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Description of a new pronophiline butterfly from the Venezuelan Cordillera de Mérida previously known as *Pedaliodes ferratilis* form *luteocosta* Adams & Bernard with data on its altitudinal distribution (Lepidoptera: Nymphalidae: Satyrinae)

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Abstract. A new species of butterfly, *Pedaliodes minabilis* (Nymphalidae, Satyrinae), is described from the cloud forests of the Cordillera de Mérida in Venezuela. It was previously confused with *P. ferratilis* found in Peru and Bolivia, related to *P. proerna* found at lower elevations in the Cordillera de Mérida. An individual form *luteocosta* Adams & Bernard (1981) appears to represent the dominant phenotype of the new species, whereas the *ferratilis*-like phenotype is common exclusively in the Chama valley and is excessively rare elsewhere. *P. minabilis* occurs in high elevation cloud forest from 2200 m to timberline, at 3100-3200 m asl. It is the dominant species in pronophiline community above 2500 m.

Key words: entomology, taxonomy, Lepidoptera, Nymphalidae, Satyrinae, *Pedaliodes ferratilis, P. minabilis* n. sp., *P. proerna*, Venezuela, Chama valley, cloud forests, Cordillera de Mérida, El Baho, Santo Domingo.

INTRODUCTION

The tribe Pronophilini (Nymphalidae, Satyrinae) *sensu* Miller (1968), considered by some authors as subtribe Pronophilina (Lamas et al. 2004), is the most speciose group of diurnal lepidoptera in montane habitats of the neotropical region. There are over 520 recognised species (Lamas et al. 2004; Pyrcz unpubl.), most of which occur in the tropical Andes. Five main faunal units of montane butterflies can be identified in Venezuela based on pronophiline distribution patterns: Perijá, Tamá, Cordillera de La Costa, Pantepuy and the Cordillera de Mérida (Viloria & Pyrcz 1993). The latter can be divided, on its turn, into three main sub-units: northern (Cendé, Guaramacal), central

(Sierra Nevada, La Culata) and southern (Batallón, Zumbador). Currently, Pyrcz (in prep.) identifies 108 species of Pronophilini in Venezuela, including 50 in the Cordillera de Mérida (Pyrcz unpubl.), compared to 36 reported by Adams & Bernard (1981). Four genera (*Redonda* Adams & Bernard, *Steromapedaliodes* Forster, *Diaphanos* Adams & Bernard and *Cheimas* Thieme) and 20 species (40%) are endemic in the Cordillera de Mérida. A total of 11 species of *Pedaliodes* occur in this range, and three of them are endemic, including the new species described below.

MATERIALS AND METHODS

Type specimens of *Pedaliodes* species, including the syntypes of *Pedaliodes ferratilis* Butler, were examined in the BMNH and in other major European and American collections listed below. Male genitalia dissections were made according to standard procedures (by soaking in warm 10% KOH solution), then preserved in glycerol vials. Anatomical and morphological structures were examined under an Olympus SZX9 stereomicroscope. Adults were photographed with an Olympus E-500 digital camera, and colour plates were composed using Adobe PhotoShop version 7 software. Field studies were conducted throughout the Cordillera de Mérida in the period 1996 - 2006. Butterflies were collected with entomological hand nets and baited traps (VanSomeren/Owen type). Traps were baited with carnivorous animal's dung (mostly dogs). Sampling for Pronophilini butterflies was carried out in El Baho (Santo Domingo Valley), along an elevational transect consisting of 15 traps set at 2400-3100 m, each 50 metres in altitude. They were checked daily over six consecutive days. Butterflies removed from the traps were placed in paper envelopes marked with date and elevation. Partly unpublished data gathered along the transect in Monte Zerpa were also used (see: Pyrcz & Wojtusiak 2002). Ecological data were processed with Statistica 7 software. The following abbreviations and collection codens are used:

