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Systematics, zoogeography and bionomics of high Andean pedalioidines,  
Part. 2: *Pedaliodes praxia* (HEWITSON) and related species  
(Lepidoptera: Nymphalidae: Satyrinae)

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ABSTRACT. A systematic revision of the *Pedaliodes praxia* group is presented. It consists of three closely related species occurring in the uppermost cloud forests of the northern Andes in Colombia and Ecuador. Two new taxa, *Pedaliodes puciula* n. sp. and *P. praxia buckleyi* n. ssp., are described. Geographic distribution patterns are overviewed. Main ecological traits are discussed.

Key words: entomology, biogeography, Lepidoptera, Nymphalidae, Satyrinae, *Pedaliodes*, new taxa, Andes, Cerro Toledo, Colombia, Ecuador, male genitalia, Puracé, subparamo.

#### INTRODUCTION

The diagnosis of the butterfly genus *Pedaliodes* BUTLER (Satyrini, Pronophilina), restricted and redefined by FORSTER (1964) and VILORIA (1998), puts a strong emphasis on the shape of the aedeagus, in the absence of other clear synapomorphies of male genitalia and the divergence of other morphological characters. VILORIA (1998) defines the aedeagus of *Pedaliodes* as generally thick and strongly contorted, very asymmetrical, variable in length and size. PYRCZ (2004b) indicates that the characters of aedeagus identified as generic synapomorphies of some genera removed from *Pedaliodes sensu lato*, particularly *Altopedaliodes* FORSTER are possibly nothing more than habitat driven

convergences, towards simplified genital structures in a species impoverished environment. Moreover, even though some of the genera described by FORSTER (*op. cit.*) are apparently monophyletic, they are merely small clades within the large *Pedaliodes* assemblage. Recent studies (GALINDO, in prep.) extending morphological analysis of the relationships within *Pedaliodes* to hitherto not recognised secondary morphological characters and the female genitalia, show important divergences compared to the aforementioned works. This clearly indicates that the genus level taxonomy of the mega diverse genus *Pedaliodes* comprising between 200 and 300 species (LAMAS *et al.* 2004), depending on the viewpoint of allopatric taxa, is still extremely weakly understood, and the attempts to “organise” it, by splitting into several smaller entities, are based on very weak premises, often leading to taxonomic misunderstandings.

Leaving aside generic level considerations, we discuss here three species belonging to the genus *Pedaliodes sensu lato*, forming a monophyletic group, called after the oldest described taxon “*P. praxia* (HEWITSON) group”. It is identified based on morphological (colour pattern, male genitalia) and ecological features. Hindwing underside patterns are very similar but very complex and without any outstanding feature, thus extremely difficult to break down into single synapomorphies. They can be, however, fairly easily recognised by comparison with other congeners. Male genitalia are characterised by a non-contorted, long, thin aedeagus, very slightly curved in the middle. Thus, its shape agrees more closely with the diagnosis of *Panyapedaliodes* FORSTER or other genera raised by FORSTER (*op. cit.*), than with *Pedaliodes sensu stricto*. Interestingly, the females are slightly smaller than the males. All the species discussed here are inhabitants of the Andean uppermost cloud forest and are found exclusively within a very narrow altitudinal band comprised between 3100-3400 m. They occur in the areas where thick, uniform cloud forests give place to patchy elfin forests and subparamo.

#### MATERIAL AND METHODS

The material used in this study was mostly obtained by the senior author during the field work in Colombia (1996-2003) and Ecuador (1999-2005) and is deposited in the Museum of Zoology of the Jagiellonian University in Kraków (MZUJ) and the author’s collection in Warsaw (TWP). Type specimens of *Pedaliodes praxia* were examined in The Natural History Museum in London (BMNH) and that of *Pedaliodes puracana* Krüger in the Museum and Institute of Zoology of the Polish Academy of Sciences in Warsaw (MIIZ). Other major collections, public and private, throughout Europe and South America were also consulted. Male genitalia were dissected according to standard procedures, examined under an Olympus SZX9 stereomicroscope, and preserved in glycerol vials. Adults were photographed with an Olympus E-500 digital camera. Colour plates were composed using Adobe PhotoShop version 7 and 8. The following abbreviations and collection codens are used in the text:

FW: forewing; HW: hindwing; D: dorsum; V: venter;  
 BMNH: The Natural History Museum, London, UK;  
 MBLI: collection of Maurizio Bollino, Lecce, Italy;  
 MIIZ: Museum and Institute of Zoology of the Polish Academy of Sciences,  
 Warsaw, Poland;  
 MZUJ: Zoological Museum of the Jagiellonian University, Kraków, Poland;  
 PBPF: collection of Piere BOYER, Le Puy Sainte Réparate, France;  
 PUCE: Museo de Historia Natural, Pontificia Universidad Católica, Quito, Ecuador;  
 TWP: collection of Tomasz W. PYRCZ, Warsaw, Poland (to be incorporated into  
 MZUJ);  
 ZMHB: Zoologische Museum Humboldt Universität, Berlin, Germany.

