

A Survey of Butterflies from Aruba and Bonaire and New Records for Curaçao

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Abstract.—We document 29 butterfly species for the island of Aruba and 32 for Bonaire. We also document five new records for Curaçao, increasing the total to 58 species. The three islands have inherently similar faunas but those of Aruba and Bonaire are significantly impoverished compared to Curaçao. The decreased diversity is ascribed to human intervention and degradation of the environment.

INTRODUCTION

The three tropical arid Dutch islands of Aruba, Curaçao, and Bonaire, a chain of Antillean islands off the coast of northern Venezuela, are bordered by the Los Roques Trench to the north and the Bonaire Trench to the south. Debrot et al. (1999) documented 53 butterflies for Curaçao, the larger central island, but nothing has been published on the diversity of the butterfly fauna of Aruba and Bonaire. We report herein on butterflies collected recently on Aruba and Bonaire, and provide five new species records for Curaçao.

Aruba lies 75 km west of Curaçao and 30 km north of the Venezuelan mainland. Its surface area is approximately 190 km² and its highest point is the 189 m Jamanota hill. Rainfall averages 426 mm/y and the vegetation is typically xerophytic. Landscapes are dominated by sparse low scrub growth and the flora numbers 303 species (Stoffers, 1981; Freitas, 1996; Freitas and Rojer, 2000). Bonaire lies 75 km east of Curaçao and 90 km north of Venezuela. Its surface is approximately 288 km² and its highest point is the 241 m Brandaris hill. Rainfall averages 504 mm/y and the vegetation is xerophytic. There are large tracts of dense scrubland (3–4 m high) and evergreen woodlands, especially on the northern half of the island. The flora numbers 353 species

(Freitas and Rojer, 2000). Curaçao, the largest of the three islands, has an area of 444 km² and receives an average rainfall of 567 mm/y. The island has dense secondary woodlands and its flora numbers 491 species (Beers et al., 1997).

METHODS

The end of the rainy season and its associated verdant vegetation normally extends until the middle or end of March in the leeward Dutch Antilles. During this period butterfly abundance is high. The second author visited six sites on Aruba and six on Bonaire (Fig. 1) during March 3–14, 2000. Sites included habitats ranging from disturbed suburban habitat to natural springs, deciduous woodland, evergreen woodland, coastal marsh, and mangrove areas. The butterflies observed during up to 3 h of effort per site were recorded or collected for identification. With the exception of *Phoebis argante* for Bonaire and *Phoebis agarithe* for Aruba, whose records are based on sightings, voucher specimens of the other species are deposited in the collections of the Allyn Museum of Entomology, Florida Museum of Natural History.

Since Aruba and Bonaire are smaller and their habitats are severely degraded compared to those of Curaçao, we hypothesized that the number of butterfly species on these two islands would be lower than

in Curaçao. However, a direct comparison of butterfly numbers is premature because our sampling occurred in one month as opposed to 13 months surveyed for Curaçao by Debrot et al. (1999). Based on habitat availability and condition on Aruba and Bonaire, we also hypothesized that species with small populations on Curaçao (*rare* or *uncommon* in Debrot et al., 1999) would be less well represented on Aruba and Bonaire than the hardy generalist species characterized as *common* or *abundant* on Curaçao. To test this hypothesis we compared the two faunas using a Chi-square Test of Independence with Yate's correction for continuity (Walpole and Myers, 1978)

RESULTS

Table 1 shows the species documented for Aruba and Bonaire, respectively. Twenty-nine species were collected on Aruba, which is comparatively high for a single collection period (Debrot et al., 1999) and suggests that collection occurred during a peak of butterfly abundance. The

most common species (represented in at least four sites) were *Danaus plexippus*, *Strymon bubastus*, *Leptotes cassius*, *Hemiargus hanno*, *Kricogonia lyside*, *Phoebis sennae*, and *Lerodea eufala*. The fauna was largely divided among the Lycaenidae (8 spp.), Pieridae (8 spp.), and Hesperiiidae (10 spp.). Nymphalidae were notably rare, amounting to only 3 % of the documented fauna as opposed to almost 20 % of the fauna on Curaçao (Debrot et al., 1999). Twenty-two of the 26 species characterized as *abundant* or *common* in Curaçao were documented on Aruba, whereas only 7 of the 31 species characterized as *rare* or *uncommon* were noted ($X^2 = 19.82$, $df = 1$, $p < 0.005$).

