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Preliminary Checklist and Field Observations of the Butterflies of the Maquipucuna Field Station (Pichincha Province, Ecuador).

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Abstract. The Maquipucuna Tropical Reserve (MTR) contains one of the few remaining fragments of rainforest in western Ecuador. A survey of butterfly species richness was performed by walking an altitudinal transect (1270 to 1900m) through MTR forest habitats from late August to October, 1989, and late November to early December, 1992. In 350 collector hours, 220 butterfly species were observed; some are characteristic of lowland tropical forests, others of Andean cloud forests and bamboo thickets. Habitat affinities, altitudinal distributions, feeding and perching behaviors were noted and discussed for many species. Cylindrical net traps baited with rotting fruit were used to collect 21 butterfly species, mostly charaxine and satyrine nymphalids. We observed apparent zonation by elevation or habitat among three species of *Taygetis* (Satyrinae) and vertical zonation in perch height among three species of *Adelpha* (Liminitinae). Future surveys performed from January to July and extending to the southern limits of the MTR (above 1900m) should identify many more butterfly species.

Key Words: Altitudinal zonation, butterflies, fruit-feeding, Maquipucuna Tropical Reserve, perching, western Ecuador.

Introduction

Recent efforts to survey and catalog biological diversity have identified western Ecuador (Esmeraldas, Guayas, Manabí and Pichincha Provinces; see map, Fig. 1) as a "hotspot" of species endemism, particularly for flowering plants (Conniff 1991, Wolf 1991, Gentry 1991). Unfortunately, little remains of the formerly extensive belt of western Ecuador's tropical forest, as an estimated 95% of the original forest cover has been cleared during the past two decades (Conniff 1991, Gentry 1991). The Maquipucuna Tropical Reserve (MTR) contains one of the few remaining fragments of western Ecuadorian forest. The 3000 hectare Reserve was established in 1988 by the *Fundación Maquipucuna*, a non-profit organization oriented toward conservation of threatened ecosystems, sustainable resource management, environmental education and ecotourism. One of the most important features

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Figure 1: Map of Ecuador, showing Provinces of western Ecuador (Esmeraldas, Guayas, Los Rios, Manabi and Pichincha), the locations of the Maquipucuna Tropical Reserve (M), the Pululahua Crater (P) and the Tinalandia resort (T). The Jatun Sacha field station, Napo Province, is indicated by (J).

of the MTR is that it contains an altitudinal transect (1270 to 2700m) that combines plant and insect species with strong affinities to the coastal lowland rainforests (Gentry 1991) with elements of the Andean flora and fauna of higher elevations.

In 1989, we initiated our census of the butterflies of the MTR as one of many floristic and faunistic baseline surveys (e.g. birds - Marín et al. 1992, Greenfield 1993; plants - G. Webster, unpublished data, Gentry 1991) performed at the Reserve. Our goals were to establish a preliminary checklist of butterfly species occurring at MTR and to create a reference collection (in Quito) of specimens that would be available to future researchers. Certain groups of butterflies and moths from western Ecuador have been studied

(riodinids; Willmott and Hall 1994, satyrines; Hewitson 1870, Kruger 1924, Brown 1941a, 1943, 1944, saturniid moths; LeMaire and Venedictoff 1989: see references in Brown [1941b]), and butterflies have been collected extensively at the Tinalandia resort (670 m elev.), 17 km east of Santo Domingo de los Colorados (Emmel and Drummond 1988, Strasburg 1978, Shaw and Shaw 1987, T. Emmel and C. Covell, pers. comm.; see map, Fig. 1), but there are few published faunal checklists of butterfly species for any single locality in western Ecuador (see Campos 1898). Here we present the results of our survey, including a preliminary checklist, and observations on elevational distributions, habitat affinities, feeding and perching behaviors of the butterflies of the MTR.

Materials and Methods

Field Site

The MTR (*Bosque Protector Maquipucuna*, 0° 5'N, 78° 37'W) is located roughly 40km northwest of Quito, near Nanegalito in the Province of Pichincha, Ecuador (see maps, Figs. 1, 2). The Reserve includes a small biological field station (Estación "Thomas Davis") and encompasses 3000 ha of premontane tropical rainforest, cloudforest and bamboo thickets (*Chusquea* sp. [Poaceae]) from a minimum elevation of 1200m near the Rio Tulambí to the 2700m peaks of Monte Sosa and Cerro Montecristi. Yearly mean temperatures (14° to 22° C) and rainfall (1000mm to 4000mm) vary considerably within the Reserve (R. Justicia, unpubl. data). Rainfall appears to be heaviest from August to December (O. Gloster, pers. obs.). More detailed meteorological information from MTR will be published elsewhere (G. Webster, in prep.).

Habitats

We surveyed the butterflies of the northern third of the MTR by walking a 3.5 km altitudinal transect south-southwest from 1270m at the station to a deeply forested ridge at 1700m below Loma Cachillacta. Altitudes were determined through the use of an altimeter calibrated against a topographic map (Calacalí Quadrangle, IGM/IAGS Ecuador, 1980). The surveys were performed along established paths from 0800 to 1400 hrs. each day from 20 to 26 Aug. 1989 (RAR and OG), 2 Sept. to 18 Oct. 1989 (OG) and from 27 Nov. to 7 Dec. 1992 (RAR). These paths originate within riparian forest (*Blakea eriocalyx* [Melastomataceae], *Otoba gordonifolia* [Myristicaceae], with a canopy of 20-35m) along Rio Tulambí and Rio Umachaca, where the chief nectar sources observed during our study were *Erato polymnioides* and *Eupatorium* sp. (Asteraceae). The paths traverse groves of banana and guava (*Psidium guajaba* [Myrtaceae]) and converge in a meadow of blooming *Asclepias curassavica* (Asclepiadaceae), *Bidens* sp. (Asteraceae) and *Lantana camara* (Verbenaceae) plants at 1300m. For the next 0.5km a single path crosses an exposed clearing near a small farm, "Finca los Espárragos", adjacent to disturbed, second growth forest with *Heliotropium* sp. (Boraginaceae), a low canopy of *Piper* sp. (Piperaceae) trees and an understory dominated by *Anthurium giganteum* (Araceae), *Gunnera pilosa* (Gunneraceae), a pink-flowered *Salvia* sp. (Labiatae) and *Solanum acerifolium* (Solanaceae). Beyond the farm the path ascends a steep ridge bordered by disturbed thickets of ferns and *Solanum* shrubs to the west and groves of *Cecropia* sp. (Moraceae) trees to the east, then winds through grassy meadows and re-enters forest at 1500m.