***Pedaliodes praxia praxia* (HEWITSON)**

(Figs. 1, 2, 3, 9)

*Pronophila praxia* HEWITSON, 1877: 91-92. Type locality: Gima [Azuay], Ecuador.

*Pronophila praxia* HEWITSON; KIRBY, 1879: 114; RILEY & GABRIEL, 1924: 48.

*Pedaliodes praxia* (HEWITSON); KIRBY, 1877: 845; GROSE-SMITH & KIRBY, [1893]: 5, figs. 9, 10; THIEME, 1905: 122; WEYMER, 1912: 261; GAEDE, 1931: 502; FORSTER, 1964: 163, fig. 217 (male genitalia); D'ABRERA, 1988: 861, figs.; RACHELI & RACHELI, 2001: 338; LAMAS *et al.*, 2004: 213.

MATERIAL EXAMINED

1 ♂: Ecuador, HC, BMNH type No. Rh. 4010 [LECTOTYPE of *Pronophila praxia* Hewitson, herein designated]; 5 ♂♂: Ecuador, Ex Grose Smith 1910, (1 genit. prep. ALV270-97), JB; 1 ♂: E. Ecuador, Granadillas, Buckley, G-S [BMNH]; 7 ♂♂ and 1 ♀: Ecuador, Morona-Santiago, Sigsig – Chigüinda, 2900-3500 m, 03.XII.1998, P. Boyer *leg.*, TWP; 2 ♂♂ and 2 ♀♀: same data, PBPF; 1 ♂: same locality, 2950 m, XI.1999, I. Aldas *leg.*, MBLI; 6 ♂♂: same locality, 3°12'S 78°47'W, 3150 m, 15-16.I.2004, M. Bollino & F. Vitale *leg.*, MBLI; 5 ♂♂ and 1 ♀: Ecuador, Morona-Santiago, Granadillas – Chigüinda, 3000-3200 m, XI.1997, I. Aldas *leg.*, TWP; 6 ♂♂ and 1 ♀: Ecuador, Morona-Santiago, Gualaceo – Limón, East of the pass, 3200 m, 08.II.2002, T. Pyrcz *leg.*, MZUJ; 3 ♂♂: Morona-Santiago, Gualaceo – Limón, East of the pass, 3150-3175 m, 09.II.2002, T. Pyrcz *leg.*, MZUJ; 3 ♀♀: same locality, 3300-3400 m, 06.XII.2002, PBPF; 1 ♂ and 1 ♀: same locality, 3200 m, 15.II.2004, PBPF; 1 ♂: same locality, 3200 m, 07.XII.2002, PBPF; 4 ♂♂: same locality, 2900 m, XII.2002, I. Aldas *leg.*, MBLI; 2 ♂♂ and 1 ♀: same locality, 2°55'S 78°39'W, 3250 m, 14.I.2004, M. Bollino & F. Vitale *leg.*, MBLI.

REMARKS

The nominate subspecies is fairly variable in the expression of the most conspicuous trait of the wing colour pattern, the FWD median orange band. This variation affects most of all its width and, in some extent, colour. In some

specimens the band is nearly as narrow as in the subspecies *buckleyi* n. ssp., whereas in others nearly as wide as in the related *Pedaliodes puciula* n. sp. (both described below). The colour varies between rusty red and dirty orange, however it is consistently different from the brick red of *buckleyi* or bright orange of *Pedaliodes puciula* n. sp. (described below) The colour of the background is dull brown, lighter than the dark brown of *buckleyi* and *Pedaliodes puciula* n. sp. The brown background and orange median bands are lighter in the females (Fig. 3).

