A remarkable new subspecies of *Heliconius* Kluk from northeastern Venezuela (Lepidoptera: Nymphalidae)

Andrés M. Orellana[1]

SUMMARY

ORELLANA AM. 2006. A remarkable new subspecies of* Heliconius *Kluk from northeastern Venezuela (Lepidoptera: Nymphalidae). Rev. perú. Entomol. 45.- **A remarkable new subspecies of the Amazonian and Guianan *Heliconius burneyi* (Hübner) is described from the state of Sucre in northeastern Venezuela. Its wing pattern resembles that of the peculiar heliconiine *Neruda metharme* (Erichson), which is absent in Sucre. Considering that races of *H. burneyi* are variations on basically the same theme, a new wing pattern element for this species is recognized. Natural selection, shifting balance and relictual mimicry may explain its occurrence.**

Key Words: Aposematísm, evolución, Paria, taxonomy.

RESUMEN

ORELLANA AM. 2006. Una notable subespecie nueva de* Heliconius *Kluk del nororiente de Venezuela (Lepidoptera: Nymphalidae). Rev. perú. Entomol. 45- **Se describe una notable subespecie de la mariposa amazónica y guayanesa *Heliconius burneyi* (Hübner), del estado Sucre en el nororiente de Venezuela. El patrón de coloración de las alas la acerca a la peculiar especie de heliconiino *Neruda metharme* (Erichson), que no ocurre en Sucre. Dado que el patrón de coloración alar de las diferentes subespecies de *H. burneyi* no representa básicamente más que variaciones de un mismo tema, se reconoce un nuevo elemento en el patrón de coloración de la especie. Se presenta hipótesis sobre selección natural, balance cambiante y mimetismo relictual que se esgrimen para explicar su ocurrencia.**

Palabras clave: Aposematismo, evolución, Paria, taxonomía.

Introduction

The Heliconiini, a tribe of the nymphalid subfamily Heliconiinae *(sensu* Harvey, 1991) is arguably the best-known group of Neotropical butterflies, both taxonomically and biogeographically. The tribe has been used extensively in the fields of population ecology, behavior, mimicry, ecological chemistry and evolution (see BROWN [1981] for a review, and online papers at http://www.uclac.uk/taxome) and as such, its members are valuable tools for field, theoretical and experimental srudies. Although the speciation explanation offered by the Pleistocene forest refuge hypothesis (BROWN 1979) has been strongly questioned (e.g. BENSON 1982), it has been employed widely as a useful frame for the analy sis of geographical distribution patterns of Neotropical lowland butterflies.

The degree of taxonomical knowledge of the tribe as it occurs in Venezuela is mainly due to the contributions of BROWN (1979) and especially BROWN & FERNÁNDEZ (1985). Efforts from a recent survey of the diurnal butterflies occurring in northeastern Venezuela (ORELLANA & OSBORN in prep.), led to the recognition of a hitherto unknown and striking subspecies of the Amazonian and Guianan *Heliconius burneyi* (Hübner, 1831), which I describe herein.

Laboratorio de Entomología, Universidad Nacional Experimental del Táchira, Apartado Postal 15, Paramillo, 5001-A, San Cristóbal, Táchira, Venezuela. E-mail: aorell® yahoo.com

***Heliconius burneyi mirtarosa* ssp. nov.**

(Fig. 1)

Diagnosis.- The marginal yellow streaks on the hindwing above and below constitute a unique and striking feature among all known subspecies of *Heliconius burneyi*. Furthermore, the reduced forewing median yellow spots and the absence of any dorsal red markings readily distinguish this new subspecies.

Male and *female* similar. Forewing length 41,1 mm +/- 2,1 mm (n = 17). Body black with scattered yellow scales on notum, scutum and postnotum. Pronotum with two prominent yellow dots, each regula with two. Two yellow lateral lines along the abdomen, and one in the venter. Head with yellow dots on front, sides and behind antennae. Palpi laterally white, black in front, joints and last segment. Thorax sides with yellow and white dots. Antennae black with tawny underside tips. Wings jet black with fringe alternately yellow and black. *Forewing* above with three median, unequal and irregularly shaped yellow spots, one or more of which may be reduced or absent: a trapezoidal one inside discal cell near its distal end, and largely sepárate from the other two; the

smallest one, an oval dash, at base of cell M_3-CuAj; and the largest more or less triangular, with wavy distal border, at base of cell CuAj-CuA_2. Three subapical yellow spots behind veins R_3, R_5 and Mj, second the largest. Minute yellow dashes at base of veins. Margin below with short yellow streaks, more evident in females and at tornus in both sexes; median spots are larger and lighter in color than above; a red streak at base between costal and subcostal veins, abou 6 mm in length. *Hindwing* above with submarginal área with sixteen yellow streaks running parallel to and between veins, reaching as far as the middle between distal end of discal cell and margin; below grayish black with same pattern elements as above; a red streak at base of and behind vein Sc+Rj; similar but shorter red streaks at base of cubital and anal cells; a small, round, red spot at base of discal cell.