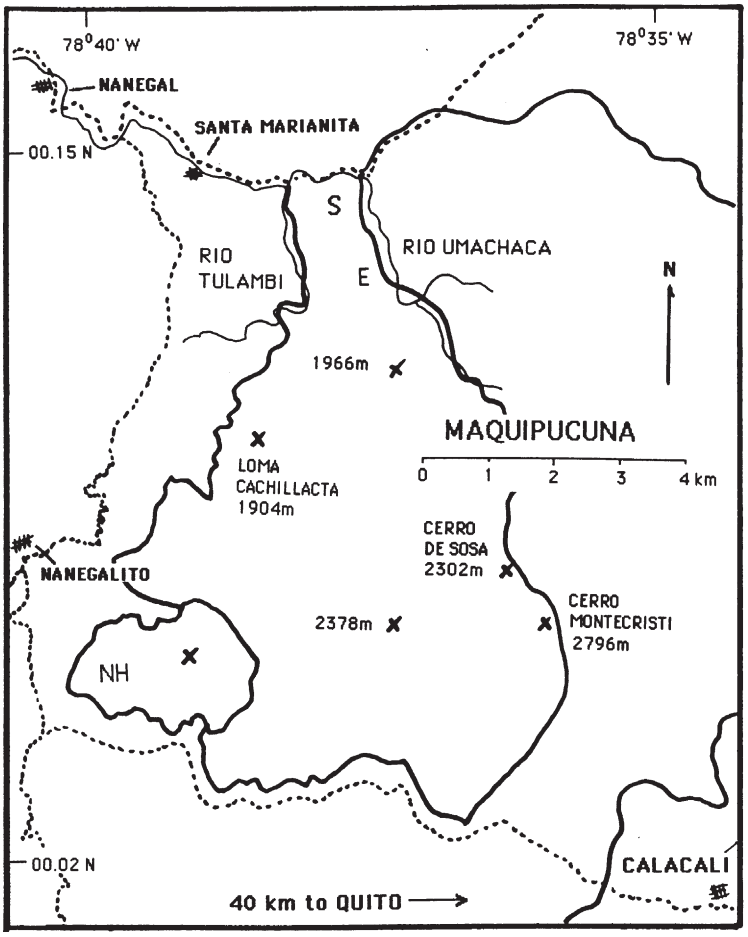

Figure 2: Map of the Maquipucuna Tropical Reserve, located near the equator between Calacali and Nanegal. Butterfly surveys were performed in the northern third of the Reserve, along transects from the Thomas Davis field station (S; 1270m) past the Finca de los Esparragos (E) toward the Loma Cachillacta (1904m). Dotted lines indicate auto roads; solid lines contain the Cooperativo Nuevos Horizontes (NH), the Reserva Maquipucuna (center) and the Bosque Protector del Rio Guayllabamba (right).

The forest canopy above the hillside switchbacks is low (15-25m), with thickets of *Heliconia grigsiana* (Heliconiaceae), ferns, individual *Centropogon solanifolium* (Lobeliaceae) plants and *Sobralia* orchids. At 1600m the forest grades into a deeper, less disturbed community of palms and taller trees (e.g. *Gustavia* sp. [Lecythidaceae], *Meriana* sp. [Melastomataceae], *Persea* sp. [Lauraceae] and *Otoba gordonifolia*, to 40m) draped with bromeliads and lianas (*Burmeistera resupinata* [Lobeliaceae], *Monstera* and *Philodendron* sp. [Araceae]). At 1700m, the path branches to the south and east over primary premontane and montane forest, continuing through a bamboo zone to Cerro Montecristi. The latter paths were still under construction

during the periods of this study; butterflies from cloud forest and bamboo habitats from 1700 to 1900m in elevation were surveyed sporadically by OG in 1989.

Collecting Methodology

Butterflies were collected with nets at flowers, sap, animal excrement, at rest or in flight; were ensnared in cylindrical net traps (30 cm diameter, 75 cm height) that were baited with rotting bananas and solanaceous fruits (tree tomato, *Cyphomandra crassifolia* and *naranjilla*, *Solanum quitoense*); and were identified by sight when possible. We recorded date, time, elevation, habitat type and details of feeding and perching behavior (time of day, height of perch, microhabitat) for each observed or collected specimen. Eight baited traps were placed in the forest understory (1.5 m above ground) in order to sample a variety of microhabitats and elevations (see Table 1). Traps were checked twice daily, in the early morning and afternoon. Heavy rainfall often began by 1430 hrs. and continued into the early evening.

Specimen Identification

Many of the butterflies collected were identified in Ecuador through comparison with specimens in the Museo Ecuatoriano de Ciencias Naturales in Quito or by consulting the texts of Fox and Real (1971), DeVries (1987) and D'Abrera (1981, 1984, 1987a,b, 1988). Specimens from problematic groups were identified at the Smithsonian Institution, Washington DC, by Drs. Robert Robbins (lycaenids), Donald Harvey (riodinids and hesperiids) and Gerardo Lamas (some ithomiines) and by one of us (RAR) at the American Museum of Natural History, New York. All specimens are currently housed either in the collection of the Pontificia Universidad Católica or in the private collection of the *Fundación Maquipucuna*, both in Quito.

Results

Species Checklist

We found 220 species of butterflies during 350 hours of observations at MTR. These species are listed in Appendix 1, along with elevation, habitat and months (from August to December) during which they were observed. Some species (e.g. *Dismorphia theucarilla*, *Leodonta dysoni*, many lycaenids and riodinids) were observed only during limited segments of our survey, while others (*Altinote ozomene, Papilio thoas*, *Pteronymia parva*, most satyrines and pierids) were observed throughout the period of study. Over one half of the butterfly species encountered were Nymphalidae, and 34 of the 116 nymphalid species collected (29%) represented the Satyrinae. Superficially, satyrine species richness at MTR is numerically comparable to faunal survey results from lower elevation South American rainforests, such as Pakitza (400m, 28% satyrines; Lamas et al. 1991) and Tambopata (300m, 25%; Lamas 1983) near Manu National Park, Perú and two sites in Rôndonia, Brazil (Jaru, 250-350m, 27.5%, Brown 1984; Caucalandia, 160-350m, 20%, Emmel and Austin 1990). However, the MTR satyrine fauna is distinguished from the others by the number of species from the tribe Pronophilini (at least 12, probably more above 2000m), which are more characteristic of higher elevation Andean biomes than are non-pronophiline satyrines (Brown 1941a, 1943, Adams and Bernard 1977, Adams 1986).

At least 70 butterfly species found at MTR (and probably many more) also are found in the 670-700m tropical forests of the Tinalandia Resort (Strasburg 1978, Shaw and Shaw 1987, Emmel and Drummond 1988, B. Harris, R. Leushner unpub. data; see Appendix 1) and elsewhere in tropical Ecuador (Campos 1921, Kruger 1924, D'Abrera 1981, 1984, 1987a, b; see Appendix 1). The presence of middle-elevation forest species, such as *Adelpha colada, Heliconius clysonymus, Patricia dercyllidas, Perisama opellii, Corades pannonia, Mygona irmina* and other pronophiline satyrines illustrate the faunal transition from coastal tropics to Andean paramo that occurs within MTR. The endpoint of this transition is illustrated by the butterfly fauna of the nearby Pululahua Crater (2500-3000m; between Calacalí and San Isidro, Pichincha Province), which is rich in lycaenid and satyrine species, including some endemics (Balint and Johnson 1994, 1995), but is depauperate in most other groups of butterflies. Nearly one-third of the 94 species identified from Pululahua are pronophiline satyrines, including four species of *Corades*, 11 *Pedaliodes* and two *Pronophila*.(G. Kareofelas and C. Witham, unpubl. data). Only 19 butterfly species found at Pululahua Crater also occur at MTR (see Appendix 1).