Twenty-nine species were collected on Bonaire, which again indicates a peak of butterfly abundance. When three species collected from previous trips are included (*Hypolimnas misippus*, on the top of Brandaris, October 1991; *Phoebis argante*, observed in October 1996 on Klein Bonaire; and *Brephidium exilis*, collected in September 1999 at Goto), the number of species known from the island increases to 32. The

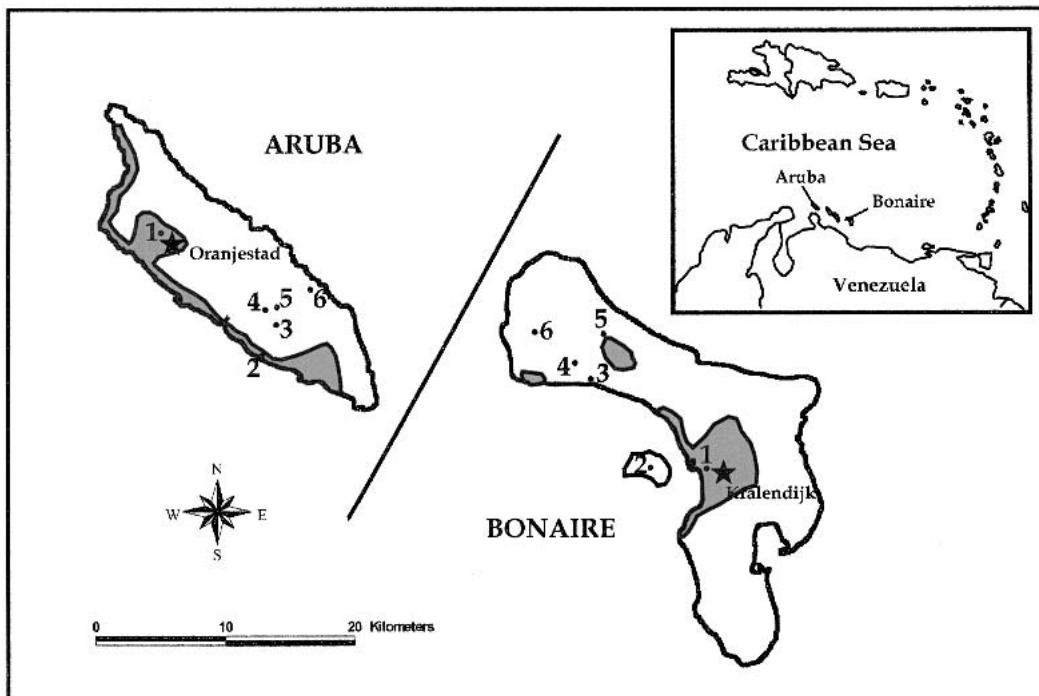


FIG. 1. Maps of Aruba and Bonaire showing the location of the six collection sites for each island.

TABLE 1. Butterfly records per survey site for the islands of Aruba and Bonaire, March, 2000. Asterisks indicate species not recorded at location in March, 2000.