Type material: **Holotype** *8*, white label: "Venezuela, Sucre, Finca Vuelta Larga, 8 Km S de Guaraunos, 35 m/nm, 19-Ene-2006, A. Orellana col."; red label: *"Heliconius burneyi mirtarosa* Orellana. Holotipo. A. Orellana det., 2006". Paratypes: 17 $, 3 ?, all from the same locality as the holotype. Dates of capture: 4 cT, 1 ?, 31-Jan-2006; 1 ?, l-Feb-2006; 1 o\ 7-Feb-2006; 8 <?, 4-Mar-2006; 1 ?, 6-Mar-2006; 1 *8*, 7-Mar-2006; 2 *8*, 8-Mar-2006; 1 *8*, ll-Mar-2006. The holotype and f our paratypes are deposited in the MIZA (Museo del Instituto de Zoología Agrícola, Universidad Central de Venezuela, Maracay, Venezuela); the remaining 16 paratypes in AO (Andrés Orellana collection, Mérida, Venezuela); CFR (Familia Romero collection, Maracay, Venezuela); AFN (Andrew F. Neild collection, London, U.K.); JIB (Joffre I. Blanco collection, San Cristóbal, Venezuela), and MUSM (Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Perú).

Etymology,- As a token of gratitude for every aspect of my life, I have the pleasure of naming this extraordinary butterfly after my mother, Mirta Rosa Borges de Orellana. The subspecific ñame is a noun in apposition.

Habitat.- Primary and oíd second growth forest at "Finca Vuelta Larga", 8 km S of Guaraunos in NE Venezuela, Sucre state. The área lies within the catchment basin of the gulf of Paria and is characterized by extensive pastures and cultivated plots in the midst of secondary growth forest and small patches of primary forest growing on hilly terrain. A large part of the ground surface is flooded on the flat lower-beds. These are daily fed by incoming tidal water and enhanced by rainfall. EWEL & MADRIZ (1968) classified the área as Tropical Wet forest, with a mean annual rainfall of 2954 mm (MANARA 1996). Large portions of the forest at Vuelta Larga once formed part of a cocoa *(Theobroma cacao* L. - Sterculiaceae) plantation, from the 1940's until 1963, when it was abandoned. Germán immigrant Klaus Müller purchased the land in 1970, and ever since then the forest has regenerated and today exhibits an advanced stage of ecological succession.

Range.- Only known from the type locality. This área is part of the Sucre/Trinidad center of endemism, as defined by BROWN (1979). It may occur in the Río Orinoco delta, but probably not in mangrove stands. Its absence from Trinidad is supported by extensive collections made on the island (KAYE 1904, BARCANT 1970). The species seems to be absent from the mountains to the north which form the backbone of Paria península (CONVEY 1990).

Bionomics.- Solitary individuáis were frequently seen flying at mid-story level during late morning and early afternoon. The wide-open wing beat and fluttering flight behavior, which is typical of many other heliconiines, allows them to display their bright wing coloration, which is very likely aposematic. Occasionally, individuáis will fly lower to the ground and eventually land on vegetation. On sepárate days, several individuáis of both sexes were caught exactly at the same spot, at the edge of a forest light-gap. No passion flower (Passifloraceae) vines (the presumed larval foodplant) seemed to grow there, and the source of their attention remains a mystery. After 1600 h, individuáis flew around low vegetation, presumably seeking a resting site where to spend the night. It shares its habitat with the locally scarcer and polymorphic *Laparus doris* (Linnaeus), which occurs in the blue, red and green morphs. Only the blue morph resembles to some extant *Heliconius burneyi mirtarosa* in that both have yellow median and preapical bands contrasting against the black wings. The dorsal hindwing blue pattern of *doris* appears subdued and the marginal white markings weakly resemble the hindwing streaks in *mirtarosa.*

Remarks.- Phenotypes of extant races of *Heliconius burneyi* occurring in the Amazonian basin and the Guianas represent variations of the same basic patterm. Unlike *mirtarosa,* all possess more than three median yellow spots on the forewing, some of which appear along the costa and behind vein CuA_2. Furthermore, a basal red patch, known in the Heliconiini as the "dennis" element, along with red rays on the hindwings in Amazonian races, form the basic ground plan for this species. *H. burneyi skinneri* Brown & Fernández lacks both the dennis and