In Fig. 3 we give a crude estimate of sampling effort and survey completeness, assayed by graphing the cumulative number of species against cumulative observer hours (see Clench 1979, Brown 1984, Raguso and Llorente 1991, Lamas et al. 1991). Species number increased sharply at the outset of our study (Aug. 1989), tabled off during the extremely wet period of Sept.-Oct. 1989 and rose steadily during the final segment of our survey, late Nov.-early Dec. 1992, without reaching an asymptote. These patterns indicate a seasonal effect on butterfly species composition at MTR and suggest that additional butterfly species are likely to be found there in December. We expect to encounter many more butterfly species when surveys are extended to higher cloud forest and bamboo thicket habitats above 1900m, and when all habitats are surveyed from January through July.

Habitat Affinities

In addition to lower montane rainforest, cloudforest and bamboo thickets, MTR includes a number of ecotone microhabitats, including successional meadows, young second growth forest edges and riparian gallery forest. Some of the butterfly species observed during our survey (e.g. *Papilio thoas*, *Anteos clorinde*, *Gluthophrissa drusilla*, *Phoebis argante* and *P. sennae*, *Dione juno*, *Anartia amathea*, *Adelpha cythaeria, Junonia evarete*, *Vanessa virginiensis*, *Hermeuptychia hermes*) are cosmopolitan, "weedy" species (DeVries 1987, Brown 1991, Raguso and Llorente 1991, see Bowman et al. 1990) associated with disturbed, exposed habitats on the fringes of MTR. Other species, including *Mechanitis menapis*, *Papilio anchisiades*, *Parides iphidamus* and *P. erithalion* (abundant at riverside flowers), *Diaethria neglecta*, *Leodonta dysoni*, *Marpesia chiron* and *Perisama vaninka* (common at mud puddles) and *Arawacus leucogyna*, *Heliconius sapho eleuchia*, *Prepona* and *Necyria* species (perched or resting on vegetation) were associated primarily with riparian habitats. A

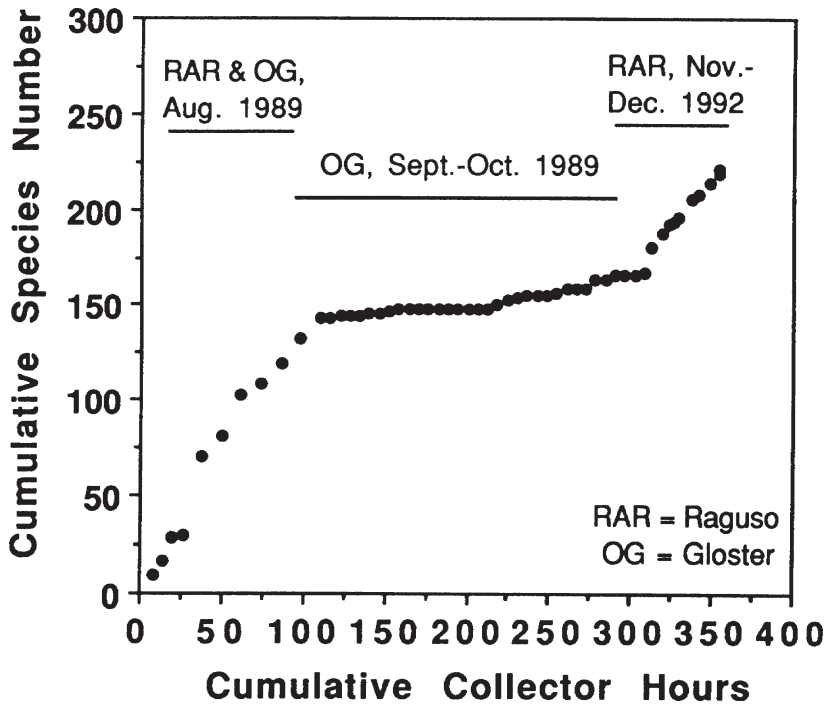

Figure 3: Cumulative butterfly species collected or observed, as a function of cumulative collector hours. Note asymptote in Sept.- Oct. due to heavy rains and high collecting effort, followed by seasonal increase of new species in December. RAR = Raguso, OG = Gloster, collectors.

number of butterflies appeared to be restricted to dark forest habitats, including *Dismorphia lelex* and *D. theucarilla* (Pieridae), *Napaea* nr. *merula* (Riodinidae), the skipper *Vettias coryna*, many ithomiines (*Greta*, *Ithomia* and *Pteronymia* sp., *Patricia dercyllidas*) and satyrines (*Chloreuptychia arnaea*, *Cithaerias menander*, *Manataria maculata*). Numerous butterfly species were associated with treefall gaps, especially from the nymphalid genera *Adelpha*, *Eresia*, *Hypanartia*, *Memphis*, *Perisama* and *Prepona*, the lycaenid *Thecla danaus*, the skippers *Astraptes fulgerator azul* and *Urbanus proteus* and most satyrines. Finally, *Antirrhea* sp. nr. *geryon* (Morphinae), *Eretris apuleja*, *Taygetis lineata* (Satyrinae) and the skippers *Cyclosaemia phidyle* and *Metrocles* sp. were found only in the bamboo zone above 1800m.

Elevational Distributions

Altitudinal data for all butterfly species are listed in Appendix 1; the distributions of all satyrine butterflies collected from the tribe Pronophilini are given in Fig. 4. *Pedaliodes peucestas* and *P. phrasiclea* were found together in forest habitats throughout the altitudinal range of our survey, including disturbed forest edges below 1400m. This contrasts with the observations of

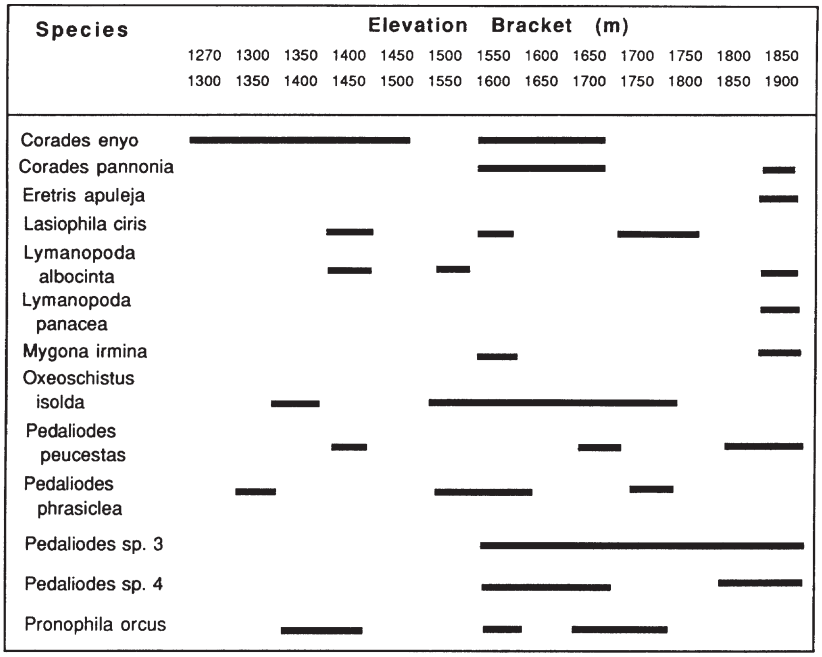

Figure 4: Elevational distributions of satyrine butterflies, tribe Pronophilini. Bars represent elevations at which specimens of a given species were observed or collected.

