JOURNAL OF
THE LEPIDOPTERISTS' SOCIETY

Volume 58 2004 Number 3

Journal of the Lepidopterists' Society
58(3), 2004, 125-142

PAPILIONOIDEA OF THE EVERGREEN TROPICAL FORESTS OF MEXICO

JOSÉ L. SALINAS-GUTIÉRREZ[1], ARMANDO LUIS-MARTÍNEZ[2] AND JORGE LLORENTE-BOUSQUETS[3]
Museo de Zoología, Facultad de Ciencias, UNAM, Apdo. Postal 70-399, México, 04510 D. F., MÉXICO

ABSTRACT. The diurnal butterflies in 11 geographical units of evergreen tropical forest in Mexico were studied, giving in a total list of 683 species of Papilionoidea (excluding Hesperiidae). This is the first list of Mexican butterflies which covers a specific type of vegetation. The species richness in this zone makes evident the need for adequate conservation strategies for these ecosystems, whose extent is rapidly decreasing. The results are compared with other areas of Neotropical rain forest.

Additional key words: butterflies, distribution, evergreen tropical forest, Neotropical region, richness.

RESUMEN. Se efectuó un trabajo de mariposas diurnas en 11 unidades geográficas con bosque tropical perennifolio en México, registrándose una lista total de 683 especies de Papilionoidea (sin incluir Hesperiidae). Ésta es la primera lista de mariposas en México que involucra la cobertura de un tipo de vegetación específico. La riqueza de especies presentes en la zona hace patente la necesidad de crear estrategias de conservación en este ecosistema que está disminuyendo su extensión rápidamente. Los resultados se comparan con otros sitios de bosque tropical del Neotrópico.

Palabras claves: mariposas, distribución, bosque tropical perennifolio, región Neotropical, riqueza.

The rain forests, or evergreen tropical forest (ETF) ecosystems are considered top priority for world conservation. This is because these forests shelter approximately 50% of the species of the planet Earth. In addition, their rate of decrease is one of the fastest (Wilson 1988, Dirzo & García 1992). The Neotropical region contains approximately 20% of the species on the Earth (Myers 1988); within this region, the ETF has the largest extent of all the regions.

The northernmost distribution of the ETF in America is in México. Originally, the ETF covered 13% of the nation, but Granillo (1985) and Toledo (1988) remark that at present it covers from 10 to a 15% of the original area, being replaced by pastures and other agroecosystems. An annual deforestation rate of 4% was registered for the last 25 years by Dirzo & García (1992) in the ETF of the Los Tuxtlas region in Veracruz, México.

The ETF was once distributed in México from southern San Luis Potosí and northern Veracruz, in the north, through parts of the states of Hidalgo, Puebla, Oaxaca, southern Veracruz, to the north and northeast of Chiapas and in some parts of Tabasco, Campeche and Quintana Roo (Fig. 1). Along the Pacific slope, it occupied the southernmost area of Sierra Madre de Chiapas and the Tapachula-Mapastepec (low Soconusco region), isolated by the Sierra Madre, the Tehuantepec isthmus and the Central Depression of Chiapas (Rzedowski 1978). Rzedowski (1996) estimated that the plant species in the ETF include over a third of the total flora of the country.

[1] sgjl@att.net.mx
[2] alm@hp.fciencias.unam.mx
[3] Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Santa Fe de Bogotá, Columbia, email:jlb@hp.fciencias.unam.mx

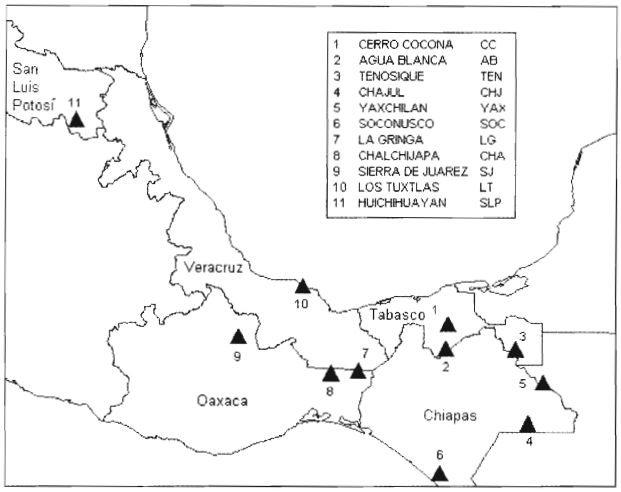

FIG. 1. Distribution in México of the geographical units having evergreen tropical forests.

Although Papilionoidea have been the subject of many studies, the knowledge of this lepidopteran superfamily is still very incomplete. Robbins & Opler (1997) estimated its approximate richness as 17,500 species; furthermore, they pointed out that this is one of the most studied groups of insects, with 90% of its species being known. These authors assumed that the greatest richness of this group is within the Neotropical region; similar results were obtained by Heppner (1991). There are not enough faunistic studies in the region and many of the studies were based on sporadic collections in extensive, ecologically heterogeneous areas. The situation becomes more critical in the ETF, whose understanding is based on very few studies, most of which were made during this century in a few areas, such as Los Tuxtlas, Veracruz and Sierra de Juárez, Oaxaca in México.

The studies made by Lamas et al. (1991, 1996), Brown (1984), Emmel & Austin (1990), and Austin et al. (1996), among others, show the need for making more intensive systematic collections in these communities, especially in areas located close to mountains (increasing the diversity; G. Lamas pers. com.). Because of the inaccessibility of the areas occupied by the ETF and the consequent logistic and financial problems for systematic studies there, methods have been proposed to estimate the potential number of species living in each community in a quick and accurate way (Soberón & Llorente 1993, Colwell & Coddington 1994).

The large diversity of butterflies living in the ETF of México has attracted attention of interested students since the 19th century; nevertheless, only about 10 faunistic studies are available which can be compared with some accuracy, such as those made by Hoffmann (1933), Ross (1964, 1976-1977), Routledge (1977), de la Maza & de la Maza (1985a, b), de la Maza & White (1990), Luis et al. (1991, 1995), Raguso & Llorente (1991, 1997), Martínez (1994), and Villegas (1998).

MATERIALS AND METHODS

The first step to obtain a list of the butterflies species inhabiting the ETF in México was to compile, systematize and summarize the studies made in these communities. A specialized bibliography was consulted for five states: Tabasco, Routledge (1977), Martínez (1994) and Villegas (1998); Chiapas, Hoffmann (1933), de la Maza & de la Maza (1985a, 1985b), and unpublished data of faunistic surveys made in Yaxchilán by members of the Museo de Zoología de la Facultad de Ciencias, UNAM; Oaxaca, the data available for the Chimalapas region and Luis et al. (1991); Veracruz, Ross (1964, 1976-1977), Raguso & Llorente (1991, 1997) and Luis et al. (1995); for San Luis Potosí, de la Maza & White (1990). The bibliography was used to obtain comparable lists, in order to be able to tabulate the data by region and by locality. Only records with vouchers collected in ETF were considered.

Once the areas in each report were analyzed, "geographical units" were defined for each collection site, giving 11 units (Fig. 1): in Tabasco, Cerro del Coconá (CC), Agua Blanca (AB) and Tenosique (TEN); in Chiapas, Chajul (CHJ), Yaxchilán (YAX) and Soconusco (SOC); in Oaxaca, La Gringa (LG), Chalchijapa (CHA) and Sierra de Juárez (SJ); in Veracruz, Los Tuxtlas (LT); and in San Luis Potosí, Huichihuayán (SLP).

For the geographical units LT, SJ and SLP, only the localities having ETF were included, since the original studies were made in several plant communities. As these studies included sites whose altitudes do not correspond to the distribution of the ETF, a detailed revision was made so as not to overestimate the richness of the fauna by inclusion of montane species or those of semideciduous tropical forest.