*Pedaliodes praxia praxia* is found on the eastern slopes of the Andes in the south-eastern Ecuadorian department of Morona-Santiago. It is fairly common, being one of the dominant species of the *Pedaliodes* community. It occurs in the uppermost forest at 3100-3300 m, slightly below timberline. The behaviour of *P. praxia* is typical of *Pedaliodes*. Males execute patrolling flights along the forest edge, usually 1-3 metres above the ground, and frequently feed on the humid soil and decomposing organic matter. Both sexes are always found in association with *Chusquea* clumps. They fly alongside other common *Pedaliodes* typical of this band of altitude, such as *P. phaedra* (HEWITSON), *P. polusca* (HEWITSON) and *P. porcia* (HEWITSON).

***Pedaliodes praxia buckleyi* VILORIA et PYRCZ, n. ssp.**

(Figs. 4, 10)

TYPE SERIES

**Holotype** ♂: Ecuador, Morona-Santiago, Guamote – Macas road, Qda. Shillán, 3200-3250 m, 24.I.2004, T. Pyrcz leg., MZUJ; Paratypes (2 ♂♂): 1 ♂: same data as the holotype, TWP; 1 ♂: Ecuadr., Ex Grose Smith 1910, (Rhop. vial No. 3963), JB, BMNH.

DESCRIPTION

Male (Fig. 4): *Head, thorax and abdomen* as in nominate subspecies. *Wings*: FW length 27-28 mm, mean: 27,5 mm, n=2. FWD ground colour dark brown, lustrous; a darker median androconial scent patch; a thin, less than 3 mm wide, median brick red band, extending from costa to vein 1A; a faint, slightly darker submarginal line; fringes short, alternately brown and white. HWD ground colour dark brown, lustrous; a thin, brick red median band extending from costa to cell M3-Cu1; marginal area slightly darker brown. FWV grey brown, dusted with magenta and light grey scales along costa, outer margin and apical area; a diffused brick red median band, with a yellow costal tip, widely spreading distally, and also basally between vein Cu1 and inner margin. HWV dark brown, liberally speckled with fine, light grey and whitish scales; a narrow light yellow costal streak with an extension in cell M2-M3. Male genitalia (Fig. 10): Not differing noticeably from the nominotypical subspecies.

Female: Thus far unknown.



1-8. Adults, left: dorsum, right: venter: 1- *Pedaliodes praxia praxia*, male form 1 (Gualaceo-Limón), 2 - *P. praxia praxia*, male form 2 (Gualaceo-Limón), 3 - *P. praxia praxia*, female (Gualaceo-Limón), 4 - *P. praxia buckleyi*, male (holotype), 5 - *P. puciula*, male (holotype), 6 - *P. puciula*, male (paratype), 7 - *P. puracana*, male (Papallacta), 8 - *P. puracana*, female (Papallacta)

## ETYMOLOGY

This subspecies is dedicate to the British collector, C. BUCKLEY, who provided his colleague naturalists with a large number of specimens from Ecuador, many of them ones used as descriptive types, deposited in the BMNH.

## REMARKS

This subspecies has been known so far only from the type locality, Quebrada Shillán on the Guamote – Macas road, south of the Sangay massif. It is probable that its entire range, given the distributions of other Pronophilina, extends on the eastern slopes of the Andes from the valley of Pastaza in the north to that of Upano in the south, even if no individuals have been collected on the relatively well sampled slopes of the Tungurahua volcano. Elevation and habitat of *P. praxia buckleyi* is the same as of the nominate subspecies.

***Pedaliodes puciula* PYRCZ et VILORIA, n. sp.**

(Figs. 5, 6, 11)

