Notes on certain high Andean orange eumaine lycaenids with description of a new species from Peru (Lepidoptera: Lycaenidae: Eumaeini)

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Abstract - High Andean species having dorsally orange wing colouration of the diverse eumaeine lycaenid lineage Penaincisalia genus-group are evaluated. The genus Thecloxurina comprises butterflies most often having dorsally vivid blue or violet wing surfaces. The status of the dorsally orange species Thecloxurina atymnides (DRAUDT, 1919) JOHNSON, 1992, known from Colombia, was hitherto considered to be uncertain. On the basis of type material, the position and placement of the nominal taxon Thecla atymnides is evaluated. The species represents the high altitude sibling of Thecloxurina loxurina (FELDER et FELDER, 1865) JOHNSON, 1992. Two butterfly specimens collected in Peru and superficially similar to Thecla atymnides have been found in the KÖNIG Collection, Naturhistorisches Museum, Wien. The same phenotype is represented by five individual specimens in the Lepidoptera collection of the Museo de Historia Natural (Universidad Mayor de San Marcos, Lima Peru). These specimens proved to be the representatives of a species new to science, which is described here as Penaincisalia felizitas sp. n. (type locality: Peru, Apurímac, SE de Huancarama, 3700 m) and is considered to be a basal taxon of the Penaincisalia lineage of eumaeine lycaenids. This dorsally orange-violet species represents the phenomenon of discoloration, which stems from a qualitative nanostructural change in the scale bodies of the dorsal wing surface, resulting in the loss of vivid structural colours and affording a positive thermoregulatory effect. Accordingly, the loss of ancestral vivid Penanincisalia or Thecloxurina dorsal colouration is considered to be a derivative loss occurring convergently in the genus-group. This derivation of discoloration appears to have made it possible for cloud-forest lineages of the genus-group to pioneer high altitude habitats in the Andes. With 14 figures.

Key words – Taxonomy, new species, genera, androconia, discoloration, Lepidoptera, Lycaenidae, *Penaincisalia*, Andes.

INTRODUCTION

The genus-group *Penaincisalia* is a diverse lineage of high-Andean eumaine lycaenid butterflies (Lepidoptera: Lycaenidae, Eumaenini). JOHNSON (1990) erected the genus *Penaincisalia* (type species: *Thecla culminicola* STAUDINGER, 1894, by

original designation), and subsequently he reviewed the genus distinguishing several lineages as genera (JOHNSON 1992). The genus-group was loosely redefined by BÁLINT & WOJTUSIAK (2001).

I am of the opinion, that the genera *Abloxurina* JOHNSON, 1992, *Penaincisalia* JOHNSON, 1990, *Pons* JOHNSON, 1992 and *Thecloxurina*, JOHNSON, 1992 represent the monophyly of the *Penaincisalia* genus-group. The common trait of the lineages is the bipartite male androconia characterized by 'two androconial brands on each forewing of males (one at distal juncture of costal and cross veins of discall cell; another abutting juncture of cross vein and vein M3)' (JOHNSON 1990: 9; see Figs 1–5). The androconia at the 'distal juncture' is a scent pad (*sensu* ROBBINS 1991: 14).

Recently I co-authored a paper (BÁLINT & WOJTUSIAK 2003) that reviewed some Ecuadorian and Peruvian members of the genus *Thecloxurina* (type species: *Thecla loxurina* FELDER et FELDER, 1865, by original designation). The mentioned genus harbours species most often having vivid blue or violet male dorsal colouration. In that paper the supralimital taxon *Thecla atymnides* DRAUDT, 1919, displaying dorsally orange colouration, was regarded as nomen dubium. Subsequently Dr. GERARDO LAMAS (Lima) located historical material of '*Thecla atymnides*' and the documentation has been forwarded to me *via* his kindness. Consequently the nominal taxon '*Thecla atymnides*' can be interpreted positively. This taxon represents the interesting phenomenon of "discoloration" discussed at some length in two papers focusing on how and why the discolored condition occurs in certain butterflies of the Andes (BÁLINT *et al.* 2004*a*, *b*).