RESULTS AND DISCUSSION

Based on the above defined 11 units, 683 species living in the ETF of México were registered, in 272 genera, 18 subfamilies and 4 families, about 53% of the total butterfly fauna of the country (assuming a total of 1,295 species of Papilionoidea and excluding the Hesperiidae). The percentage of species in each family is similar to that reported in other regions of México (Sierra de Manantlán, Jalisco-Colima: Vargas et al. 1999;

Sierra de Atoyac de Álvarez, Guerrero: Vargas et al. 1992): Papilionidae 5.4%, Pieridae 7.7%, Nymphalidae 45.1%, and Lycaenidae 41.7%.

Even though the studies chosen for this analysis used different methods, time periods and objectives, a general comparison is presented for each of the 11 geographical units by species in each family and subfamily, together with the estimated total number of species inhabiting the ETF in México (Table 1).

According to Llorente et al. (1993) and Luis et al. (2000) the butterfly fauna of México represents about 10% of the wold total, thus indicating that México is a megadiversity country. In this paper only a single plant community was analyzed, covering 13% of the total land surface; due to deforestation over the last 50 years, this is now reduced to less than 2%. The percentage of species living in this plant community is surprisingly high, representing 50% of the Mexican butterfly fauna. Heppner (1991) gave a total of 7,927 species of butterflies in the Neotropical region, including the family Hesperiidae, which was excluded in the present paper; even so the ETF included 8.6% of this fauna. If only the 4,800 species of Papilionoidea are considered, the ETF in México holds 14.2% of this figure.

Table 1 also includes the percentage of the Mexican total in each subfamily. This table shows that LT is the most diverse geographical unit, with 482 species (70.6%), followed by SJ with 355 (52%), CHJ with 352 (51.5%), and SLP with 300 (43.9%). The latter geographical unit is the northernmost ETF site in México, followed by LT and SJ. Considering that México is in a transitional biogeographical zone between the Nearctic and the Neotropical regions, and that the predominance of these elements varies with latitude and altitude, this suggest an increase of species with clear Nearctic affinity, which do not belong to the ETF in a strict sense.

The geographical units LT, SJ and CHJ have similar patterns of number of species per subfamily, with the exception of the Theclinae in LT, which include 54.78% of the species mentioned for ETF, or 50% of those for all of México. This may be due to the fact that, for many years, amateur collectors have paid local people for hairstreak specimens (L. González-Cota pers. com.). This collecting effort is clearly seen in the percent representation (Table 1).

The geographical unit LT has the highest representation for 8 out of 18 subfamilies collected. Heppner (1991) mentioned the importance of the Ithomiinae, Morphinae and Brassolinae, which have maximum number of species in the following geographical units: Ithomiinae in SJ with 21 species; Morphinae in CHJ, CHA, SJ and LT with three species; and Brassolinae in CHJ and LT with 11 species.

TABLE 1. Species richness of Papilionoidea by geographical unit. See 'Methods' for abbreviations.

	CC	AB	TEN	CHJ	YAX	SOC	LG	CHA	SJ	LT	SLP	ETF	MEX
Papilionidae	**6**	**5**	**7**	**9**	**8**	**4**	**8**	**5**	**11**	**10**	**9**	**12**	
Papilioninae	15(18.29)	11(13.41)	14(17.07)	24(29.27)	15(18.29)	9(10.98)	16(19.51)	12(14.63)	29(35.37)	30(36.59)	20(24.39)	37(45.12)	82
Pieridae	**12**	**8**	**11**	**19**	**15**	**14**	**10**	**12**	**25**	**26**	**21**	**27**	
Dismorphiinae	2(9.52)	1(4.76)	0	4(19.05)	2(9.529	2(9.52)	2(9.52)	1(4.76)	4(19.05)	7(33.33)	4(19.05)	10(47.62)	21
Coliadinae	14(40)	13(37.14)	17(48.57)	17(48.57)	16(45.71)	13(37.14)	12(34.29)	14(40)	21(60)	22(62.86)	20(57.14)	24(68.57)	35
Pierinae	7(11.29)	1(1.61)	4(6.45)	10(16.13)	6(9.68)	5(8.06)	5(8.06)	4(6.45)	16(25.81)	16(25.81)	11(17.74)	19(30.65)	62
Nynphalidae	**69**	**59**	**51**	**94**	**70**	**62**	**64**	**68**	**94**	**98**	**78**	**115**	
Heliconinae	19(46.34)	17(41.46)	13(31.71)	19(46.34)	12(29.27)	13(31.71)	14(34.15)	16(39.02)	23(56.10)	19(46.34)	13(31.71)	28(68.29)	41
Nymphalinae	16(10.88)	14(9.52)	14(9.52)	21(14.29)	17(11.56)	18(12.24)	11(7.48)	15(10.20)	27(18.37)	27(18.37)	38(25.85)	51(34.69)	147
Limenitidinae	37(25.87)	28(19.58)	30(20.98)	56(39.16)	37(25.87)	33(23.08)	31(21.68)	32(22.38)	56(39.16)	59(41.26)	40(27.97)	90(62.94)	143
Charaxinae	14(21.88)	4(6.25)	3(4.69)	22(34.38)	11(17.19)	7(10.94)	17(26.56)	10(15.63)	26(40.63)	23(35.94)	14(21.88)	38(59.38)	64
Apaturinae	3(27.27)	1(9.09)	1(9.09)	4(36.36)	2(18.18)	3(27.27)	1(9.09)	0	5(45.45)	4(36.36)	4(36.36)	5(45.45)	11
Morphinae	1(10)	1(10)	1(10)	3(30)	1(10)	1(10)	1(10)	3(30)	3(30)	3(30)	1(10)	6(60)	10
Brassolinae	4(22.22)	3(16.67)	6(33.33)	11(61.11)	6(33.33)	5(27.78)	7(38.89)	6(33.33)	9(50)	11(61.11)	7(38.89)	12(66.67)	18
Satyrinae	8(7.41)	6(5.56)	5(4.63)	20(18.52)	15(13.89)	9(8.33)	11(10.19)	8(7.41)	21(19.44)	25(23.15)	16(14.81)	41(37.96)	108
Danainae	4(52.14)	4(57.14)	2(28.57)	4(57.14)	3(42.86)	2(28.57)	4(57.14)	4(57.14)	4(57.14)	6(85.71)	4(57.14)	6(85.71)	7
Ithomiinae	11(23.40)	12(25.53)	6(12.77)	20(42.55)	11(23.40)	12(25.53)	15(31.91)	17(36.17)	21(44.68)	20(42.55)	8(17.02)	30(63.83)	47
Libytheinae	1(50)	1(50)	1(50)	1(50)	1(50)	0	1(50)	1(50)	1(50)	1(50)	1(50)	1(50)	2
Lycaenidae	**36**	**9**	**12**	**71**	**43**	**13**	**11**	**23**	**55**	**97**	**58**	**116**	
Riodininae	18(7.96)	6(2.65)	8(3.54)	64(28.32)	21(9.29)	8(3.54)	0	1(0.44)	54(23.89)	76(33.63)	42(18.58)	125(55.31	226
Theclinae	29(12.61)	6(2.61)	5(2.17)	49(21.30)	33(14.35)	5(2.17)	8(3.48)	28(12.17)	30(13.04)	126(54.78	50(21.74)	150(65.22	230
Polyommatinae	4(9.76)	0	0	3(7.32)	4(9.76)	0	4(9.76)	1(2.44)	5(12.20)	7(17.07)	7(17.07)	10(24.39)	41
TOTAL	207	129	130	352	213	145	160	173	355	482	300	683	1295

NOTE: The numbers in family rows correspond to the total genera in each geographical unit and, in parentheses, the percentage of species per subfamily in relation to the total in México. ETF: represents the total for México ETF

MEX: represents the total for all of México

Table 1 also details the total number of species in the ETF of México for Papilionidae (37), Pieridae (53), Nymphalidae (308), and Lycaenidae (285), and the total

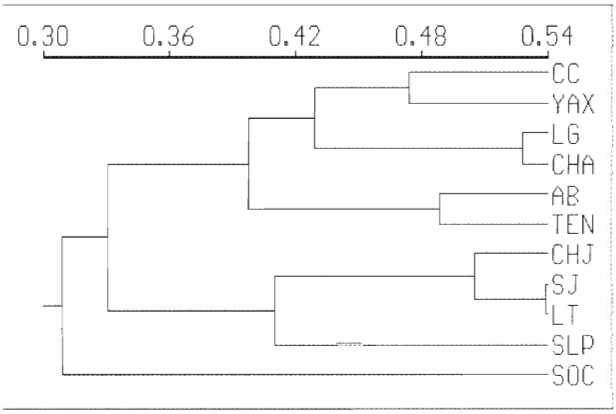

FIG. 2. UPGMA DENDROGRAM OF THE GEOGRAPHICAL UNITS BASED ON THE JACCARD SIMILARITY COEFFICIENT.

number of genera per family for each geographical unit.