## TYPE SERIES

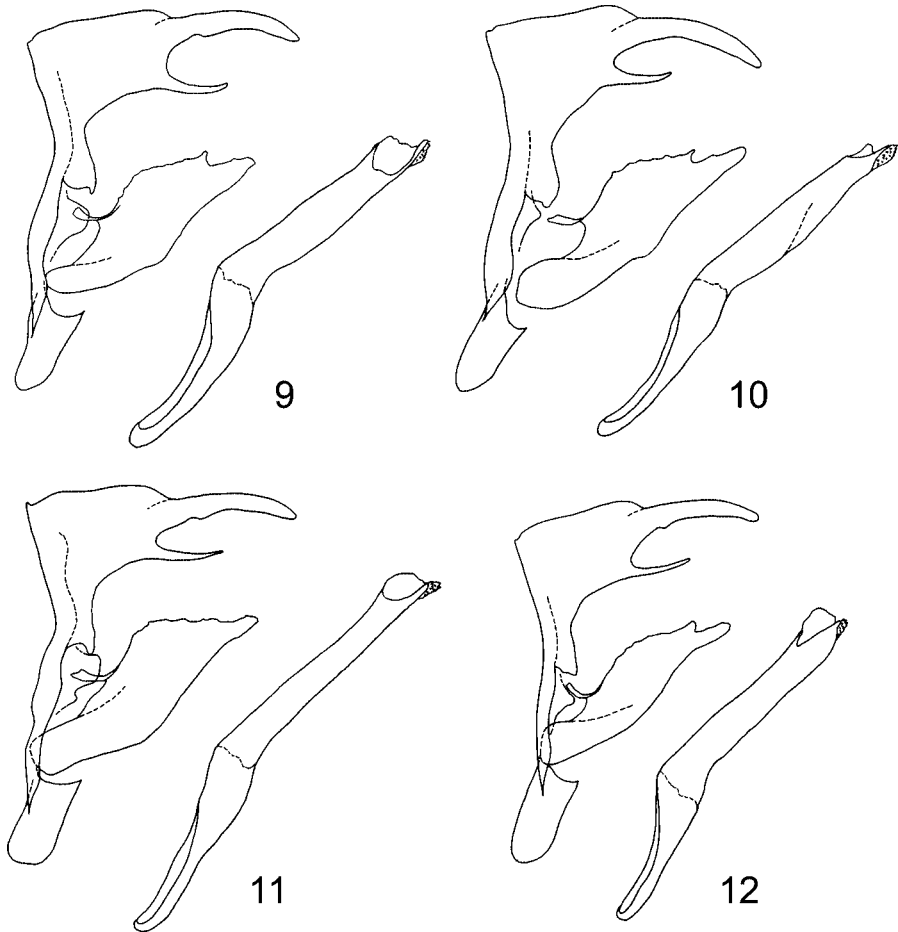
**Holotype** ♂: Ecuador, Loja, Parque Nacional Podocarpus, Yangana, Cerro Toledo, 3100-3150 m, 14.IX.2004, T. Pyrcz & R. Garlacz *leg.*, MUZJ; **3 paratypes** (♂♂): same data as the holotype, TWP.

## DESCRIPTION

Male (Figs. 5, 6): *Head*: eyes chocolate brown, densely setose; palpi medium brown, covered with dense lustrous, dark brown hair; frons with a tuft of brown hair; antennae reaching half of the length of costa, medium brown, club made of 10-11 segments, twice as thick, flattened dorso-laterally, tip distinctively curved. *Thorax*: dorsally blackish brown, ventrally blackish brown, covered with chocolate brown hair; legs medium brown. *Abdomen*: dorsally and laterally blackish brown, ventrally medium brown. *Wings*: FW length 26-27mm, mean: 26,6mm, n=5, apex blunt, outer margin very slightly concave; fringes alternately dark brown and dirty white. HW outer margin undulated, fringes dark brown with some white scales towards apex. FWD ground colour dark brown; a faint, pale brown median patch across discal cell, in some individuals dusted with orange; a wide postmedian to submarginal band, varying between bright orange and brick red orange, 4 - 6 mm in width, with sharp but irregular inner edge and somewhat diffuse but regular distal edge; a faint blackish brown submarginal line. HWD ground colour dark brown; a postmedian band, of same colour as on the FWD, roughly parallel to outer margin, extending from costa to cell Cu1-Cu2, approximately 2 mm wide on the costa, then gradually narrowing and fading. FWV ground colour pale, dark brown; a faint reddish median band extending from subcosta to inner margin; a postmedian to submarginal band shaped as on the upperside, slightly paler and dusted with whitish scales on costa; subapical and

apical area dusted with whitish scales. HWV ground colour dark brown, liberally dusted with lighter brown scales forming a "ripple" pattern covering the whole wing; a barely noticeable slightly lighter postmedian to submarginal band with the inner edge marked with pale orange or red scales in some individuals forming a narrow costal streak; a series of six minute whitish submarginal dots. Male genitalia (Fig. 11): compared to *P. praxia* and *P. puracana*, differ in the absence of the short dorsal process on the valvae, and slightly longer aedeagus, otherwise similar.

Female: Thus far unknown.



9-12. Male genitalia, lateral view, aedeagus removed in lateral and dorsal view: 9 - *Pedaliodes praxia praxia* (Gualaceo - Limón road), 10 - *P. praxia buckleyi* (paratype), 11 - *P. puciula* (paratype), 12 - *P. puracana* (Papallacta)

## ETYMOLOGY

This species is called after the senior author's female cat, Puciula who accompanied him during the preparation of this manuscript.

