Lepidoptera diversity of an Ecuadorian lowland rain forest[1]

(Lepidoptera: Papilionidae, Pieridae, Nymphalidae, Saturniidae, Sphingidae)

by

TOMMASO RACHELI & LUIGI RACHELI

Introduction

Faunistic lists are a very important tool for several fields in biological researches.
We must stress however that comparisons of faunistic lists of different sites are always difficult to be made due to differences in area size, to divergence in classification, and to the differences of the operators techniques. Therefore it is often uneasy to deal with sets of data and to compare the results. None the less, surveys and comparisons of butterflies in selected sites of the Neotropical realm seem to be very popular nowadays (LAMAS, 1983a, 1983b; LAMAS et al., 1991; RAGUSO & LLORENTE, 1991; AUSTIN et al., 1996; BALCAZAR, 1993). They are particularly aimed at gathering sets of data tor conservation purposes and at identifying hotspots of endemicity. Dramatic is the lacking of published long-term surveys on moths in limited areas of the Neotropics.

Unexpectedly, no recent faunistic lists of Ecuadorian butterflies have appeared except that of Maquipucuna Reserve on the western side of the country (RAGUSO & GLOSTER, 1996). Having observed butterflies, Saturniids and Hawkmoths for almost 15 years in Ecuador, as CLENCH (1979) suggests, the time is arrived to submit a survey of these taxa occuring in an Amazonian area of Ecuador. Further, we tried to reply to BROWN's (1984) question who was wondering whether there was a place in western Amazonia richer in butterflies than Jaru, Brazil and Tambopata, Peru (LAMAS, 1983c).
Although human settlements are increasing and vast areas have been heavily deforested, none the less, Misahuallí, the study-area has still many sites with primary forests. The finding of species, like "canopy-dwellers" *Agrias*, which are very susceptible to changes in the environment, could show hotspots for protection purposes. It is not unlike that most of the species reported here may be found in the Jatun Sacha protected area (NEILL, 1988) which lies next to the area surveyed.

Study area and methods

The study area

Two square plots of forest 9 sq kms each around Puerto Misahuallí (Fig. 1 A) and around the confluence of Rio Puní (= Rio Punín, = Rio Puno) with Rio Arajuno (Fig. 1B) have been surveyed. These areas are located on opposite sides of the Rio Napo at altitudes between 350 m to 600 m.
The terrain NW of Misahuallí 460 m, steeply arises at 800 m and it takes some aspects of a wet premontane rain forest. GRUBB et al. (1963) described the vegetation of the left bank of Rio Napo, properly Shinguipino 7 km SE of Tena, as a typical lowland rain forest. The right bank of the Rio Napo is characterized by a topographic variation from 350 to 515 m and then descending at 360 m at the confluence of Rio Puni with Rio Arajuno. The physiognomy of the areas is a typical lowland rain forest.
Meteorological data of two sites nearby the study area, i. e. Tena at an altitude of 527 m, located approx. 15 kms N of Misahuallí, has a mean annual precipitation of 3880 mm and a mean annual temperature of 23.1 °C. Arajuno, located approx. 14 kms S of the study site on the right bank of the Rio Napo, at an altitude of 537 m shows a mean annual precipitation of 3699 mm, and a mean annual temperature of 23.7 °C. The driest months in the area are December and January, and the wettest June to August (CAÑADAS CRUZ, 1983; GOMEZ, 1989; TERAN, 1995).

---

1 Presented at the XI. European Congress of Lepidopterology, March 1998, Malle, Belgium.

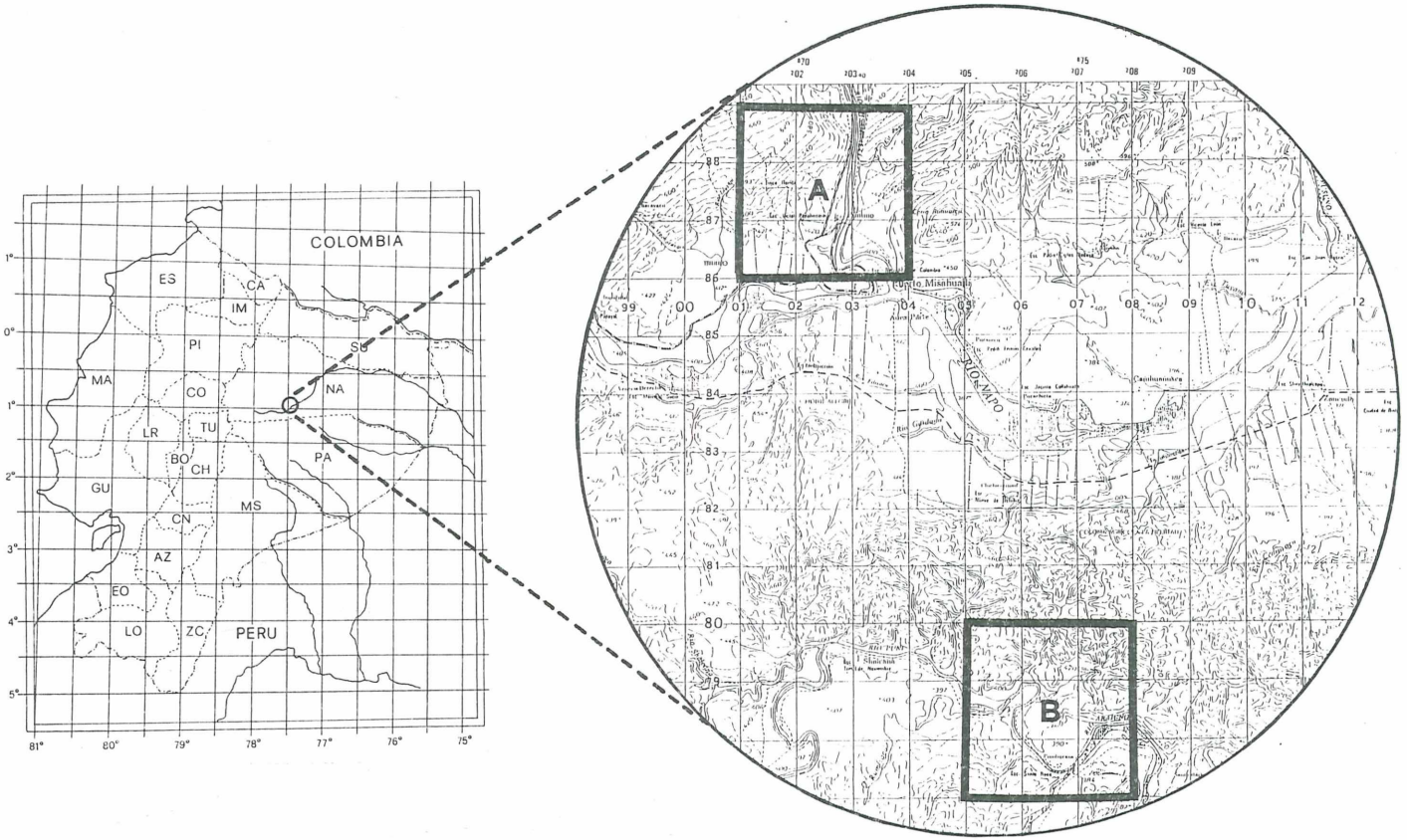

Fig. 1: Map of study sites.

Collecting methodology

Butterflies were netted, identified and released, observed at banana baits, and seldom attracted with the use of traps with rotten fruits, meat or fish. The traps were located between 2 and 20 m of height along trails especially on the left bank of Rio Napo.
The activity was made from 9 am to 4 pm spanning over a period of 15 non-consecutive years from 1983 to 1997, covering each month (tab. 1).
As far as moths are concerned, data on Saturniidae and Sphingidae came only from the Misahuallí area. Moths have been collected with the method of light trap with Mercury vapour lamps. The survey has been limited to 52 nights during a period spanning from 1992 to 1997.

Tab. 1: Periods, cumulative hours/persons collecting, and cumulative number of species at the study sites.