CM: Cordillera de Mérida
BMNH: Natural History Museum, London, UK (formerly British Museum (Natural History));
IVIC: Instituto Venezolano de Investigaciones Científicas, Caracas, Venezuela;
MIZA: Museo de Agronomía de la Universidad Central de Venezuela, Maracay, Venezuela;
MZUJ: Muzeum Zoologiczne Uniwersytetu Jagiellońskiego, Kraków, Poland.;
PBPF: collection of Pierre Boyer, Le Puy Sainte Réparade, France;
TWPP: collection of Tomasz Wilhelm Pyrcz, Warsaw, Poland;
ZMHB: Zoologische Museum, Humboldt Universität, Berlin, Germany;
FW: forewing;
HW: hindwing;
V: venter;
D: dorsum.

RESULTS

***Pedaliodes minabilis* n. sp.**

[*Pedaliodes ferratilis* form *luteocosta* Adams & Bernard, 1981: 363, fig. 24 (unavailable)].
[*Pedaliodes ferratilis*: Butler, Pyrcz & Wojtusiak, 2002: 211, 213, 214, 217, 218 (misidentification)].

Etymology

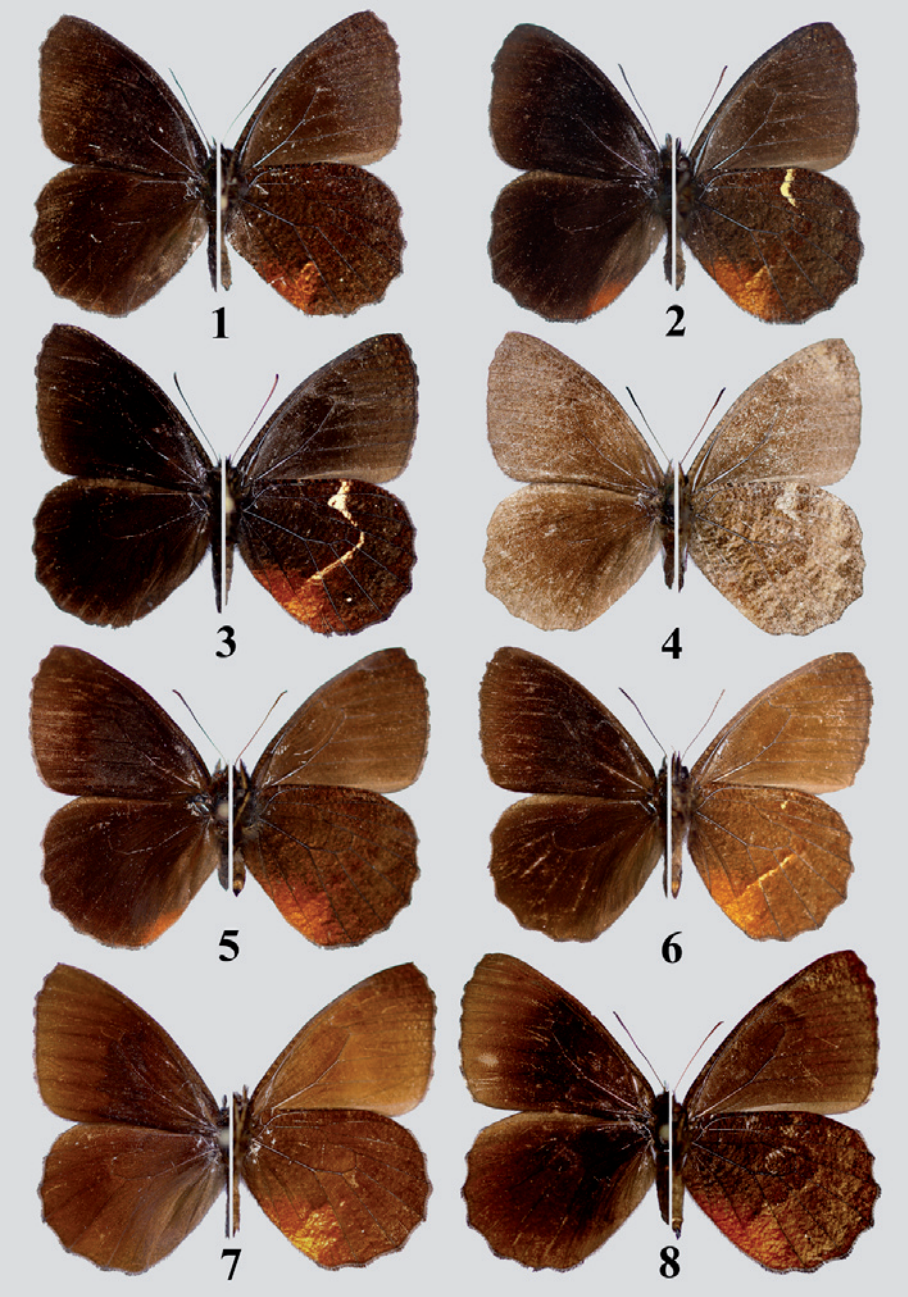
Specific name of this taxon, *minabilis* (Latin, adjective), means mediocre, and is an allusion to the fact that it is an extremely common and dull-marked species.