The geographical units having the highest number of exclusive species are LT (84), CHJ (40), and SJ (23). When the geographical units were gruped by state, the three in Tabasco (CC-AB-TEN) shared 78 species; in Oaxaca (LG-CHA-SJ), 105; and in Chiapas (CHJ-YAX-SOC) 84. In Chiapas, the units CHJ-SOC share 114 species, while CHJ-YAX share 170; this makes sense since the latter two geographical units belong to the same biogeographical "island" of ETF, while SOC, on the Pacific slope, belongs to a different biogeographical area.

The geographical units SLP and LT, the northernmost localities of ETF, share 243 species, this large figure suggests that both belong to the same biogeographical "island." If the four geographical units having that largest number of species are grouped (LT-SJ-CHJ-SLP), these share only 138 species, again emphasizing the importance of the geographical history of such units, with mixture of species in the northern units having influence over the total number of species.

The UPGMA (unweighted pair-group method using arithmetic averages) dendrogram of all geographical units (Fig. 2) was prepared, based on the Jaccard coefficient to assess the degree of similarity. This similarity between the geographical units was based in part on the synthetic data matrix (Table 2) that groups the species shared by each unit.

As mentioned above, SOC belongs to a distinct geographical "island" of ETF, a fact seen in the dendrogram where it appears as the most dissimilar from all other geographical units. An important group is that whose geographical units have the largest collection effort (SJ-LT-CHJ) and number of species. The remaining group whose geographical units have the lowest number of species, may need more collecting effort. The similarities between LG and CHA, and that between AB and TEN are probably due to their geographical proximity (Fig. 1).

Table 3 compares the numbers of species in various areas of ETF in the Neotropical region, such as Tikal, Guatemala (Austin et al. 1996); Jaru, Manaus, Campinas and Rondonia in Brazil (Brown 1984, Emmel & Austin 1990); Pakitza, Tambopata and Río Napo in Peru

TABLE 2. Synthetic matrix of species shared by the geographical units.

	CC	AB	TEN	CHJ	YAX	SOC	LG	CHA	SJ	LT	SLP
CC	0										
AB	105	0									
TEN	105	85	0								
CHJ	164	110	114	0							
YAX	135	89	98	170	0						
SOC	91	66	70	114	90	0					
LG	118	83	82	139	110	75	0				
CHA	118	84	77	137	105	75	115	0			
SJ	172	116	119	243	160	121	139	142	0		
LT	185	114	122	273	185	119	143	157	293	0	
SLP	130	81	91	168	132	93	102	99	198	243	0

TABLE 3. Butterfly species richness in some localities in the Neotropical region.

	LOCALITIES										
FAMILIES	GUATEMALA	BRASIL					PERU		COSTA RICA		ECUADOR
	Tikal	Jaru	Manaus	Campinas	Rondonia	Pakitza	Tambopata	Río Napo	AL	PE	Misahuallí
Papilionidae	18	23	7	17	18	25	26	26	16	17	36
Pieridae	23	26	7	29	29	31	27	23	26	26	34
Nymphalidae	141	343	137	208	275	371	341	238	219	174	317
Lycaenidae	98	89	50	54	87	181	172	68	*	*	*
Riodinidae	48	196	111	60	203	251	242	153	97	79	*
TOTAL	328	677	312	368	612	859	808	508	358	296	387

NOTE: Asterisks indicate missing data.

ABBREVIATIONS: AL = Atlantic lowland; PE = Pacific evergreen (DeVries 1997).

(Lamas et al. 1991, 1996); several localities in Costa Rica (DeVries 1997); and Misahuallí in Ecuador (Racheli & Racheli 1998). When these data are compared with those from México (Table 1), the species richness of geographical units such as LT or SJ becomes obvious, comparable with that of areas such as Tikal (328 species) or Campinas (368). LT and SJ have the largest know numbers of Pieridae (45 and 41, respectively), for México (and also the Neotropical region).

CONCLUSIONS

The ETF of México show a total of 683 species of Papilionoidea (excluding Hesperiidae). Robbins & Opler (1997) state that the higher diversity of butterflies follows the amount of rainfall. The data in this paper include collections made in sites having 1,500 mm minimum average annual rainfall, supporting the empirical observation that wet sites have a large species diversity. However, other parameters must be considered to explain and compare the diversity and richness of species, such as area and topographical or ecological heterogeneity.

Emmel & Austin (1990) discussed the role played by the great "microheterogeneity" present in the locality of Jarú. Environmental heterogeneity is also relevant in our observations; for example SLP and LT are more heterogeneous, giving mixture of species from montane and lowland areas, due to altitude (montane effect) in LT and latitude in SLP.

ACKNOWLEDGMENTS

The authors thank Dr. Juan José Morrone Lupi for reviewing the manuscript. Also, we thank the "Consejo Nacional para la Ciencia y la Tecnología" (CONACYT) project 32002, Dirección General de Asuntos del Pesonal Académico (DGAPA-IN) project 209900 and the "Comisión para el Conocimiento y Uso de la Biodiversidad" (CONABIO) for financial aid for field work in the regions of Chimalapas, Oaxaca and Yaxchilán, Chiapas.

LITERATURE CITED

AUSTIN, G. T., N. M. HADDAD, C. MÉNDEZ, T. D. SISK, D. D. MURPHY, A. E. LAUNER & P. E. EHRLICH. 1996. Annotated checklist of the butterflies of the Tikal National Park Area of Guatemala. Tropical Lepidoptera, 7: 21-37.

BROWN, K. S. 1984. Species diversity and abundance in Jaru, Rondônia (Brazil). News Lep. Soc., 1984: 45-47.

COLWELL, R. & J. CODDINGTON. 1994. Estimating terrestrial biodiversity through extrapolation. Phil. Trans. R. Soc. London. B., 345: 101-118.

DE LA MAZA, J. E. & R. G. DE LA MAZA. 1985a. La fauna de mariposas de Boca de Chajul, Chiapas, México (Rhopalocera). Parte I. Rev. Soc. Mex. Lep., 9: 23-44.

DE LA MAZA, J. E. & R. G. DE LA MAZA. 1985b. La fauna de mariposas de Boca de Chajul, Chiapas, México (Rhopalocera). Parte II. Rev. Soc. Mex. Lep., 10: 1-17.

DE LA MAZA, R. G. & A. WHITE. 1990. Rhopaloceros de la Huasteca Potosina, su distribución, composición, origen y evolución. Rev. Soc. Mex. Lep., 13(2): 31-88.

DE LA MAZA, R. G. & D. GUTIÉRREZ. 1994. Rhopaloceros de Quintana Roo, su distribución, origen y evolución. Rev. Soc. Mex. Lep., 15(1): 3-43.

DEVRIES, P. J. 1997. The Butterflies of Costa Rica and Their Natural History. Volume II: Riodinidae. Princeton University Press, Princeton, N. J. 288 pp.

DIRZO, R. & M. C. GARCÍA. 1992. Rates of deforestacion in Los Tuxtlas, a Neotropical Area in Southeast Mexico. Conservation Biology, 6(1): 84-90.