## REMARKS

*Pedaliodes puciula*, although closely related, is considered as specifically distinct from *P. praxia* based on the fact that its male genitalia differ more noticeably from *P. praxia*, than the latter from *P. puracana*.

*Pedaliodes puciula* has been known so far only from the type specimens collected in the Cerro Toledo, in the Nudo de Sabanillas. Considering the distributions of other species of Pronophilina found in the same locality and altitude, we may speculate that its range extends from Loja into extreme northern Peru along the main Andean ridge. All the individuals of *P. puciula* were collected in humid gullies covered predominantly with bamboo, when apparently flying down from higher elevations to feed on humid soil and prepared bait consisting of dung and rotten shrimp. The dominating species in the *Pedaliodes* community in this biotope were *P. phaedra phaedra*, *P. polusca* ssp. and *Neopedaliodes phoenicusa* (HEWITSON). Among other commonly observed species were *P. pheretias* (HEWITSON), *P. porcia pallantis* (HEWITSON) and *N. parrhoebia parrhoebia*. It is worth pointing out that Cerro Toledo is the type locality of two other endemic species of pedalioidines, *Altopedaliodes halli* PYRCZ (2004) and *Pedaliodes* sp. (PYRCZ, in prep.).

***Pedaliodes puracana* KRÜGER**

(Figs. 7, 8, 12)

*Pedaliodes puracana* KRÜGER, 1924: 28. Type locality: "Páramo de Neiva" = Páramo de Puracé, 3100 m, [Central Cordillera], Colombia.

*Pedaliodes puracana* KRÜGER; GAEDE, 1931: 503; ADAMS, 1986: 240, 317; PYRCZ, 1999: 365-366, fig. 2 (adult), fig. 10 (male genitalia) [Lectotype designated]; RACHELI & RACHELI, 2001: 338; LAMAS *et al.*, 2004: 213.

## MATERIAL EXAMINED

**5** ♂♂: Colombia, Cauca, Puracé, 30.X.1917, 3100 m, E. Krüger *leg.*, MIIZ, lectotype and paralectotypes [examined]; **13** ♂♂ and **10** ♀♀: Ecuador, Napo, Papallacta, arriba de Las Termas, 3250-3300 m, 19.I.2004, T. Pyrcz, R. Garlacz & J. Wojtusiak *leg.* MZUJ, TWP; **3** ♂♂: Ecuador, Napo, Los Llanganates, Río Mulatos, 3250-3300 m, 23.I.2004, T. Pyrcz *leg.*, TWP; **1** ♂: Ecuador, Pichincha, Cayambe, Laguna San Marcos, I.1996, S. Jasiński *leg.*, TWP; **4** ♂♂ and **1** ♀: Ecuador, Tungurahua, Baños, Morogacho, 3400-3500 m, IX.2004, O. Velástegui *leg.*, TWP.

## REMARKS

*Pedaliodes puracana* is a little known species. Its description by KRÜGER (1924), although elaborate and accurate, was not illustrated and contained a



printing error – an incorrect FW measurement. This fact confused ADAMS (1986), who, having no access to this species, had even expressed his doubts about the tribal status of *P. puracana*! PYRCZ (1999) located the entire syntype series of *P. puracana*, designated the lectotype, and confirmed its status within the genus *Pedaliodes*.

*P. puracana* was described from the Puracé massif in the southern part of the Colombian Central Cordillera. During this study it was found to have a much wider geographic range southerly, extending as far as the Pastaza valley in central Ecuador. Despite its wide geographical range *P. puracana* demonstrates few phenetic differences between distant populations. The only slightly more differentiated is the southernmost population. Its individuals are somewhat larger, darker with smaller yellow dots (Papallacta: FW length: 24-26, mean: 25.1mm, n=12; Morogacho: FW length: 25-28, mean: 26.5mm, n=4). Individual variation is also little pronounced and affects mostly the expression of the yellow dorsal patches.