Diagnosis

Compared to the most similar congeners in the CM, *P. montagna* Adams & Bernard and *P. manis* (C. & R. Felder), it is recognised by the larger size and darker uniform blackish brown upperside. Typical individuals have a conspicuous yellow „L" shaped hindwing underside costal streak. The latter character is found in several unrelated taxa, including *P. pheretias* (Hewitson), *P. porcia* (Hewitson) and *P. rudnyi* Pyrcz. In most individuals of the Chama valley population, and in a rare individual form from other localities in the CM, this character is not apparent, and it resembles closely an undescribed species from the Tamá range and Colombia (Pyrcz & Viloria in press), which is considerably smaller, has a different scent patch and male genitalia. The latter is considered as the most closely allied species.

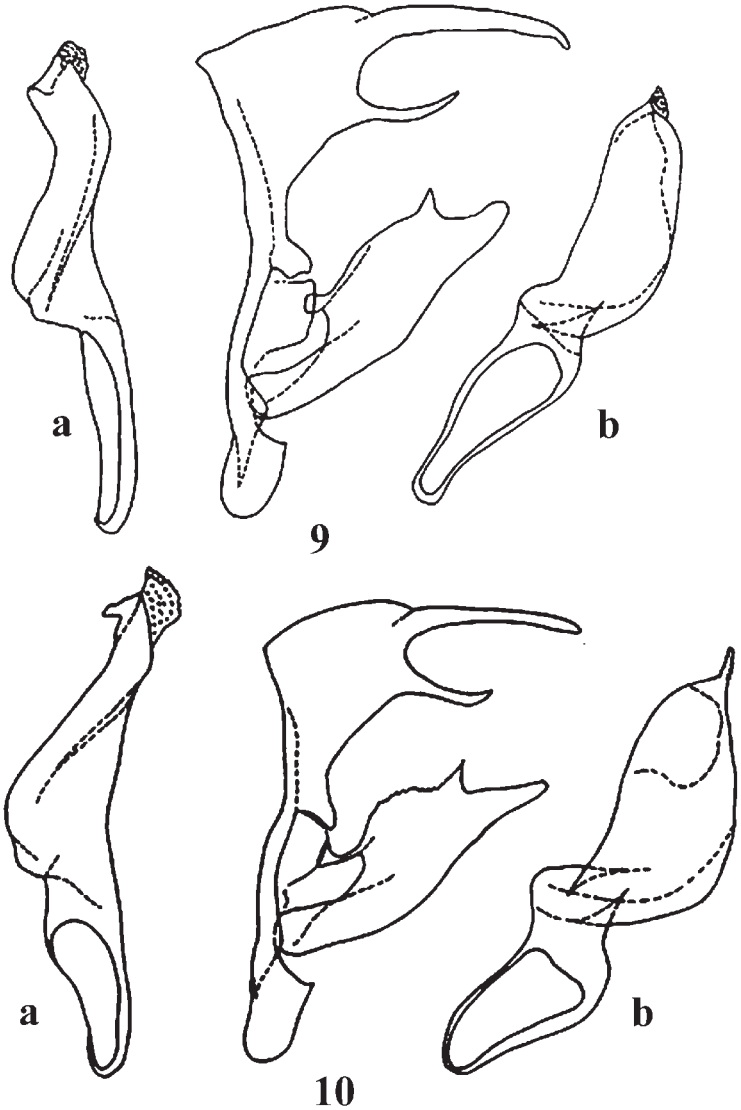
Description

Male (Figs. 1, 2, 3, 5, 6): Head: Eyes dark chocolate-brown, setose; labial palpi twice the length of head, dark brown, covered with grey-brown hair; antennae slender, two-fifths the length of costa, antennal club twice the width of shaft, flattened laterally, dorsally blackish-brown, ventrally chocolate-brown. Thorax: Dorsally and ventrally blackish brown, lustrous, hairy, legs tibia blackish-brown, femora and tarsus lighter, grey-brown. Abdomen: Dorsally and laterally blackish-brown, ventrally slightly lighter and duller. Wings: Forewing (length: 26-29 mm, mean: 28.1 mm, n= 289) costa gently arched, apex sub-acute, outer margin slightly angled at vein M2, otherwise straight; fringes short, alternately brown and milky white. Hindwing rounded, outer margin delicately crenulated; fringes brown, slightly longer than on the forewing. FWD uniform blackish