EMMEL, T. C. & G. T. AUSTIN. 1990. The tropical rain forest butterfly fauna of Rondonia, Brazil: Species diversity and conservation. Tropical Lepidoptera, 1:1-12.

GRANILLO, V. S. 1985. Uso y abuso de la selva. Información Científica y Tecnológica, 7: 35-38.

HEPPNER, J. B. 1991. Faunal regions and diversity of Lepidoptera. Tropical Lepidoptera. 2 (suppl. 1): 1-85.

HOFFMANN, C. 1933. La fauna de lepidópteros del Distrito del Soconusco (Chiapas). Un estudio zoogeográfico. Anales Inst. Biol. (Zoología), UNAM, 4(3-4): 207-307.

LAMAS, G., D. J. HARVEY & R. K. ROBBINS. 1996. Mariposas del alto Río Napo, Loreto, Perú (Lepidoptera: Papilionoidea y Hesperioidea). Rev. Peru. Ent. 39: 63-74.

LAMAS, G., R. K. ROBBINS & D. J. HARVEY. 1991. A preliminary butterfly fauna of Pakitza, Parque Nacional del Manú, Peru, with an estimate of its species richness. Publ. Mus. Hist. Nat. UNMSM (A), 40: 1-19.

LLORENTE, J., A. LUIS, I. VARGAS & J. SOBERÓN. 1993. Biodiversidad de las mariposas: su conocimiento y conservación en México. Rev. Soc. Mex. Hist. Nat., 44: 313-324.

LUIS, A, I. VARGAS & J. LLORENTE. 1991. Lepidopterofauna de Oaxaca I: Distribución y fenología de los papilionoidea de

la Sierra de Juárez. Publicaciones Especiales del Museo de Zoología. Fac. Ciencias. No. 3, Mexico City. 119 pp.

LUIS, A., I. VARGAS & J. LLORENTE. 1995. Síntesis de los Papilionoidea (Lepidoptera: Rhopalocera) del Estado de Veracruz. Folia Entomol. Mex. 93: 91-133.

LUIS, A., J. LLORENTE, I. VARGAS & A. L. GUTIÉRREZ V. 2000. Síntesis preliminar del conocimiento de los Papilionoidea (Lepidoptera: Insecta) de México, pp. 275-285. *In*: Martín-Piera, F., J. J. Morrone & A. Melic (eds.). Hacia un proyecto CYTED para el inventario y estimación de la diversidad Entomológica en Iberoamérica: PrIBES-2000, Sociedad Entomológica Aragonesa, Vol. 1.

MARTÍNEZ, G. L. 1994. Inventario de la división Rhopalocera (Lepidoptera: Frenatae) del parque estatal de Agua Blanca, Tabasco. Tesis Profesional. División Académica de Ciencias Biológicas. Universidad Juárez Autónoma de Tabasco. 54 pp.

MYERS, N. 1988. Tropical forests and their species. *In*: E.O. Wilson (ed). Biodiversity, pp. 28-35. National Academy Press. Washington, D.C.

RACHELI, T. & L. RACHELI. 1998. Lepidoptera diversity of an Ecuadorian lowland rain forest (Lepidoptera: Papilionidae, Pieridae, Nymphalidae, Saturniidae, Sphingidae). Neue Ent. Nachr. 41: 95-117.

RAGUSO, R. A. & J. LLORENTE. 1991. A comparative analysis of the butterflies (Lepidoptera:Papilionoidea) of the Tuxtlas mountains, Veracruz, México. J. Res. Lep., 29: 105-133.

RAGUSO, R. A. & J. LLORENTE. 1997. Las mariposas de la estación de Biología Tropical Los Tuxtlas, Veracruz, de la UNAM, pp 257-291. *In*: E. González, R Dirzo & R. C. Vogt (eds.). Historia Natural de la Región de Los Tuxtlas. Universidad Nacional Autonoma de México.

ROBBINS, R. K. & P. A. OPLER. 1997. Butterfly diversity and preliminary comparison with bird and mammal diversity, pp 69-82. *In*: D.E. Wison, M.L. Reaka-Kudla & E.O. Wilson (eds.). Biodiversity II, Understanding and Protecting our Biological Resources. Joseph Henry Press, Washington, D. C.

ROSS, G. N. 1964. A distributional study of the butterflies of the Sierra de Tuxtla in Veracruz, México. Ph. D. Louisiana State University. 265 pp.

___. 1976-1977. An ecological study of the butterflies of the Sierra de Tuxtla, Veracruz, México. Jour. Res. Lep. 14(2): 103-124, (3): 169-188, (4): 233-252; 15(1): 41-60, (2): 109- 128, (3): 185-200, (4): 225-240; 16(2): 87-130.

ROUTLEDGE, C. E. 1977. El suborden Rhopalocera (Lepidoptera) del estado de Tabasco. Su lista, frecuencia, diversidad y distribución. Rev. Soc. Mex. Lep., 3: 57-73.

RZEDOWSKI, J. 1978. La vegetación de México. Edit. Limusa, México. 432 pp.

___. 1996. Diversidad y origenes de la flora fanerogámica en México, pp. 27-40. *In*: J. Llorente, A. García y E, González (eds.). Biodiversidad, taxonomía y biogeografía de artrópodos de México: Hacia una síntesis de su conocimiento, Volumen 1, UNAM-CONABIO, México, D. F.

SOBERÓN, J. & J. LLORENTE. 1993. The use of species accumulation functions for the prediction of species richness. Conservation Biology. 7(3): 480-488.

TOLEDO, V. M. 1988. La diversidad biológica de México. Ciencia y Desarrollo, 81: 17-30.

VARGAS, I., J. LLORENTE & A. LUIS. 1992. Listado lepidopetrofaunistico de la Sierra de Atoyac de Alvarez en el estado de Guerrero: notas acerca de su distribución local y estacional (Rhopalocera: Papilionoidea). Folia Entomolgica Mexicana. 86:41-178.

VARGAS, I., J. LLORENTE & A. LUIS. 1999. Distribución de los Papilionoidea (Lepidoptera: Rhopalocera) de la Sierra de Manantlán (250-1,650 m) en los estados de Jalisco y Colima. Publicaciones Especiales del Museo de Zoología. 11: 1-153.

VILLEGAS, I. S. 1998. Inventario de los Papilionoidea (Insecta: Lepidoptera) del Monumento Natural Cerro del Coconá, Teapa, Tabasco y algunos aspectos de su fenología. Tesis Profesional. División Académica de Ciencias Biológicas. Universidad Juárez Autónoma de Tabasco. iii + 87 pp.

WILSON, E. O. 1988. The current state of biological diversity, pp. 3-18. *In*: E.O. Wilson (ed). Biodiversity. National Academy Press. Washington, D.C.

Received for publication 1 November 2001; revised and accepted 5 September 2003

Appendix 1: Preliminary list of species. Data for each species are represented in the following format first column is the species name and subsequent columns mention the sites where the butterflies were collected.Asterisks (*)indicate doubtful data.