Adams (1986) throughout the Colombian Andes, where *P. phrasiclea* always occurs in a lower elevational belt (2000-2600m cloud forest) than the white-banded *P. peucestas* 2500-3000m). The altitudinal distributions of *Corades enyo* (1270-1660m) and *C. pannonia* (1500-1860m) overlapped at MTR as they do in Colombia (Adams 1986), but *C. pannonia* was less frequently encountered outside of mature forest. Among other satyrines, *Taygetis andromeda* was found from 1450-1600m, but apparently is replaced by *T. puritana* in cloud forest at 1600-1800m and by *T. lineata* in the bamboo zone from 1800-1900m. Other pairs of related nymphalids with non-overlapping elevational distributions were: *C. illioneus* (Brassolinae, 1270-1300m; banana groves) and *Caligo prometheus* (1450-1500m; in banana groves and *Heliconia* thickets), *Pteronymia parva* (Ithomiinae, 1270-1510m) and *P. zerlina* (1460-1900m) and *Heliconius sapho eleuchia* (Heliconiinae, 1270-1300m) and *H. clysonymus* (1510-1700m).

Feeding Behavior

Butterflies were observed and collected feeding at a variety of sources, including flowers, rotting fruit, sap, animal waste and mud puddles. Table 2 lists the butterfly species observed taking nectar from common riverside or trailside flowers. In contrast, Table 1 lists the butterflies (mostly charaxines and satyrines) collected in traps baited with rotting fruit and placed along

Table 1. Butterflies collected at Van Someren/Rydon Traps 7 Aug.-28 Oct. 1989, 27 Nov.-7 Dec. 1992)

	Elev.	Habitat	Butterfly Species
1.	1260 m	meadow nr. banana grove	*Archaeoprepona chromus* *Euptychia harmonica* *Oxeoschistus isolda* *Pareuptychia hesionides*
2.	1260 m	riverside gallery forest	*Hypanartia lethe* *Prepona laertes* *Smyrna blomfildia*
3.	1300 m	disturbed path, lightgap	*Corades enyo* *Diaethria marchalii* *Euptychia harmonica* *Memphis morvus* *Oxeoschistus isolda* *Pareuptychia hesionides* *Pareuptychia metaleuca*
4.	1410 m	hillside forest	*Opsiphanes quiteria* *Pedaliodes peucestas*
5.	1500 m	dark forest understory	*Caligo prometheus* *Corades pannonia* *Euptychia harmonica* *Oxeoschistus isolda*
6.	1560 m	dense forest	nothing caught
7.	1580 m	hillside lightgap	*Corades enyo* *Corades pannonia* *Oressinoma typhla* *Oxeoschistus isolda* *Pronophila orcus*
8.	1640 m	dense forest	*Corades enyo* *Perisama opellii*
9.	1750 m	bamboo clearing	*Manataria maculata* *Taygetis puritana*

paths at different elevations. The absence of species overlap between these two tables is characteristic of the narrowness of flower-feeding and fruit-feeding butterfly guilds in neotropical rainforests (DeVries 1987, 1988). We summarize all observations of butterflies feeding at non-floral sources in Table 3, distinguishing among bird, dog, horse and cow feces, human urine,

Table 2. Butterflies collected or observed at flowers.

Flower Species	Butterfly Species
on *Bidens* sp. (Asteraceae)	*Euptychia inornata*
	Heliconius clysonymus
	Heliopetes sp.
on *Erato polymnioides* (Asteraceae)	*Autochton neis*
	Charis iris
	Emesis ocypore
	Eusalesia bettina
	Ouleus fridericus
	Parides iphidamus
	Siproeta epaphus
on *Eupatorium* sp. (Asteraceae)	*Archonias tereas*
	Charis iris
	Leucochimona lagora
on *Heliotropium* sp. (Boraginaceae)	*Leptophobia caesia*
	Ithomia terra
on *Lantana camara* (Verbenaceae)	*Altinote ozomene*
	Danaus plexippus
	Dismorphia theucarilla
	Hypoleria riffarthi
	Symmachia probator

rotting bananas, tree-tomato and *naranjilla* fruits, sap and aluminum foil as non-floral attractants.

Perching

In Table 4 we list times, heights above ground, habitat types and elevations of butterfly species observed to defend perches (*sensu* Callaghan 1982, Rutowski et al. 1991). All species included here defended specific perches (usually a leaf or tree trunk) by repeatedly accosting passing butterflies (or tossed objects) and returning to the same sites. Most species defended well-lit perches in treefall gaps, sunflecks or along trailside or riverside forest edges. *Archaeoprepona* spp., *Diaethria marchallii*, *Hypanartia lethe*, *Necyria zaneta* and *Sarota chrysus* were commonly encountered at perches along riverside gallery forests from 1270-1350m. *Euselasia bettina* and *E. eucrates* perched on sunlit *Piper* foliage from 0900-1000 hrs., at vantage points adjacent to dark forest trails (see Callaghan 1982, Brown and Alcock 1991). *Adelpha* species,

Table 3. Butterflies collected or observed at non-floral attractants.

Species	Mud	Feces[1]	Fruit[2]	Other
Papilionidae				
Papilio anchisiades	X			
Papilio thoas	X			
Pieridae				
Leodonta dysoni	X			
Pereute callinira	X			
Nymphalidae				
Adelpha cythaeria	X			
Altinote alcione	X	X[1,7]		
Altinote ozomene	X	X		
Archaeoprepona chromus			X	
Archaeoprepona demophon		X[3]		
Archonias tereas	X			
Catonephele chromis				X[5]
Caligo illioneus		X		
Caligo prometheus		X	X	
Corades pannonia			X	
Diaethria marchallii	X	X	X	
Diaethria neglecta	X			
Dryas iulia	X			
Euptychia benedicta			X	
Euptychia harmonica			X	
Euptychia obscura			X	
Fountainea nessus		X		
Hermeuptychia hermes			X	
Historis odius				X[6]
Hypanartia lethe	X	X	X	
Manataria maculata			X[3]	
Marpesia coresia	X			
Marpesia corinna	X			
Memphis austrina		X[3]		
Memphis morvus		X		
Mygona irmina				X[5]
Opsiphanes quiteria			X	
Oressinoma typhia			X	
Oxeoschistus isolda			X[4]	
Pareuptychia hesionides			X[4]	
Pareuptychia metaleuca			X[4]	