brown, lustrous, scent patch rectangular, large, covering roughly median one-third (as illustrated). HWD uniform blackish-brown, lustrous, basal one-third hairy, in approximately one-fourth of individuals some brick red scaling at tornus. FWV dark brown, duller than on the upperside; apex and outer margin dusted with chocolate brown scales; in rare individuals a faint, white postdiscal costal streak. HWV dark chocolate brown, somewhat suffused by orange-brown; in most individuals a sandy yellow mid-costal streak, somewhat variable in shape and length, „L" shaped, sporadically faint or absent altogether (except in the Chama population, where absent in roughly half of individuals), generally extending to vein M2, sharply bent at vein M1; a concentration of orange-brown scales along inner margin near tornus, in most individuals forming



1-8. Dorsal and ventral side. 1. *Pedaliodes minabilis* male form (paratype, El Baho); 2. *P. minabilis* male (holotype); 3. *P. minabilis* male form (paratype, El Baho); 4. *P. minabilis* female (allotype); 5. *P. minabilis* male form (Monte Zerpa); 6. *P. minabilis* male form (San Eusebio); 7. *P. ferratilis* male (Cuzco, ex coll. Staudinger); 8. *P. ferratilis* female (Acjanaco – Pillcopata)

a diffused triangular wedge, with a slightly sharper inner edge extending as a roughly straight line to vein M2, in most individuals faint or barely visible, in rare, particularly well marked individuals, making up an orange line connecting to the yellow costal streak. Genitalia (Fig. 9): Uncus long and thin, longer than tegumen, nearly straight except for a curved tip; subunci thin about half the length of uncus; saccus wide and shallow; valvae shorter than the length of tegumen+uncus, with a smooth ampulla, a