Periods	hours/persons	N. species
12–22 Aug. 1983	25	162
10 Jan–10 Feb 1985	100	201
18 Dec 1986–20 Jan 1987	150	230
15 Feb–15 March 1988	225	265
13 March–15 April 1990	295	280
15 June–15 July 1991	370	285
22 May–13 June 1992	425	320
16 April–6 May 1993	525	343
15 Oct–6 Nov 1993	695	360
11 Sept–8 Oct 1994	905	375
20 July–17 Aug 1996	1040	383
25 April–17 May 1997	1120	387

Results

A total of 387 species of butterflies are reported for the Misahuallí and Arajuno areas (307 at each plot, see Appendix 1). This figure represents one of the highest number of species found in the Neotropics if we compare data of other sites. In detail, 36 species of Papilionidae, 34 species of Pieridae, and 317 of Nymphalidae have been found. For comparison, are reported the absolute figures and percentages of species of Papilionidae, Pieridae and Nymphalidae occuring in the Misahuallí area and in other neotropical sites. Maquipucuna in western Ecuador, is the only Ecuadorian locality which has been studied. in recent times. Each subfamily or tribe of Nymphalidae has been considered for evaluation purposes (tab. 2). The cumulative curve of the number of species and the cumulative hours/persons collecting is shown in fig. 2.
Saturniidae of the area totalled 92 species, in comparison with 275 species reported for the whole country (tab. 3). Sphingidae, with 50 species, represent 1/3 of ecuadorian hawkmoths fauna

Discussion

Several topics may be discussed in the light of these preliminary studies. We focus on some example of phenological and distributional data as well as the diversity of butterflies and moths in the study areas. Some techniques for monitoring butterlies are discussed.

1. The temporal and spatial composition of species in the Misahuallí-Arajuno areas, is similar to the results obtained by Orr & Häuser (1996) for a lowland tropical rainforest site in Sabah, Malaysia.

Tab. 2: Total butterfly species richness and percentages for individual taxon at Misahuallí and other neotropical sites.

	M	%	P	%	T	%	R	%	J	%	VC	%	TK	%	MQ	%
Papilionidae	36	9.30	8	3.52	25	7.14	18	5.61	23	5.87	14	9.59	18	9.83	5	3.52
Pieridae	34	8.78	18	7.93	25	7.14	29	9.03	26	6.63	19	13.01	23	12.57	21	14.78
Nymphalidae	317	81.92	201	88.55	300	85.72	274	85.36	343	87.50	113	77.40	142	77.60	116	81.70
Total	387		227		350		321		392		146		183		142	

Nymphalidae	M	%	P	%	T	%	R	%	J	%	VC	%	TK	%	MQ	%
Danainae	4	1.27	1	0.50	3	1.0	3	1.10	2	0.58	3	2.66	4	2.82	1	0.86
Ithomiinae	65	20.50	44	21.89	40	13.33	46	16.79	57	16.62	13	11.50	9	6.34	14	12.07
Brassolinae	20	6.31	9	4.48	21	7.0	8	2.92	23	6.71	5	4.42	6	4.23	4	3.45
Morphiinae	9	2.84	4	1.99	11	3.67	11	4.01	8	2.33	2	1.77	3	2.11	2	1.72
Acraeini	2	0.63	1	0.50	1	0.33	0	0	1	0.29	1	0.89	1	0.70	3	2.59
Heliconiini	19	5.99	15	7.46	24	8.0	25	9.12	24	7.00	13	11.50	11	7.75	9	7.76
Libytheinae	1	0.32	0	0	1	0.33	0	0	1	0.29	0	0	1	0.70	0	0
Satyrinae	35	11.04	58	28.85	74	24.67	55	20.07	95	27.70	10	8.85	21	14.79	34	29.31
Nymphalinae	123	38.80	57	28.36	97	32.33	104	37.96	46	40.71	62	43.66	39	33.62		
Charaxinae	31	9.78	11	5.47	22	7.33	21	7.66	132	38.48	19	16.81	21	14.79	10	8.62
Apaturinae	8	2.52	1	0.50	6	2.0	1	0.37	1	0.89	3	2.11	0	0		
Total	317		201		300		274		343		113		142		116	

M = Ecuador, Misahuallí-Arajuno (present study); P = Peru, Pakitza (LAMAS et al. 1991); T = Peru, Tambopata (LAMAS, 1981, 1983a, 1983b, 1985a); R = Brazil, Rondonia, Cacaulandia (EMMEL & AUSTIN, 1990); J = Brazil, Rondonia, Jaru (BROWN, 1984; Nymphalinae includes Charaxinae and Apaturinae): VC = Mexico, Vera Cruz, Erbitrolotu (RAGUSO & LLORENTE, 1991); TK = Guatemala, Tikal (AUSTIN et al., 1996); MQ = Ecuador, Maquipucuna (RAGUSO & GLOSTER, 1996).

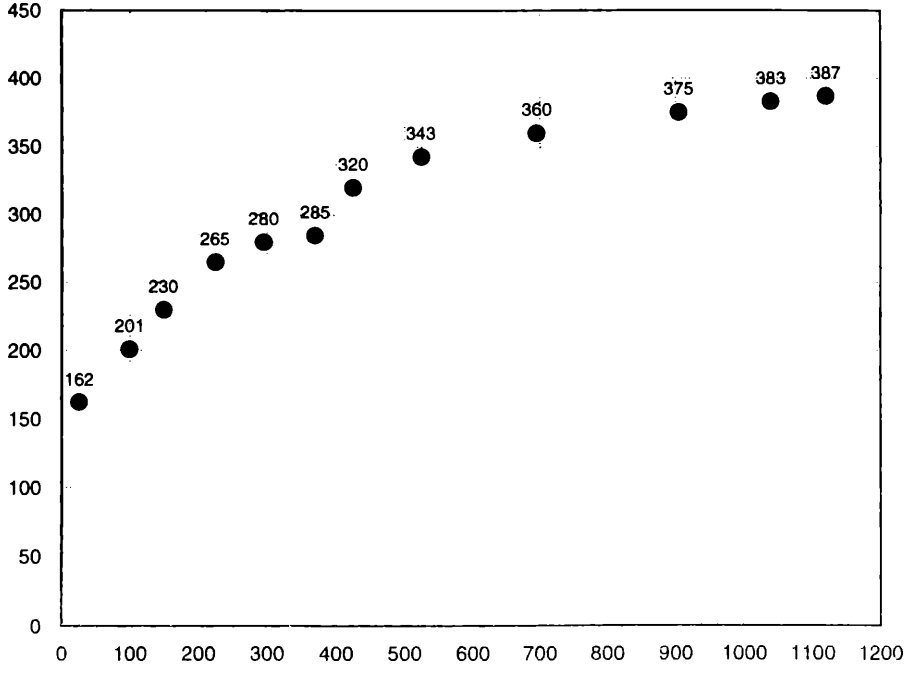

Fig. 2: Cumulative number of species/collecting vs hours/persons.

These authors observed at Kuala Belalong an unpredictable species phenology as well as an extreme localisation for some species. We must underline that daily climatic conditions in Misahuallí area are very different only a few kilometers, if not hundreds of meters, apart.
As an example, the Papilionid *Parides* species show peculiar temporal and spatial characteristics. *Parides childrenae* (GRAY, 1832) and *P. cutorina* (STAUDINGER, 1898) have been found only once in two different sites in the Misahuallí area. *P. orellana* (HEWITSON, 1852) and *P. chabrias* (HEWITSON, 1852) were rarely seen only inside the Arajuno area. *P. aeneas* (LINNAEUS, 1758), *P. lysander* (CRAMER, 1775), *P. neophilus* (GEYER, [1837]), *P. sesostris* (CRAMER, 1780), *P. vertumnus* (CRAMER, 1780), and *P. anchises drucei* (BUTLER, 1874) are present, although phenologically separated, in both areas. *P. sesostris, P. aeneas*, and *P. vertumnus* are more abundant during December and January, while *P. erithalion guillerminae* (PISCHEDDA & RACHELI, 1986), although extremely local in the Misahuallí area, is on the wings during March–May.
Other species such as *Mimoides xynias* (HEWITSON, 1875), *M. trapeza* (ROTHSCHILD & JORDAN, 1906), *M. ariarathes* (ESPER, 1788) and *M. pausanias* (HEWITSON, 1852), involved in a possible Batesian mimicry system, are widespread in both areas. *M. xynias* and *M. trapeza* are synchronic and syntopic during March–May, the former less abundant, *M. ariarathes* and *M. pausanias* can been found all the year round but very local and scarce. During March–April 1990 and April–May 1997 there was a conspicuous decrease in the number of species and individuals of both *Parides* and *Mimoides* species. This phenomenon involved also many other species of butterflies and moths and it is not unlikely related to the relative low precipitations during these seasons.