Parides erithalion	X			
Patricia dercyllidas				X
Pedaliodes peucestas			X	
Perisama oppelii			X	
Perisama rhodoptera		X		
Perisama vitringa		X		
Prepona laertes			X	
Pronophila orcus			X	
Smyrna blomfildia			X	
Riodinidae				
Charis iris	X			
Hesperiidae				
Phocides sp.	X			

[1]: horse or cow feces
[2]: rotting banana and tree-tomato fruit
[3]: aluminum foil and urine
[4]: *naranjilla* fruit
[5]: dog feces
[6]: sap
[7]: bird droppings

Astraptes fulgerator, Memphis morvus, Perisama vitringa defended low canopy or lightgap perches along the hillside switchbacks. Sorties were directed at individuals of the same species, at other perching species, at canopy-flying species such as *Gluthophrissa drusilla* and *Anteos clorippe* and at patrolling species such as *Oxeoschistus isolda* and *Pronophila orcus*. Finally, many species defended perches in treefall gaps and sunflecks within deep rainforest at 1700m. Perching heights of *Astraptes fulgerator*, three *Euptychia* sp., *Pedaliodes* sp., *Stichelia apoplecta*, *Thecla danaus* and diurnal *Erateina* moths (Geometridae) were 3-7m above ground, while those of *Adelpha colada*, *Epiphile oreas* and *Perisama opellii* were above 10m in height.

Discussion

Faunal checklists for specific localities or habitats provide data bases that may be used to identify local endemism (Descimon et al. 1974, Llorente and Luis 1988, Llorente and Escalante 1992), aid in comparative studies on a regional scale (Adams 1986, DeVries 1987, DeVries, Chacon and Murray 1992, Raguso and Llorente 1991, in press), focus conservation efforts (de la Maza and de la Maza 1985, Emmel and Austin 1990, Brown 1991, Kremen 1992, 1994) and identify avenues for further research. Our preliminary checklist of the butterflies of MTR represents the first step in characterizing the butterfly fauna of an important mid-elevation forest habitat fragment in

Table 4. Record of Perching Species.

Species	Time	Height Above Ground	Elevation	Habitat Type*
Pieridae				
Leodonta dysoni	1245-1330	5-7m	1270-1300m	T, C
Nymphalidae				
Adelpha colada	1100-1430	6-10m	1550-1600m	E, C
	1100-1200	10-15m	1700m	S, C
Adelpha rothschildi	1100-1430	4-7m	1270m	R
			1550-1600m	E, T
Adelpha serpa	1100-1430	8-15m	1550-1600m	E, C
Diaethria marchallii	1400-1430	2-3m	1270m	R
Diaethria neglecta	1400-1430	5m	1350-1400m	R, T
Epiphile oreas	1100-1130	10-20m	1700m	H, S
Euptychia phineus	1100-1130	5-7m	1700m	H, T, S
Euptychia nossis	1100-1130	5-7m	1700m	H, T, S
Euptychia harmonica	1230-1300	6-7m	1700m	H, S
Hypanartia lethe	1100-1430	2-4m	1270-1400m	R
Memphis morvus	1100-1300	7-12m	1550-1600m	C
Pedaliodes sp. 3	1230-1300	2m	1550-1600m	T, S
	1230-1300	3-4m	1700m	H, S
Perisama opellii	1230-1300	15-30m	1700m	H, T, C
Perisama vitringa	1000-1100	4-5m	1550-1600m	T, E
Prepona laertes	1200-1300	6-8m	1550-1600m	T, E, C
Riodinidae				
Charis iris	0900-0930	3-4m	1350m	E, (*Piper* sp.)
Euselasia bettina	0900-0930	3-4m	1350m	E, (*Piper* sp.)

Euselasia eucrates	0900-0930	3-4m	1350m	E, (*Piper* sp.)
Necyria zaneta	1130-1245	4-5m	1270m	R
Sarota chrysus	1440-1500	2m	1270	R
Sarota gamelia	0900-0930	3-4m	1350m	E, (*Piper* sp.)
Stichelia apoplecta	1300-1330	4-5m	1700	H, S
Lycaenidae				
Calycopis xeneta	1500-1530	2m	1270m	R
Cyanophrys	1400-1415	4-5m	1350-1400m	H, S
pseudo-longula	1400-1415	10m	1700m	H, S
Lamprospilus nicetus	1230-1300	6-7m	1700m	H, S
Thecla balzabamba	1100-1430	6-8m	1700m	H, S
Thecla caninus	1500-1515	2m	1270m	R
Thecla	1200-1350	6-8m	1550-1600m	T, E
danaus	1200-1400	4-5m	1700m	H, T, S
Thecla eronos	1130-1230	3-4m	1550-1600m	T, E
Thecla photismos	1515-1530	1-2m	1550-1600m	T, E
Hesperiidae				
Astraptes	1200-1300	6-8m	1550-1600m	T, E
fulgerator	1030-1300	2-5m	1700m	H, T, S
Pyrrhopyge nr. phydias	0900-0930	3-4m	1350m	E, (*Piper* sp.)
Urbanus proteus	1230-1500	3-5m	1700m	H, T

*Habitat types (modified from Callaghan)
R. riverside gallery forest
E. forest edge, trail
C. forest canopy
S. sunfleck
T. treefall lightgap
H. hilltop

western Ecuador. Closer examination of our specimens, especially riodinids and satyrines, may lead to the identification of novel taxa endemic to western Ecuador (see Willmott and Hall 1994, Balint and Johnson 1994, 1995), as may further surveys at higher elevations within the MTR.

Altitudinal stratification of related insect species has been described for passalid beetles on Guatemalan volcanos (MacVean and Schuster 1981) and satyrine (Pronophilini) butterflies from cloud forests, bamboo thickets and *páramo* in the Andes of Colombia (Adams and Bernard 1977, 1979, Adams 1986) and Venezuela (Adams and Bernard 1981). The altitudinal transect found within the MTR (1270-2800m) is appropriate for such an endeavor. Our preliminary results show some interesting patterns of altitudinal distribution among related species of *Taygetis*, *Caligo* and *Pteronymia*, but these results should be viewed with caution, considering that species absence over such narrow elevational bands (50-200m) are likely to be an artifact of habitat heterogeneity or disturbance on a small spatial scale. One such example is the case of *Leptophobia caesia*, which is absent below 1400m at MTR but abundant at 670m at Tinalandia. We found a large number of pronophiline satyrines at MTR, but genera such as *Lymanopoda*, *Pedaliodes* (+ *Penrosada* and *Steroemnia*) and *Pronophila* may have been underrepresented in our survey due to our inability to thoroughly sample the bamboo zone from 1800-1900m and the *páramo* near the higher summits within MTR. Species richness and altitudinal zonation among these genera are greatest above 2000m in Colombia, Venezuela and probably in Ecuador; thus Adams and Bernard's zonation hypothesis cannot be appropriately tested for the pronophilines of the northwest Ecuadorean Andes with our data set.