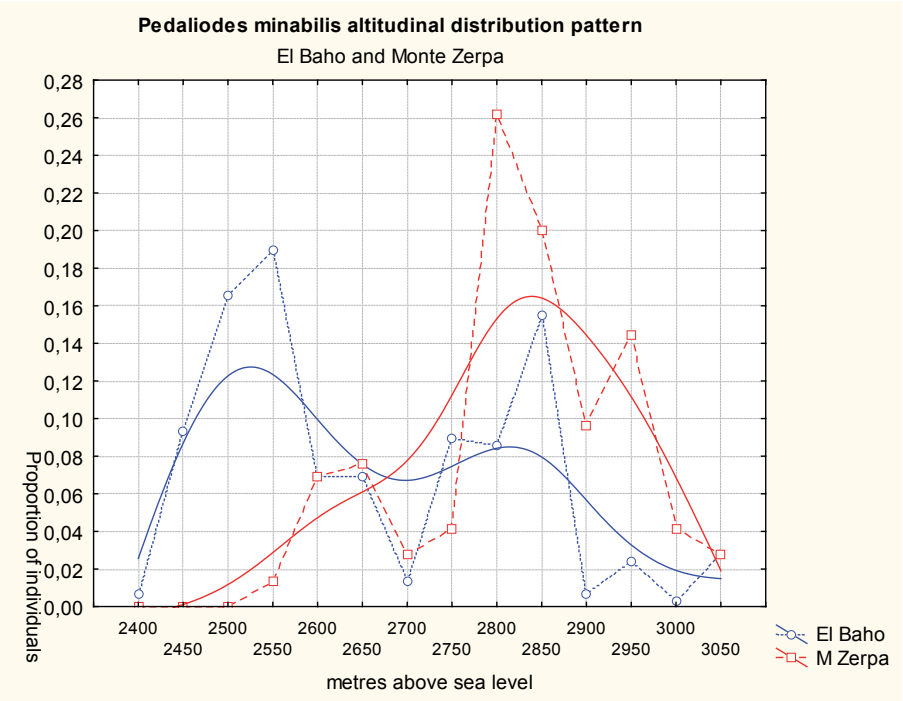
9-10. Male genitalia: 9 – *Pedaliodes minabilis* paratype; 10 – *P. ferratilis* (Cuzco, ex coll. Staudinger) (a – aedeagus in lateral view, b– aedeagus in dorsal view)

teeth-like dorsal process and a wide, blunt apex; aedeagus longer than valvae, strongly contorted and flattened, with an apical crest.

Female (Fig. 4): Head, thorax and abdomen as in male. FW length: 28.5 mm. FWD and HWD medium brown, considerably lighter than in the male. FWV dull, light brown; generally a faint, white postdiscal streak; apex and outer margin dusted with dark brown scales forming a ripple-like pattern. HWV dull brown with a darker basal and lighter outer half defined by a postmedian line; a whitish or pale yellow costal streak dusted with brown; some reddish scaling near tornus and along inner margin; a dark brown ripple-like pattern covering uniformly the entire wing surface. Genitalia: Not examined.

Type material

Holotype (male): VENEZUELA: Estado Mérida, valle de Santo Domingo, El Baho - El Hatico, 2750 m, 21.XI.2005, T. Pyrcz *leg.* (baited trap), [MIZA]; **Allotype** (female): Estado Mérida, valle de Santo Domingo, El Baho - El Hatico, 3100 m, 26.XI.2005,



Continuous lines represent distance weighted least squares fit (DWLS).
Proportion of individuals is the percentage of individuals recorded at each elevation of the total sample.