Cataloguing the eumaeine material of the KÖNIG Collection (Naturhistorisches Museum, Wien, Austria = NHW) I have found two individuals of a distinctive orange-violet species collected in Peru. Dr. GERARDO LAMAS (Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima Peru = MUSM) kindly sent me the documentation of five specimens which represent this phenotype and are deposited in the collection under his curation. These samples somewhat resemble '*Thecla atymnides*', but they differ in many traits. I consider that this phenotype represents a species hitherto unknown to science and belonging to a distinctive group within the *Penaincisalia* eumaeine lycaenids. Specimens of the new species were collected at high altitudes and, in my opinion, consistent with the literature on discoloration, this new species also represents the discoloration phenomenon (BÁLINT *et al.* 2004*a*, *b*).

Accordingly, this paper will (1) evaluate the taxonomic status of '*Thecla* atymnides'; (2) describe the new species from Peru and examine its intra-generic relationships; and (3) discuss this new species in light of the discoloration phenomenon found in many Lycaenidae occurring in the Andes mountains.



Figs 1–5. Penaincisalia genus-group male dorsal fore wing androconia: 1 = Penaincisalia felizitas sp. n. (HNHM paratype), 2 = Abloxurina balzapamba JOHNSON, 1992 (C Ecuador), 3 = Penaincisalia perezi BÁLINT, 2001 (N Peru), 4 = Pons saraha JOHNSON, 1992 (C Ecuador), 5 = Thecloxurina chachapoya BÁLINT et WOJTUSIAK, 2003 (NE Peru) 6–7 = Penaincisalia felizitas, sp. n., holotype: 6 = MUSM, dorsum, 7 = venter (photos: 1–5 = A. KUN; 6–7 = G. LAMAS).

SPECIES ACCOUNTS

Thecloxurina atymnides (DRAUDT, 1919) JOHNSON, 1992

Thecla loxurina f. atymnides DRAUDT, 1919: 758, pl. 153, row e, fig. 'atymnides'. Thecloxurina atymnides (DRAUDT): JOHNSON 1992: 19 (new status, new combination).

Remarks – In a recent review of the genus *Thecloxurina* the nominal taxon *Thecla atymnides* DRAUDT, 1919 was considered to be a nomen dubium (BÁLINT & WOJTUSIAK 2003: 383). The species was described as a local form of the dorsally violet *Thecla loxurina* on the basis of an unstated number of specimens of unstated sex from 'Quindiu Pass', Colombia. There was no indication of the location of type material. The source of the original sample was presumably ANTON HERMANN FASSL, who extensively explored the Colombian Andes and visited the type locality of '*Thecla atymnides*' several times (FASSL 1910). He widely dispersed *Thecloxurina* specimens originating from the type locality of '*Thecla atymnides*' (*cf.* FAYNEL & BÁLINT 2004).

In the SEITZ volumes authored by MAX DRAUDT, a specimen lacking the characteristic male forewing androconia of the group is figured as '*atymnides*' (DRAUDT 1919). However, in the text, there is a hint of the presence of an androconial cluster ('... nur in der Vrdsmitte des Vfgls ein schwarzer Dreiecks-fleck stehen bleibt') contradicting the figure. Consequently the sex or sexes of the specimen or specimens serving as type material could not be objectively determined from the original documentation. Similar mistakes and controversies concerning legends and/or plates accompanying DRAUDT texts for eumaines are not rare (*cf.* BÁLINT & GOODGER 2003).