Most of the butterfly species that we collected in traps baited with rotting fruit were charaxines or satyrines, and thus were similar taxonomically to those species collected using comparable methods in Costa Rica (DeVries 1988), Brazil (Austin and Riley 1995), Malaysia (Corbet 1942, Corbet and Riley 1956), Kenya (Van Someren 1963, Larsen 1991) and Australia (Common and Waterhouse 1972). The importance of using non-floral attractants to more fully sample tropical butterfly faunas has been discussed amply by Owen (1971), DeVries (1987), Brown (1991), Larsen (1991), Raguso and Llorente (1991), Lamas et al. (1993) and many others. The variety of empirically tested attractants described by Corbet (1942), van Someren (1963), Owen (1971) and Austin and Riley (1995) and detailed in Table 3 hints at the diversity of nutrient sources utilized by tropical butterflies.

Perching behavior in butterflies has been defined by various workers (Scott 1974, Callaghan 1982, Rutowski et al. 1991) as the occupation and defense of a specific site (often by males on tree trunks or vegetation), from which passing butterflies are accosted (defensive sorties) and to which the occupant repeatedly returns. The importance of perching to reproductive isolation has been investigated for numerous nymphalid and riodinid butterflies (Callaghan 1982, Brown and Alcock 1991, Rutowski 1991, Rutowski et al. 1991). Our observations of butterfly perching suggest that the "sit and wait" strategy of mate location (Alcock 1984, Rutowski 1991) is fairly common

among many MTR butterflies, that subsets of these species show different habitat preferences (e.g. riparian vs. hilltop perch sites) and that different individuals of the same species (e.g. *Thecla danaus*) exhibit variation in perch height and microhabitat choice at different elevations.

Vertical zonation of butterflies has been discussed with reference to different "mimicry rings" (Papageorgis 1975, Llorente and Garces 1983, Burd 1994) and foraging patterns of fruit-feeding butterflies (DeVries 1988). Vertical stratification also may occur among species that engage in hilltopping behavior as a mating strategy when the hilltops are covered with forest (Turner 1990). Studies of other insects (scarab and tiger beetles) suggest that resource partitioning among related species with similar habits or trophic requirements could occur through vertical stratification of perching (and foraging; Howden and Nealis 1978, Pearson and Anderson 1985). In this context, the potential for vertical stratification among perching *Adelpha rothschildi* (4-7m), *A. colada* (6-10m) and *A. serpa* (8-15m) in low canopy sites (1500-1600m) along hillsides at MTR deserves further examination.

In conclusion, we have presented observational and distributional data for 220 species of butterfly found from 1270 to 1900m at the Maquipucuna Tropical Reserve in western Ecuador. This list of species represents a seasonally, regionally and elevationally biased subset of the true butterfly fauna that inhabits the MTR's rainforests between Nanegal and Calacalí, a fauna comprised of both coastal (tropical) and Andean (temperate) elements. We urge Ecuadorian researchers and visiting lepidopterists to extend these surveys beyond the cloud forest into the bamboo zone, *páramo* and less-disturbed forests in the southern end of the Reserve and to sample throughout the year. It is our hope that this communication will serve as a point of departure for further research, observation and conservation of the butterflies of MTR.

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Appendix 1. Preliminary Checklist of the butterflies of the Maquipucuna Field Station, Pichincha Province, ECUADOR

Butterfly Species	Elevation (m)	Habitat Types[1] Observed	Dates[2]
Papilionidae: (5)			
Eurytides protesilaus Linnaeus B	1270	M,R	5
(**T**) *Papilio anchisiades* Esper	1270	R	8,11,12
(**P,T**) *Papilio thoas nealces* Rothschild and Jordan	1270-1300	M,R,C	8,9,11,12
Parides erithalion zeuxis Boisduval	1270	R,C	8,9
(**T**) *Parides iphidamus* Fabricius	1270-1300	R,D	11,12
Pieridae: (21)			
Anteos clorinde Godart *	1700	C	12
(**T**) *Archonias tereas archidona* Fruhstorfer	1270	R,M	8,9,12
Catasticta susiana Hopffer	1540	L	8
Dismorphia lelex Hewitson	1580-1650	D	8,9,11,12
Dismorphia medora Doubleday	1450-1685	D,L	8,10,11,12
Dismorphia (Leienix) nemesis Latreille	1520	L	8
(**T**) *Dismorphia theucarilla* Doubleday	1350-1400	D,M	12
Dismorphia zathoe othoe Hewitson	1300-1450	D,L	11,12
Enantia melite Linnaeus	1310	M,R	8,11,12
(**T**) *Eurema reticulata* Butler	1270-1300	R,D	8,11
(**P,T**) *Eurema xanthochlora* Kollar	1270-1600	M,L	8,9,11
Eurema sp. 3	1270	M	10
(**T**) *Gluthophrissa drusilla* Cramer	1280-1700	M,C	8,9,11
Leodonta dysoni Doubleday	1270	R	8
(**T**) *Leptophobia caesia* Lucas	1400-1650	L,D	8,9,11,12
(**P**) *Leptophobia eleusis* Lucas	1270	R	8
(**T**) *Leptophobia tovaria* Felder	1460-1700	L,D	8,9,11,12
Pereute callinira Staudinger	1270-1400	R	8,10,11,12
(**T**) *Phoebis argante* Fabricius	1270	M,R	12
Phoebis rurina Felder *	1650	C	12
(**T**) *Phoebis sennae marcellina* Cramer	1270	R	11,12

Nymphalidae: (116)				
Heliconiinae				
	Altinote alcione Hewitson	1270-1550	R,L	8,11
(**P**)	*Altinote equatoria* Bates	1270-1300	M,C	10,11,12
(**P,T**)	*Altinote ozomene* Godart	1270-1550	R,M,L	8,10,11,12
(**T**)	*Dione juno* Cramer	1270-1300	R,M	8
(**P,T**)	*Dione moneta butleri* Stichel	1270-1300	R,M	8
(**T**)	*Dryas iulia* Fabricius	1270-1320	R,M,C	8,11,12
	Eueides emsleyi Brown	1550	L	12
	Eueides procula (= *edias*) Doubleday	1270	R,M	8
(**T**)	*Heliconius athis* Doubleday	1270	R,C	8,10
	Heliconius clysonymus Latreille	1510-1700	D,L	8-12
(**T**)	*Heliconius melpomene* Linnaeus	1400	M	11
(**T**)	*Heliconius sapho eleuchia* Hewitson	1270-1300	R,C,L	8,10,11,12
Nymphalinae				
(**T**)	*Anartia amathea* Linnaeus	1270-1300	M	8-12
	Anthanassa ardys Hewitson	1300	M	8
(**T**)	*Anthanassa drusilla* Felder	1350		M,L 12
	Eresia alsina Hewitson	1540	L	8
	Eresia carme Doubleday	1600	L	12
(**T**)	*Eresia casiphia* Hewitson	1550	L	11,12
	Hypanartia dione Latreille	1270	L	10
	Hypanartia kefersteinii Doubleday	1270-1550	R,L,C	8,12
(**T**)	*Hypanartia lethe* Fabricius	1270-1600	R,L,C	8,10,11,12
(**P,T**)	*Junonia evarete* Cramer	1270-1320	M	8-12
	Pycina zamba Doubleday	1270	L	11
(**T**)	*Siproeta epaphus* Latreille	1270-1400	M,C	8,9,11,12
(**T**)	*Tegosa anieta* Hewitson	1270-1400	M,L	8,10,11,12
(**P**)	*Vanessa virginensis* Drury	1450-1500	M	8,9
Limenitidinae				
	Adelpha colada	1400-1550	L,C	8,11,12
(**T**)	*Adelpha cytheria* Linnaeus	1270-1350	R,M	8,10,11,12
	Adelpha irmina Doubleday	1570-1590	L,C	8
	Adelpha justina Felder	1580	L,C	10
	Adelpha melanthe spruceana Bates	1550	L,C	8,11,12
	Adelpha sp. aff. *phylaca* Bates	1300	L,C	10