Fig. 11. Altitudinal distribution pattern of *Pedaliodes minabilis*

T. Pyrcz *leg*., [MZUJ]; **Paratypes** (295 males and 3 females): Estado Mérida, valle de Santo Domingo, El Baho - El Hatico: 1 male: 2400 m, 25.XI.2005; 1 male: 2400 m, 26.XI.2005; 5 males: 2450 m, 21.XI.2005; 1 male: 2450 m, 22.XI.2005; 8 males: 2450 m, 24.XI.2005; 7 males: 2450 m, 25.XI.2005; 6 males: 2450 m, 26.XI.2005; 15 males: 2500 m, 21.XI.2005; 4 males: 2500 m, 22.XI.2005; 16 males: 2500 m, 24.XI.2005; 6 males: 2500 m, 25.XI.2005; 7 males: 2500 m, 26.XI.2005; 19 males: 2550 m, 21.XI.2005; 3 males: 2550 m, 22.XI.2005; 16 males: 2550 m, 24.XI.2005; 12 males: 2550 m, 25.XI.2005; 5 males: 2550 m, 26.XI.2005; 4 males: 2600 m, 21.XI.2005; 1 male: 2600 m, 22.XI.2005; 4 males: 2600 m, 24.XI.2005; 3 males: 2600 m, 25.XI.2005; 8 males: 2600 m, 26.XI.2005; 2 males: 2650 m, 21.XI.2005; 1 male: 2650 m, 22.XI.2005; 2 males: 2650 m, 24.XI.2005; 7 males: 2650 m, 25.XI.2005; 8 males: 2650 m, 26.XI.2005; 1 male: 2700 m, 22.XI.2005; 2 males: 2700 m. 25.XI.2005; 1 male: 2700 m, 25.XI.2005; 8 males: 2750 m, 21.XI.2005; 2 males: 2750 m, 21.XI.2005; 3 males: 2750 m, 21.XI.2005; 5 males: 2750 m, 21.XI.2005; 7 males: 2750 m, 21.XI.2005; 8 males: 2800 m, 21.XI.2005; 2 males: 2800 m, 22.XI.2005; 4 males: 2800 m, 24.XI.2005; 6 males: 2800 m, 25.XI.2005; 5 males: 2800 m, 26.XI.2005; 9 males: 2850 m, 21.XI.2005; 5 males: 2850 m, 22.XI.2005; 4 males: 2850 m, 24.XI.2005; 11 males: 2850 m, 25.XI.2005; 16 males: 2850 m, 26.XI.2005; 1 male: 2900 m, 22.XI.2005; 1 male: 2900 m, 24.XI.2005; 2 males: 2950 m, 21.XI.2005; 1 male: 2950 m, 22.XI.2005; 1 male: 2950 m, 24.XI.2005; 1 male: 2950 m, 25.XI.2005; 2 males: 2950 m, 26.XI.2005; 1 male: 3000 m, 24.XI.2005; 1 male: 3100 m, 22.XI.2005; 4 males: 3100 m, 24.XI.2005; 2 males: 3100 m, 25.XI.2005; 1 male: 3100 m, 26.XI.2005, all T. Pyrcz *leg*. (baited traps) [MIZA 10], [IVIC 10], [MZUJ 178], [BMNH 10], [TWPP 81]; 2 males: Estado Mérida, El Baho, Sto Domingo vers Apartaderos km 4, 2400-2600 m, 19.XI.2005, P. Boyer *leg*.; 2 males: same data but 21.X1.2005; 1 male: same data but 26.XI.2005; 1 male: El Baho, Sto Domingo vers Apartaderos km 4, 2600 m, 26.XI.2005, P. Boyer *leg*.; 1 female: same data but 2600-2850 m, 21.XI.2005, P. Boyer *leg*., 1 female: same data but 2850-3100 m, 21.XI.2005, P. Boyer *leg*.; 1 female: same data but 26.XI.2005 [PBPF].

Additional material

VENEZUELA: 1 male, [no data, *holotype* of *Pedaliodes ferratilis* f. *luteocosta* Adams & Bernard]; 1 male, 1 female: Cordillera de Mérida, S. of Mérida, above La Montaña, 2500-2550 m, 09.VIII.1977, M. J. Adams & G. I. Bernard, AB2; 1 male: same data, 19.VIII.1977, 2450-2550 m; 2 males: Cordillera de Mérida, S. of Mérida, La Montaña, 2900 m, 03.VIII.977, M. J. Adams & G. I. Bernard, AB2; 2 males: same data, 2450-2550 m, 09.VIII.1977; 1 male, same data, 18.VIII. 1977; 1 male: same data, 20.VIII.1977; 1 male: same data, 2700 m, 3.VIII.1977; 2 males: Cordillera de Mérida, N. of Mérida, Río Albarregas, 3150 m 13.VIII.1977, M. J. Adams & G. I. Bernard, AB2; 1 male: same data, 3100 m, 15.VIII.1977; 1 male: same data, 3150 m, 16.VIII. 1977; 2 males: same data, 14.VIII.1977; 1 male: Pedregosa, CB; 2 males: Mérida, 1897, (1 genit. prep. ALV129-96), OC; 1 male: Mérida, Briceño, JB; 7 males, 1 female: Mérida, P. N. La Culata, Monte Zerpa, 2100-2800 m, 31.V. 1992, T. Pyrcz *leg*.; 22 males: 1 female: same data, 2200-3000 m, 1/28.II.1996; 5 males: same data,