2. The Saturniid fauna of Misahuallí, 92 species recorded (Appendix 2), constitutes the 33% of the total Ecuadorian fauna. Only at Lumbaquí, Sucumbios province, the total number of species shows higher figures, 120 species according to LEMAIRE & VENEDICTOFF (1989) (tab. 3).
During April–May 1993 54 species were collected, while during the same months in 1997 only 10 species were found. Species such as *Arsenura mossi* JORDAN, 1922, *Arsenura b. batesii* (FELDER & ROGENHOFER, 1874), *Titaea timur* (FASSL, 1915) and *Automeris jucunda* (CRAMER, 1779) were collected during July–August 1994. During the same months in 1996 these species were absent. None the less, RACHELI & RACHELI (1997) reported new records to the fauna of Misahuallí, including rare and elusive species such as *Automeris larra* (WALKER, 1855), *Automeris heppneri* LEMAIRE, 1982, *Leucanella apollinairei* (DOGNIN, 1923) and *Leucanella maasseni* (MÖSCHLER, 1872). This latter species was predicted to occur in a list of 8 possible species for this area (RACHELI, 1995b).
With some confidence, we could predict 10–15 additional species for the fauna of Misahuallí, especially of Hemileucinae species, although it is unlikely to reach a diversity comparable to that of Lumbaquí.

Tab. 3: Number of Saturniidae at Misahuallí and total number of species occurring in Ecuador. (LEMAIRE & VENEDICTOFF, 1898; RACHELI, 1995a, 1995b).

	Total no of species and percentages at Misahuallí		Total no of species and percentages for Ecuador		Fauna of Misahuallí on total ecuadorian species
Arsenurinae	12	13.04%	28	10.18%	43%
Ceratocampinae	18	19.57%	50	18.18%	36%
Hemileucinae	56	60.87%	179	65.09%	31%
Saturniinae	6	6.52%	18	6.55%	33%
Total	92	100%	275	100%	33%

3. The Sphingids of Misahuallí, with 50 species (Appendix 3), are approx. 1/3 of the total Ecuadorian fauna, if the estimate of 155–160 species is realistic.
Sphingidae of a western Amazonian locality, Tambopata in SE Peru, totalled 47 species, and only 18 of these are in common to both Ecuadorian and Peruvian localities (LAMAS, 1985b, 1989).

Two closely related species of *Callionima*, i. e., *pan* and *denticulata*, often considered as two subspecies, coexist in the study area during the same month. The genus *Xylophanes* counts a total of 10 species while the genus *Manduca* 9 species, including also three undetermined species. Four species of the genus *Enyo* are present out of a total of six recorded for Ecuador.
The highest number of species of Sphingidae was collected in April (28 species), and August (27 species) while the lowest in November with only two records.
Five to ten species more can be added because species such as *Cocytius antaeus medor* and *Erinnyis ello*, two of the commonest Ecuadorian species, have been collected very close to the study area.

4. The pooled data of butterflies obtained in the two plots on both banks of Napo river have been compared with other Neotropical sites which presumably have a well known butterfly fauna (tab. 2). Western amazonian localities like Pakitza and Tambopata have similar figures for Pieridae but not for Papilionidae and Nymphalidae. The Papilionidae of Pakitza probably have not been investigated thouroughly. In fact, LAMAS et al. (1991) report that ca 68% of the entire fauna has been surveyed. On the other hand, Misahuallí data for Nymphalidae may be underestimated especially for Satyrinae (11% vs 28.85% of Pakitza, vs 27.69% of Jaru).
The high overall species richness of the three butterfly taxa recorded in the present study mirrors the high species richness of plants in the area. Misahuallí and surroundings lie on an ecotonal zone between lowland rain forest and premontane rain forest, being close to the foot of the Andes, approx. 35 km. Similar geographical features are shared with Tambobata, in Peru. The number of plant species in premontane forests is certainly very high, although not substantiated with precise data, in comparison with that of lowland rainforests. RENNER et al. (1990) report 3104 species of flowering plants below 600 m on Amazonian Ecuador. BALSLEV (1988) estimates that between 900 and 3000 m half the Ecuadorian species is present (cf BALSLEV & RENNER, 1989; ULLOA & JORGENSEN, 1995).
The number of human settlements around Misahuallí may enhance the number of microhabitats suitable for "common species", although they represent only a small fraction of the entire fauna. The more structured forests of Arajuno is home for elusive and forestal species.

5. BECCALONI & GASTON (1995) claimed that it is possible to use the species total of a single taxon to predict the overall species richness in a given area (% species of a taxon/total number of species). Ithomiinae butterflies, perhaps one of the best known group in the Neotropics, have been selected as an indicator group. The mean proportion for this taxon in 21 analysed areas corresponds to 4.6%. A roughly estimate of the total butterfly fauna of Misahuallí, including Lycaenids, Riodinids and Skippers, may count 1300–1400 species. The indicator figure for Ithomiids given by BECCALONI & GASTON (1995) fits with our presumptive data (5% and 4.6%, respectively) but not with our actual data.
Because the composition of a butterfly neotropical fauna is sustained mainly by Riodinids, Lycaenids and Hesperiids which are taxa biosystematically less known than other groups (BROWN, 1991), it would be better not include these figures in the total number of species, and to focus on better known groups. Total number of species of a single taxon (e. g. Papilionidae, Heliconiini etc) may be accurate alone but not so if compared and pooled with the total number of species in a given area.
As first step one can adopt the "overall classification" of BROWN (1987), surveying Papilionidae, Pieridae, and Nymphalidae at each locality and pooling these data The percentage of species collected, for example during two weeks in different months on the same spot, can give a fair estimate of the species richness. As it was suggested by BECCALONI & GASTON (1995) Ithomiids are good indicators of forested areas only, to have informations on non-forested sites, other taxa should be selected and pooling the above three taxa seems to constitute a better estimate (SPARROW et al., 1994).

6. The total number of species found in both areas is 387 and we failed to reply to BROWN's question (1984) in finding the richest place in western Amazonia. Our data however suggest that the Misahuallí-Arajuno areas may potentially host more species than those actually reported. The very low but constant increase of species added each year confirms this hypothesis (fig. 2). The high number

of Papilionidae and Nymphalinae which were particularly "cured", contrasts with the low figure found in Satyrinae. One of the main reason for the underestimation of this taxon lies on the scarce use of bait -traps while collecting along the right bank of Rio Napo.

Conclusions

It is predicted that the number of butterfly species still to be found in Ecuador, Sw Brazil and Peru will flatten the accumulative curves of the butterfly of western Amazonia, and their plateaux will eventually converge.

The estimate of ca 1070 species for the three butterfly taxa under consideration likely to occur in Ecuador makes the Misahuallí area the reservoir for 1/3 of the entire fauna. This figure corresponds to the same estimate for both Saturniidae and Sphingidae.
Although it is possible that butterflies cannot be compared with moths for many reasons (ecological, ethological, geographical, etc.), and especially because neotropical moths are poorly known, all the same the presence of 1/3 of the total Ecuadorian fauna of the five taxa surveyed, makes Misahuallí area one of the richest site of western Amazonia.
It is perhaps not due to chance alone that also the Bornean locality surveyed by ORR & HÄUSER (1996) hosts 1/3 of the total butterfly fauna.
This is a preliminary study of this area and we hope this list will stimulate other researchers to investigate in the same or different Ecuadorian areas, so as these data will be refined for a better knowledge of the composition and species richness of Lepidoptera in Neotropical forests.

References

AUSTIN, G. T., HADDAD, N. M., MENDEZ, C., SISK, T. D., MURPHY, D. D., LAUNER, A. E. & P. R. EHRLICH (1996): Annotated checklist of the butterflies of the Tikal National Park area of Guatemala. – Trop. Lepid. **7**: 21–37.

BALCAZAR, L. M. A. (1993): Butterflies of Pedernales, Michoacán, Mexico, with notes on seasonality and faunistic affinities (Lepidoptera: Papilionoidea and Hesperioidea). – Trop. Lepid. **4**: 93–105.

BALSLEV, H. (1988): Distribution patterns of Ecuadorean plant species. – Taxon **37**: 567–577.

BALSLEV, H. & S. S. RENNER (1989): The diversity of the Ecuadorean forest east of the Andes. pp. 287–295. In L. B. HOLM-NIELSEN, I. NIELSEN & H. BALSLEV (eds.). Tropical forests: Botanical dynamics, Speciation and Diversity. – Academic Press, London.

BECCALONI, G. W. & K. J. GASTON (1995): Predicting the species richness of neotropical forest butterflies: Ithomiinae (Lepidoptera: Nymphalidae) as indicators. – Biol. Cons. **71**: 77–86.

BROWN, K. S. Jr. (1984): Species diversity and abundance in Jaru, Rondonia (Brazil). – News Lepid. Soc. **1984** (3): 45–47.

