	Tribu Thymelicini Tutt, 1905											
169	*Ancyloxypha arene* (W. H. Edwards, 1871)		**2**	**3**	**4**		**7**	**8**		**b**		α
170	***Oarisma era* Dyar, 1927**								**a**			
171	*Copaeodes aurantiaca* (Hewitson, 1868)											α
172	*Copaeodes minima* (W. H. Edwards, 1870)		**2**	**3**	**4**			**8**		**b**		α
	Tribu Calpodini A. Clark, 1948											
173	*Argon lota* (Hewitson, 1877)					**5**						
174	*Tromba xanthura* (Godman, 1901)								**a**			
175	*Calpodes ethlius* (Stoll, 1782)											α
176	*Panoquina ocola ocola* (W.H. Edwards, 1863)	**1**			**4**	**5**		**8**		**b**		α
177	*Panoquina hecebolus* (Scudder, 1872)	**1**			**4**							α
178	*Panoquina lucas* (Fabricius, 1793)											α
179	*Panoquina evansi* (H.A. Freeman, 1946)											α
180	*Saliana fusta* Evans, 1955											α
181	*Thracides phidon* (Cramer, 1779)								**a**			
182	*Neoxeniades luda* (Hewitson, 1877)								**a**			
	Tribu Anthoptini A. Warren, 2009											
183	*Synapte pecta* Evans, 1955								**a**			
184	*Synapte syraces* (Godman, 1901)	**1**	**2**		**4**			**8**		**b**		α
185	*Synapte shiva* (Evans, 1955)											α
186	*Anthoptus insignis* (Plötz, 1882)											α
187	*Corticea corticea* (Plötz, 1882)		**2**		**4**							α
188	***Corticea similea* (E. Bell, 1942)**											α

	Tribu Moncini A. Warren, 2008							
189	***Zariaspes mythecus* Godman, 1900**							α
190	*Callimormus juventus* Scudder, 1872					a		
191	*Callimormus saturnus* (Herrich-Schäffer, 1869)			5				α
192	*Remella remus* (Fabricius, 1798)							α
193	***Amblyscirtes folia* Godman, 1900**							α
194	***Amblyscirtes raphaeli* H. A. Freeman, 1973**					a		
195	*Amblyscirtes patriciae* (E. Bell, 1959)							α
196	***Amblyscirtes exoteria* (Herrich-Schäffer, 1869)**							α
197	***Amblyscirtes fluonia* Godman, 1900**	1		4		a		
198	***Amblyscirtes elissa elissa* Godman, 1900**							α
199	*Amblyscirtes tolteca tolteca* Scudder, 1872						b	α
200	***Amblyscirtes fimbriata pallida* (H. A. Freeman, 1993)**	1		4		a		
201	***Amblyscirtes novimmaculatus* A. D. Warren, 1998**							α
202	*Methionopsis ina* (Plötz, 1882)							α
203	*Repens florus* (Godman, 1900)							α
204	*Phanes aletes* (Geyer, [1832])					a		
205	*Vidius perigenes* (Godman, 1900)		2	4		8		α
206	***Monca jera* Godman, 1900**							α
207	*Nastra julia* (H. A. Freeman, 1945)					a		
208	*Cymaenes trebius* (Mabille, 1891)							α
209	*Vehilius inca* (Scudder, 1872)		2	4		8		α
210	*Vehilius stictomenes illudens* (Mabille, 1891)							α

