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Pseudolucia maricunga sp. n., a new high Andean butterfly from northern Chile (Lepidoptera, Lycaenidae: Polyommatinae)

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Abstract – *Pseudolucia maricunga* sp. n. is described from Cuesta Codoceo, Maricunga, Copiapó, Atacama Region, Chile. The *sibylla* and *argentina* species subgroups of *Pseudolucia* Nabokov, 1945 are distinguished from the *plumbea* (s. str.) subgroup. Identification key for these groups and the species of the *sibylla* species subgroup is given. Classification and biogeography of the *sibylla* subgroup is discussed. With 9 figures.

Key words – *Adesmia*, *argentina* species group, Atacama, Polyommatini, *sibylla* species group

INTRODUCTION

The *sibylla* subgroup of the *Pseudolucia plumbea* species group in Chile is represented by six species (Benyamini & Bálint 2011). Within this assemblage, on the basis of wing pattern and genitalia we can distinguish two groups of species. One of them is the *sibylla* subgroup *sensu stricto* and the other one is the *argentina* subgroup. Both subgroups inhabit high Andean puna and low alpine vegetational belts in both sides of the Andes. As the *sibylla* subgroup is very characteristic in wing pattern and genitalia morphology, it deserves distinct position in classification, the *argentina* subgroup seems to be more closely related to the *plumbea* (s. str.) species subgroup both in external appearance and anatomy.

Since the publication of our paper, mentioned above, additional field work has been conducted in remote areas of the Antofagasta and Atacama regions of northern Chile by the junior author and our mutual friend Mr Alfredo Ugarte (Santiago, Chile). New records have been collected regarding the biology and dis-

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tribution of the previously recognised species. Additionally, as it was suggested by us, new taxa have been discovered indeed in Chile (see Benyamini *et al*. 2013).

The purpose of this paper is to characterise the *sibylla* subgroup and to describe one new species discovered very recently. We provide a key for their identification based on their wing pattern and genitalia structures, and present evidence on their biogeography. The *argentina* subgroup will be treated later in a separate paper dealing with the *Pseudolucia* fauna dwelling in the eastern side of the Andes and Patagonia.

Abbreviations of depositories – DBC = Dubi Benyamini Collection (Bet Arye, Israel); HNHM = Hungarian Natural History Museum (Budapest, Hungary); MNHN = Museo Nacional de Historia Natural (Santiago, Chile).

Abbreviations used in genitalia measurements – AB = valval length line measured from valva base to lower projection terminus; C = point on valval length line (AB) where the highest distance is measured perpendicularly to lower costa; CD = highest valval width measured from C; E = point on valval length line (AB) where the highest distance is measured perpendicularly to upper costa; EF = highest valval width measured from E.

MATERIAL AND METHODS

Our results are based on 91 specimens (79, DBC, 12, HNHM) and 11 dissections representing the *sibylla* subgroup (see below). Genital structures in dissected specimens were measured by OLYMPUS SZX12 binocular optical microscope with ocular accessory GSWH X/22 under magnification ×90. Distribution and biology of the species are compiled according to the database of the junior author.

Dissections (gen. prep. nos HNHM Bálint): no. 302 (male: Chile, Antofagasta; "*Scolitantides oligocyanea* paratype"), no. 303 (female: Chile, Antofagasta; "*Scolitantides oligocyanea* paratype"), no. 392 (male: Chile, Atacama; *Pseudolucia aureliana* holotype), no. 393 (female: Chile, Atacama; *Pseudolucia aureliana* "allotype"). 1437 (male, Argentina, San Juan: *Pseudolucia* sp. n.), 1438 (female, Argentina, San Juan: *Pseudolucia* sp. n.), 1448 (male, Chile, Elqui: *Pseudolucia sibylla*), 1489 (male, Chile, Antofagasta, *Pseudolucia* sp. n.), 1490 (female, Chile, Antofagasta, *Pseudolucia* sp. n.), 1491 (male, Chile, Atacama, *Pseudolucia* sp. n.), 1492 (male, Atacama, *Pseudolucia* sp. n.).