Taxon	CC	AB	TEN	CHJ	YAX	SOC	LG	CHA	SJ	LT	SLP
Papilionidae											
Battus philenor philenor		X							X	X	X
B. polydamas polydamas	X	X	X	X	X	X	X	X	X	X	X
B. laodamas copanae	X	X	X	X			X	X	X	X	
B. ingenuus				X					X	X	
B. lycidas				X		X			X	X	
Parides photinus	X			X		X			X	X	X
P. montezuma						X				X	X
P. eurimedes mylotes	X	X	X	X	X	X	X	X	X	X	
P. sesostris zestos	X	X	X	X	X		X	X	X	X	
P. panares panares							X	X		X	
P. panares lycimenes	X	X		X					X		
P. erithalion polyzelus	X	X	X	X	X	X	X	X	X	X	
P. iphidamas iphidamas	X		X	X	X	X		X	X	X	
Protographium epidaus epidaus	X	X	X	X					X	X	X
P. philolaus philolaus		X	X	X	X				X	X	X

APPENDIX 1. Continued

Taxon	CC	AB	TEN	CHJ	YAX	SOC	LG	CHA	SJ	LT	SLP
P. agesilaus neosilaus	X		X	X	X				X	X	
P. dioxippus lacandones				X			X				
P. calliste calliste									X	X	X
P. thyastes marchandi				X			X		X	X	
Eurytides salvini				X	X		X				
Protesilaus macrosilaus penthesilaus			X	X				X	X		
Mimoides thymbraeus thymbraeus									X	X	X
M. ilus branchus	X	X	X	X			X	X	X	X	
M. phaon phaon	X		X	X			X	X	X	X	X
Priamides pharnaces					X				X	X	X
P. anchisiades idaeus	X		X	X	X		X	X	X	X	X
P. erostratus erostratinus											X
P. erostratus erostratus					X						
Troilides torquatus tolus									X		
Calaides ornythion ornythion										X	X
C. astyalus pallas				X	X		X		X	X	X
C. androgeus epidaurus			X	X	X	X	X		X	X	X
Heraclides thoas autocles	X	X	X	X	X		X	X	X	X	X
H. cresphontes	X			X		X	X	X	X	X	X
Papilio polyxenes asterius									X	X	X
Pyrrhosticta victorinus victorinus									X	X	X
P. abderus abderus											X
Pieridae											
Enantia lina marion				X	X	X			X		
E. albania albania				X						X	X
E. jethys										X	X
E. mazai mazai									X		
Lieinix nemesis atthis										X	X
Dismorphia amphiona praxinoe	X	X		X	X	X	X			X	X
Dismorphia crisia virgo										X	
D. eunoe eunoe									X		
D. eunoe popoluca										X	
D. theucharila fortunata	X			X			X	X	X	X	
Zerene cesonia cesonia		X	X					X	X	X	X
Anteos clorinde nivifera		X	X	X	X			X	X	X	X
A. maerula lacordairei	X	X	X	X	X			X	X	X	X
Phoebis agarithe agarithe	X	X	X	X	X			X	X	X	X
P. argante argante	X		X	X	X	X	X	X	X	X	X
P. neocypris virgo							X	X	X	X	X
P. philea philea	X	X	X	X	X	X	X	X	X	X	X
P. sennae marcellina	X	X	X	X	X	X	X	X	X	X	X
Rhabdodryas trite ssp.			X	X	X	X		X	X	X	
Aphrissa statira jada	X	X	X	X	X	X	X	X	X	X	X
Abaeis nicippe						X			X	X	X
Pyrisitia dina westwoodi	X	X	X	X	X	X	X		X	X	X
P. lisa centralis	X		X		X	X				X	X
P. nise nelphe	X	X	X	X	X	X	X	X	X	X	X
P. proterpia proterpia	X	X	X	X	X	X	X	X	X	X	X
Eurema agave millerorum	X										
E. albula celata	X	X	X	X	X	X	X	X	X	X	X
E. boisduvaliana	X		X	X	X				X	X	X
E. daira	X	X	X	X	X		X	X	X	X	X
E. mexicana mexicana		X	X	X		X			X	X	X
E. salome jamapa							X		X		X
E. xantochlora xantochlora							X		X	X	

APPENDIX 1. Continued

Taxon	CC	AB	TEN	CHJ	YAX	SOC	LG	CHA	SJ	LT	SLP
Nathalis iole				X	X	X			X	X	X
Kricogonia lyside				X						X	
Hesperocharis costaricensis pasion						X			X	X	
Archonias brassolis aproximata				X			X		X	X	
Charonias theano nigrescens				X	X				X	X	
Catasticta flisa flisa									X	X	X
Catasticta nimbice nimbice										X	X
C. ochracea ochracea										X	
Pereute charops charops									X	X	X
Melete lycimnia isandra	X		X	X		X			X	X	X
M. polyhymnia florinda				X					X		
Glutophrissa drusilla tenuis	X	X	X	X	X		X	X	X	X	X
Pontia protodice									X	X	X
Leptophobia aripa elodia				X		X			X	X	X
Itaballia demophile centralis	X					X			X	X	X
I. pandosia kicaha				X			X	X	X	X	
Pieriballia viardi viardi	X			X	X		X	X	X	X	X
Perrhybris pamela chajulensis				X	X				X		
Ascia monuste monuste	X		X	X	X	X	X	X	X	X	X
Ganyra josephina josepha	X		X		X				X	X	X
G. phaloe tiburtia	X										
Nymphalidae											
Altinote ozomene nox	X					X		X	X	X	
Actinote guatemalena veraecrusis	X	X					X		X	X	
A. guatemalena guatemalena		X	X	X	X						
A. thalia anteas						X					
Philaethria diatonica	X			X					X	X	
Dione juno huascuma	X	X	X	X	X	X	X	X	X	X	X
D. moneta poeyii							X	X	X	X	X
Agraulis vanillae incarnata	X	X	X	X	X	X	X	X	X	X	X
Dryadula phaetusa	X	X	X	X			X	X	X	X	X
Dryas iulia moderata	X	X	X	X	X	X	X	X	X	X	X
Eueides aliphera gracilis	X	X		X	X	X	X	X	X	X	
E. isabella eva	X		X	X			X		X	X	X
E. lineata	X	X		X	X				X	X	X
E. procula asidia	X								X		
E. vibilia vialis	X			X				X		X	
Laparus doris viridis	X	X		X				X	X	X	
Heliconius charitonia vazquezae	X	X	X	X	X	X	X	X	X	X	X
Heliconius cydno galanthus		X		X	X		X	X			
H. erato petiveranus	X	X	X	X	X	X	X	X	X	X	X
H. hecale zuleika	X	X	X						X		
H. hecale fornarina						X					
H. hecalesia octavia				X		X		X	X		
H. hortense			X			X			X	X	X
H. ismenius telchinia	X	X	X	X	X	X	X	X	X	X	X
H. sapho leuce	X	X	X	X	X		X	X	X	X	
H. sara veraepacis		X		X					X		
Euptoieta claudia daunius									X		X
E. hegesia hoffmanni	X	X	X	X	X	X	X	X	X	X	X
Vanessa atalanta rubria										X	X
Cynthia cardui										X	X
C. virginiensis				X						X	X
C. anabella											X
Nymphalis antiopa antiopa											X

APPENDIX 1. Continued

Taxon	CC	AB	TEN	CHJ	YAX	SOC	LG	CHA	SJ	LT	SLP
Polygonia interrogationis										X	
Hypanartia dione						X			X		
H. godmanii				X		X			X	X	X
H. lethe				X		X		X	X	X	X
H. kefersteini											X
Anartia amathea venusta	X	X	X	X	X	X	X	X	X	X	X
A. jatrophae luteipicta	X	X	X	X	X	X	X	X	X	X	X
Siproeta epaphus epaphus	X	X	X	X	X	X	X		X	X	X
S. stelenes biplagiata	X		X	X	X	X	X	X	X	X	X
S. superba superba	X	X	X	X		X			X	X	
Junonia coenia		X							X	X	X
J. evarete	X			X	X	X		X	X	X	X
Chlosyne erodyle erodyle	X	X	X		X	X		X	X	X	
C. gaudialis gaudialis	X	X	X	X	X	X		X	X	X	
C. hippodrome hippodrome			X		X				X	X	X
C. janais	X	X	X	X	X	X	X	X	X	X	X
C. lacinia lacinia	X		X	X	X		X	X	X	X	X
C. marina marina		X									
C. rosita browni											X
Thessalia theona theona	X	X	X	X					X		X
T. theona thekla					X						
Texola elada elada		X									
T. elada ulrica											X
Microtia elva horni								X			X
Phyciodes mylitta mexicana	X		X								
P. vesta graphica					X				X	X	X
P. phaon											X
Phyciodes tharos tharos					X						X
Anthanassa ardys ardys			X							X	X
A. argentea				X			X				X
A. atronia sydra									X		X
A. atronia atronia						X					
A. drusilla lelex	X	X					X	X	X	X	X
A. frisia tulcis					X	X			X	X	X
A. ptolyca ptolyca				X		X					X
A. texana texana											X
A. annulata											X
Tegosa anieta cluvia					X						
T. anieta luka									X		X
T. guatemalena	X			X				X	X	X	
T. similis				X							X
Eresia clara clara			X	X	X		X		X	X	X
E. phillyra phillyra	X	X		X		X	X	X	X	X	X
Castilia eranites mejicana				X				X	X	X	X
C. myia myia	X	X		X	X	X	X	X	X	X	X
C. ofella ofella						X			X		
Historis odius dious	X	X	X		X	X	X		X	X	X
Coea acheronta acheronta	X	X	X	X	X	X	X	X	X	X	X
Baeotus beotus beotus				X							
Smyrna blomfildia datis	X		X	X	X	X	X	X	X	X	X
S. karwinskii				X		X	X		X		X
Colobura dirce dirce	X	X	X	X	X	X	X	X	X	X	X
Tigridia acesta ssp.				X	X						
Biblis hyperia aganisa	X	X	X	X	X	X	X	X	X	X	X
Mestra dorcas amymone	X	X	X	X	X	X			X	X	X
Myscelia cyananthe cyananthe							X				