BROWN, K. S. Jr. (1987): Biogeography and evolution of neotropical butterflies. pp. 66–104. In T. C. WHITMORE & G. T. PRANCE (eds), Biogeography and quaternary history in Tropical America. – Clarendon Press, Oxford.

BROWN, K. S. Jr. (1991): Conservation of Neotropical environments: Insects as indicators. pp. 349–404. In N. M. COLLINS & J. A. THOMAS (eds) The Conservation of insects and their habitats. – Academic Press, London.

CAÑADAS CRUZ, L. (1983): El mapa bioclimatico y ecologico del Ecuador. – Banco Central del Ecuador, Quito, 210 pp.

CLENCH, H. K. (1979.): How to make regional lists of butterflies: some thoughts. – J. Lepid. Soc. **33**: 215–231

EMMEL, T. C. & G. T. AUSTIN (1990): The tropical rain forest butterfly fauna of Rondonia, Brazil: species diversity and Conservation. – Trop. Lepid. **1**: 1–12.

GOMEZ, E. N. (1989.): Elementos de Geografia del Ecuador: el hombre y el medio. – Ediguias, Quito, 130 pp.

GRUBB, P. J., LLOYD, J. R., PENNINGTON, T. D. & WHITMORE, T. C. (1963): A comparison of montane and lowland rain forest in Ecuador I. The forest structure, physiognomy, and floristics. – J. Ecol. **51**: 567–601.

LAMAS, G. (1981): La fauna de mariposas de la Reserva de Tambopata, Madre de Dios, Peru (Lepidoptera, Papilionoidea y Hesperioidea). – Rev. Soc. mex. Lepid. **6**: 23–40.

LAMAS, G. (1983a): Adiciones y correcciones a la lista de mariposa de la Reserva de Tambopata. – News Lepid. Soc **1983** (4): 53–55

LAMAS, G. (1983b): Adiciones y correcciones a la lista de mariposas de la Reserva de Tambopata, Peru. – Rev. Soc. mex. Lepid. **8**: 13–24.

LAMAS, G. (1983c): How many butterflies species in your backyard? – News Lepid. Soc. **1983** (4): 53–55.

LAMAS, G. (1985a): Los Papilionoidea (Lepidoptera) de la zona reservada de Tambopata, Madre de Dios, Peru. I: Papilionidae, Pieridae y Nymphalidae (en parte). – Revta peruana Ent. **27**: 59–73.

LAMAS, G. (1985b): The Castniidae and Sphingidae (Lepidoptera) of the Tambopata reserved zone, Madre de Dios, Peru: a preliminary list. – Revta peruana Ent. **27**: 55–58.

LAMAS, G. (1989): Lista preliminar de los Saturniidae, Oxytenidae, Uraniidae y Sematuridae (Lepidoptera) de la Zona Reservada de Tambopata, Madre de Dios, Peru. – Revta peruana Ent. **31**: 57–60.

LAMAS, G., ROBBINS, R. K. & D. J. HARVEY (1991): A preliminary survey of the butterflies fauna of Pakitza, Parque Nacional del Manu, Peru, with an estimate of its species richness. – Publ. Mus. Hist. nat. UNMSM (A) **40**: 1–19.

LEMAIRE, C. & N. VENEDICTOFF (1989): Catalogue and biogeography of the Lepidoptera of Ecuador. I Saturniidae. With description of a new species of *Meroleuca* PACKARD. – Bull. Allyn Mus. **129**: 1–60.

NEILL, D. A. (1988): Jatun Sacha biological station, amazonian Ecuador: an invitation to tropical biologists. – Biotropica **20**: 59.

ORR, A. G. & C. L. HÄUSER (1996): Temporal and spatial patterns of butterfly diversity in a lowland tropical rainforest. pp. 125–138. In EDWARDS, D. S., BOOTH, W. E. & S. C. CHOI (eds), Tropical Rainforest Research – Current Issues. – Kluwer Academic Publishers, Dordrecht-Boston-London.

RACHELI, L. (1995a): Contributo alla conoscenza dei Saturnidi dell' Ecuador (Lepidoptera, Saturniidae). – Frag. entomol. **26** (2): 253–258.

RACHELI, L. (1995b): Lista preliminare dei Saturnidi di Misahuallí, Napo, Ecuador. – Frag. entomol. **27** (1): 117–144.

RACHELI, L. & T. RACHELI (1997): Further notes on the Saturniidae of Ecuador (Lepidoptera, Saturniidae). – Nachr. entomol. Ver. Apollo, N.F. **18** (2–3): 173–180.

RAGUSO, R. A. & O. GLOSTER (1996): Preliminary checklist and field observations of the butterflies of the Maquipucuna field station (Pichincha Province, Ecuador). – J. Res. Lepid. **32** (1993): 135–161.

RAGUSO, R. A. & J. LLORENTE (1991): The butterflies (Lepidoptera) of the Tuxtlas Mts., Veracruz, Mexico, revisited: species-richness and habitat disturbance. – J. Res. Lepid. **29**: 105–133.

RENNER, S. S., BALSLEV, H. & L. B. HOLM-NIELSEN (1990): Flowering plants of Amazonian Ecuador – a checklist. AAU Reports 24. – Botanical Institute Aarhus University & Pontificia Universidad Catolica de l'Ecuador, Quito, 241 pp.

SPARROW, H. R., SICK, T. D., EHRLICH, P. R. & D. D. MURPHY (1994): Techniques and guidelines for monitoring neotropical butterflies. – Cons. Biol. **8**: 800–809.

TERAN, F. (1995): Geografia del Ecuador. Octava edicion. – Libresa, Quito 466 pp.

ULLOA, U. C. & P. M. JORGENSEN (1995): Arboles y Arbustos de los Andes del Ecuador. Segunda edicion. – Abya-Yala, Quito, xxi + 329 pp.

Appendix 1

	Misahuallí	Arajuno
Papilionidae		
Papilioninae		
Troidini		
Battus polydamas LINNAEUS, 1758	+	+
Battus belus varus KOLLAR, 1850		+
Battus ingenuus DYAR, 1907	+	+
Battus lycidas CRAMER, 1777		+
Battus crassus CRAMER, 1777		+
Parides chabrias chabrias HEWITSON, 1852		+
Parides orellana HEWITSON, 1852		+
Parides aeneas bolivar HEWITSON, 1850	+	+
Parides lysander brissonius HÜBNER, 1819	+	+
Parides neophilus olivencius BATES, 1861	+	+
Parides sesostris sesostris CRAMER, 1779	+	+
Parides childrenae unimacula JOICEY & TALBOT, 1922	+	
Parides cutorina STAUDINGER, 1898	+	
Parides vertumnus bogotanus FELDER & FELDER, 1864	+	+
Parides erithalion guillerminae PISCHEDDA & RACHELI, 1986	+	
Parides anchises drucei BUTLER, 1874	+	+
Graphiini		
Protographium agesilaus autosilaus BATES, 1861	+	+
Protographium thyastes thyastinus OBERTHÜR, 1879	+	
Eurytides serville GODART, [1824]	+	+
Eurytides dolicaon deileon FELDER & FELDER, 1865	+	+
Protesilaus telesilaus FELDER & FELDER, 1864	+	+
Protesilaus protesilaus LINNAEUS, 1758	+	+
Protesilaus glaucolaus BATES, 1864	+	+
Mimoides xynias HEWITSON, 1875	+	+
Mimoides trapeza ROTHSCHILD & JORDAN, 1906	+	+
Mimoides ariarathes ESPER, 1788	+	+
Mimoides pausanias HEWITSON, 1852	+	+
Papilionini		
Heraclides (Priamides) chiansiades WESTWOOD, 1872		+
Heraclides (Priamides) anchisiades ESPER, 1788	+	+
Heraclides (Troilides) hyppason CRAMER, 1776	+	+
Heraclides (Troilides) torquatus CRAMER, 1777	+	+
Heraclides (Calaides) astyalus phanias ROTHSCHILD & JORDAN, 1906	+	+
Heraclides (Calaides) androgeus CRAMER, 1776	+	+
Heraclides (Heraclides) thoas cyniras MÉNÉTRIÉS, 1857	+	+
Pterourus (Pyrrostichta) menatius ctesiades ROTHSCHILD & JORDAN, 1906	+	+
Pterourus (Pyrrostichta) zagreus DOUBLEDAY, 1847	+	+

