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Systematics, bionomics and zoogeography of high Andean pedaliodines; Part 6: *Pedaliodes dematha*ni Pyrcz – a widely polytypic species from Peru and Bolivia (Lepidoptera: Nymphalidae: Satyrinae)

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Abstract. *Pedaliodes dematha*ni Pyrcz is one of the most polytypic representatives of the genus, with ten recognised subspecies. The nominotypical subspecies was discovered in northern Peru (Amazonas and San Martín). We describe nine new subspecies here, which differ from each other in colour patterns, mostly of the hindwing upper and underside. Further differences are in male genital morphology. New subspecies are distributed through central (Huánuco, Pasco, Junín and Ayacucho) and southern Peru (Cuzco and Puno), and the Bolivian Yungas de La Paz. Two subspecies of *P. dematha*ni in central Peru form a mimicry ring involving four loosely related congeners.

Key words: entomology, taxonomy, Pronophilina, new taxa, male genitalia, Cuzco, Huánuco, Puno, Yungas.

INTRODUCTION

One of the most frequent dilemmas of a systematician/taxonomist is the attributing subspecific or specific status to related allopatric taxa. Thus, their systematic status are largely individual appreciations of taxonomists. Considering the definition of the biological species, the most solid proof that two allopatric populations are conspecific is when their cross-breeding produce fertile offspring. However, in the field the carry-

ing out of breeding experiments may be extremely time consuming, and logistically complicated. These can be achieved almost exclusively in laboratory conditions with easily mating butterflies (i.e. *Heliconius*). In most cases we have to evaluate sexual isolation mechanisms that prevent free mating, involving ecological, ethological and morphological factors. Wing colour patterns in butterflies are particularly important. Marked differences in colours prevent one individual from visually recognising the other as a potential sexual partner.

Current systematics of neotropical montane satyrine butterflies of the genus *Pedaliodes* Butler *sensus lato* bases in this respect largely on standards imposed in the papers (1976-1986) of the first modern taxonomists working on this group, M. J. Adams and G. I. Bernard. Allopatric taxa that are the object of this study present consistent similarities in wing colour patterns and, importantly in male genitalia, characters well taken into account by Adams and Bernard. Their colour pattern differences are clearly marked but concern the expression of small portions of wings, such as hindwing upperside anal patches and hindwing underside yellow wedges. We therefore consider that they represent one polytypic species widely distributed between central Peru and Bolivia rather than a number of allopatric species. The new species described herein is by this reason the most polytypic species of the genus *Pedaliodes* as recognised so far. Distribution patterns of allopatric subspecies allow a more thorough insight into some biogeographic patterns of central and southern Peruvian Andes.

MATERIALS AND METHODS

Type material was examined in BMNH, ZMHB, MUSM and MZUJ. Additional material was examined in other major collections. Male genitalia were dissected according to standard procedure, preserved in glycerol, and examined, alongside other morphological microstructures, under an Olympus SZX9 stereomicroscope. Adults were photographed with an Olympus E-500 digital camera, and colour plates were composed using Adobe PhotoShop 9. The following abbreviations and collection codens were used:

FW: forewing;
HW: hindwing;
V: ventral surface;
D: dorsal surface;
BMNH: Natural History Museum, London, UK (formerly British Museum (Natural History)), including: CF: ex Fruhstorfer collection, Brit. Mus. 1937-319 [accession code]; JB: Joicey Bequest, Brit. Mus. 1934-120 [accession code]; RB: Rothschild Bequest, Brit. Mus. 1939-1 [accession code];
HMNH: Hungarian Museum of Natural History, Budapest, Hungary;
MBLI: collection of Maurizio Bollino, Lecce, Italy;
MUSM: Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos, Lima, Peru;
MZUJ: Muzeum Zoologiczne Uniwersytetu Jagiellońskiego, Kraków, Poland;

PBF: collection of Pierre Boyer, Le Puy Sainte Réparade, France;
TWP: collection of Tomasz Wilhelm Pyrcz, Warsaw, Poland (to be integrated into MZUJ);
ZMHB: Zoologische Museum, Humboldt Universität, Berlin, Germany;
ZSBS: Zoologisches Staatssammlung München, Munich, Germany.

SYSTEMATIC OVERVIEW

*Pedaliodes dematha*ni Pyrcz, 2004
*Pedaliodes dematha*ni *pisca* Lamas et Viloria n. ssp.
*Pedaliodes dematha*ni *kuni* Pyrcz et Boyer n. ssp.
*Pedaliodes dematha*ni *chaneli* Pyrcz et Boyer n. sp.
*Pedaliodes dematha*ni *benedeki* Pyrcz n. ssp.
*Pedaliodes dematha*ni *alfa* Pyrcz et Boyer n. ssp.
*Pedaliodes dematha*ni *ockendeni* Lamas et Viloria n. ssp.
*Pedaliodes dematha*ni *kalinowskii* Pyrcz et Boyer n. ssp.
*Pedaliodes dematha*ni *horsti* Pyrcz et Viloria n. ssp.
*Pedaliodes dematha*ni *nussi* Pyrcz n. ssp.

***Pedaliodes dematha*ni Pyrcz**

(Figs. 1, 2, 3, 4, 21, 22)

[*Pedaliodes paneis* (Hewitson); d'Abrera, 1988: 857.]
*Pedaliodes dematha*ni Pyrcz, 2004: 558, figs. 99, 100, 174.

Type locality: Molinopampa - Granada, Amazonas, Peru.