Recently, Dr. GERARDO LAMAS found type material of variouis Neotropical Rhopaloceran taxa described by DRAUDT in the Senckenberg Museum für Naturkunde (Frankfurt am Main, Germany) and, amongst them, was one dorsally orange *Thecloxurina* specimen, which was labelled as 'Typus'. The individual possesses an original printed FASSL label 'Paso del Quindiu, Columb., Centr. Cord., 3800 m, coll. Fassl', plus two hand written identification labels: (1) 'Thecla, loxurina, var.' (handwriting of FASSL; *cf.* HORN *et al.* 1990: Taf. 36, fig. 2) and (2) 'atymnides' (probably handwriting of DRAUDT; *cf.* HORN *et al.* 1990: Taf. 8, fig. 2). This individual is a name-bearing syntype specimen, as evidenced by the handwritten identification label of Draudt. Consequently, the original type material of '*Thecla atymnides*' either contained specimens of both genders (text: male; figure: female) or the artist, who prepared the coloured plate 'Thecla, no. 153', was mistaken and did not indicate the male androconia obvious on the specimen Dr. LAMAS located.

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Reflecting this historical confusion, I am of the opinion that the Bolivian specimen figured as a male '*Thecla atymnides*' by JOHNSON (1992, fig. 110A) is a female individual and I doubt, that it actually represents '*Thecla atymnides*' as described from Colombia. The female specimen figured by JOHNSON (1992, fig. 110B) as a '*Thecla atymnides*' male represents, I believe, *Thecloxurina atymna* (HEWITSON, 1870) JOHNSON, 1992, since it possesses the distinctive trait later pointed out by BÁLINT & WOJTUSIAK (2003) as defining '*Thecla atymna*'. Also, there is further confusion because JOHNSON indicated that the specimen he determined and figured as a male of '*Thecla atymnides*' originated from Bolivia while, contrary to his figure, his text refers to a single Bolivian female. Thus it is possible that JOHNSON either (1) was incorrect in labelling his figured specimen a male, given the historical uncertainly of the above-mentioned DRAUDT figure which carried the name, (2) accidentally omitted further mention of that specimen in his text, or (3) the Bolivian female listed by JOHNSON actually was from a longer list of females enumerated later from Ecuador (JOHNSON 1992: 20).

'Thecla atymnides' shares some obvious traits with Thecloxurina loxurina distributed from Venezuela to Peru, and they further belong to a monophyletic group characterised by a circular-shaped scent pad comprised of greyish scales (see Fig. 5), an extended hindwing vein 2A comprising a long sword-like "tail" (Fig. 14), and rufous ventral ground colouration with a red medial line. 'Thecla atymnides' seems to be more closely related to loxurina than to atymna based on the following traits: (1) Thecloxurina atymnides and loxurina have a slightly bent fore wing ventral median line, which is not angulate distally in cell M3-CuA1 as in Th atymna; (2) The cloxurina atymnides and loxurina exhibit the hind wing ventral median line starting from the costa and extending straight to vein CuA2, whilst in Thecloxurina atymna this line reaches vein CuA2 in an irregularly wavy fashion; and (3) in Thecloxurina atymnides and loxurina hind wing tails (measured from the CuA2 vein terminus to tail terminus) are longer than the diameter of the anal lobe (measured from the CuA2 vein terminus to the lobe's furthest point from the anal margin). Certainly, a detailed character analysis of all Thecloxurina taxa is necessary to find out more about their phylogenetic relationships, especially those taxa which occur in the Quindiu Pass region of Colombia (from where a number of taxa have historically been described). If the traits outlined above accurately suggest relationships, Thecloxurina atymnides and loxurina should be considered as a sister species pair with atymna most likely being their sibling in a monophyletic cluster within Thecloxurina, i.e. atymna / loxurina-atymnides.

The new taxon described below has a trapezoidal scent pad, a slightly extended hindwing vein CuA2 comprising a filamentous tail, and a larger tornal lobe than other known the cloxurines. As I have stated in the Introduction and Species Account above, given all these reasons, I described the new taxon in *Penaincisalia*, as below.

Penaincisalia felizitas sp. n.