	Misahualli	Arajuno
Pieridae		
Dismorphiinae		
Pseudopieris nehemia BOISDUVAL, 1836	+	+
Enantia melite JOHANSSON, 1763	+	+
Enantia licinia CRAMER, [1777]	+	+
Dismorphia amphiona CRAMER, [1779]	+	+
Dismorphia lysis HEWITSON, 1869		+
Dismorphia ithomia HEWITSON, 1867	+	+
Dismorphia pinthaeus ela HEWITSON, 1877	+	
Dismorphia theucarila DOUBLEDAY, 1848		+
Pierinae		
Hesperocharis nera HEWITSON, 1852	+	+
Hesperocharis hirlanda STOLL, [1790]	+	+
Charonias eurytele HEWITSON, 1852	+	+
Archonias negrina FELDER & FELDER, 1862	+	
Catasticta sisamnus FABRICIUS, 1793	+	
Leptophobia cinerea HEWITSON,1867	+	+
Itaballia demophile LINNAEUS, 1767	+	+
Itaballia pandosia HEWITSON, 1853	+	
Pieriballia viardi BOISDUVAL, 1836	+	+
Perrhybris pamela CRAMER, 1782	+	+
Perrhybris lorena HEWITSON, 1852	+	+
Melete lycimnia CRAMER, [1777]	+	+
Melete leucanthe FELDER & FELDER, 1861	+	+
Melete leucadia FELDER & FELDER, 1862	+	+
Appias drusilla CRAMER, [1777]	+	
Coliadinae		
Phoebis argante FABRICIUS, 1775	+	+
Phoebis neocypris HÜBNER, 1823	+	
Phoebis philea LINNAEUS, 1763	+	
Phoebis trite LINNAEUS, 1758	+	+
Aphrissa statira CRAMER, [1777]	+	+
Eurema (Sphaenogona) fabiola FELDER & FELDER, 1861	+	
Eurema daira phoenicia FELDER & FELDER, 1865	+	
Eurema albula CRAMER, 1776	+	+
Eurema venusta BOISDUVAL, 1836	+	
Eurema leuce BOISDUVAL, 1836	+	
Leucidia brephos HÜBNER, [1816]	+	+
Nymphalidae		
Heliconiinae		
Acraeini		
Altinote alcione HEWITSON, 1852	+	

	Misahuallí	Arajuno
Actinote pellenea HÜBNER, 1821	+	
Heliconiini		
Philaethria dido LINNAEUS, 1763	+	+
Agraulis vanillae lucina FELDER & FELDER, 1862	+	+
Dione juno CRAMER, [1779]	+	+
Dryas iulia FABRICIUS, 1775	+	+
Dryadula phaetusa LINNAEUS, 1758	+	+
Eueides vibilia unifasciata BUTLER, 1873	+	
Eueides aliphera GODART, 1819	+	+
Eueides isabella margaritifera STICHEL, 1903	+	+
Eueides tales CRAMER, [1775]	+	+
Neruda aoede auca NEUKIRCHEN, 1997		+
Laparus doris LINNAEUS, 1771	+	+
Heliconius xanthocles BATES, 1862	+	+
Heliconius wallacei REAKIRT, 1866	+	+
Heliconius numata aristiona HEWITSON, 1853	+	+
Heliconius hecale quitalenus HEWITSON, 1853	+	+
Heliconius elevatus willmotti NEUKIRCHEN, 1997	+	
Heliconius melpomene malleti LAMAS, 1988	+	+
Heliconius erato lativitta BUTLER, 1877	+	+
Heliconius sara thamar HÜBNER, [1806]	+	+
Nymphalinae		
Nymphalini		
Hypanartia lethe FABRICIUS, 1793	+	+
Kallimini		
Metamorpha elissa HÜBNER, 1819	+	+
Siproeta stelenes LINNAEUS, 1758	+	+
Anartia amathea LINNAEUS, 1758	+	+
Anartia jatrophae LINNAEUS, 1863	+	+
Junonia genoveva CRAMER, 1782	+	+
Melitaeini		
Telenassa teletusa burchelli MOULTON, 1909	+	+
Anthanassa drusilla alceta HEWITSON, 1869	+	
Dagon pusillus SALVIN, 1869	+	
Tegosa similis HIGGINS, 1981	+	
Tegosa pastazena BATES, 1864	+	+
Tegosa anieta HEWITSON, 1864	+	
Eresia clara BATES, 1864	+	
Eresia nauplius plagiata RÖBER, 1913	+	+
Eresia polina HEWITSON, 1852	+	
Eresia datis moesta SALVIN & GODMAN, 1868	+	
Eresia letitia HEWITSON, 1869		+
Eresia eunice esora HEWITSON, 1857	+	+

	Misahuallí	Arajuno
Eresia pelonia HEWITSON, 1852	+	+
Eresia aveyrona mylitta HEWITSON, 1869	+	+
Castilia perilla HEWITSON, 1852	+	+
Castilia guaya HALL, 1929		+
Castilia angusta HEWITSON, [1868]	+	
Janatella leucodesma FELDER & FELDER, 1861	+	+
Mazia amazonica BATES, 1864		+
Limenitidinae		
Coloburini		
Historis odius dious LAMAS, 1995	+	+
Historis acheronta FABRICIUS, 1775	+	+
Pycina zamba DOUBLEDAY, [1849]		+
Smyrna blomfildia FABRICIUS, 1782	+	+
Colobura dirce LINNAEUS, 1758	+	+
Baeotus amazonicus RILEY, 1919	+	+
Baeotus japetus STAUDINGER, 1885	+	+
Baeotus deucalion FELDER & FELDER, 1860	+	+
Tigridia acesta LINNAEUS, 1758	+	+
Biblidini		
a) **Bibliditi**		
Biblis hyperia CRAMER, [1780]	+	+
b) **Eurytelíti**		
Vila cacica STAUDINGER, 1885	+	+
Vila emilia sinefascia HALL, 1935		+
c) **Ageroniiti**		
Batesia hypochlora hypoxantha SALVIN & GODMAN, 1868		+
Panacea prola amazonica FRUHSTORFER, 1915	+	+
Panacea procilla divalis BATES, 1868	+	+
Panacea regina BATES, 1864	+	+
Ectima iona DOUBLEDAY [1848]		+
Ectima lirides STAUDINGER, [1886]	+	
Hamadryas feronia LINNAEUS, 1758		+
Hamadryas fornax HÜBNER, 1823		+
Hamadryas alicia BATES, 1865		+
Hamadryas chloe STOLL, [1787]	+	+
Hamadryas amphinome LINNAEUS, 1767	+	
Hamadryas laodamia CRAMER, [1777]	+	
Hamadryas arinome LUCAS, 1853	+	
d) **Epicaliiti**		
Catonephele nyctimus WESTWOOD, 1850	+	+
Catonephele salambria FELDER & FELDER, 1861	+	
Catonephele salacia HEWITSON, 1852	+	+
Catonephele numilia CRAMER, [1775]	+	+

	Misahuallí	Arajuno
Catonephele acontius LINNAEUS, 1771	+	+
Nessaea obrina lesoudieri LE MOULT, 1933	+	+
Nessaea hewitsonii FELDER & FELDER, 1859	+	+
Eunica caelina alycia FRUHSTORFER, 1909	+	
Eunica mygdonia GODART, [1824]	+	+
Eunica malvina malvina BATES, 1864	+	+
Eunica marsolia fasula FRUHSTORFER, 1909	+	+
Eunica clytia HEWITSON, 1852	+	+
Eunica orphise CRAMER, [1775]	+	
Eunica sydonia sydonia GODART, [1824]		+
Eunica sophonisba agele SEITZ, 1925	+	
Eunica norica occia FRUHSTORFER, 1909	+	+
Eunica volumna celma HEWITSON, 1852	+	
Eunica alpais alpais GODART, [1824]	+	
Eunica eurota eurota CRAMER, [1775]	+	+
Eunica alcmena flora FELDER & FELDER, 1862	+	+
e) **Epiphiliti**		
Asterope markii hewitsoni STAUDINGER, 1886	+	+
Asterope optima BUTLER, 1869	+	
Asterope degandii HEWITSON, 1857	+	+
Asterope buckleyi HEWITSON, 1869		+
Nica flavilla sylvestris BATES, 1864	+	+
Peria lamis CRAMER, [1779]	+	+
Temenis pulchra HEWITSON, 1861	+	+
Temenis laothoe CRAMER, [1777]	+	+
Pyrrhogyra otolais olivenca FRUHSTORFER, 1908	+	+
Pyrrhogyra crameri hagnodorus FRUHSTORFER, 1908	+	+
Pyrrhogyra neaerea amphiro BATES, 1865	+	+
f) **Dynaminiti**		
Dynamine athemon LINNAEUS, 1758	+	
Dynamine gisella peruviana RÖBER, [1916]	+	+
Dynamine ate GODMAN & SALVIN, 1883	+	
Dynamine chryseis BATES, 1865	+	
Dynamine anubis HEWITSON, 1859	+	+
Dynamine racidula HEWITSON, 1852	+	+
g) **Catagrammiti**		
Haematera pyrame HÜBNER, 1819	+	+
Diaethria neglecta SALVIN, 1869	+	+
Diaethria eluina HEWITSON, 1852	+	+
Diaethria clymena peruviana GUENÉE, 1872	+	+
Callicore atacama HEWITSON, 1852	+	
Callicore aegina FELDER & FELDER, 1861	+	+
Callicore hesperis GUÉRIN, 1844	+	+