	Adelpha rothschildi Fruhstorfer	1270-1580	L,C	9,11,12
(**T**)	*Adelpha serpa* Boisduval	1560	L,C	9
	Adelpha sp. aff. *valentina* Fruhstorfer	1270	R,C	9
(**T**)	*Catonephele chromis* Doubleday	1500	L	10
(**T**)	*Diaethria marchalii* Guérin	1270-1550	R,L	8,9,11,12
	Diaethria neglecta (f. *nystographa*) Salvin	1270-1450	R,L,D	8,9,11,12
	Epiphile epicaste Hewitson	1580-1660	L	9
	Epiphile orea negrina Felder *	1700	L,C	12
(**T**)	*Hamadryas amphinome* Linnaeus*	1650	L,C	11,12
(**T**)	*Historis odius* Fabricius *	1270,1700	R,L,C	11,12
(**T**)	*Marpesia chiron* Fabricius	1270	R	8
(**T**)	*Marpesia coresia* Godart	1270-1560	R,L	8,9,12
(**T**)	*Marpesia corinna* Latreille	1270-1580	R,M,L	8,9
	Perisama euriclea Doubleday	1560	L	8
	Perisama humboldtii (= *rhodoptera*) Guérin	1270	R	8
	Perisama opelii Latreille	1640-1660	L,C	8,9
	Perisama vaninka Hewitson	1270	R	8
	Perisama vitringa Hewitson	1550-1650	L	8,11,12
(**T**)	*Smyrna blomfildia* Fabricius	1450	L	11,12
Charaxinae				
	Archaeoprepona (*Noreppa*) *chromus* Guérin	1270	R	8
	Archaeoprepona demophon muson Fruhstorfer	1270	M,L	11
(**T**)	*Archaeoprepona demophoon andicola* Fruhstorfer	1270	R,M	8
	Archaeoprepona meander Cramer	1270	R	8
	Fountainea nessus Latreille	1350	M	8
	Memphis austrina Comstock	1270	R	8,9,11,12
	Memphis morvus Fabricius	1400-1600	D,L	8,9
	Prepona laertes Hübner	1270	R	8
	Prepona omphale amesia Fruhstorfer B	no data		
	Siderone sp. *	1550	L	12
Morphinae				
	Antirrhea sp. aff. *geryon* Felder	1870	B	8,10
	Morpho granadensis Felder	1270-1350	R,M,L	11,12

Brassolinae			
(**T**) *Caligo illioneus oberon* Butler	1270-1300	R,M	8,11,12
Caligo prometheus atlas Rober	1450-1500	D,L	8,11,12
(**T**) *Opsiphanes bogotanus* Distant	1270	R,M	8,10
Opsiphanes quiteria angostura Bristow	1450	L	8
Satyrinae			
(**T**) *Chloreuptychia arnaea* Fabricius	1400	D	12
(**T**) *Cissia confusa* Staudinger	1550	L	11
(**T**) *Cissia labe* Butler	1270-1420	D,L	8,9,12
(**T**) *Cissia tiessa* Hewitson	1440-1650	L,M	8-12
(**T**) *Cithaerias menander* Drury	1300-1500	D	8,9,12
(**P**) *Corades enyo* Hewitson	1270-1660	L,C	8,9,11,12
Corades pannonia Hewitson	1500-1860	L,B	8,9,10
(**P**) *Eretris apuleja* (= *subrufuscens?*) Felder	1850	B	10
(**T**) *Euptychia benedicta* Butler	1300-1780	D,L,M	8-12
Euptychia harmonica Butler	1270-1700	D,L,M	8,9,11,12
(**T**) *Euptychia inornata* Felder	1310-1600	D,L,M	8,9,11,12
Euptychia nossis Hewitson	1450-1700	D,L	8,9,11,12
Euptychia sp. nr. *phineus*	1700	L	11,12
Euptychia obscura Butler	1500-1900	D,L,B	8-12
Euptychia polyphemus Butler	1300-1320	M	8
(**T**) *Hermeuptychia hermes* Fabricius	1270-1450	L,M	8-12
(**P**) *Lasiophila ciris* Thième	1470-1780	fill	8,9,10
Lymanopoda albocinta Hewitson	1400-1800	fill	9,10
Lymanopoda panacea Hewitson	1890	L	10
(**T**) *Manataria maculata* Hopffer	1500-1800	D	8,9,11,12
Megeuptychia antonoe Cramer	1400	L	8
(**P**) *Mygona irmina* Doubleday	1550-1900	D,L	8,9,10
Oressinoma typhla Doubleday	1500-1600	L	8,11,12
(**T**) *Oxeoschistus isolda* Thième	1270-1700	D,L	8,9,11,12
(**T**) *Pareuptychia hesionides* Forster	1270-1600	D,L	8-12
(**T**) *Pareuptychia metaleuca* Boisduval	1300-1400	D,L	11,12
(**P**) *Pedaliodes peucestas* Hewitson	1400-1860	L,B	8,9,10
Pedaliodes phrasiclea Grose-Smith	1320-1725	D,L,M	8,10,11,12
Pedaliodes sp. 3	1550-1810	D,L	8-12