(Figs 6–10)

Type material – MUSM holotype male, set dorsally, in good condition (right wings slightly worn, tip of right antenna missing), deposited in MUSM, labelled as 'PERU, AP, SE de [//] Huancarama 3700 m [//] 1342/7302 24.vi.2003 [//] G. Lamas'(rectangular shaped white paper, printed letters (Figs 6–7). – MUSM paratypes (nos 1–4), all males from Peru, with holotype data (no. 1); Panao, Huánuco, '1850 m' (lapsus according to G. LAMAS, *pers. comm.*, correct: 2850 m)(at 0953/7559), 1.xii, 1982, leg. P. HOCKING (nos 2–3), male, Acostambo, Huancavelica (at 1222/7502), 3500 m, 25.iv.1995, leg. A. VILORIA (no. 4). – HNHM paratype (no. 5) male from Peru, Huancavelica, Pampas (at1224/7452), 3000 m, leg. F. König, the specimen is dissected (gen. prep. BÁLINT, no. 1023) (Fig. 10). – NMW paratype (n. 6), with HNHM paratype data, not dissected.

Diagnosis - Antennal base adjacent to the margin of the compound eye (family: Lycaenidae). Male prothoraic leg not greatly modified and foreleg coxa not arched upward distally (subfamily Theclinae). Male fore tarsus stubby-tipped (tribe Eumaeini). Ventral wing with darker basal and lighter limbal area in generally divided by a zigzagged or linear median line, male forewing androconia with discal scent pad and medial scent patch elements (Penaincisalia genus-group). Reminiscent of congener Thecloxurina atymnides but male has differing markedly as follows: (1) Fore wing outer margin wavy between vein termini M1 and CuA2 (straight or slightly convex in Thecloxurina atymnides); (2) Fore wing scent patch trapezoidal (circular in Thecloxurina atymnides); (3) Hind wing tail at CuA2 vein terminus shorter than the tornal lobe diameter (longer in *Thecloxurina atymnides*); and (4) ventral colouration and pattern compared with Thecloxurina atymnides also distinctive with: (a) The fore wing submedian area being vivid orange (pale mottled red in Thecloxurina atymnides); (b) The fore wing submarginal area being differently coloured than the medial (not differently coloured in Thecloxurina atmynides); and (3) The hind wing median line being irregular (linear in Thecloxurina atymnides). Male genitalia are typical Penaincisalia but with a sclerotised zonal element in the aedeagus (not heavily sclerotised in Abloxurina-Penaincisalia-Pons-Thecloxruina) and with conspicuously long median cornutus (shorter in Abloxurina-Penaincisalia-Pons-Thecloxurina).

Description – Male. Head: Labial palpus covered by large white sclales, white and red hairs longer than scales; vertex with golden scales heavily covered by long white, red and black hairs; eye hairy; antennal segments dorsally brown with white scalings at base, ventrally white; club brown. Thorax and legs: thoraic sclerotised parts dorsally covered by golden scales and long red hairs, later-

ally and ventrally covered by long white and red hairs; legs with rusty brown femur and tibia, tarsus grey. Wings: Fore wing costal margin straight and longer than outer and anal margins, outer margin wavy, anal margin straight, apex pointed, tornus rounded; dorsal wing ground colour Meadow Violet (MAERZ & PAUL 1950: Pl. 51, fig. 9/A) in basal and medial areas excluding discocellular space, Orange Red in discocellular, submedian and antemarginal areas Chrome Orange (MAERZ & PAUL 1950: Pl. 10, Fig. 12/K), with wide black marginal border and ochraceous ciliae; ventral ground colour Burnt Orange (MAERZ & PAUL 1950: Pl. 3, Fig. 12/E) with rusty brown medially, costal submedian line rusty brown, submarginal area lighter orange, costal, discoidal and marginal area ash grey. Androconia: Dorsal fore wing discal cell with a larger trapezoidal shaped scent pad situated in apical area, and with in a smaller oval scent patch at vein erection M3. Hind wing costa concave, outer margin waved with tail-like vein CuA2 terminus and anal lobe, anal margin waved; dorsal ground colour as in fore wing with black marginal border reducing in width from costa to vein CuA1; vein CuA2 terminus with short and red coloured filamentous tail-like projection, tornal lobe large and red, cell 3A grey with hair-like scales. Hind wing ventral ground colour Chestnut Brown (MAERZ & PAUL 1950: Pl. E. Fig. 10/E), with red basal and postbasal suffusion and red median line running from costa to vein terminus 2A at tornal lobe; submedian area slightly lighter than median and basal parts. Abdomen: dorsally brown, ventrally pale yellow; genitalia commonplace Penaincisalia lacking brush organ (Fig. 8), sensory hairs situated on valva and the end of last segment; genital capsule bullet shaped with large tegumen with sensory hairs, pair of ganthos, moderately slender vinculum; valva relatively slender with pointed terminus, manica mebranous and tight; aedeagus long with stubby terminus covered by sensory hairs, length two times valval length, vesica with pair of cornuti, basal one small and heavily bristled and rounded, median one large, long (three times longer than basal cornutus), sclerotised and flat (Figs 8-9). Measurements (n = 1; paratype no. 5): length from cubital vein base to vein R4 terminus =14 mm; valve length = 1.20 mm, saccus length = 0.50 mm, internal aedeagus length = 1.10 mm, external aedeagus length = 1.20 mm, drosal capsule length = 0.03mm (holotype; for the measurements see ROBBINS 1991: 22).