	Misahuallí	Arajuno
Callicore excelsior HEWITSON, 1857	+	+
Callicore eunomia eunomia HEWITSON, 1853	+	+
Callicore pygas cyllene DOUBLEDAY, 1847	+	+
Callicore astarte stratiotes FELDER & FELDER, 1861	+	+
Callicore maimuna HEWITSON, 1858	+	+
Callicore hystaspes zelphanta HEWITSON, 1858	+	+
Callicore tolima HEWITSON, [1853]	+	+
Paulogramma pyracmon peristera HEWITSON, 1853	+	+
Catacore kolyma HEWITSON, 1852	+	+
Limenitidini		
Adelpha mesentina chancha STAUDINGER, 1886	+	+
Adelpha cocala urraca FELDER & FELDER, 1862	+	+
Adelpha boeotia FELDER & FELDER, 1865	+	
Adelpha aethalia davisii BUTLER, 1877	+	+
Adelpha erotia HEWITSON, 1847	+	+
Adelpha melona HEWITSON, 1847	+	
Adelpha naxia FELDER & FELDER, 1867	+	+
Adelpha iphiclus LINNAEUS, 1758	+	+
Adelpha cytherea olbia FELDER, 1867	+	+
Adelpha jordani FRUHSTORFER, 1915		+
Adelpha serpa BOISDUVAL, 1836	+	+
Adelpha boreas BUTLER, 1866	+	+
Adelpha delinita FRUHSTORFER, 1915	+	
Adelpha alala erhardti NEUBURGER, 1907	+	
Adelpha thesprotia delphicola FRUHSTORFER, 1909	+	
Cyrestidini		
Marpesia zerynthia HÜBNER, [1823]	+	+
Marpesia petreus CRAMER, [1776]	+	+
Marpesia corinna LATREILLE, [1813]	+	+
Marpesia furcula oechalia WESTWOOD, 1850	+	+
Marpesia themistocles norica HEWITSON, 1852	+	
Marpesia chiron marius CRAMER, 1780	+	+
Marpesia marcella FELDER & FELDER, 1861	+	+
Marpesia livius KIRBY, 1871	+	
Charaxinae		
Preponini		
Agrias claudina sara FRUHSTORFER, 1902	+	+
Agrias amydon zenodorus HEWITSON, 1870		+
Agrias beatifica HEWITSON, 1869		+
Archaeoprepona demophon muson FRUHSTORFER, [1905]	+	+
Archaeoprepona demophon andicola FRUHSTORFER, 1904	+	+
Archaeoprepona licomedes CRAMER, [1777]	+	
Prepona pylene HEWITSON, 1853	+	

	Misahuallí	Arajuno
Prepona laertes ikarios FRUHSTORFER, 1904	+	+
Prepona idexamenus HOPFFER, 1874	+	
Prepona omphale HÜBNER, 1819	+	
Prepona pheridamas CRAMER, 1777	+	
Anaeomorpha splendida ROTHSCHILD, 1894		+
Anaeini		
Consul fabius diffusus BUTLER, 1875	+	+
Fountainea eurypyle FELDER & FELDER, 1862	+	+
Fountainea ryphea CRAMER, 1776	+	
Polygrapha xenocrates WESTWOOD, 1850	+	+
Polygrapha cyanea SALVIN & GODMAN, 1868	+	+
Memphis xenocles HEWITSON, 1850	+	+
Memphis glauce felderi RÖBER, 1916	+	+
Anaea (Memphis) laertes psammis FELDER & FELDER, 1867	+	+
Anaea (Memphis) oenomais BOISDUVAL, 1870	+	
Anaea (Memphis) polycarmes FABRICIUS, 1775	+	+
Anaea (Memphis) moruus morpheus STAUDINGER, 1886	+	+
Anaea (Memphis) polyxo DRUCE, 1874	+	
Anaea (Memphis) anna STAUDINGER, 1897		+
Hypna clytemnestra negra FELDER & FELDER, 1862	+	+
Coenophlebia archidona HEWITSON, 1860	+	+
Siderone marthesia vulcanus FELDER & FELDER, 1862	+	+
Siderone galanthis thebais FELDER & FELDER, 1862	+	+
Zaretis itys CRAMER, 1777	+	+
Apaturinae		
Doxocopa laurentia GODART, 1824	+	+
Doxocopa seraphina HÜBNER, 1825	+	+
Doxocopa elis FELDER & FELDER, 1861	+	
Doxocopa cyane cyanippe GODART, 1824	+	
Doxocopa pavon LATREILLE, [1809]	+	+
Doxocopa agathina CRAMER, 1777		+
Doxocopa zunilda felderi GODMAN & SALVIN, 1884	+	+
Doxocopa linda FELDER & FELDER, 1862	+	+
Brassolinae		
Brassolis sophorae LINNAEUS, 1758	+	+
Narope anartes sarastro STAUDINGER, 1886		+
Narope cyllabarus WESTWOOD, [1851]		+
Opoptera aorsa GODART, 1824		+
Catoblepia xanthicles orientalis BRISTOW, 1981		+
Catoblepia xanthus rivalis NIEPELT, 1911		+
Catoblepia generosa STICHEL, 1902		+
Catoblepia berecynthia midas STICHEL, 1908	+	+
Catoblepia soranus WESTWOOD, [1851]		+

	Misahuallí	Arajuno
Eryphanis zolzivora opimus STAUDINGER, 1887		+
Eryphanis automedon CRAMER, 1775	+	
Opsiphanes cassiae LINNAEUS, 1758	+	+
Opsiphanes cassina icassina FELDER & FELDER, 1862	+	+
Opsiphanes quiteria quaestor STICHEL, [1902]	+	+
Caligo illioneus praxsiodus FRUHSTORFER, 1912	+	+
Caligo eurilochus livius STAUDINGER, 1886	+	
Caligo idomeneus idomenides FRUHSTORFER, 1903		+
Caligo placidianus STAUDINGER, 1887	+	
Caligo prometheus KOLLAR, 1850		+
Morphinae		
Morpho cisseis phanodemus HEWITSON 1869	+	+
Morpho telemachus foucheri LE MOULT, 1926	+	+
Morpho rhetenor cacica STAUDINGER, 1875	+	+
Morpho menelaus occidentalis FELDER & FELDER, 1862	+	+
Morpho adonis CRAMER, [1775]	+	+
Morpho achilles theodorus FRUHSTORFER, 1907	+	+
Morpho deidamia neoptolemus WOOD, 1863	+	+
Antirrhea taygetina BUTLER, 1868		+
Antirrhea philoctetes avernus HOPFFER, 1874		+
Satyrinae		
Haeterini		
Pierella lamia chalybaea GODMAN, 1905	+	+
Pierella hyceta HEWITSON, 1859	+	
Pierella hortona HEWITSON, 1854	+	+
Pierella astyoche lucia WEYMER, 1885	+	+
Pierella lena brasiliensis FELDER & FELDER, 1862	+	+
Haetera piera negra FELDER & FELDER, 1862	+	+
Cithaerias pireta aurorina WEYMER, [1910]	+	+
Biini		
Bia actorion rebeli BRYK, 1953	+	+
Satyrini		
Manataria hercyna HÜBNER, 1821	+	+
Pseudodebis valentina CRAMER, 1779	+	+
Taygetis echo koepckei FORSTER, 1964		+
Taygetis xenana BUTLER, 1870	+	
Taygetis mermeria CRAMER, [1776]	+	
Taygetis larua FELDER & FELDER, 1867	+	
Taygetis virgilia CRAMER, [1776]		+
Taygetis thamyra cleopatra FELDER & FELDER, 1862	+	
Posttaygetis penelea CRAMER, 1777		+
Pareuptychia interjecta hesionides FORSTER, 1964	+	+
Megeuptychia antonoe CRAMER, [1775]	+	+