Material examined

PERU: HOLOTYPE ♂: Amazonas, Molinopampa - Granada, 3115 m, 04.VII.1998, T. Pyrcz & J. Wojtusiak *leg*. **[TWP]** to be deposited in **[MUSM]**; ALLOTYPE ♀: Amazonas, Molinopampa - Granada, 2800-3100 m, 20.VIII.1998, T. Pyrcz *leg*. **[TWP]**; 2 ♂♂: Amazonas, Molinopampa - Granada, 2650-3250 m, 29.VI.1998, T. Pyrcz & J. Wojtusiak *leg*. **[MUSM]**; 2 ♂♂: same data **[MZUJ]**; 2 ♂♂: same data **[BMNH]**; 1 ♂: same data; 1 ♂: same data but 2715 m, 01.VII.1998; 2 ♂♂: same data but 3000-3250 m, 01.VII.1998; 1 ♂: same data but 3100-3400 m, 03.VII.1998; 1 ♂: same data but 3015 m, 04.VII.1998; 5 ♂♂: same data but 3115 m, 04.VII.1998; 1 ♂: same data but 2800-3100 m, 05.VII.1998; 1 ♂: same data but 3015 m, 06.VII.1998; 1 ♂: same data but 3065 m, 06.VII.1998; 5 ♂♂: same data but 3000-3300 m, 06.VII.1998; 1 ♂: same data but 2800-3100 m, 20.VIII.1998; 2 ♂♂: same data but 3015 m, 26.VIII.1998; 1 ♂: same data but 2765 m, 26.VIII.1998; 1 ♂: same data but 2800-3100 m, 26.VIII.1998; 4 ♂♂: same data but 3100-3250, III.2003, M. Tafur *leg*.; 1 ♂: same data but III.2003 **[TWP]**; 2 ♂♂: El Oso, near Laguna de Pomacochas, 2800-2950 m, VI.2000, B. Calderón *leg*.; 10 ♂♂: same data but 3000 m; 12 ♂♂: same data but 3050-3150 m, VI.2000; 3

1-8. Adults, dorsal (left) and ventral (right): 1 – *P. dematha*ni *dematha*ni male, Paratype (Molinopampa); 2 – *P. d. dematha*ni female, Paratype (Molinopampa); 3 – *P. d. dematha*ni male, Paratype (Pomacochas); 4 – *P. d. dematha*ni female, Paratype (Pomacochas); 5 – *P. d. pisca* male, Holotype (Carpish); 6 – *P. d. pisca* female, Paratype (Carpish); 7 – *P. d. kuni* male, Holotype, (Milpo); 8 – *P. d. kuni* female, Paratype (Milpo)

9-16. Adults, dorsal (left) and ventral (right): 9 – *P. demathani chaneli* male, Holotype (Concepción-Mariposa); 10 – *P. d. chaneli* male, Paratype (Concepción-Mariposa); 11 – *P. d. benedeki* male, Holotype (Jano); 12 – *P. d. benedeki* female, Paratype (Jano); 13 – *P. d. alfa* male, Holotype (Qda. San Luis); 14 – *P. d. alfa* female, Paratype (Qda. San Luis); 15 – *P. d. ockendeni* male, Holotype (Qda. Toccahuayco); 16 – *P. d. kalinowskii* male, Holotype (Qda. Toccahuayco)

♂♂: Peña Blanca, Laguna de Pomacochas, 2900-3050 m, VI.2000, B. Calderón *leg*.; 7 ♂♂: Road Leimebamba - Balsas, 3550-3650 m, 1-15.XII.2001, B. Calderón *leg*.; 2 ♂♂: Molinopampa - Granada, 3000 m, X.2000, B. Calderón *leg*.; 4 ♂♂: same data but 3100 m; 4 ♂♂: same data but 3300 m; 1 ♂: same data but 3350 m **[MBLI]**; 4 ♂♂: same data but 3100-3250 m, IX.2002 **[TWP]**; 27 ♂♂: Molinopampa - Granada, 3150-3250 m, X.2000, B. Calderón *leg*. same data but 3150-3250 m **[MUSM]**; 1 ♂: Pomacochas, Peña Blanca, 3000 m, 20.VI.2000, B. Calderón *leg*.; 1 ♂: same data but 5.VI.2000; 1 ♂: Pomacochas, El Oso, 2900 m, 15.V.2000, B. Calderón *leg*. **[PBF]**; 4 ♂♂: Pomacochas, Qda. El Chido, 2500-2900 m, VI.2002, B. Calderón *leg*., TWP; 3 ♂♂: same data but III.2003, M. Tafur *leg*. **[TWP]**; 1 ♂: Molinopampa - Granada, 3100 m, 23.VIII.1998, T. Pyrcz *leg*. **[PBF]**; 1 ♀: 2 km. from Granada, 3400 m, X.2001, B. Calderón *leg*.; 1 ♀: Molinopampa - Granada, 3100 m, X.2000, B. Calderón *leg*. **[MBLI]**; 4 ♂♂: same data but 3100-3250 m, III.2003, M. Tafur *leg*. **[TWP]**; 5 ♀: same data but 3150-3250 m; 1 ♀: same data but 3300 m **[MBLI]**; 1 ♀: same data but 3000 m, 28.VI.2000, B. Calderón *leg*. **[PBF]**; 1 ♀: Molinopampa, 2900-3100 m, I.2001, B. Calderón *leg*. **[PBF]**; 1 ♀: same data but IX.2002 **[TWP]** (all PARATYPES); 1 ♂: Huambo, IVe Trim. 1889, M. De Mathan, OC; 1 ♂: Huambo, OC **[BMNH]**; 1 ♂: P.N. Abiseo, Huicungo, Puerta del Monte, SM, 3190-3250 m, 18.VII.1990, M. Medina; 2 ♂♂: same data, 17.VII.1990; 1 ♂: AM, Molinopampa, 0610/7739, 3000 m, 20.VIII.1998, J. Grados; 1 ♂: AM, 5 km N Molinopampa, 3000 m, 0610/7739, 20.VIII.1998, J. Grados; 1 ♂: Yumal, arriba de Ocalí, 0614/7816, 2500-3000 m, B. Calderón **[MUSM]**.

Redescription

(Partly quoted from Pyrcz 2004): MALE (Figs. 1, 2): FW (length: 26-27 mm, mean: 26.4 mm, n=31) apex acute, outer margin slightly truncate between apex and vein M1, straight from vein M1 to tornus; fringes dark-brown. HW oval, outer margin wavy; fringes dark-brown. FWD uniform dark-brown, lustrous; androconial patch covering median one-fourth, roughly rectangular, compact, broadly entering discal cell, a separate elongated patch along vein 1A. HWD uniform dark-brown. FWV dark-brown, dull; a faint, white postdiscal streak from costa to vein M2; subapical area speckled with sparse lighter scales; outer margin from apex to vein M1 dark-brown. HWV dark-brown; a faint sandy yellow costal streak displaced on discal cell, extending into middle of discal cell; a sandy yellow postmedian band extending and gradually narrowing from mid anal margin and tornus to vein M2 with a straight and sharp inner edge from anal margin to vein M2 and diffuse outer edge; postmedian line bent at a straight angle at vein M2, and continuing to Rs where outcurved again before reaching costa; distally the entire submarginal area suffused with sandy yellow scales somewhat denser at basal edge of a dentate submarginal line; marginal area only lightly dusted with lighter brown, ripple-like pattern scales; a row of five white dots in cells Rs-M1 to Cu1-Cu2 just distal to sandy yellow band. **Male genitalia** (Figs. 21, 22): Uncus the length of tegumen; subunci thin, slightly less than half the length of uncus; valvae with a rudimentary, pointed dorsal process, and a serrate ampulla; saccus moderately deep and wide; aedeagus very slightly contorted, slender, with an apical crest.