Interesting eco-ethological observations of *Pedaliodes puracana* have been made, repeatedly, in the upper Papallacta valley in central Ecuador on the eastern slopes of the Andes, where *P. puracana* is locally common at 3300-3400 m. It occurs in a wide valley, in an environment consisting of a mosaic of extremely dense bushes and boggy páramo grassland. Numerous individuals of *P. puracana* have been observed flying rather fast, in and out of the forest some 2-4 metres above the ground. Occasionally, they were feeding on tree flowers but have not been seen coming to the ground. Interestingly in the area where the activity of *P. puracana* was observed there was no *Chusquea* bamboo, which is the primary host plant of *Pedaliodes* (PYRCZ 2004). The nearest bamboo stands were some hundred metres away, along the river and on the deep ridges culminating the valley. In those places however no *P. puracana* were observed, and instead numerous other related species of pronophilines, such as *Pedaliodes spina* WEYMER, *Pedaliodes polusca* (HEWITSON) and *Neopedaliodes juba* (STAUDINGER).

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#### REFERENCES

- ADAMS, M. J., 1986. Pronophiline butterflies (Satyridae) of the three Andean Cordilleras of Colombia. Zool. Journ. Linn. Soc., **87**: 235-320.

- D'ABRERA, B., 1988. Butterflies of the Neotropical Region. Part V. Nymphalidae (Conc.) & Satyridae. Victoria, Black Rock, Hill House, [viii] + 679-877.
- FORSTER, W., 1964. Beiträge zur Kenntnis der Insektenfauna Boliviens, XIX. Lepidoptera III. Satyridae. Veröffentl. Zoologisch.en Staatssamml. München, **8**: 51-188, pls. 27-35.
- GAEDE, M., 1931. Satyridae. II. In: STRAND, E. (Ed.): Lepidopterorum Catalogus, 29(46): 321-544.
- GROSE-SMITH, H., KIRBY, W. F., [1893]. *Pedaliodes* I. In: Rhopalocera Exotica, being illustrations of new, rare, and unfigured species of butterflies. London: Gurney & Jackson, pp.1-5, 1 pl.
- HEWITSON, W. C., 1877. Satyridae. In: Equatorial Lepidoptera collected by Mr. Buckley, V. London: Gurney & Jackson, pp. 81-96.
- KIRBY, W. F., 1877. A synonymic catalogue of diurnal Lepidoptera. Supplement. London: John van Voorst, pp. i-viii + 691-883.
- , 1879. Catalogue of the collection of diurnal Lepidoptera formed by the late William Chapman Hewitson, of Oatlands, Walton-on-Thames; and bequeathed by him to the British Museum. London: John van Voorst, iv + 246 p.
- KRÜGER, E., 1924. Beiträge zur Kenntnis der columbischen Satyriden. Entomol. Rundsch., **41**: 23-24, 27-28, 31-32, 35.
- LAMAS, G., VILORIA, A. L., PYRCZ, T. W., 2004. Subtribe Pronophilina, in: E. LAMAS ed., Atlas of Neotropical Lepidoptera, Checklist: Part 4A, Hesperoidea – Papilionoidea. Association for Tropical Lepidoptera, Gainesville, pp. 206-215.
- PYRCZ, T. W., 1999d, The E. Krüger collection of pronophiline butterflies, Part 2: genera *Manerebia* to *Thiemeia*, Lambillionea, **99**(3): 351-376.
- , 2004a. Pronophiline butterflies of the highlands of Chachapoyas in northern Peru: faunal survey, diversity and distribution patterns (Lepidoptera, Nymphalidae, Satyrinae), Genus, Wrocław, **15**(4): 455-622.
- , 2004b. New taxa of oreal pedaliidine in southern Ecuador (Nymphalidae, Satyrinae). Bol. Cien. Mus. Hist. Nat. Caldas, **8**: 287-301.
- RACHELI, T., RACHELI, L., 2001. An annotated list of Ecuadorian butterflies (Lepidoptera: Papilionidae, Pieridae, Nymphalidae). Fragm. entomol., **33**(2): 213-318.
- RILEY, N. D., GABRIEL A. G., 1924. Catalogue of the type specimens of Lepidoptera Rhopalocera in the British Museum Part I. Satyridae. London: The Trustees of the British Museum/Oxford University Press, 62 p.
- THIEME, O., 1905. Monographie der gattung *Pedaliodes* BUTL. (Lepidoptera. Rhopalocera. Satyridae). Berliner Entomol. Zeitschr., **50**(1/2): 43-141, pls. 1-3.
- VILORIA, A. L., 1998. Studies on the systematics and biogeography of some montane satyrid butterflies (Lepidoptera), Ph.D. Thesis (unpublished).
- WEYMER, G., 1912. 4 Familie: Satyridae. In: SEITZ, A. (ed.): Die Gross-Schmetterlinge der Erde, 2; Exotische Fauna, 5. Stuttgart: A. Kernen, pp. 173-283.