Site name Site number	Aruba						
	Playa 1	Mangel Haltu 2	Masiduri 3	Papilon 4	Jamanota 5	Fontein 6	Other
Danaidae							
<i>Danaus plexippus megalippe</i> (Hübner)	x	x	x	x		x	
Nymphalidae							
<i>Hypolympas misippus</i> (Linn.)							
<i>Junonia genoveva</i> (Cramer)							
<i>Anartia j. jatrophae</i> (Linn.)				x	x		
Heliconiidae							
<i>Dryas iulia alicionea</i> (Cramer)							
<i>Agraulis v. vanillae</i> (Linn.)	x			x		x	
<i>Heliconius erato hydara</i> (Hewitson)							
Riodiniidae							
<i>Theope virgilius</i> (Fabricius)							
Lycaenidae							
<i>Chlorostrymon s. simaethis</i> (Drury)							
<i>C. telea</i> (Hewitson)							x
<i>Ministrymon azia</i> (Hewitson)							x
<i>Ministrymon ligia</i> (Hewitson)				x		x	
<i>Electrostrymon nubes</i> (H. H. Druce)				x			
<i>S. b. bubastus</i> (Stoll)	x		x	x		x	
<i>Leptotes c. cassius</i> (Cramer)	x	x	x	x		x	
<i>Brephidium exilis ssp.</i> (Boisduval)		x					
<i>Hemiargus h. hanno</i> (Grose-Smith)	x	x	x	x	x	x	
Pieridae							
<i>Appias d. drusilla</i> (Cramer)			x	x	x		
<i>Ascia m. monuste</i> (Linn.)					x		
<i>Eurema elathea</i> (Cramer)	x			x			
<i>E. gratiosa</i> (Doubleday)							
<i>E. lisa euterpe</i> (Boisduval & LeConte)	x			x	x		
<i>E. p. proterpia</i> (Fabricius)				x			
<i>Kricogonia lyside</i> (Godart)	x	x	x			x	
<i>Phoebis a. argante</i> (Fabricius)							
<i>P. agarithe</i> (Boisduval)				x	x		
<i>P. s. sennae</i> (Linn.)			x	x	x	x	
Hesperiidae							
<i>Chiodes c. catillus</i> (Cramer)							
<i>Urbanus d. dorantes</i> (Stoll)				x	x	x	
<i>Calpodetes ethlius</i> (Stoll)						x	
<i>Gesta gesta</i> (Herrich-Schaeffer)				x	x	x	
<i>Zopyrion satyrina</i> (C. & R. Felder)	x				x		
<i>Pyrgus adepta</i> (Plötz)	x		x	x			
<i>Heliopetes d. domicella</i> Erichson				x	x	x	
<i>Hylephila phyleus</i> (Drury)	x					x	
<i>Atalopedes clarkei</i> Burns		x					
<i>Leroda eufala</i> (W. H. Edwards)	x			x	x	x	
<i>Panoquina p. panoquinoides</i> (Skinner)		x					
Total species	12	7	9	19	11	13	2

TABLE 1. Continued.

Bonaire						
Kralendijk 1	Klein Bonaire 2	Karpata 3	Dos Pos 4	Rincon 5	Wash./ Slagbaai 6	Other
x	x				x	
					x*	
x			x			
x	x	x	x x x	x x	x	
		x	x*			
					x	
x					x	
x	x	x	x x	x x	x	
x	x	x	x	x	x	x*
x				x		x
	x	x	x	x x	x	x
	x*	x				
x	x	x	x	x	x x	
	x	x		x	x x	
x		x	x	x		
	x	x	x	x	x	
x				x		
x x	x	x	x		x x	
13	10	12	12	14	15	2

only species for which we found earlier records of collection from Bonaire is *Theope virgilius* from Dos Pos (2 ♂; 15.i.1961; B. Heineman; AMNH). Whereas 20 of the 26 species characterized as *common* or *abundant* in Curaçao were documented for Bonaire, only 12 of the 31 species characterized as *rare* or *uncommon* were found in Bonaire ($X^2 = 6.27$, $df = 1$, $p < 0.025$). The most common species (represented in at least four sites) were *Agraulis vanillae*, *Strymon bubastus*, *Hemiargus hanno*, *Eurema lisa*, *Phoebis sennae*, *Chioides catillus*, *Pyrgus adepta*, and *Lerodea eufala*. Again, the fauna was largely divided among the Lycaenidae (6 spp.), Pieridae (9 spp.), and HesperIIDae (9 spp.). As in Aruba, Nymphalidae were very rare.

A notable difference between islands (based on two visits in October 1996 and September 1999) was the greater abundance of *Phoebis argante* and *P. agarithe* on Bonaire compared to the two other islands. On Bonaire, these two species are most often seen associated with the shrub *Senna bicapsularis* and the shrubby tree *Pithecellobium unguis-catis*, which are far more abundant here than on Curaçao and Aruba.