FEMALE (Figs. 3, 4): FW and HWD surface lighter and duller than in the male. The female of nominotypical *P. demathani* differs from other subspecies in the whitish HWV anal wedge, yellow or orange in others, invariably suffused with brown scaling.

Remarks

Superficially, *P. demathani demathani* most closely resembles *P. paneis* (Hewitson). The two species are characterised by a HWV wide, yellow band anal wedge extending to vein M2, where bent at sharp angle. *P. paneis* however has no white distal dots, a characteristic feature of *P. demathani*. It also resembles an individual form of *P. sophismata* Pyrcz, which has no white dots either, and instead only one yellow spot in cell Cu1-Cu2, and whose yellow wedge ends at vein M2. The three species are sympatric in northern Peru and occur within the same elevational band, however *P. demathani* is the less frequent of all (Pyrcz 2004). *P. demathani demathani* occurs in the central (Molinopampa) and northern (Pomacochas) unit of the Eastern Cordillera in the highlands of Chachapoyas (Amazonas), as well as in the Central Cordillera (Barro Negro), South to Abiseo National Park (San Martín, La Libertad).

Pedaliodes demathani pisca Lamas et Viloria n. ssp.

(Figs. 5, 6, 23)

[*Pedaliodes* [n. sp.] Lamas & Viloria, MS; Lamas et al., 2004: 213].

Type locality: Carpish, Huánuco, Peru.

Material examined

PERU: HOLOTYPE ♂: Huánuco, Carpish, 2700-2800 m, 08.VI.1995, 0943/7606, G. Lamas *leg*., (genit. prep. ALV?2001) **[MUSM]**; PARATYPES (7 ♂♂ and 2 ♀♀): 3 ♂♂: Huánuco, Carpish, 2700-3000 m, 25-27.VII.2002, T. & C. Pyrcz *leg*. **[TWP]**; 1 ♂: Huánuco, Río Palcazu, (W. Hoffmanns), RB; 1 ♂: Peru, H. Fruhstorfer **[BMNH]**; 1 ♂: Huánuco, Paso Carpish, 2800-3000 m, 19.I.2003, P. Boyer *leg*.; 1 ♂: Huánuco, au dessus de Huanacaure, km 43 de Pachachupan, est de Acomayo, 3000-3100 m, 23.X.2006, P. Boyer *leg*.; 1 ♀: Huánuco, route Pachachupan vers Huanacaure km 39, est de Acomayo, 2800 m, 23.X.2006, P. Boyer *leg*. **[PBF]**; 1 ♀: Huánuco, Carpish, 2700 m, 20.X.[19]64, P. Hocking *leg*. **[MUSM]**.

Description

MALE (Fig. 5): Head, thorax and abdomen not differing from the nominotypical subspecies. FW length: 26-27 mm, mean: 26.5 mm, n=4. HW outer margin slightly less scalloped. FWD uniform blackish-brown, lustrous, same as in the nominotypical. FW androconial patch compact, roughly rectangular, entering discal-cell, a separate elongated patch along 1A. HWD blackish-brown, differs from the nominotypical by having a small, somewhat variable brick red anal patch near tornus. FWV marginally differing from the nominotypical, dull, dark brown; a faint whitish postdiscal streak; a faint submarginal chocolate-brown, sinuate line; apex dusted with chocolate-brown

and light brown scales. HWV dark brown; differing mostly from the nominotypical by the colour of the anal wedge, bright yellow dusted with orange ripple-pattern in *pisca*, sandy yellow in the nominotypical, in both subspecies gradually narrowing from approximately 4mm wide at anal margin to 1mm at vein M2, with straight, sharp inner margin and somewhat diffused outer margin; distally a row of 5 white dots from Rs-M1 to Cu1-Cu2; the area distal from yellow wedge to outer margin only slightly lighter than basal to it, liberally dusted with beige scales, heavily dusted with sandy yellow in the nominotypical; an undulate submarginal line. **Male genitalia** (Fig. 23): Differ marginally from the nominotypical; aedeagus very slightly contorted, tubular, the length of tegumen+uncus, with a prominent spiny process at distal extremity, proximal opening wide and oval; uncus as long as tegumen, very slightly hooked; subunci well developed, two-thirds the length of uncus, rather thin; saccus globular, approximately aligned to vinculum; valvae the length of tegumen-uncus, with a serrate dorsal surface without any dorsal process pointing distally, distal extremity sharpened.

FEMALE (Fig. 6): Differs from the male in the slightly larger size; FW and HWV lighter and duller; chestnut – sandy yellow suffusion on most surface of HWV; HWV wedge sandy yellow instead of rich yellow, contrary to nominotypical *dematha*ni whose wedge is whitish.

Etymology

The epithet is derived from the traditional alcoholic drink from Peru and Chile, *pisco*.

Remarks

Underside colour pattern of *P. dematha*ni *pisca* closely resembles several sympatric species, including an undescribed *Pedaliodes* sp. (Pyrcz et al., in press), which differs in having a lighter brown and magenta submarginal suffusion and lacking any reddish HWD scaling. It also closely resembles some individual forms of *P. sophismata* Pyrcz with a fully developed HWV yellow wedge, but these never have white submarginal dots. This subspecies is found in the central Peruvian department of Huánuco, mostly in the area of the type locality, Carpish, on the left bank of the Río Huallaga. To the north, appropriate elevations have not been sampled as far as the Abiseo National Park in San Martín, where *pisca* is replaced by nominotypical *P. dematha*ni.

*Pedaliodes dematha*ni *kuni* Pyrcz et Boyer n. ssp.

(Figs. 7, 8, 24)

Type locality: Milpo, Pasco, Peru.