KEY FOR IDENTIFICATION

The key for the *plumbea* group (*sensu* Benyamini & Bálint 2011) we present here is constructed on the basis of material consisting more than 400 specimens collected in both sides of the Andes. It supplements the previous key

given in Bálint & Benyamini (2001) as "Key to the species groups of the genus *Pseudolucia* based on male and female genital characters", where the last entry is the *plumbea* species-group.

1 Male dorsal wing surface blue with wide (> 1.0 mm) black margin with indistinct inner border; female dorsal forewing surface with large and vivid median orange colouration ..... *plumbea* (s. str.) subgroup

– Male dorsal wing surface blue with very narrow (> 0.5 mm) black margin or without black margin, or with brown dorsal wing surface; female dorsal forewing surface either with small and faint median orange colouration or orange colouration absent or wing surface blue (*argentina* and *sibylla* subgroups) 2

2 Male dorsal wing surface silvery blue with faint or without intervenial spots in hindwing submarginal area; female wing surface also blue with faint orange forewing medial area; forewing ventral ground colour orange; male genitalia tegumen sclerotised without dorso-cephalic pointed extension, aedeagus with membraneous sagum; female ostium stronger and shorter, also winged but without central plate ..... *argentina* subgroup

– Male dorsal wing surface azure blue with well visible black intervenial spots in hindwing submarginal area; female wing surface medial area blue; forewing ventral ground colour pale orange, brown or brownish grey; male genitalia tegumen sclerotised with a dorso-cephalic pointed extension, aedeagus without sagum; female ostium slender and winged with a long sclerotised central plate narrowing cephalad (*sibylla* subgroup) 3

3 Ventral wing surface ground colour pale orange, hindwing pattern with black basal and medial hindwing spots (Atacama) ..... *P. aureliana* Bálint et Johnson, 1993

– Ventral wing surface ground colour brown, hindwing pattern with black basal and brown medial spots 4

4 Blue dorsal colouration deep violet restricted to discal and basal area (Antofagasta) ..... *P. oligocyanea* (Ureta, 1956)

– Blue dorsal colouration light azure and extends beyond discal area 5

5 Male forewing subapical area blue in dorsal surface, hindwing ventral ground colour grey, pattern between vein M1 and anal margin with continuous, more or less regular row of medial spots (Coquimbo) ..... *P. sibylla* (Kirby, 1871)

– Male forewing subapical area not blue in dorsal surface, hindwing ventral ground colour brownish grey, pattern between vein M1 and anal margin with discontinuous and irregular row of medial spots (Atacama) ..... *P. maricunga* sp. n.

Pseudolucia maricunga sp. n.
(Figs 1–5)

Type material – Holotype, male (Figs 1–2), labelled as "Chile, Atacama, [//] Copiapó, Maricunga, [//] Cuesta Codoceo, 3933 m, [//] 11/12/2012 [//] Leg. Dubi Benyamini" [white, printed], "DBC-4802" [yellow, printed]; forewing costal length: 9.0 mm, will be deposited in MNHN.

Paratypes (n = 16): DBC nos 1–2: labelled as the holotype (males; no. 2 dissected: gen. prep. Bálint no. 1489), nos 3–4: labelled as the holotype (females, no. 4. dissected: gen. prep. Bálint no. 1490); HNHM no. 5: labelled as "Chile, Antofagasta, Cordillera de Domeyco, Park Nacional Llullaillaco, Rio Frio, 3718

m, 9. XI. 2012, leg. Alfredo Ugarte" (male, dissected: gen. prep. Bálint no. 1491), HNHM no. 6: *ditto*, but 3524 m (male, dissected: gen. prep. Bálint no. 1492), DBC nos 7–12: *ditto* (males and female); DBC nos 13–16: *ditto*, but collected on 11.XI. 2012 at elevation 3718 m, (13–15: males, no. 16: female).