APPENDIX 1. Continued

Taxon	CC	AB	TEN	CHJ	YAX	SOC	LG	CHA	SJ	LT	SLP
Myscelia cyaniris cyaniris	X	X	X	X	X			X	X	X	X
M. ethusa ethusa		X							X	X	X
Catonephele mexicana	X			X	X	X	X	X	X	X	X
C. numilia esite	X	X	X	X	X	X	X	X	X	X	X
Catonephele cortesi					X						
Nessaea aglaura aglaura	X			X	X			X	X	X	
Eunica alcmena			X	X	X		X		X	X	
E. alpais excelsa				X							
Eunica sydonia caresa				X	X	X					
E. malvina albida	X			X		X					
E. monima	X	X		X	X	X	X	X	X	X	X
E. mygdonia omoa			X	X	X						
E. olympias augusta	X		X	X		X	X		X	X	
E. venusia				X							
E. tatila tatila					X						X
Hamadryas amphinome mexicana	X	X	X	X	X		X	X	X	X	X
H. februa ferentina	X	X	X	X	X	X	X	X	X	X	X
H. feronia farinulenta	X	X	X	X	X	X	X	X	X	X	X
H. fornax fornacalia					X				X		X
H. glauconome glauconome				X				X	X	X	X
H. guatemalena marmarice	X	X			X		X	X	X	X	X
H. guatemalena guatemalena				X					X		
H. iphthime joannae	X		X	X	X	X	X	X	X	X	
H. laodamia saurites	X	X	X	X	X	X	X	X	X	X	
Ectima erycinoides ssp.				X							
Pyrrhogyra edocla edocla				X					X	X	
P. neaerea hypsenor	X	X	X	X	X	X			X	X	
P. otolais otolais	X	X	X	X	X	X			X	X	X
Temenis laothoe hondurensis	X	X	X	X	X		X	X	X	X	X
Epiphile adrasta adrasta									X	X	X
E. hermosa									X		
E. orea plutonia									X	X	
Bolboneura sylphis veracruzana											X
B. sylphis lacandona				X							
Nica flavilla bachiana	X	X	X	X	X	X	X	X		X	X
Dynamine artemisia glauce		X		X					X	X	
D. ate				X							
D. dyonis										X	X
D. postverta mexicana	X	X	X		X		X	X		X	
D. theseus		X									
Diaethria anna	X		X	X		X	X	X	X	X	X
D. astala astala				X		X	X	X	X	X	X
Cyclogramma bacchis										X	
Cyclogramma pandama									X	X	X
Callicore astarte casta								X	X	X	
Callicore astarte patelina				X	X						
C. lyca lyca		X		X			X	X	X	X	
C. texa grijalva	X	X	X				X	X	X	X	
C. texa titania				X	X	X					
C. tolima tehuana									X		
C. tolima pacifica						X					
C. pitheas						X					
Adelpha basiloides basiloides	X	X	X	X	X			X	X	X	X
A. baeotia milleri										X	
A. baeotia oberthurii				X							
A. celerio diademata	X	X	X	X		X			X	X	X

APPENDIX 1. Continued

Taxon	CC	AB	TEN	CHJ	YAX	SOC	LG	CHA	SJ	LT	SLP
Adelpha bredowii eulalia											X
A. cytherea marcia				X			X	X	X		
A. escalantei									X		
A. felderi jarias				X				X	X	X	
A. iphiclus iphicleola	X			X	X		X		X	X	
A. diazi	X							X		X	
A. ixia leucas	X			X					X	X	
A. leuceria leuceria				X		X			X	X	X
A. leucerioides leucerioides										X	
A. lycorias melanthe	X								X	X	X
A. naxia epiphicla				X	X	X			X	X	
A. paroeca emathia										X	
A. phylaca phylaca	X		X	X			X		X	X	X
Adelpha pithys										X	
A. salmoneus salmonides										X	
A. serpa massilia	X		X	X					X	X	X
A. zalmona sophax				X							
A. fessonia fessonia											X
Basilarchia archippus hoffmanni									X	X	X
Marpesia chiron marius	X	X	X	X	X	X	X	X	X	X	X
M. corita corita				X		X		X	X	X	
M. harmonia	X	X	X	X	X	X	X	X	X	X	
M. petreus tethys	X	X	X	X	X	X	X		X	X	X
M. zerynthia dentigera						X		X	X		X
Archaeoprepona amphimachus amphiktion	X		X	X	X	X	X				
A. demophon centralis	X			X	X	X	X	X	X	X	X
A. demophoon gulina	X	X		X	X	X	X		X	X	X
A. meander phoebus				X	X						
A. phaedra aelia									X		
Prepona deiphile brooksiana									X		
P. deiphile escalantiana										X	X
P. dexamenes medinai				X							
P. laertes octavia	X			X	X		X		X	X	
P. pylene philetas				X					X		
Agrias aedon rodriguezi				X							
A. amydon oaxacata				X			X				
Zaretis callidryas	X								X	X	
Z. itus ellops	X	X		X			X	X	X	X	
Siderone galanthis ssp.				X						X	
S. syntiche syntiche	X				X	X	X	X	X		
Anaea troglodyta aidea	X					X		X	X	X	X
Consul electra electra	X	X	X	X	X		X		X	X	X
C. fabius cecrops	X	X	X	X	X	X	X		X	X	X
Fountainea eurypyle confusa	X		X	X	X		X	X	X	X	X
F. glycerium glycerium									X	X	X
F. halice martinezi									X		
F. ryphea ryphea									X	X	
Memphis artacaena	X			X	X		X			X	
M. aureola									X		
M. dia ssp.									X		
M. forreri									X	X	X
M. hedemanni				X						X	
M. herbacea				X							
M. mora orthesia	X			X			X				X
M. phila boisduvali	X			X					X	X	X
M. neidhoeferi				X					X	X	