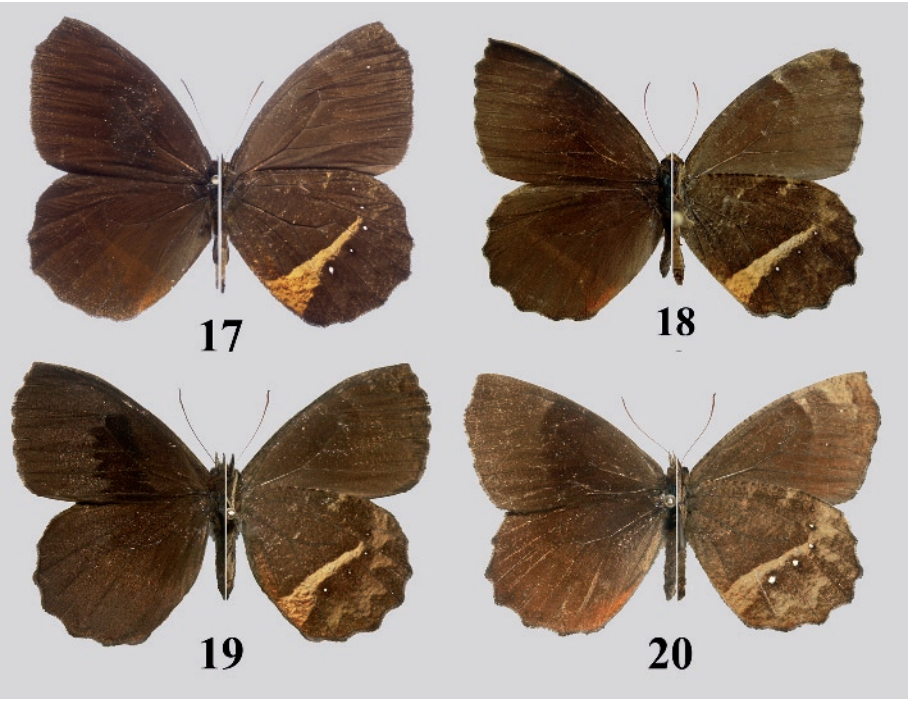
Material examined

PERU: HOLOTYPE ♂: Pasco, Oxapampa, Milpo, 3000-3200 m, IV.2006, J. Bottger *leg*. **[MUSM]**; PARATYPES (63 ♂♂ and 7 ♀♀): 25 ♂♂: same data as the holotype, 13 **[TWP]**, 5 **[MUSM]**, 2 **[HMNH]**; 2 ♂♂: La Antena, Oxapampa, Pasco, V.2003, J. Bottger *leg*. **[MZUJ]**; 6 ♂♂ and 1 ♀: Pasco, Ichco, au dessus de Milpo,

Huancabamba, 3100-3300m, 3.XI.2006, P. Boyer *leg*.; 1 ♂ and 1 ♀: same data, but 27.V.2005; 3 ♀♀: Pasco, Milpo, 3000-3400m, IX.2006, J. Bottger *leg*. **[PBF]** ; 1 ♂: Pasco, Oxapampa, La Antena, 3000-3200 m, IV.2006, J. Bottger *leg*.; 23 ♂♂ and 1 ♀: Pasco, Oxapampa, La Antena, 3000-3200 m, IV.2006, J. Bottger *leg*.; 5 ♂♂: Pasco, Oxapampa, La Antena, 2300-2700 m, V.2003, J. Bottger *leg*.; 1 ♀: Pasco, Huancabamba, Milpo-Iccho, 3000-3200 m, IV.2006, J. Bottger *leg*. **[TWP]**.

Description

MALE (Fig. 7): Head, thorax and abdomen not differing from the nominotypical subspecies. FW length: 26-27 mm, mean: 26.9 mm, n=61. This subspecies differs scarcely from *P. dematha*ni *pisca* in facies, except for the slightly larger HWD orange anal patch, and the more intense orange suffusion of the HWV anal wedge. **Male genitalia** (Fig. 24): Uncus long and nearly straight; subuncus half the length of uncus; valvae elongated with a blunt apex and a serrate dorsal surface, without any prominent dorsal process contrary to *pisca* and nominotypical *P. dematha*ni; saccus shallow and wide; aedeagus almost straight, very slightly bent in the middle, with a prominent apical crest.



17-20. Adults, dorsal (left) and ventral (right): 17 – *P. dematha*ni *horsti* male, Holotype (Carcel Punco); 18 – *P. d. horsti* female, Paratype (Carcel Punco); 19 – *P. d. nussi* male, Holotype (Cotapata); 20 – *P. d. nussi* female, Paratype (Cotapata)

FEMALE (Fig. 8): Slightly larger and lighter than the male, HWV yellow wedge brighter yellow than in the nominate subspecies; otherwise similar.

Etymology

This species is dedicated to András Kun, a Hungarian taxonomist, participant of the first Polish-Hungarian entomological expedition in 2003 to the Yanachaga-Chemillén National Park in (Pasco), where this subspecies occurs.

Remarks

This subspecies is found only in the department of Pasco, in the area of Oxapampa and Huancabamba. Its northern distribution limit is the valley of Huallaga, and southern, the valley of Chanchamayo. It occurs in mid to high elevation cloud forests, at 2500-3000 m, and is locally common.

Pedaliodes dematani chaneli Pyrcz et Boyer n. ssp.

(Figs. 9, 10, 25)

Type locality: Mariposa, Junín, Peru.

Material examined

PERU: HOLOTYPE ♂: Junín, route Satipo vers Concepción vía Mariposa km 68, 2700 m, 2-12.XI.2006, P. Boyer *leg*. **[MUSM]**; PARATYPES (3 ♂♂): 2 ♂♂: route Satipo vers Concepción vía Mariposa km 68, 2700 m, 2-12.XI.2006, P. Boyer *leg*. **[PBF]**; 1 ♂: route Satipo vers Concepción vía Mariposa km 77, 3350 m, 2-12.XI.2006, P. Boyer *leg*. **[TWP]**.

Description

MALE (Figs. 9, 10). Head, thorax and abdomen not differing from the nominotypical subspecies. FW length: 25-27 mm, mean: 26 mm, n=4. Differs readily from other subspecies of *P. dematani* in the darker, blackish brown upper and underside ground colour. In particular, the HWV yellow anal wedge, which is the most prominent colour pattern element in *P. dematani* is heavily overcast with black, and is a barely noticeable, faint whitish band. Five whitish submarginal dots. It has no reddish scaling at all on the HWD anal area. **Male genitalia** (Fig. 25): Uncus one-fourth longer than tegumen; subunci less than half the length of uncus; saccus intermediate in depth and width; valvae slightly more slender than in *kuni* and nominotypical, with a serrate basal half and a thin, sharp mid-dorsal process; aedeagus slightly bent and humped in the middle, with an apical crest, slightly smaller than in *kuni* or the nominotypical.