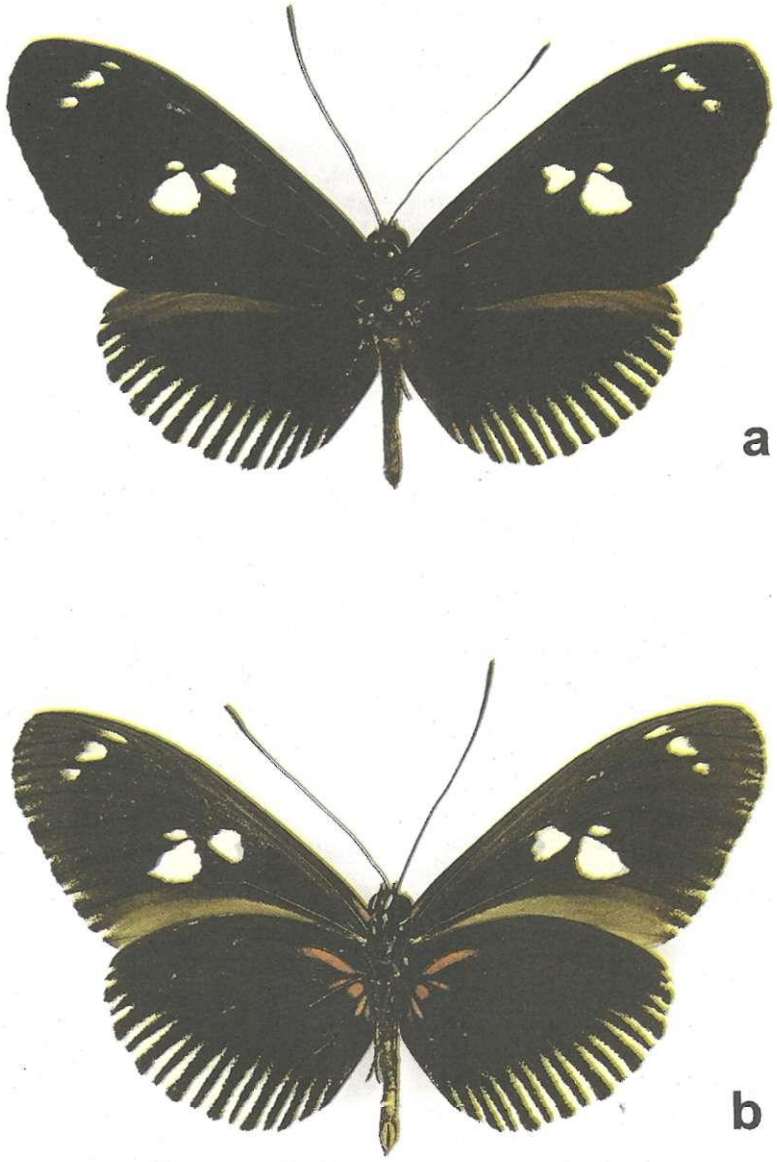

FIGURE **1.-** ***Heliconius burneyi mirtarosa*** Orellana, new subspecies, paratype. a) dorsal side; b) ventral side.

rays, and perhaps is a recombinant phenotype, since it commonly occurs together with *H. burneyi catharinae* Staudinger (showing dennis only) in southern Venezuela, and *H. burneyi ada* Neustetter (both dennis and rays) further south. Variation in width, shape and size of these pattern elements represent the main basis to distinguish the *burneyi* subspecies. No attempts have been made to elucídate the genetic basis of wing pattern elements in *burneyi*, as has been done extensively for other species, like *H. mehpomene* (Linnaeus) and *H. erato* (Linnaeus) (e.g. TURNER & CRANE 1962, SHEPPARDeffl/. 1985). Since *Heliconius* wing pattern elements are generally encoded by a single or few loci, the marginal yellow streaks in the hindwing of *H. b. mirtarosa* represent a new pattern element in the phenotype of *burneyi*. NIJHOUT (1991) argües for the independent development of dorsal and ventral patterns in the wings of butterflies, thus the streaks seen in the wing underside of *H. burneyi catharinae* (and other subspecies of *burneyi*, as well as in *Heliconius wallacei* Reakirt, its sister species) must be expressions from a different locus to that which expresses itself on the dorsal side. A few specimens of *burneyi* from Bolívar state in southern Venezuela display weak traces of the streaks resembling those of *mirtarosa*, perhaps due to introgression from remote populations of the latter in northeastern Sucre.