APPENDIX 1. Continued

Taxon	CC	AB	TEN	CHJ	YAX	SOC	LG	CHA	SJ	LT	SLP
Memphis oenomais				X			X	X	X	X	X
M. philumena xenica							X	X	X	X	
M. pithyusa	X			X	X	X	X	X	X	X	X
M. proserpina				X			X	X	X	X	
M. xenocles carolina							X				
M. perenna perenna						X					
Asterocampa idyja argus				X					X	X	X
Doxocopa cyane mexicana									X		
D. laure laure	X	X	X	X	X	X			X	X	X
D. laurentia cherubina	X			X		X			X	X	X
D. pavon theodora	X			X	X	X	X		X	X	X
Morpho achilles montezuma	X	X	X	X			X	X	X	X	X
M. achilles octavia					X	X					
Pessonia luna luna				X				X	X	X	
Iphimedeia telemachus justitiae				X							
I. telemachus ssp.										X	
I. telemachus oaxacensis								X	X		
Dynastor darius stygianus				X							
D. macrosiris strix				X						X	X
Opsiphanes boisduvalii	X		X	X					X	X	X
O. cassiae			X				X		X	X	X
O. tamarindi	X	X		X	X	X	X	X	X	X	X
O. invirae fabricii	X	X	X	X	X	X	X	X	X	X	X
O. quiteria quirinus				X			X	X	X	X	
Caligo atreus uranus				X	X	X	X	X	X	X	X
C. oileus scamander			X	X	X		X	X		X	
C. prometheus memnon	X	X	X	X	X	X	X	X	X	X	
Eryphanis aesacus aesacus			X	X	X	X			X	X	X
Narope cyllastros testacea				X					X	X	
Pierella luna rubecula	X	X	X	X	X		X	X	X	X	
Manataria maculata				X		X			X	X	X
Cepheuptychia glaucina				X	X				X	X	X
Chloreuptychia sericeella				X				X	X	X	
Cissia confusa					X					X	X
C. labe				X			X		X	X	
C. terrestris			X						X		
Cyllopsis hedemanni hedemanni									X		
C. hedemanni tamaulipensis											X
C. hilaria				X							
C. suivalens escalantei									X		
C. pyracmon						X					
C. gemma freemani											X
C. dospassosi											X
Euptychia mollina				X					X	X	X
Hermeuptychia hermes	X			X	X	X	X	X	X	X	X
H. alcinoe										X	
Oxeoschistus hilara hilara						X					
Magneuptychia libye	X	X	X	X	X	X	X		X	X	
Megeuptychia antonoe				X	X				X	X	
Pareuptychia binocula metaleuca	X			X	X		X	X	X	X	X
P. interjecta		X									
P. ocirrhoe	X		X	X	X	X	X	X	X	X	X
Pseudodebis zimri				X	X					X	
Satyrotaygetis satyrina										X	
Splendeuptychia kendalli					X						X
Paramacera xicaque xicaque											X

APPENDIX 1. Continued

Taxon	CC	AB	TEN	CHJ	YAX	SOC	LG	CHA	SJ	LT	SLP
Taygetis kerea kerea							X				
T. leuctra				X							
T. mermeria excavata			X	X	X				X	X	
T. uncinata									X	X	
T. virgilia		X		X	X	X	X		X	X	X
T. weymeri				X							
T. thamyra				X	X		X	X		X	X
Vareuptychia usitata pieria	X	X		X	X		X	X	X	X	X
V. themis										X	
V. similis		X				X				X	
V. undina	X									X	
Yphthimoides renata disaffecta	X			X	X		X	X	X	X	
Dioriste tauropolis tauropolis						X			X	X	X
Pedaliodes dejecta circumducta									X		
Danaus eresimus montezuma	X	X		X	X		X	X	X	X	X
D. gilippus thersippus	X	X	X	X	X		X	X	X	X	X
D. plexippus plexippus	X	X	X	X		X	X	X	X	X	X
Lycorea halia atergatis	X	X		X	X	X	X	X	X	X	X
L. ilione albescens										X	
Anetia thirza thirza										X	
Tithorea harmonia hippothous	X			X	X		X		X	X	
T. tarricina duenna									X		X
Aeria eurimedea pacifica		X	X	X	X	X	X		X	X	
Olyras crathis theon									X	X	
Melinaea lilis flavicans	X	X		X				X	X	X	
M. lilis imitata						X					
Mechanitis lysimnia utemaia	X		X	X	X		X	X	X	X	
M. menapis doryssus	X	X		X	X	X	X	X	X	X	
M. polymnia lycidice	X	X	X	X	X	X	X	X	X	X	
Hyposcada virginiana virginiana		X		X		X		X	X		
Oleria paula	X			X	X	X	X	X	X	X	X
Napeogenes tolosa tolosa		X		X	X		X	X	X	X	
Hypothyris euclea valora										X	
H. lycaste dionaea				X	X	X		X	X	X	
Ithomia leila				X			X	X	X	X	
I. patilla patilla	X	X		X	X	X	X	X	X	X	
Callithomia hezia hedila							X	X	X		
C. hezia wellingi				X							
Dircenna dero ssp.	X	X		X			X	X			
D. jemina ssp.									X		
D. klugii klugii	X	X		X		X		X	X	X	X
Episcada salvinia salvinia						X			X		
Pteronymia artena artena										X	
P. cotytto	X	X		X			X	X	X	X	X
P. simplex fenochioi											X
Godyris zavaleta sosunga		X	X	X							
Hypomenitis annette annette										X	X
Greta morgane oto	X	X	X	X	X	X	X	X	X	X	X
G. nero nero			X	X	X	X	X	X	X	X	X
Hypoleria lavinia cassotis				X			X	X		X	
Libytheana carinenta mexicana	X	X	X	X	X		X	X	X	X	X
Lycaenidae											
Euselasia cataleuca				X					X	X	
E. chrysippe				X							
E. regipennis regipennis				X							
E. sergia sergia				X					X	X	

APPENDIX 1. Continued

Taxon	CC	AB	TEN	CHJ	YAX	SOC	LG	CHA	SJ	LT	SLP
Euselasia procula				X							
E. hieronymi hieronymi									X	X	X
E. inconspicua									X		
E. pusilla									X	X	
E. eubule eubule									X	X	X
E. aurantiaca aurantiaca				X		X			X	X	
Hades noctula				X					X	X	
Perophthalma tullius lasus				X						X	
Leucochimona vestalis vestalis				X					X	X	
L. lepida nivalis	X			X	X				X	X	X
Mesosemia telegone telegone	X	X		X	X				X	X	X
M. gaudiolum				X						X	
M. gemina								X	X	X	
Eurybia patrona persona				X							
E. lycisca			X	X					X	X	
E. halimede elvina	X	X		X	X				X	X	
Hermathena oweni										X	
Diophtalma lagora iphias						X					
Napaea eucharila picina				X							
N. theages theages				X							
N. umbra umbra					X				X	X	X
Cremna actoris				X							
C. thasus subrutila				X						X	
Lyropteryx lyra cleadas				X					X		
Ancyluris jurgensenii montezuma				X					X	X	
A. inca mora				X					X	X	
Rhetus arcius thia	X		X	X	X	X			X	X	X
R. periander naevianus				X					X		
Isapis agyrtus hera				X					X		
Brachyglenis dodone				X							
Notheme erota diadema				X	X					X	
Lepricornis melanchroia				X					X	X	
Calephelis nemesis nemesis										X	
C. mexicana				X							
C. fulmen									X	X	X
C. stallingsi										X	X
C. huasteca									X		X
C. acapulcoensis									X		
C. yucatana									X		
C. perditalis perditalis											X
C. montezuma											X
C. laverna laverna						X					
Charis gynaea zama				X	X					X	
C. velutina					X				X	X	
Chalodeta chaonitis				X							
Caria ino melicerta									X	X	X
C. domitianus vejento				X							
C. rhacotis rhacotis					X					X	
C. lampeto				X					X		
Baeotis zonata simbla					X				X	X	X
B. sulphurea macularia					X						
B. sulphurea sulphurea											X
Lasaia meris				X							
L. agesilas callaina	X			X					X	X	X
L. sessilis	X										
L. maria anna				X	X					X	X