FEMALE: So far unknown.

Etymology

The epithet of this species is derived from Coco Chanel, a famous French fashion designer renowned for her Chanel Number 5 perfume brand; five white submarginal spots are the only conspicuous colour pattern element of the HWV of this taxon.

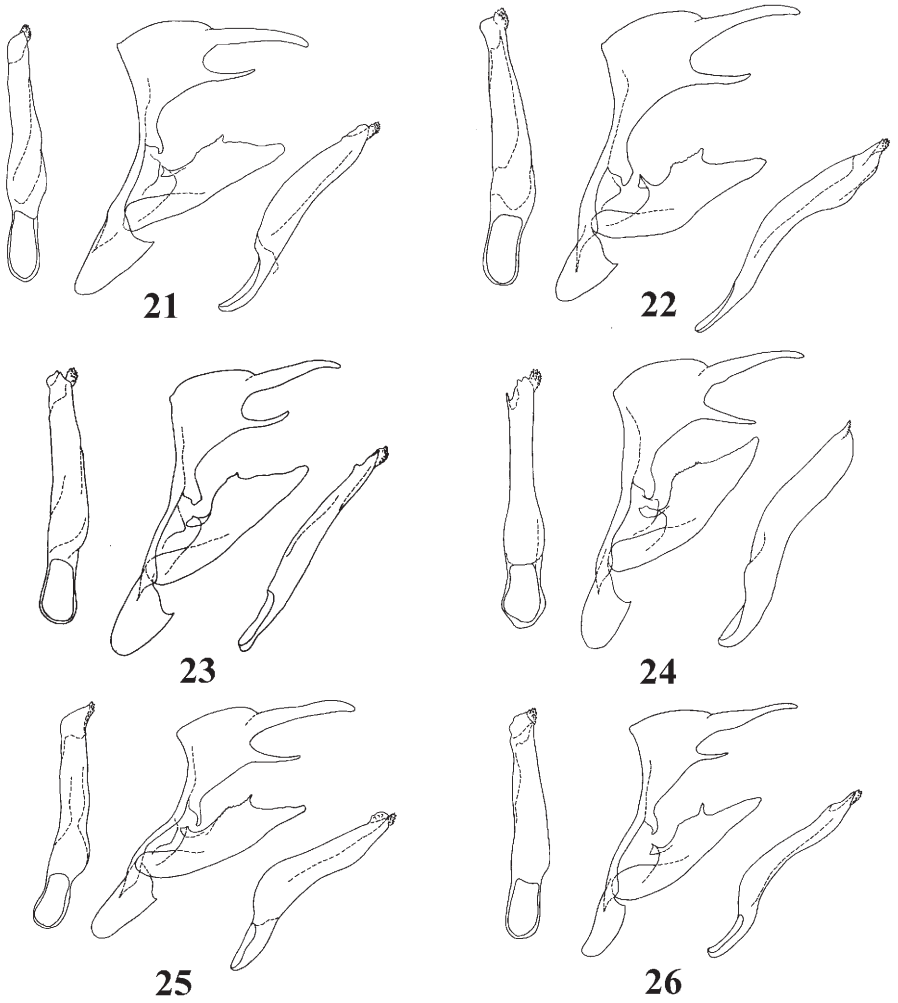
Remarks

P. demathani chaneli is known exclusively from the Satipo – Mariposa road in Junín. It is apparently involved in mimetic relationship with the sympatric subspecies of *P. sophismata*, and two new species of *Pedaliodes* (Pyrcz et al., in press).

Pedaliodes demathani benedeki Pyrcz et Boyer n. ssp.

(Figs. 11, 12, 26)

Type locality: Jano, Ayacucho, Peru.



21-26. Male genitalia (aedeagus extracted in lateral and dorsal view): 21 – *P. demathani demathani* Paratype (Molinopampa-Granada); 22 – *P. d. demathani* Paratype (Qda. Chido-Pomacochas); 23 – *P. d. pisca* Paratype (Carpish); 24 – *P. d. kuni* Paratype (La Antena, Oxapampa); 25 – *P. d. chaneli* Paratype (Concepción-Mariposa); 26 – *P. d. benedeki* Holotype (Jano)

Material examined

PERU: HOLOTYPE ♂: Ayacucho, Huanta-Ayno, vía Jano, 3000-3050 m, 29.VII.2003, T. Pyrcz *leg*. **[MZUJ]**; PARATYPE ♀: same data as the holotype **[TWP]**.

Description

(Fig. 11): Head, thorax and abdomen not differing from the nominotypical subspecies. FW length: 26.5 mm. This subspecies differs from *chaneli*, its immediate allopatric replacement to the North, by having a wide yellow HWV wedge extending from anal margin to wing median area; it is similar in this respect to *pisca* and *kuni*, whereas *chaneli* has only a faint whitish pattern. **Male genitalia** (Fig. 26): Uncus one-fourth longer than tegumen; subunci less than half the length of uncus; saccus intermediate in depth and wide; valvae more elongated, particularly towards apex, and thinner than in other subspecies, with a thin, upwards-pointing mid-dorsal process, similar to *chaneli*, dorsal surface less dentate basally than in *chaneli*; aedeagus slightly bent and humped in the middle, with an apical crest.

FEMALE (Fig. 12): Differs from the male in the lighter and duller brown FW and HWD and light, beige suffusion on the FW subapical and HW submarginal area.

Etymology

This subspecies is dedicated to Balazs Benedek, a lepidopterist from the Hungarian Natural History Museum in Budapest, participant of scientific expeditions to Peru (2003) and Venezuela (2008), and collector of many interesting specimens of butterflies, including *Pedaliodes*.

Remarks

P. chaneli benedeki is known exclusively from the Jano – San Francisco road in the department of Ayacucho, and is apparently endemic in the upper valley of Apurímac.

Pedaliodes demathani alfa Pyrcz et Boyer n. ssp.

(Figs. 13, 14, 27)

Type locality: Alfamayo, Cuzco, Peru.