Distribution – Geographic: known from the central Peruvian administrative "Departamentos" (departmens) Apurímac, Huánuco and Huancavelica. Spatial: recorded between 2850 m and 3700 m. Seasonal: specimens were collected in December, April and June.

Etymology – 'Felizitas': Noun, gender feminin, in honour of FELIZITAS KÖNIG, wife of FRITZ KÖNIG, collector of the HNHM and NMW paratype specimens, whose extensive collection of diapositive slides documenting their joint trips in Peru (KÖNIG 1984) is in the possession of the NMW.



Figs 8–9. *Penaincisalia felizitas*, sp. n.: 8 = paratype (HNHM), male genital organ from dorsal view, 9 = aedeagus of the same organ, magnified (photos: A. KUN)

Figs 10–14. Penaincisalia genus-group male phenotypes: 10 = Penaincisalia felizitas, paratype (HNHM), 11 = Abloxurina balzapamba JOHNSON, 1992 (C Ecuador), 12 = Penaincisalia perezi BÁLINT, 2001 (paratype no. 12), 13 = Pons saraha JOHNSON, 1992 (C Ecuador), 14 = Thecloxurina chachapoya BÁLINT et WOJTUSIAK, 2003 (NE Peru) (photos: A. KUN)

Note – The female is unknown. Knowing the discolored species of the group (see below), the *felizitas* female, along with lacking androconia, likely also lacks dorsal violet colour; the wing dorsa are most probably orange or brown with wider black margins; ventral wing surface is likely identical with that of the male.

DISCUSSION

Generic placement of Penaincisalia felizitas

I noted in the introduction and in the diagnosis of Penaincisalia felizitas that, in spite of superficial resemblance to Thecloxurina atymnides, the new taxon differs in many major traits from other Thecloxurina and, therefore, I have described it in the sister genus *Penaincisalia* (therein suggesting it as a basal taxon). This placement is still controversial, however, because of the distinctive fore wing shape, ventral pattern and male genital characters of this new taxon. The documented general wing shape of Penaincisalia is distinctive: fore wing medial veins M1-3, branching from the discal cell, are in length more or less equal, with the ratio M1 : M2 : M3 = 1 : 1 : 1; in Penaincisalia felizitas medial veins are disequal in length creating a ratio M1>M2>M3, more typical of some Thecloxurina and also seem in the group Johnson described as Abloxurina, whose taxa generally all exhibit this character. The ventral pattern of the new taxon shows the generalized Penaincisalia genus-group pattern elements but the fore wing's orange colouration is distinctive and appears unique in that the submarginal area on both of the wings is as dark as the basal area. This trait is somewhat suggestive of the group Johnson described as Pons. All these traits suggest that Penaincisalia felizitas is a basal taxon and that, in the Penaincisalia genus-group lineage as a whole, various of these characters were differentially lost whilst others were retained (and along the lineage diversified and specialized into many distinctive phenotypes) as these butterflies moved into and exploited the voluminous niches of the higher Andes. Similarly, the male genitalia of Penaincisalia felizitas could also be interpreted as representing a basal taxon- the aedeagus being distinctive with its sclerotised zonal area, with stubby valval terminus and conspicuously long medial cornutus. If my speculation is correct and mirrors the phylogeny of this group, Penaincisalia felizitas represents the sibling lineage of Abloxurina : Penaincisalia : Pons : Thecloxurina and therefore it warrants description as a new generic taxon.