The overall phenotype of this new subspecies recalls that of another heliconiine, the scarce and localized *Neruda metharme* (Erichson) which, however, does not occur in Venezuela north of the Río Orinoco. *Neruda metharme* is an exclusively Amazonian and Guianan species, and a present-day mimetic relationship between *metharme* and *mirtarosa* should not be invoked to explain their similar phenotypes. This resemblance may be better suported by genetic drift and the shifting balance process (MALLET & SINGER1987, FUTUYMA 1998). It may be that the phenotype of *mirtarosa* is relictual and/or ancestral, having survived in the periphery of the distribution área of *H. burneyi* after another, more modern, phenotype evolved over most of the range of the species, i.e. the "red dennis-ray", which appears to represent a better aposematic signal in Amazonia. This evolutionary event may have diminished fitness in *N. metharme*, which occurs today only in very localized colonies throughout Amazonia and Guyana. In the past, the distribution área of *metharme* may have been more extensive, perhaps including Sucre, later becoming extinct there, but without affecting the survival of of its putative co-mimic, peripheral *mirtarosa*.

Acknowledgments - The discovery of this new subspecieswaspossiblethankstoFRANCEsOsBORN (Instituto de Investigaciones en Biomedicina y Ciencias Aplicadas, Universidad de Oriente, Cumaná, Venezuela), who trusted me to lead the project "Diversidad y Ensamble de Especies de Mariposas en Corredores Forestales", sponsored by "Proyecto Fortalecimiento de Centros Emergentes (GIAS-UDO) código PEM-2001001621" and financed by FONACIT-Sucre. Field logistics and support in Guaraunos were graciously givenby KLAUsMÜLLERand Fundación Vuelta Larga. I must express my gratitude to SANDRA DÍAZ and her mother Iraida for their attentions and hospitality while in Cumaná. To GERARDO LAMAS and BLANCA HUERTAS for their advise and encouragement.

Literature

Barcant M. 1970. Butterflies of Trinidad & Tobago. London, Collins. 314 pp.

Benson WW. 1982. Alternative models for infrageneric diversification in the humid tropics: tests with passion vine butterflies, pp. 608-640. In: Prance G (ed.), Biological diversification in the tropics. New York, Columbia University Press.

Brown KS Jr. 1979. Ecología geográfica e evolucáo ñas florestas neotropicais. Sao Paulo, Universidade Estadual de Campiñas, xxxi + 265 pp.

———. 1981. The biology of *Heliconius* and related genera. Ann. Rev. En. 26: 427-456.

———, Fernández F. 1985. Los Helicorúini (Lepidoptera: Nymphalidae) de Venezuela. Bol. Ent. venez. (N.S.) 3(4): 29-73.

Convey P. 1990. Butterflies of the Paria península, NE Venezuela. Br. J. Ent. nat. Hist. 3:167-171.

Ewel JJ, Madriz A. 1968. Zonas de vida de Venezuela. Memoria explicativa sobre el mapa ecológico. Caracas, Editorial Sucre. 265 pp.

Futuyma DJ. 1998. Evolutionary Biology. Sunderland, Sinauer Associates. Ed. 3. viii + 763pp.

Harvey DJ. 1991. Appendix B. Higher classification of the Nymphalidae, pp. 255-273. In: Nijhout HF, The development and evolution of butterfly wing patterns. Washington DC, Smithsonian Institution Press, xvi + 297 pp.

Kaye WJ. 1904. A catalogue of the Lepidoptera Rhopalocera of Trinidad. Trans. ent. Soc. London 1904:159-224.

Mallet JLB, Singer MC. 1987. Individual selectíon, kin selectíon, and the shifting balance in the evolution of warning colours: the evidence from butterflies. Biol. J. linn. Soc. London 32: 337-350.

Manara B. 1996. Paria. En el tiempo y en el corazón. Campano, Fundación Thomas Merle. 132 pp.

Nijhout HF. 1991. The development and evolution of butterfly wing patterns. Washington DC, Smithsonian Institution Press, xvi + 297 pp.

Sheppard PM, Turner JRG, Brown KS Jr, Benson WW, Singer MC. 1985. Genetics and the evolution of Muellerian mimicry in *Heliconius* butterflies. Phil. Trans. R. Soc. London (B)308: 433-613.

Turner JRG, Crane J. 1962 The genetics of some polymorphic forms of the butterflies *Heliconius mehpomene* Linnaeus and *H. erato* Linnaeus. I. Major genes. Zoológica (New York) 47:141-152.