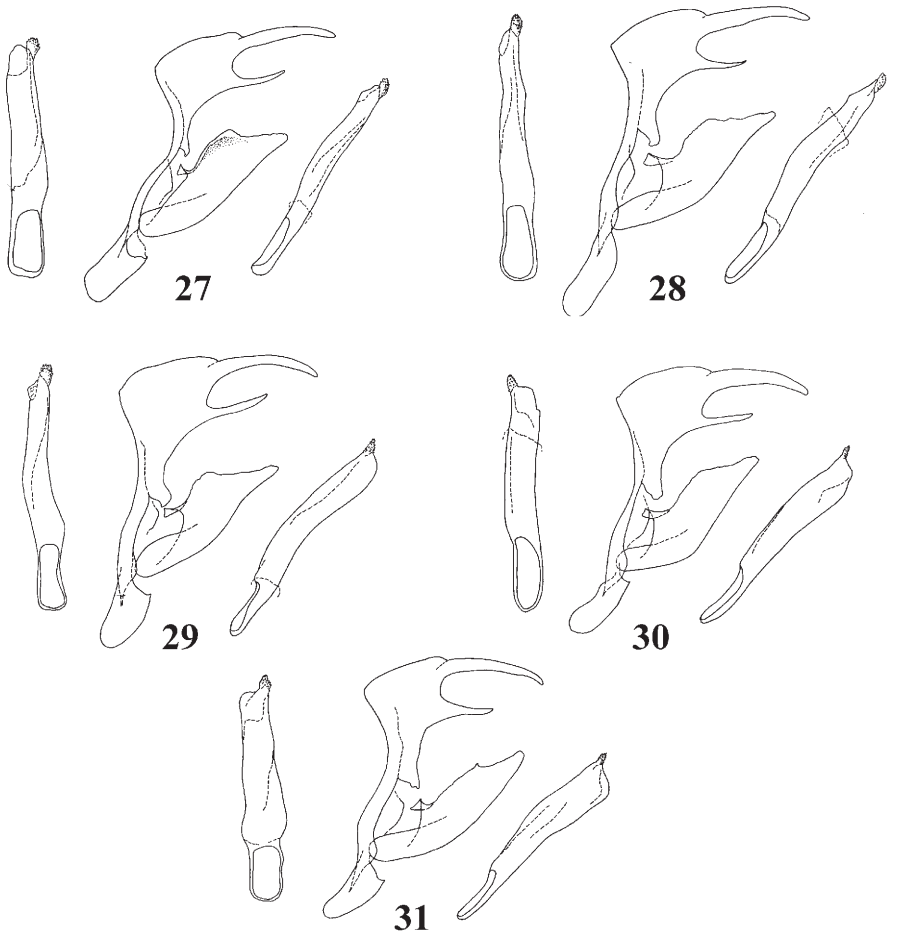
Material examined

PERU: HOLOTYPE ♂: Cuzco, Ollantaytambo-Alfamayo, above Carrizales, 3300-3400 m, IV.2005, J. Bottger *leg*. **[MUSM]**; PARATYPES: (5 ♂♂ and 1 ♀): 1 ♂: Cuzco, Carrizales, Route Abra Malaga vers Quillabamba, 3200 m, IV.2005, P. Boyer *leg*.; 1 ♂: Cuzco, Ollantaytambo-Alfamayo, Qda. San Luis, 2700-2725 m, 14.V.2003, T. Pyrcz *leg*.; 1 ♂: same data but 3200-3250 m, 19.V.2003 **[TWP]**. 2 ♂♂: Cuzco, Carrizales, Abra Malaga vers Quillabamba, 3200 m, III.2006, J. Bottger *leg*.; 1 ♀: Cuzco, Qda. San Luis, vía a Quillabamba, 3000-3200m, 14.V.2003, P. Boyer *leg*. **[PBF]**.

Description

(Fig. 13): Head, thorax and abdomen not differing from the nominotypical subspecies. This subspecies resembles most closely *benedeki* but has no reddish HWD anal suffusion; HWV is a shade lighter and duller brown underside, with some sparse dusty yellow suffusion, particularly in submarginal area. FW length: 26-29 mm, mean: 27 mm, n=6. **Male genitalia** (Fig. 27): Uncus slightly longer than tegumen; subunci half the length of uncus; saccus wider than in previous subspecies; valvae with a prominent, blunt dorsal hump, and a slightly irregular apical part; aedagus slender, almost straight, the length of valva+saccus, with a prominent apical crest.

FEMALE (Fig. 14): Differs from the male in the chestnut - sulfur suffusion of the HWV, which overcasts the anal yellow wedge, and spreads over submarginal area; some sulfur scaling apparent on the FWV subapical area.



27-31. Male genitalia (aedeagus extracted in lateral and dorsal view): 27 – *P. demathani alfa* Paratype (Qda. San Luis); 28 – *P. d. ockendeni* Paratype (Qda. Toccahuayco); 29 – *P. d. kalinowskii* Paratype (Marcapata); 30 – *P. d. horsti* Paratype (Carcel Punco); 31 – *P. d. nussi* Paratype (Yungas de La Paz)

Etymology

The specific epithet is derived from the locality of Alfamayo situated just below the collecting area, and incidentally is the first letter of Greek alphabet.

Remarks

This subspecies is known so far only from the upper valley of the Río Lucumayo, a right affluent of the Urubamba. It possibly occurs in other localities situated in the basin of Urubamba. LAMAS (2003) did not find it in the neighbouring Machu Picchu Sanctuary.

Pedaliodes demathani ockendeni Lamas et Viloria n. ssp.

(Figs. 15, 28)

[*Pedaliodes* [n. sp.] Lamas & Viloria, MS; Lamas et al., 2004: 213]

Type locality: Qda. Toccahuayco, Acjanaco, Cuzco, Peru.

Material examined

PERU: HOLOTYPE ♂: Cuzco, entre Qbda. Toccohuayco y Pillahuata, 2600-2800 m, 1311/7137, 14.VIII.2001, J. Grados *leg*. **[MUSM]**; PARATYPES (3 ♂♂): 1 ♂: Cuzco, Acjanaco-Pillcopata, Qda. Toccahuayco, 2800-2850 m, 24.V.2003, D. Vicente *leg*. **[TWP]**; 1 ♂: Cuzco, Acjanaco vers Boca Manu, 2600-2700 m, 22.V.2003, P. Boyer *leg*. **[PBF]**; 1 ♂: Cuzco, Toccahuayaco, 2700 m, 10.IX.2008, P. Boyer *leg*. **[PBF]**; 1 ♂: Peru, Urcos, Aug. 1900, Garlepp **[BMNH]**.