Diagnosis and description – Male (Fig. 1) and female (Fig. 3) wing dorsal surface blue with long white fringes melanised at vein termini. Wing margins black with white inner border and faint submarginal pattern comprised by black intervenial spots. Wing ventral surface in both sexes (Figs 2, 4) with complete polyom-

Figs 1–5. *Pseudolucia maricunga* sp. n.: 1 = holotype (male), dorsum, 2 = ditto, ventrum, 3 = paratype no. 3 (female), dorsum, 4 = ditto, ventrum (forewing costal lengths = 9.0 mm), 5 = male genitalia in dorsal view (scale bar = 0.1 mm) (photos: 1–4, O. Tomer; 5, Zs. Bálint)

Figs 6–8. 6 = The type locality of *Pseudolucia maricunga* sp. n.: Cuesta Codoceo, Salar Maricunga, Copiapó, Atacama Region, Chile, at elevation 3933m, 7 = *Adesmia aegiceras* Phil., the larval host plant of *Pseudolucia maricunga* sp. n, in bloom; 8 = a pair of guanacos (*Lama guanicoe*) grazing *Adesmia* in the type locality, in the foreground *Adesmia* cushions (photos: D. Benyamini)

matine pattern in brownish ground colour. The species closely resembles *P. sibylla* known from the Coquimbo area (for detailed diagnosis see under the name *Pseudolucia penai* in Bálint et Johnson1993: 21), but the underside ground colour is pale brown (grey in *P. sibylla*), the upperside has less blue colouration in the postmedian area in both wings (completely blue in *sibylla*), female dark margin is wide (often ornamented by white intercellular spots in *sibylla*) and the ventral pattern of the wing surfaces is less distinctive, especially the forewing postmedian and hindwing median spots (fully developed and conspicuous in *sibylla*). Genitalia typical of the group as diagnosed in the key, but according to the number of dissections the male valva is shorter and wider, therefore it looks more robust compared to relatives (Fig. 5). Male genitalia measurements in mm (n = 2). AB = 2; C = 1.35; CD =0.7; E = 1.5; E = 0.16.

Type locality – Cuesta Codoceo, Salar Maricunga, Copiapó, Atacama Region (Chile), elevation: 3933 m, coordinates: 26° 50' 14" S; 69° 13' 13" W (Fig. 6).

Distribution – Geographical: known from the regions Atacama (type locality) and Antofagasta (Rio Frio, Parque Nacional Llullaillaco, Cordillera de Domeyco). Spatial: all the specimens were collected in the subalpine vegetational belt between elevations 3524–4200 m. Temporal: all the specimens were collected in the middle of November (Antofagasta), December (Atacama).

Larval host plant – *Adesmia* aff. *aegiceras* Phil. (Fabaceae) (Figs 7–8).

Etymology – Named after the type locality, which is a mountain pass descending to Salar Maricunga.

DISCUSSION

As mentioned in the introduction, the *argentina* species group is more closely related to *Pseudolucia plumbea* (Butler, 1881) and its relatives, than to the representatives of the *sibylla* group. This observation is based on the following characters of *argentina* group members shared with *plumbea* and its relatives: (1) ventral forewing ground colour vivid orange, (2) male genitalia with a membraneous sagum and a dorsally humped uncus in lateral view; and (3) female genitalia ostium is short lacking the very long central sclerotised plate pointed cephalad. The key presented above shows that the *sibylla* and the *argentina* groups can be easily separated on the basis of characters of the wings and the internal structures. Based on these results we present a new classification for the Chilean species of these groups (see Checklist below).

Looking at the life history the *argentina* group is also informative, as in contrast with *Pseudolucia plumbea* and its relatives, the members of the *argentina* group inhabit the highest elevations in the Andes. The *plumbea* group members do not penetrate into such heights. The representatives of both groups exclusively utilise

Adesmia as larval host, but one of the members of this assemblage recently discovered in Argentina takes also *Astragalus* as larval host posing interesting questions (see Benyamini 2013). Because of the high-altitude specialisation, the *argentina* group is restricted to the ranges with the highest peaks over 6500 m, in both sides of the Andes, below the Tropic of Capricorn and seems to be displaying adaptive radiation caused by the rapid holocenic desiccation of the region. Interestingly, the *plumbea* group is widely distributed southwards from the latitude 33°, also on both sides of the Andes, and beside the congener *P. magellana* Bálint, Benyamini et Johnson, 2001 (representing the *andina* group), one of the members of the group is the most southerly occurring lycaenid butterfly in the globe, recorded even from the Falkland Islands (Benyamini & Bálint, unpublished).