	Misahuallí	Arajuno
Cissia labe BUTLER, 1870	+	+
Cissia penelope FABRICIUS, 1775	+	
Cissia alcinoe FELDER & FELDER, 1867	+	
Euptychia francisca BUTLER, [1870]		+
Euptychia mollina HÜBNER, 1816		+
Euptychia meta WEYMER, 1911		+
Magneuptychia tricolor fulgora BUTLER, 1869		+
Caeuruleuptychia lobelia BUTLER, 1870		+
Caeuruleuptychia aetherialis BUTLER, 1877		+
Caeuruleuptychia coelica HEWITSON, 1869		+
Yphthimoides umbrosa BUTLER, 1870	+	
Yphthimoides maepius erigone BUTLER, 1866	+	
Yphthimoides benedicta BUTLER, 1877	+	
Harjesia obscura eremita WEYMER, 1911	+	
Chloreuptychia arnaca FABRICIUS, 1776	+	+
Chloreuptychia chloris CRAMER, 1780		+
Libytheinae		
Libytheana carinenta CRAMER, 1777	+	
Danainae		
Lycorea halia pales FELDER & FELDER, 1862	+	
Lycorea pasinuntia CRAMER, 1780	+	+
Danaus plexippus erippus CRAMER, 1776	+	
Danaus gilippus CRAMER, [1776]	+	
Ithomiinae		
New Tribe (BROWN in litt.)		
Aeria eurimedia negricola FELDER & FELDER, 1862	+	+
Roswellia acrisione HEWITSON, 1869	+	
Tithoreini		
Tithorea tarricina bonita HAENSCH, 1903	+	
Tithorea harmonia hermias GODMAN & SALVIN, 1898	+	+
Melinaeini		
Athyrtis mechanitis oberthueri SRNKA, 1885		+
Melinaea mnasias abitagua BROWN, 1977	+	+
Melinaea maelus maeonis HEWITSON, 1869	+	+
Melinaea marsaeus mothone HEWITSON, 1860	+	+
Melinaea menophilus cocana HAENSCH, 1903	+	+
Methonini		
Methona curvifascia WEYMER, 1884	+	+
Methona *confusa psamathe* GODMAN & SALVIN, 1898	+	+
Mechanitini		
Thyridia psidii ino FELDER & FELDER, 1862	+	+
Scada reckia ethica HEWITSON, 1861	+	+
Forbestra olivencia juntana HAENSCH, 1903		+

	Misahuallí	Arajuno
Forbestra equicola equicoloides GODMAN & SALVIN, 1898		+
Mechanitis polymnia doryssides STAUDINGER, 1884	+	+
Mechanitis lysimnia elisa GUERIN-MENEVILLE, 1844	+	+
Mechanitis mazaeus HEWITSON, 1860	+	+
Mechanitis messenoides deceptus BUTLER, 1873		+
Dircennini		
Callithomia alexirrhoe butes GODMAN & SALVIN,1898	+	+
Callithomia lenea zelie GUERIN, 1844	+	+
Dircenna loreta HAENSCH, 1903	+	+
Dircenna jemina varina HEWITSON, 1869	+	
Ceratinia tutia poecila BATES, 1862	+	+
Pteronymia vestilla sparsa HAENSCH, 1903		+
Ceratiscada hymen HAENSCH, 1905		+
Ithomiini		
Ithomia agnosia HEWITSON, 1854	+	+
Ithomia salapia HEWITSON, 1853		+
Ithomia amarilla HAENSCH, 1903		+
Napeogenini		
Napeogenes aethra HEWITSON, 1869		+
Napeogenes stella HEWITSON, 1854	+	+
Napeogenes achaea HEWITSON, 1869		+
Napeogenes duessa HEWITSON, 1859	+	
Napeogenes cranto FELDER & FELDER, [1867]		+
Napeogenes sylphis caucayaensis FOX & REAL, 1971		+
Napeogenes inachia avila HAENSCH, 1903	+	+
Napeogenes pheranthes crocodes BATES, 1862		+
Hyalyris coeno norellana HAENSCH, 1903	+	+
Hypothyris fluonia berna HAENSCH, 1903		+
Hypothyris semifulva satura HAENSCH, 1903	+	+
Hypothyris euclea intermedia BUTLER, 1873	+	+
Hypothyris moebiusi HAENSCH, 1903	+	+
Hypothyris mamercus mamercus HEWITSON, 1869	+	+
Hypothyris anastasia bicolora HAENSCH, 1903		+
Oleriini		
Hyposcada anchiala ecuadorina BRYK, 1953	+	+
Hyposcada illinissa ida HAENSCH, 1903	+	+
Hyposcada kena HEWITSON, 1872		+
Oleria agarista FELDER & FELDER, 1862		+
Oleria assimilis HAENSCH, 1903		+
Oleria sexmaculata HAENSCH, 1903		+
Oleria lerda HAENSCH, 1909		+
Oleria gunilla lota HEWITSON, 1872		+
Oleria tigilla WEYMER, 1899	+	

	Misahuallí	Arajuno
Godyridini		
Godyris zavaleta matronalis WEYMER, 1883	+	+
Dygoris dircenna pastazana FOX, 1945	+	+
Hypoleria lavinia chrysodonia BATES, 1862	+	+
"Hypoleria" orolina HEWITSON, 1861		+
"Hypoleria" seba oculata HAENSCH, 1903		+
Hypoleria sarepta aureliana BATES, 1862	+	+
Hypoleria virginia famina HAENSCH, 1905	+	+
Mcclungia cymo subtilis HAENSCH, 1903	+	+
Heterosais nephele nephele BATES, 1862		+
Pseudoscada florula egla HEWITSON, 1872	+	+
Pseudoscada timna HEWITSON, 1854	+	+

Appendix 2

Systematic list of Saturniidae collected in the Misahuallí area

Relative abundance: C = Common (20 to 30 specimens); O = Occasional (10 to 19 specimens); U = Uncommon (5 to 9 specimens); R = Rare (1 to 4 specimens); ? = Species reported by LEMAIRE & VENEDICTOFF (1989). Phenology: numbers refer to months.

	relative abundance	phenology
Arsenura armida (CRAMER, 1779)	C	4–6–7–10
Arsenura mossi JORDAN, 1922	R	7–8
Arsenura ciocolatina DRAUDT, 1930	O	4–7–8–10
Arsenura albopicta JORDAN, 1922	U	4–8–10
Arsenura rebeli GSCHWANDNER, 1920	C	4–5–7–8–10
Arsenura batesii batesii (FELDER & ROGENHOFER, 1874)	R	7–8
Dysdaemonia boreas (CRAMER, 1775)	U	4–7–10
Titaea tamerlan amazonensis LEMAIRE, 1980	U	7–8
Titaea lemoulti (SCHAUS, 1905)	R	7–8
Titaea timur (FASSL, 1915)	R	7
Rhescyntis hippodamia hippodamia (CRAMER, 1777)	O	7–8–10
Paradaemonia platydesmia (ROTHSCHILD, 1907)	U	4–6–7–10
Eacles imperialis cacicus (BOISDUVAL,1868)	C	4–7–8–10
Eacles penelope (CRAMER, 1775)	C	4–7–8
Eacles masoni fulvaster ROTHSCHILD, 1907	O	4–7–8
Eacles ormondei peruviana BOUVIER, 1927	U	4
Citheronia hamifera hamifera ROTHSCHILD, 1907	O	4–7–8
Citheronia aroa SCHAUS, 1896	U	4–10
Citheronia phoronea (CRAMER, 1779)	R	10
Othorene hodeva (DRUCE, 1904)	R	12