Regarding all of the above, and generic considerations, although application of the generic name *Penaincisalia* in the broadest sense to all these taxa stresses the kind of monophyly that a generic name should mirror (VANE-WRIGHT 2003), this kind of broad usage seems to me to be unsatisfactory in this case. The usage of *Penaincisalia* in such a broad sense results here in a phenotypically very diverse entity, harbouring many distinct lineages, all of which colonized the same habitat type several times *via* convergent phenomena (see below) producing beautiful, conspicuous and unique phenotypes (Figs 10–14). This information is completely lost in the broad application of *Penaincisalia*. Moreover, the lineages recognized by JOHNSON (1992) as distinct genera are diverse and complex even in themselves and merit recognition as much as many very recently reviewed moderately, or far less diverse, Neotropical butterfly genera (eg. WILLMOTT *et al.* 2001: *Hypanartia*; WILLMOTT *et al.* 2001: *Colobura*; both in Nymphalidae).

Discoloration

Considering range of phenotypes in the blue-violet-orange lineages *Thecloxurina loxurina–atymna–atymnides* and *Penaincisalia culminicola–perezi–aurulenta* (cf. BÁLINT et al. 2004b), I hypothesize that a sibling species of *Penaincisalia felizitas* likely exists (that is, if not extinct) which is dorsally blue or violet and inhabits the cloud forest ecotones in the same area or region as *Penaincisalia felizitas* itself. Of this sister pair, *Penaincisalia felizitas* would represent the partly discolored sibling of the blue species which, typical of how the discoloration phenomenon has been elucidated, would still possesses scales with nanostructures working as 'Photonic Band Gap' (PBG) (BIRÓ et al. 2003), and which generate structural colouration on the wing dorsa. Interestingly, these PBG scales generating violet colour are restricted to the basal and subbasal areas of the wings in *Penaincisalia felizitas* and the 'empty' orange-red scales are distributed medially and submedially.

It has been stated, in the example of the *Thecloxurina atymna/atymnides/loxurina* clade that, most probably, sympatric or syntopic speciation has occurred which was, in some part, generated by the qualitative changes in scale nanostructures of the individual butterflies (as in BÁLINT *et al.* 2004*a*, *b*). As has also been pointed out, the phenomenon of discoloration seems quite common amongst high altitude lycaenids (*cf.* BÁLINT *et al.* 2004*a*, pl. 1). Accordingly, the violet basal area *Penaincisalia felizitas* suggests that it is not actually a species inhabiting maximal high altitudes in the Andes because it is not entirely discolored as are species like *Penaincisalia aurulenta* JOHNSON, 1990 in the Peruvian Cordillera Blanca or *Thecloxurina atymnides* in the Colombian Andes. Thus, one might also suggest that a totally 'orange' species closely related to *Penaincisalia felizitas* may well also exist somewhere in the high altitude paramos of the central Andes. In closing, it should also be noted that a general pattern of the *Penaincisalia* lineage seems to be toward high altitude transformation of dorsally vivid blue colour not to brown but to reddish or orange. Regarding this, it should be noted that, along with species already listed as examples of this in BÁLINT *et al.* (2004*b*) there is a further instance adding veracity to this observation. I am aware of another undescribed species, superficially similar to *Thecla atymnides* and occurring in Ecuador (figured as "*T. atymna* male" by JOHNSON 1992, fig 109A). This entity which, on wider examination of the *Penaincisalia* genus-group, has proved to be distinctive in wingshape, colouration, markings, and other features will be described in the near future.

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