211	*Lerodea eufala eufala* (W. H. Edwards, 1869)									α
212	*Lerodea arabus* (W. H. Edwards, 1882)									α
213	*Mnasilus allubita* (Butler, 1870)									α
214	*Mnasinous patage* Godman, 1900							a		
215	*Moeris striga stroma* Evans, 1955									α
216	*Lerema accius* (J. E. Smith, 1797)	1	2		4		8		b	α
217	*Lerema liris* Evans, 1955						8			α
218	*Morys valda* Evans, 1955									α
219	*Morys micythus* Godman, 1900									α
220	*Halotus rica* (Bell, 1942)							a		
221	***Halotus jonaveriorum* Burns, 1992**									α
222	*Niconiades incomptus* Austin, 1997									α
223	*Vettius fantasos* (Cramer, 1780)		2		4				b	α
224	*Saturnus reticulata obscurus* (Bell, 1941)							a		
225	*Rhinthon osca* (Plötz, 1882)									α
226	*Mucia zygia* (Plötz, 1886)							a		α
	Tribu Hesperiini Latreille, 1809									
227	*Hylephila phyleus phyleus* (Drury, 1773)		2	3	4		8		b	α
228	*Polites subreticulata* (Plötz, 1883)									α
229	***Polites pupillus* (Plötz, 1882)**									α
230	*Polites vibex praeceps* (Scudder, 1872)						8		b	α
231	*Wallengrenia otho otho* (J. E. Smith, 1797)						8			α
232	*Pompeius pompeius* (Latreille, [1824])		2		4		8		b	α

233	*Pompeius dares* (Plötz, 1883)						**a**		
234	*Atalopedes campestris huron* (W. H. Edwards, 1863)								α
235	*Poanes zabulon* (Boisduval and LeConte, [1837])		**3**	**4**		**7**		**b**	α
236	*Poanes inimica* (Butler and H. Druce, 1872)							**b**	α
237	*Poanes melane vitellina* (Herrich-Schäffer, 1869)		**3**					**b**	α
238	***Poanes monticola* (Godman, 1900)**						**a**		
239	***Ochlodes samenta* Dyar, 1914**								α
240	***Paratrytone aphractoia* Dyar, 1914**								α
241	***Paratrytone raspa* (Evans, 1955)**								α
242	***Paratrytone omiltemensis* Steinhauser, 1996**								α
243	***Onespa gala* (Godman, 1900)**								α
244	*Librita librita* (Plötz, 1886)								α
245	*Anatrytone mazai* (H. A. Freeman, 1969)						**a**		
246	*Quasimellana eulogius* (Plötz, 1882)		**2**	**4**		**8**			α
247	*Quasimellana balsa* (Bell, 1942)						**a**		
248	***Quasimellana mulleri* (E. Bell, 1942)**		**2**				**a**		α
249	*Quasimellana aurora* (Bell, 1942)						**a**		
250	*Quasimellana myron* (Godman, 1900)								α
251	*Euphyes peneia* (Godman, 1900)								α
252	***Euphyes canda* Steinhauser and Warren, 2002**						**a**		
253	*Quinta cannae* (Herrich-Schäffer, 1869)	**1**		**4**		**8**		**b**	α
254	*Conga chydaea* (Butler, 1877)								α
255	*Decinea lucifer* (Hübner, [1831])								α

256	*Atrytonopsis deva* (W.H. Edwards, 1877)	**2**	**4**	**8**		
257	*Nyctelius nyctelius nyctelius* (Latreille, [1824])	**2**	**4**			α
258	*Thespieus dalman* (Latreille, [1824])					α
259	*Thespieus macareus* (Herrich-Schäffer, 1869)	**2**	**4**	**8**	**b**	α
260	*Vacerra litana* (Hewitson, 1866)					α
261	*Vacerra gayra* (Dyar, 1918)					α
262	*Vacerra cervara* Steinhauser, 1974					α

Literature: (**1**) Acuña (1990), (**2**) Balcázar (1988), (**3**) Jurado (1990), (**4**) Jurado and Ponce (1991), (**5**) Maya (1999), (**6**) Maya et al. (unpublished), (**7**) Ponce et al. (1996), and (**8**) Rosas (1998).
Biological collections: (**a**) Private collection, ADW (Andrew D. Warren), (**b**) Natural History Museum, Mexico City (Müller Collection), and (**c**) National Insects Collection (CNIN), Lepidoptera Collection, Biology Institute, UNAM.
Database: (α) MARIPOSA Database, Zoology Museum (MZFC), Faculty Science, UNAM.
Taxa listed in **bold** are endemic to Mexico (Luis et al. 2003).