2000-2100 m, 4/8.IV. 1996; 4 males: same data, 2200-3000 m, 1/30.IV. 1996; 1 male, 1 female: same data, 2450 m, 13.III.1992; 13 males: 1 female, same data, 2200-3000 m, 12.II.1996; 2 males, same data: 1/31.III. 3 males, 1 female: same data, 15.II. 1996; 10 males: same data, 25.II.1996; 6 males: same data, 14.II. 1996; 8 males: 2 females, same data, 20.II.1996; 4 males: same data, 23.II. 1996; 1 male: Mérida, Quebrada La Cuesta, 2400 m, 11.IV. 1991, T. Pyrcz; 1 male: same data, 10.IV.1991; 1 female: same data, 24.III. 1991; 10 males, 2 females: Mérida, San Eusebio, 2200-2300 m, 20/24. X.1991, T. Pyrcz *leg*.; 1 female: Táchira, Páramo El Rosal, 2950-3050 m, 1-2.III.1996, T. Pyrcz; 2 males: same data, 2900 m, 03.III.1996; 1 male, 1 female: Táchira, Páramo El Zumbador, 3200 m, 05.II.1988, R. Murphy; 1 male: [Mérida], L.[a] M.[ucuy], 19.IV.1989 [TWPP]; 1 male: Mérida, Briceńo [ZMHB].

DISCUSSION

P. minabilis was first collected in the early Twentieth century, and since then has been somewhat traditionally confused with *P. ferratilis* Butler (1873) (syntypes: 1 male, Peru, 9000 ft., coll. by Whitely, 73-42, BMNH type No. Rh. 3987; 1 male, Peru, 9000 ft., coll. by Whitely, 73-47, genit. Rh. slide No. 29543 [examined]). Identification errors committed by Thieme (1905), Krüger (1924) and other early lepidopterists in reference to *P. minabilis* and *P. ferratilis* are understandable, considered the many restrictions, such as the access to the types, limited comparison material and the lack of more sophisticated taxonomical methods. It is however very surprising that Adams & Bernard (1981) and Adams (1986), with their vast knowledge on the Pronophilini systematics and distributions, considered without any reservation the population inhabiting the Venezuelan Cordillera de Mérida to represent *P. ferratilis*. Pyrcz & Wojtusiak (2002), who studied the altitudinal distribution patterns of pronophiline butterflies in the Cordillera de Mérida, were aware of the separate specific status of the Venezuelan species, but referred to *P. ferratilis*, because that paper was concerned exclusively with ecological issues and was not dealing with taxonomic issues. Pyrcz (2004) explained that *P. ferratilis*, described from southern Peru (Huasampilla) is a species ranging from Bolivia to northern Peru (Chachapoyas area), and that all the reports referring to its presence in Ecuador, Colombia and Venezuela are misidentifications of other species (mostly to *P. proerna* (Hewitson) and *P.* n. sp. Pyrcz & Viloria, in press, etc.). *P. ferratilis* and *P. minabilis* share some common features, such as the size, unicolour upperside and most specifically a dark brown HWV with an orange or red anal wedge dusted with brown. Their male genitalia are also similar in many respects, particularly the long and thin uncus, long subunci and valvae. There are however differences, including a serrate ampulla, thinner dorsal process and longer and narrower valval apex in *P. ferratilis* (Fig. 10). Colour pattern and male genitalia characters shared by *P. minabilis* and *P. ferratilis* are rather simple, and are found in many other congeners (*P. ershoffi* Pyrcz, *P. proerna* (Hewitson), *P. morenoi* Dognin, *P. obstructa* Pyrcz & Viloria etc.). Considered the enormous species richness of the genus *Pedaliodes* they are not enough to associate two taxa widely separated geographically and distinct ecologically. The