	Pedaliodes sp. 4	1550-1860	D,L,B	8,10,11,12
(**P**)	*Pronophila orcus* Latreille	1350-1700	L,C	8-12
(**T**)	*Taygetis andromeda* Cramer	1480-1550	D,L	8,9,10,11
	Taygetis lineata Godman and Salvin	1800-1900	B	9,10
	Taygetis puritana Weeks	1625-1750	D,B	8,9
	Danainae			
(**P,T**)	*Danaus plexippus megalippe* Hübner *	1270-1350	R,M	8,11,12
	Ithomiinae			
	Dircenna adina Hewitson	1300-1660	D,L	8
	Eutresis hyperia Doubleday and Hewitson	1550	L	12
(**T**)	*Greta andromica* Hewitson	1300-1700	D	8,11,12
	Greta dircetis Doubleday and Hewitson	1600-1860	D	8,10
	Hypoleria riffarthi Haensch	1300-1400	D	11,12
(**T**)	*Ithomia cleora* Hewitson	1400	D	11,12
	Ithomia terra Hewitson	1450-1550	D,L	8,11,12
(**T**)	*Mechanitis menapis mantineus* Hewitson	1270-1400	R,M	11,12
(**T**)	*Miraleria cymothoe* Hewitson	1300-1500	D	11,12
	Oleria victorina Guérin	1300-1700	D,L,M	8-12
	Patricia dercyllidas Hewitson	1640-1900	D	8-12
	Pteronymia parva Salvin	1270-1510	D,L	8,10,11,12
	Pteronymia zerlina Hewitson	1460-1900	D	8,10
	Tithorea harmonica Cramer	1400	D	11,12
	Lycaenidae: (17)			
	Arawacus leucogyna Felder	1270	R	8
	Calycopis xeneta Hewitson	1270	R	11
	Contrafacia marmoris Druce	1700	L	11
	Cyanophrys pseudolongula Clench	1400-1700	L	12
	Lamprospilus nicetus Felder	1700-1890	D,L	10,12
(**P**)	*Micandra aegides* Felder	1560	L	8
	Strymon bazochii Godart	1270	R	11
(**P**)	*Thecla balzabamba* Goodson	1700	L	12
	Thecla caninius Druce	1270	R	11
(**P**)	*Thecla danaus* Felder	1550-1700	L	11,12
	Thecla eronos Druce	1550	L	11
	Thecla monica Hewitson	1460	D	8
	Thecla photismos Druce	1550	L	12

Thecla upupa Druce	1540	L	8
Thecla sp. (*auda* gr.)	1520	L	8
Theritas mavors Hubner	1620-1660	L	8
(**T**) *Zizula* sp.	1270-1300	M	8-12
Riodinidae: (21)			
(**T**) *Charis iris* Staudinger	1270-1350	R,M	11,12
(**T**) *Emesis cypria* Felder	1270-1550	R,M	8,10,11,12
Emesis tenedia Felder	1270-1580	R,M	8-10
(**T**) *Emesis ocypore* Hübner	1350-1700	R,D,L	11,12
(**T**) *Euselasia bettina* Hewitson	1270-1350	L	8,11,12
Euselasia eucrates Hewitson	1270-1350	L	8,11,12
Hermathena candidata Hewitson	1610	D	8
(**T**) *Leucochimona lagora* Herrich-Schaffer	1270-1570	R,L	8,11,12
Mesosemia asa Hewitson	1550-1740	D,L	10,12
Mesosemia mancia Hewitson	1550	L	12
Mesosemia mevania Hewitson	1640-1880	L	10
Mesosemia sp. 4	1600	L	12
Napaea theages Godman and Salvin	1400-1650	D,L	11,12
Napaea nr. *merula* Thième	1520-1660	D	8,10
Necyria zaneta Hewitson	1270	R	8
Necyria sp. 2	1270	R	8
(**T**) *Sarota* nr. *chrysus* Cramer	1270	R	11
Sarota nr. *gamelia* Godman and Salvin	1350-1560	L	8,11
Siseme aristoteles saturata Thième	1270	R	8
Stichelia apoplecta Bates	1580-1700	L	11,12
Symmachia probator Stoll	1350-1700	M,L	12
Hesperiidae: (40)			
Pyrrhopiginae			
Pyrrhopyge sp. aff. *phidias* Linnaeus	1350	L	11
Pyrginae			
(**T**) *Achlyodes pallida* Felder	1300-1530	M,L	8,10
Astraptes alardus Stoll	1610-1660	D,L	8
Astraptes fulgerator azul Reakirt	1590-1700	L	8,11,12
(**T**) *Autochton* sp. aff. *neis* Hübner	1270-1580	R,L	8,10,12
(**T**) *Carrhenes unifasciata* Felder	1270-1700	R,M,L	11,12

	Cyclosaemia phidyle Godman and Salvin	1870	B	10
	Dion rubrinota Druce	1400	L	12
	Ebrietas badia Plötz	1270	R	8
	Entheus dius Mabille	1700	L	11
	Entheus matho Godman and Salvin	1600	D,L	8
	Eracon sp.	1600	D,L	8
	Goniurus talus Cramer	1620	L	10
(**T**)	*Heliopetes* sp.	1270-1330	R,M	10-12
(**T**)	*Lento epictetus* Fabricius	1350	M	12
	Metrocles sp.	1890	B	10
	Ouleus fredericus hilarina Mabille	1270-1500	R,D	8,11,12
	Phocides thermus Mabille	1270	R,M	8,11
(**P**)	*Pyrgus oileus* Linnaeus	1270-1360	R,M	8-12
	Pythonides menedemus (?)	1280-1320	M	10
	Pythonides paterculus Herrich-Schaffer	1550	L	12
	Serdis sp.	1550	L	8,12
(**T**)	*Spathelepia clonius* Cramer	1540	L	8
	Theagenes albiplaga Felder	1360-1470	M	8,10
	Thracides sp.	1510	L	10
	Urbanus dorantes Stoll	1300	M	8
	Urbanus sp. aff. *euricles* Latreille	1270	M	10
	Urbanus proteus Linnaeus	1500-1700	L	8,11,12
(**T**)	*Urbanus teleus* Hübner	1270	R	8,11,12
	Xeniades orchamus Cramer	1270	R	8
(**T**)	*Xenophanes tryxus* Cramer	1270-1560	M,L	8,10,11
	Zera tetrastigma Godman and Salvin	1640	D	8
Hesperiinae				
(**T**)	*Apaustas gracilis* Felder	1270-1600	R,L	8-12
	Callimormus alsimo Möschler *	1270	R	11
(**T**)	*Enosis* sp.	1270	R	8
(**P**)	*Vettias coryna* Hewitson + 4 unidentified species	1540-1660	D	8,10,12

Total: 220 species of butterflies

Number of species per family listed in parentheses.

1. Habitat types: R = riverside gallery forest, M = meadow or disturbed open trail, D = Deep mature forest understory, L = forest light gap, B = bamboo (*Chusquea*) above 1700 m.

2. Dates observed: 8 = August, 9 = September, 10 = October, 11 = November, 12 = December. Note: observations were limited due to heavy rains in late Sept./early Oct. 1989. Observations during other months are described in text.

* indicates a sight record.

B: collected by Sr. Ernesto Burriones at Maquipucuna

(**T**) indicates species also present at Tinalandia resort, near Santo Domingo de los Colorados, Pichincha Province (670-700m); data from B. Harris, R. Leushner, D. Strasburg (unpublished), Shaw and Shaw (1987), Emmel and Drummond (1988).

(**P**) indicates species also present at Pululahua Crater, between Calacalí and San Isidro, Pichincha Province (2500-3000m); unpublished data from G. Kareofelas and C. Witham.