Description

MALE (Fig. 15): Head, thorax and abdomen not differing from the nominotypical subspecies. This subspecies diagnostic character is the wide HWD brick red suffusion, which contrary to the *kalinowskii* n. ssp. is not limited to the anal area but spreads wide over distal one-third of HW, from postdiscal area and vein M3 towards anal and outer margin, ending sharply without reaching outer margin - the most similar is the following subspecies, whose reddish suffusion is however considerably smaller and fainter; underside color pattern does not differ from *alfa* and is characterized by the presence of sandy yellow median line, postmedian costal streak and submarginal speckling. FW length: 26-28 mm, mean: 27 mm, n=2. **Male genitalia** (Fig. 28): Uncus one-fourth longer than tegumen, tip very slightly curved downwards; subunci half the length of uncus; saccus intermediate in depth; valvae elongated with a slightly serrate dorsal surface from base to the middle and slightly humped in the middle, less than *alfa*, slightly undulated from the middle to apex; saccus intermediate in depth and width; aedeagus as long as valvae+saccus, nearly straight, slightly narrowing apically, with a prominent apical crest.

FEMALE: So far unknown.

Etymology

This subspecies is dedicated to G. Ockenden, a German Nineteenth-Twentieth Century break collector of many interesting Peruvian Pronophilina, including at least one subspecies of *P. demathani*.

Remarks

This subspecies is known so far exclusively from the upper valley of the Río Kosñipata, and is probably endemic of that area, since it is replaced southwards in the parallel Marcapata valley by a separate subspecies and northwards, in the basin of Urubamba by *alfa*.

Pedaliodes demathani kalinowskii Pyrcz et Boyer n. ssp.

(Figs. 16, 29)

Type locality: Marcapata, Cuzco, Peru.

Material examined

PERU: HOLOTYPE ♂: Cuzco, Ccachería, Puente Amacho, route Marcapata vers Quincemil km 5, 2700-3000 m, 13.II.2005, Pierre Boyer *leg*. **[MUSM]**; PARATYPES (5 ♂♂): 2 ♂♂: Cuzco, Marcapata, Cerro Ccachería, 2900-2950 m, 15.II.2005, T. Pyrcz *leg*. **[MZUJ]**. 3 ♂♂: Cuzco, Ccachería, Puente Amacho, route Marcapata vers Quincemil km 5, 2700-3000 m, 13.II.2005, P. Boyer *leg*. **[PBF]**.

Description

MALE (Fig. 16): Head, thorax and abdomen not differing from the nominotypical subspecies. It is recognized from *ockendeni* by the smaller HWD suffusion, restricted to tornal area, however contrary to the *horsti* and *pisca*, not forming a dense anal patch, but instead a faint patch extending along outer margin to vein Cu1, it is dark red, considerably darker than the brick red of *ockendeni*. HWV yellow wedge colour is similar to *ockendeni* and *alfa* but its sandy yellow speckling is barely noticeable. FW length: 26-29 mm, mean: 27.7 mm, n=6. **Male genitalia** (Fig. 29): Very much similar to *ockendeni*, with a characteristic humped and slightly irregular dorsal surface of the valvae; saccus marginally shallower; aedeagus slightly more contorted with a very prominent apical crest.

FEMALE: So far unknown.

Etymology

This species is dedicated to Jan Kalinowski, a Polish naturalist, renowned ornithologist, and explorer, also a butterfly collector established in Cuzco.

Remarks

This subspecies is known so far only from the upper valley of the Río Marcapata. To the north it is replaced by *ockendeni* in the parallel Kosñipata valley. Its southern distribution limit remains an open issue.

Pedaliodes demathani horsti Pyrcz et Viloria n. ssp.

(Figs. 17, 18, 30)

[*Pedaliodes* [n. sp.] Lamas & Viloria, MS; Lamas *et al*., 2004: 213].

Type locality: Carcel Punco, Puno, Peru.

Material examined

PERU: HOLOTYPE ♂: Puno, Carcel Punco, 2700-2750 m, IV.2005, J. Bottger *leg*. **[MUSM]**; PARATYPES (31 ♂♂ and 5 ♀♀): 3 ♂: Puno, Carcel Punco, 2700-2750 m, IV.2005, J. Bottger *leg*.; 2 ♂♂: Punco, Carcel Punco, 2700-2750 m, III.2006, J. Bottger *leg*. **[TWP]**; 4 ♂♂: Carabaya, Limbani, 9500 ft., May-'04, G. Ockenden, JB; 1 ♂: SE. Peru, Limbani, 9000 ft., April-1904, JB; 1 ♂: same locality, 9500 ft., Jan-[19]01, RB; 4 ♂♂: Carabaya, Limbani, 9000 ft., Mar-1904, wet s., (G. Ockenden), RB; 4 ♂♂: same locality, 9500 ft., dry s., April-'04, (1 genit. prep. ALV316-97), RB; 2 ♂: SE Peru, Agualani, 10000 ft., Oct-[19]01, (Ockenden), RB; 1 ♂: Carabaya, Limbani, 9000 ft., Oct-[19]05, wet season, (G. R. Ockenden), RB; 2 ♂♂: Carabaya, Oconoque to Agualani, 6-9000 feet, Mar-'05, (G. Ockenden), (1 genit. prep. ALV314-97); 1 ♂: Carabaya, Oconoque, 7000 ft., July-1904, dry s., (G. Ockenden) **[BMNH]**; 1 ♂ and 1 ♀ : Puno, Carcel Punco, Agualanes, 8 km nord de Limbani, 2400-2700 m 16.X.2004, P. Boyer *leg*.; 4 ♂♂ and 4 ♀♀: Puno, Vallée du Río Sina, San Antonio de Putina, 2700-3100m, 12.X.2004, P. Boyer *leg*. **[PBF]**; 1 ♂: Limbani, H. Fruhstorfer, Ernst A. Böttcher, Berlin, coll. O. Thieme **[ZSBS]**.