APPENDIX 1. Continued

Taxon	CC	AB	TEN	CHJ	YAX	SOC	LG	CHA	SJ	LT	SLP
L. narses°						X					
L. sula peninsularis											X
Melanis pixe pixe	X	X	X	X	X	X			X	X	X
M. cephise cephise										X	
M. cephise huasteca											X
Mesene croceella				X					X	X	X
M. margaretta margaretta				X		X				X	X
Xenandra caeruleata				X						X	
Chimastrum argenteum argenteum				X							
Symmachia rubina rubina				X						X	
S. accusatrix									X	X	X
Symmachia probetor championi									X	X	X
S. tricolor hedemanni				X					X	X	
Pterographium sagaris tyriotes										X	
Sarota gamelia										X	
S. acanthoides myrtea										X	X
S. chrysus dematria				X					X	X	X
Anteros formosus micon				X							
A. carausius carausius	X				X				X	X	X
Calydna lusca venusta										X	
C. sturnula hegias										X	X
C. sinuata										X	
Emesis aurimna				X						X	
E. saturata			X						X		X
E. liodes										X	
E. mandana furor				X					X	X	X
E. vulpina	X				X				X		
E. fatimella nobilata				X							X
E. tenedia tenedia	X			X	X				X	X	X
E. lupina				X						X	
E. ocypore aethalia				X							
E. zela zela									X		
E. emesia emesia				X						X	X
E. cypria paphia									X		
E. tegula										X	
E. zela cleis											X
Argyrogrammana holosticta	X			X						X	X
Pseudonymphidia clearista									X		X
Pachythone gigas				X							
Apodemia multiplaga										X	
A. hypoglauca hypoglauca										X	X
A. walkeri				X							
Thisbe irenea belides	X	X							X	X	
T. lycorias lycorias	X	X	X	X					X	X	X
Lemonias caliginea			X							X	
L. agave									X	X	X
Juditha molpe	X	X	X	X	X				X	X	
Synargis calyce mycone	X			X	X	X			X	X	
S. ethelinda nymphidioides										X	
S. nycteus										X	
Menander menander purpurata	X		X	X	X				X	X	
Pandemos godmanii									X		X
Calospila pelarge				X						X	
C. sudias	X			X	X				X	X	
Theope pedias isia				X							
T. virgilius virgilius				X					X		X

APPENDIX 1. Continued

Taxon	CC	AB	TEN	CHJ	YAX	SOC	LG	CHA	SJ	LT	SLP
Theope eupolis										X	
T. cratylus										X	
T. publius	X				X						
T. eleutho										X	X
T. mania										X	
T. diores											X
Calociasma lilina										X	
Nymphidium ascolia ascolides				X							
Brephidium exilis exilis											X
Leptotes marina										X	X
L. cassius striata	X			X	X		X		X	X	X
Zizula cyna cyna	X			X	X		X		X		X
Hemiargus ceraunus	X				X		X	X	X	X	X
H. isola isola									X		
H. huntingtoni hannoides										X	
Everes comyntas	X			X	X		X		X	X	X
E. amyntula amyntula										X	
Celastrina argiolus gozora										X	X
Eumaeus childrenae				X	X				X	X	
E. toxea	X			X	X				X	X	X
Paiwarria antigonus					X						
Theorema eumenia				X					X	X	
"Thecla" (busa group) busa				X					X	X	
Evenus regalis				X	X					X	X
E. coronata				X							
E. batesii										X	
"Thecla" (gibberosa group) barajo				X				X	X	X	
"Thecla" (eunus group) eunus										X	
Allosmaitia strophius										X	X
Pseudolycaena damo	X		X	X	X	X	X		X	X	X
Arcas imperialis		X		X					X		
A. cypria				X	X				X	X	X
Theritas mavors				X		X			X	X	X
"Thecla" (hemon group) augustinula									X		
"Thecla" (hemon group) theocritus				X						X	
"Thecla" (hemon group) hemon				X							
"Thecla" (hemon group) lisus										X	
Atlides gaumeri										X	
A. polybe			X	X						X	X
A. inachus										X	
A. carpasia										X	X
A. halesus											X
A. caranus°											X
Radissima umbratus										X	
"Thecla" (ligurina group) ligurina				X			X			X	
"Thecla" (ligurina group) lyde										X	
Denivia theocritus											X
Contrafacia ahola										X	
C. imma										X	X
Thereus cithonius										X	
T. oppia	X									X	
T. ortalus										X	
Arawacus togarna	X	X	X	X	X		X	X	X	X	
A. sito	X	X	X	X	X	X		X	X	X	X
A. jada	X										X
Rekoa meton	X			X	X				X	X	X

APPENDIX 1. Continued

Taxon	CC	AB	TEN	CHJ	YAX	SOC	LG	CHA	SJ	LT	SLP
Rekoa palegon	X			X	X			X	X	X	X
R. zebina										X	
R. marius	X									X	
R. stagira										X	
Ocaria petelina										X	
O. thales				X	X						
O. ocrisia										X	X
Magnastigma elsa										X	
Chlorostrymon simaethis				X	X					X	X
C. telea										X	X
Cyanophrys goodsoni										X	X
C. amyntor				X						X	X
C. fusius				X						X	X
C. herodotus					X			X		X	X
C. miserabilis	X									X	X
C. longula										X	
Panthiades bitias	X	X		X	X		X		X	X	X
P. ochus				X				X	X	X	X
P. bathildis	X	X	X	X	X		X	X	X	X	X
P. phaleros				X	X					X	
Oenomaus ortygnus				X	X					X	X
O. atesa				X							
Parrhasius polibetes				X					X	X	X
P. orgia				X					X	X	
P. moctezuma										X	X
Michaelus jebus				X						X	X
M. thordesa				X						X	
M. hecate										X	
M. vibidia										X	
M. zenaida					X						
Ignata gadira									X	X	
I. nr. gadira										X	
I. norax									X	X	
Strymon melinus										X	X
S. albata	X									X	X
S. alea									X		
S. bazochii				X	X					X	X
S. mulucha								X		X	
S. yojoa	X			X	X					X	X
S. cestri					X			X		X	X
S. astiocha										X	
S. istapa					X			X		X	X
S. ziba	X				X					X	
S. nr. megarus #1										X	
S. serapio					X					X	
S. basalides°											X
Lamprospilus collucia										X	
"Thecla" (aruma group) galliena										X	
Kisutam syllis	X				X			X		X	
K. hesperitis				X	X			X		X	
K. ceromia	X										
K. denarius									X	X	
K. guzanta				X					X	X	
K. sethon											X
"Thecla" (camissa group) vespasianus							X		X		
Electrostrymon mathewi										X	X

APPENDIX 1. Continued

Taxon	CC	AB	TEN	CHJ	YAX	SOC	LG	CHA	SJ	LT	SLP
Electrostrymon sangala					X					X	X
E. canus										X	
Calycopis calus										X	
C. demonassa	X			X						X	X
C. atnius	X							X			
C. clarina	X								X	X	
C. isobeon	X			X		X	X	X		X	X
C. susanna										X	
C. drusilla	X										
C. trebula				X	X			X		X	
Tmolus echion	X			X	X			X		X	X
T. crolinus										X	
T. cydrara				X					X	X	
Crimsinota phobe										X	
"Tmolus" (heraldica group) heraldica	X										
"Thecla" (empusa group) halciones	X							X			
"Thecla" (keila group) keila										X	
Siderus philinna										X	
S. gargophia										X	
S. caninius								X			
S. thoria										X	
Aubergina paetus										X	
"Thecla" (mycon group) mycon	X			X	X		X	X	X	X	X
"Thecla" (tephraeus group) tephraeus			X						X		
"Thecla" (tephraeus group) syedra				X				X			
"Thecla" (tephraeus group) ambrax									X		
Ministrymon clytie										X	X
M. arola					X					X	
M. una									X	X	
M. inoa										X	
M. phrutus										X	X
M. azia					X				X	X	
Janthecla janthodonia										X	
J. janthina	X			X				X	X	X	
Ipidecla schausi										X	
Brangas neora					X					X	X
B. getus										X	
B. coccineifrons				X				X		X	
B. carthaea										X	
"Thecla" (cupentus group) cupentus			X								
Chalybs janias				X		X			X	X	X
C. hassan										X	
"Thecla" (theia group) theia										X	
Hypostrymon critola		X						X			
Iaspis nr castitas	X									X	
I. temesa	X						X	X			
Nesiostrymon calchinia										X	
N. celona										X	
N. dodava										X	
Erora carla								X		X	
E. opisena										X	
E. muridosca										X	
"Thecla" (ares group) semones										X	
Caerofethra carnica								X		X	
Celmia celmus								X		X	X
"Thecla" (color group) conoveria										X	