closest relative of *P. ferratilis* in the Cordillera de Mérida is *P. proerna* (Hewitson), which occurs at lower altitudes than *P. minabilis* (1600-2000 m).

Typical specimens of *Pedaliodes minabilis*, bearing a yellow HWV costal streak, were called *P. ferratilis* form *luteocosta* by Adams & Bernard (1981: 363, fig. 24). This name is unavailable because it was used explicitly to designate an individual form (ICZN, Article 45.6.4). Ironically, this form constitutes an overwhelming majority of individuals in most populations of *P. minabilis*, except in the Chama valley, sampled by Adams & Bernard (1981). The proportions between typical (*luteocosta*) and all brown specimens in the Chama Valley are roughly even. In El Baho, from among 290 collected individuals of *P. minabilis*, only two were all brown. Although this data has not been published by Pyrcz & Wojtusiak (2002), it has been observed that in Monte Zerpa typical specimens dominate at higher (>2700 m), whereas all brown at lower (<2600 m) elevations.

P. minabilis is the commonest representative of the tribe Pronophilini in the uppermost cloud forests (above 2500 m) of the Venezuelan Cordillera de Mérida. From among 541 individuals of Pronophilini collected along the entire altitudinal transect in El Baho (2400-3050 m), 290 were *P. minabilis.* They made up 53% of the whole sample. *P. minabilis* is also the dominant species in the *Pedaliodes* community. In Monte Zerpa, above 2600 m *P. minabilis* is the co-dominant species alongside *P. ornata* Staudinger (Pyrcz & Wojtusiak 2002). The two constitute 98% of all *Pedaliodes sensu lato* (112 *P. minabilis*, 89 *P. ornata*, 9 *P. montagna*, 3 *P. polla*). In El Baho, where *P. ornata* does not occur, *P. minabilis* apparently takes over its ecological niche, and is the only dominant species (Figs. 9, 10). Above 2600 m, *P. minabilis* constitutes 97% of all individuals of *Pedaliodes* (138 *P. minabilis,* 4 *P. polla*).

Pyrcz & Wojtusiak (2002) define the altitudinal spread of *P. minabilis* as 2200-3200 m, which closely agrees with Adams & Bernard (1981), who report it at 2300-3150 m (in both sources referred to as *P. ferratilis*). In Monte Zerpa and El Baho *P. minabilis* is found down to 2400 m (Pyrcz & Wojtusiak 2002). In La Carbonera (Jají – La Azulita road) it was found by Pyrcz (unpubl.) exceptionally at 2200 m. The upper distribution limit of *P. minabilis* is correlated with timberline. This species is found to the upper limit of cloud forests, which generally corresponds with the altitude band 3000-3300 m in the CM. In El Baho, *P. minabilis*, where the ecotone forest-páramo is gradual and a mixture of high trees, *Espeletia* composites, Ericaceae shrubs and grassland extends over 400 metres in altitude, *P. minabilis* is found well above the limit of compact forests, wherever clumps of bamboos, its host plant, are found. The highest abundance is reported at three elevational stations, 2500 m, 2550 m and 2850 m. It sharply decreased above 2900 m, the elevation which corresponds with the a major turnover in vegetation structure, from dense elfin forest, to semi-open sub-páramo. In Monte Zerpa, the highest abundance was recorded at 2850 m, some 200 metres below timberline.

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