Description

(Fig. 17): Head, thorax and abdomen not differing from the nominotypical subspecies. This subspecies is recognized from *kalinowskii* by the smaller size (FW length: 23- 27 mean: 24.5 mm, n=11), by the faint dark red or brick red anal patch, smaller than in the nominate but always noticeable; HWV colour pattern is similar to *pisca* and *benedeki* in that yellow scaling is scarce, and visible only in the apical area, and in that its yellow wedge is rich yellow. **Male genitalia** (Fig. 30): Differs from *kalinowskii* in the slightly broader aedeagus, from *kalinowskii* and *ockendeni* in the barely marked dorsal hump on the valvae and shorter, blunt apical one third of the valvae, and the somewhat shallower saccus.

FEMALE (Fig. 18): FW and HWD slightly lighter brown. FWV with a beige suffusion in the postdiscal and subapical area, outer half with a delicate reddish-brown sheen. HWV speckled with beige, heavier in the submarginal area; anal wedge darker than in the male, sandy yellow beige.

Etymology

This subspecies is called after Horst Bembenek, ex-curator of Lepidoptera at the Museum of Natural History in Dresden (SMTD) in recognition for his assistance during our research visits at the Museum.

Remarks

This subspecies is known to occur in the southernmost Peruvian valleys of Sina and Limbani (Puno).

***Pedaliodes dematthani nussi* Pyrcz n. ssp.**

(Figs. 19, 20, 31)

Type locality: Cotapata, La Paz, Bolivia.

Material examined

BOLIVIA: HOLOTYPE ♂: Yungas de La Paz, Cotapata, 3000 m, 20.VIII.1985, (labelled M85/867), M. J. Adams *leg*. **[BMNH]**; PARATYPES (13 ♂♂ and 2 ♀♀): 4 ♂♂: same data as the holotype; 2 ♀♀: Yungas de La Paz, Cotapata, 2800 m, 20.VIII.1985, M. J. Adams *leg*.; 1 ♂: La Paz, 1000 m (altitude data unreliable), (genit. prep. ALV320-97). JB; 1 ♂: Bolivie, (genit. prep. ALV319-97), OC **[BMNH]**; 3 ♂♂: Yungas de La Paz, Cillutincara, ex. coll. Staudinger & Bang-Haas **[MZUJ]**; 1 ♂: (La Paz), Río Tanampaya, 1894, Garlepp **[ZMHB]**; 1 ♂: Tola-Mapiri, Barrancas, 2800 m, 29-Aug-1950, W. Forster **[ZSBS]**; 1 ♂: La Paz, Sacramento, N.Yungas, 2500 m, 19.XI.1991, P. Boyer *leg*. **[PBF]**; 1 ♂: La Paz, Unduavi, 3300 m, 19.III.2002, P. Boyer *leg.* **[PBF]**.

Description

MALE (Fig. 19): Head, thorax and abdomen not differing from the nominotypical subspecies. This subspecies is characterized by small size, approximately that of *horsti* or even slightly smaller (FW length: 24-25 mm, mean: 24.6 mm, n=5); from the latter it differs in having no trace of red HWD anal suffusion; most of all it differs from all other subspecies in the faint and narrow HWV yellow wedge, heavily suffused distally with brown scales, particularly towards anal margin. **Male genitalia** (Fig. 31): Uncus one-fourth longer than tegumen; valvae differing from *horsti, kalinowskii* and *ockendeni* in having a tooth-like dorsal process on the valvae; saccus intermediate in depth and width, marginally wider than in *horsti*; aedeagus closely similar to *horsti*, shorter and broader towards apex than in other subspecies, with a prominent apical crest.

FEMALE (Fig. 17): FWD medium brown in basal half, pale brown in distal half, lighter than in male. HWD pale brown with a diffused orange suffusion from mid anal margin to tornus and along outer margin to vein Cu1. FWV medium brown with a light reddish sheen; subapical and apical area suffused with beige; three whitish submarginal dots from M1-M2 to M3-Cu1; HWV medium brown suffused with chocolate brown and light beige ripple-pattern in median half and towards outer margin; a light beige anal wedge shaped as in the male, and a diffused submarginal band of same colour; a series of five whitish submarginal dots gradually larger from Rs-M1 to Cu1-Cu2.

Etymology

This subspecies is dedicated to Mathias Nuss, current curator of Lepidoptera in the Museum of Natural History in Dresden (SMTD), and taxonomist specializing in pyralid moths, in recognition for his outstanding cooperation during our research trips to the museum.

Remarks

This is the only Bolivian subspecies of *P. dematthani* known so far. It has been reported from the Yungas de La Paz and its effective distribution remains unknown.

Known distribution areas of other sympatric *Pedaliodes* indicate it may also occur in the southern Yungas de Cochabamba.

DISCUSSION

The taxa discussed in this paper are treated as subspecies rather than allopatric species because morphological differences of colour patterns and male genitalia separating them are not important enough and clear-cut, but clinal. Furthermore, they all present several common characters, that discriminate them from the sympatric congeners. In particular, a truncate FW outer margin below apex, and an elongated HWV yellow anal wedge gradually narrowing from anal edge to vein M2 where bent at straight angle, edged distally with a series of five white submarginal dots. Male genitalia are also roughly similar with a wide but shallow saccus, a long uncus, longer than tegumen shoulder, subunci not exceeding half the length of uncus, and valvae gradually narrowing from the middle to a blunt apex. Differences between the subspecies affect mainly the shape of the dorsal surface of valvae, varying between smooth in *horsti* and *ockendeni*, humped in *alfa*, and possessing a short teeth-like process in other subspecies. The latter character is subject to some infrasubspecific variation, as we can see on the example of the nominotypical subspecies.

Distribution patterns of *Pedaliodes dematha*ni yield several interesting results. Most subspecies have narrow geographical ranges often restricted to single river basins. This particularly concerns the upper valley of Madre de Dios where each parallel valley harbours a separate, well differentiated subspecies, namely *ockendeni*, *kalinowskii, horsti* and *nussi*. The divide between the watersheds of Madre de Dios and Ucayali confirms as an important zoogeographical barrier, separating *ockendeni* from *alfa*. In fact, several species of Pronophilina and *Pedaliodes* occurring in the valley of Kosñipata have their sister species or subspecies in the valley of Río Lucumayo (Pyrcz 2005; Pyrcz et al., in press). Also, the valleys of Huallaga and Chanchamayo separating *chaneli, kuni* and *pisca* confirm as zoogeographical barriers. The subspecies *chaneli* in the upper Junín is apparently involved in a mimetic relationship with several, locally microsympatric, undescribed *Pedaliodes*, a matter which will be discussed in a separate work (Pyrcz, MS).

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