	relative abundance	phenology
Cicia pelota (SCHAUS, 1905)	?	?
Syssphinx molina (CRAMER, 1780)	C	4–7–8–10
Syssphinx amena (TRAVASSOS, 1941)	R	4–10
Adeloneivaia subangulata subangulata (HERRICH-SCHÄFFER, [1855])	U	4
Adeloneivaia acuta (SCHAUS, 1896)	O	4–10
Adeloneivaia catoxantha catoxantha (ROTHSCHILD, 1907)	R	4
Adeloneivaia pelias (ROTHSCHILD, 1907)	0	4–10
Adeloneivaia jason jason (BOISDUVAL, 1872)	O	4–7
Adelowalkeria plateada (SCHAUS, 1905)	?	?
Citioica anthonilis (HERRICH-SCHÄFFER, [1854])	U	4–10
Ptiloscola photophila (ROTHSCHILD, 1907)	O	4–10
Lonomia descimoni descimoni (LEMAIRE, 1972)	C	4
Lonomia achelous achelous (CRAMER, 1777)	O	4–8
Catacantha stramentalis (DRAUDT, 1929)	U	4–12
Automeris janus (CRAMER, 1775)	U	4–6–8–10
Automeris egeus (CRAMER, 1775)	R	4
Automeris larra (WALKER, 1855)	R	7
Automeris hamata SCHAUS, 1906	C	4–8–10
Automeris duchartrei BOUVIER, 1936	O	7–8
Automeris jucunda (CRAMER, 1779)	R	8
Automeris cinctistriga (FELDER & ROGENHOFER, 1874)	R	7
Automeris midea (MAASSEN, 1885)	R	7
Automeris liberia (CRAMER, 1780)	C	7–8–10
Automeris abdominalis (FELDER & ROGENHOFER, 1874)	?	?
Automeris curvilinea SCHAUS, 1906	R	8
Automeris denticulata CONTE, 1906	R	8
Automeris annulata annulata SCHAUS, 1906	?	?
Automeris styx LEMAIRE, 1982	R	4
Automeris schwartzi LEMAIRE, 1967	R	4
Automeris heppneri LEMAIRE, 1982	R	8
Leucanella apollinairei (DOGNIN, 1923)	R	7
Leucanella maasseni (MÖSCHLER, 1872)	R	7
Pseudautomeris irene armirene (STRAND, 1920)	U	10
Pseudautomeris lata (CONTE, 1906)	?	?
Gamelia abasia (STOLL, 1781)	U	8–10
Gamelia rindgei LEMAIRE, 1967	R	7
Hyperchiria nausica (CRAMER, 1779)	0	4–8
Automerina cypria (GMELIN, 1790)	U	4
Automerula auletes (HERRICH-SCHÄFFER, [1854])	O	4–8
Hylesia nanus (WALKER, 1855)	R	4
Hylesia coex rex DYAR, 1913	R	8
Hylesia canitia (CRAMER, 1780)	0	4–8–10
Hylesia olivenca SCHAUS, 1927	?	?

	relative abundance	phenology
Hylesia pauper DYAR, 1913	U	4–8–10–12
Hylesia murex DYAR, 1913	R	4–12
Hylesia umbrata SCHAUS, 1911	O	4–8–10
Hylesia tapareba DYAR, 1913	?	?
Hylesia subfasciata DOGNIN, 1916	R	4–8–10
Hylesia indurata DYAR, 1910	R	10
Hylesia praeda DOGNIN, 1901	R	4
Hylesia index DYAR, 1913	R	10
Hylesia melanostigma (HERRICH-SCHÄFFER, [1855])	O	4–7–8
Hylesia gyrex DYAR, 1913	R	4
Molippa nibasa MAASSEN, 1885	U	4
Molippa latemedia (DRUCE, 1890)	R	4–12
Paradirphia oblita oblita (LEMAIRE, 1976)	O	10
Cerodirphia speciosa (CRAMER, 1777)	U	10
Cerodirphia brunnea brunnea (DRAUDT, 1929)	R	
Dirphia aculea VUILLOT, 1892	R	7
Dirphia avia (STOLL, 1780)	O	8
Dirphia panamensis panamensis (SCHAUS, 1921)	C	4–7–8–10–12
Dirphia fraterna fraterna (FELDER & ROGENHOFER, 1874)	C	4–8–10
Dirphia thliptophana thliptophana (FELDER & ROGENHOFER, 1874)	C	4–7–8–10
Periphoba hircia (CRAMER, 1775)	R	4–7–8
Pseudodirphia agis agis (CRAMER, 1775)	O	4–10
Pseudodirphia eumedidoides (VUILLOT, 1892)	U	4–8
Copaxa decrescens WALKER, 1855	U	4–7–8
Copaxa cineracea ROTHSCHILD, 1895	R	4
Rothschildia erycina erycina (SHAW, [1796])	O	4–8–10
Rothschildia hesperus hesperus (LINNAEUS, 1758)	C	4–7–10
Rothschildia arethusa rhodina JORDAN, 1911	R	4–8
Rothschildia aurota aurota (CRAMER, 1775)	O	4–8

Appendix 3

Systematic list of Sphingidae collected in the Misahuallí area

Relative abundance: C = Common (20 to 30 specimens); O = Occasional (10 to 19 specimens); U = Uncommon (5 to 9 specimens); R = Rare (1 to 4 specimens). Phenology: numbers refer to months.

	relative abundance	phenology
1. *Cocytius duponchel* (POEY, 1832)	O	4–6–7–8–10
2. *Neococytius cluentius* (CRAMER, 1775)	U	4–8–12
3. *Manduca diffissa tropicalis* (ROTHSCHILD & JORDAN, 1903)	C	4–7–8–12
4. *Manduca hannibal hannibal* (CRAMER, 1779)	U	4–8–10

	relative abundance	phenology
5. *Manduca perplexa* (ROTHSCHILD & JORDAN, 1910)	R	4
6. *Manduca* spec. 1	R	4
7. *Manduca rustica rustica* (FABRICIUS, 1775)	U	7–10
8. *Manduca albiplaga* (WALKER, 1856)	O	7–8–10
9. *Manduca dalica dalica* (KIRBY, 1877)	R	4
10. *Manduca* spec. 2	R	7–8
11. *Manduca* spec. 3	R	7
12. *Protambulyx goeldii* ROTHSCHILD & JORDAN, 1903	R	4
13. *Adhemarius gannascus* (STOLL, 1790)	C	8–10
14. *Adhemarius ypsilon* (ROTHSCHILD & JORDAN, 1903)	R	8
15. *Adhemarius palmeri* (BOISDUVAL, [1875])	R	7–8
16. *Isognathus scyron* (CRAMER, 1780)	R	8
17. *Erinnyis alope* (DRURY, 1770)	C	7–8
18. *Erinnyis lassauxii* (BOISDUVAL, 1859)	R	8
19. *Pachylia ficus* (LINNAEUS, 1758)	C	4–8
20. *Pachylia darceta* DRUCE, 1881	C	4–6–7–8–10–11
21. *Pachylioides resumens* (WALKER, 1856)	C	4–8
22. *Oryba kadeni* (SCHAUFUSS, 1870)	R	7
23. *Oryba achemenides* (CRAMER, 1779)	R	4–10
24. *Hemeroplanes triptolemus* (CRAMER, 1779)	R	4
25. *Callionima pan* (CRAMER, 1779)	R	8
26. *Callionima denticulata* (SCHAUS, 1895)	R	8
27. *Enyo lugubris lugubris* (LINNAEUS, 1771)	U	4–7
28. *Enyo ocypete* (LINNAEUS, 1758)	R	4
29. *Enyo gorgon* (CRAMER, 1777)	R	4
30. *Enyo cavifer* (ROTHSCHILD & JORDAN, 1903)	R	4
31. *Nyceryx nictitans saturata* ROTHSCHILD & JORDAN, 1903	R	8
32. *Perigonia stulta* HERRICH-SCHÄFFER, [1854]	U	10
33. *Aellopos ceculus* (CRAMER, 1777)	R	12
34. *Eumorpha anchemola* (CRAMER, [1779])	O	4–7–8
35. *Eumorpha triangulum* ROTHSCHILD & JORDAN, 1903	O	4–8–10
36. *Eumorpha satellitia licaon* (CRAMER, 1776)	R	8
37. *Eumorpha obliqua obliqua* (ROTHSCHILD & JORDAN, 1903)	R	8
38. *Eumorpha vitis vitis* (LINNAEUS, 1758)	O	4–11
39. *Eumorpha capronnieri* (BOISDUVAL, [1875])	R	4–7
40. *Eumorpha lambruscae* (LINNAEUS, 1758)	R	12
41. *Xylophanes schausi serenus* ROTHSCHILD & JORDAN, 1910	R	8
42. *Xylophanes fusimacula* FELDER, 1874	U	4–7–8–10
43. *Xylophanes undata* ROTHSCHILD & JORDAN, 1903	U	4–7–8
44. *Xylophanes media* ROTHSCHILD & JORDAN, 1903	U	4–10
45. *Xylophanes anubus* (CRAMER, 1777)	R	4
46. *Xylophanes cosmius* ROTHSCHILD & JORDAN, 1906	R	4–6
47. *Xylophanes tersa* (LINNAEUS, 1771)	R	8

	relative abundance	phenology
48. *Xylophanes dolius* ROTHSCHILD & JORDAN, 1906	R	7
49. *Xylophanes libya* (DRUCE, 1878)	O	4–7–8
50. *Xylophanes thyelia* (LINNAEUS, 1758)	O	4–7–10

Addresses of the authors

TOMMASO RACHELI
Department of Animal and Human Biology
University of Rome
Rome, Italy

LUIGI RACHELI
Via Fara Sabina 1
I-00199 Rome, Italy