The following are new records for Curaçao: *Eurema proterpia* was collected on the western side of the island at Sta. Martha Grandi, November 1999, where it was ovipositing on *Senna bicapsularis* (M. Koomen, pers. comm.). This species was also observed at Cas Abou in February 2000 (AOD). *Anartia jatrophae* (already known for Curaçao) was observed ovipositing on *Ruellia tuberosa* in this same area in November, 1999. *Calpodus ethlius* was collected from the introduced ornamental *Canna coccinea* in a garden pot at Girouette in December, 1998, and observed every year since then, most recently in December 2002. *Theope virgilius*, last recorded in Curaçao from Hato Field (7♂, 4♀ USNM; 1♂ (21.xi.1943, W. H. Wagner), 1♀ (25.xi.1943, W. H. Wagner) AMNH) was also collected at Sta. Martha Grandi, April and October 1999, and Jeremi, January 2002 (M. Koomen, pers. comm.). *Rekoa marius* (Lucas) was collected at Sta. Martha Grandi, Curaçao, in March, 1999 and February 2001; this species was collected from and

raised on *Senna obovata* (its native larval host plant) and the non-native *Gliricidia sepium* (M. Koomen, pers. comm.). One *Aphrissa statira* (Cramer) was collected at Sta. Martha Grandi in May 2002. All new records for Curaçao can be considered as *rare* (sensu Debrot et al., 1999). A species that Debrot et al. (1999) previously reported as near *M. maevia* has been correctly identified (JYM, LDM) as *Ministrymon ligia* (Hewitson). These five additional species records increase the butterfly fauna of Curaçao to 58 species.

DISCUSSION

Our principal surveys for this study were conducted at the end of the extended rainy season, when peak vegetation conditions occur. Thus, the butterflies documented here are most likely a characteristic sample of the insular butterfly faunas. Although our limited survey is probably incomplete, some comparison of butterfly faunas among these sister islands is possible.

All of the species found on Aruba and Bonaire are present on Curaçao. Most of the species listed in Table 1 are shared among the three islands but some more specialized and uncommon species have limited distributions. Other species, such as *Ministrymon azia*, are vagrant, opportunistic species that establish small colonies and may disappear as quickly. Curaçao has a larger land area and more rainfall; thus, it can be expected to possess greater habitat and floral diversity, and a more diverse butterfly fauna.

Previous field work and publications (Snellen, 1887; Smith et al., 1994; Debrot et al., 1999) indicate that butterflies are excellent bioindicators and provide a wealth of information about habitats, associated host-plants, and nectar sources in the West Indies and the Netherlands Antilles. An analysis of these observations, in conjunction with those of Kaye (1940), suggest that there has been a major turnover in the species represented, from those normally associated with undisturbed wet to dry tropical forests to those more commonly associated with xeric disturbed habitats. Although the butterfly fauna of Curaçao is the most di-

verse, its species representation is depauperate compared to the number of species expected from its larger area.

It is likely that the relative impoverishment of the present butterfly faunas of Aruba and Bonaire is due to the much greater extent and persistence of rural man- and livestock-related deforestation (Versteeg and Ruiz, 1995; Beers et al., 1997). For example, whereas Aruba and Bonaire had extensive deforestation into the 1950's for the cultivation of *Aloe* (in Aruba up to 30 % of the island surface area), this rural industry did not occur on a significant scale in Curaçao. Also, in Aruba and Bonaire, the highly deleterious practice of traditional extensive goat husbandry is widespread, whereas in Curaçao rampant livestock theft and an increase in speculative private land ownership has all but eliminated extensive livestock husbandry and other rural practices such as the felling of trees for use as fenceposts.

There have been renewed conservation efforts in recent years to set aside natural forest reserves and protect some of the unique natural habitats in the Netherlands Antilles. However, the habitat depletion has already markedly changed butterfly diversity. Monitoring species diversity in conjunction with observed changes in the climate and other alterations in habitat can provide greater insight into the ecological requirements for such insular populations and enable us to conserve and manage these areas more judiciously.

Acknowledgments.—On Aruba, we thank Roeland de Kort and Eddy Croes of Parke Nacional Arikok for their generous field assistance and Fedde Boerstra for providing excellent accommodations. On Bonaire, we thank Jack Chalck, Kalli de Meijer, July Frans, George Saragoza, and Din Domacasse of STINAPA Bonaire for their generous field assistance and Jack Chalck of Habitat Bonaire for providing a luxurious apartment during our stay. We thank

Michiel Koomen for his collecting efforts and for providing specimens of four of the five new species records for Curaçao. Special thanks are due to Leon Pors for drafting our map. John de Freitas provided up-to-date figures on the total floras of Aruba and Bonaire. Eric Quinter (AMNH), Jason P. W. Hall, and Donald J. Harvey (both USNM) provided information on collection dates. Our thanks to Luis Roberto Hernandez, Stephen R. Steinhauser, and to three anonymous referees for their constructive comments.

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