Recording the distribution of the *sibylla* group on the basis of available data it is obvious that the group members inhabit two kinds of habitat types, which characterise the Andean region in vegetational belts (Fig. 9) (see Villagran *et al.* 1983): (1) *P. aureliana* occurs in desert bushland (matorral) area in the relatively low elevation 2000 m at latitude 27°, whilst (2) *P. oligocyanea*, *P. sibylla*, *P. maricunga* occur in the "low Alpine (cushion belt)" and live much higher from 3200 m to 4200 m. Future faunistical exploration will reveal how far this interesting group of species extends its range northwards and how far it descends to the south. We mention here that the *sibylla* group is also represented in the eastern side of the

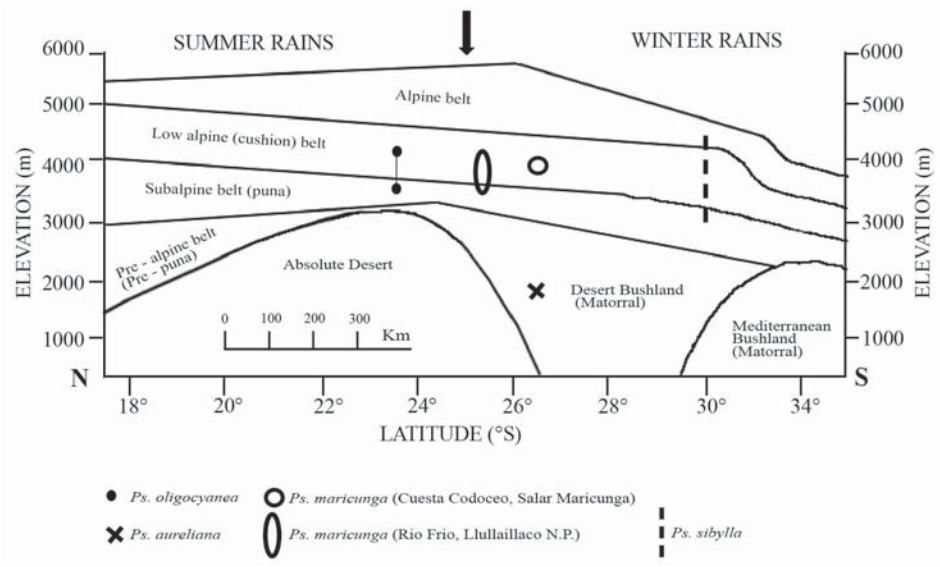

Fig. 9. Vegetation belts of the western slopes of the Andes in north Chile drawn in a schematic against elevation and latitude (modified from Villagran *et al.* 1983). Locations in habitats of various species are keyed as the symbols indicate

Andes by a still undescribed species (Benyamini & Bálint, unpublished). Its occurrence either mirrors the phenomenon that the vegetation belts characteristic for the western Andes are shifted south by several hundred kilometres in the eastern side, or it reflects the well known phenomenon evidenced by many cases that continental drift gives birth to sister species pairs or a complex of species.

Checklist of the *argentina* and *sibylla* species subgroups of *Pseudolucia plumbea* group

Pseudolucia argentina species subgroup

Pseudolucia argentina (Balletto, 1993) – Argentina: Mendoza (Paso Bermejo), Chile: Metropolitan Region.
Pseudolucia sigal Benyamini et Bálint, 2011 – Chile: Coquimbo.
Pseudolucia talia Bálint, Benyamini et Johnson, 1995 – Argentina: San Juan (Paso de Agua Negra).
Pseudolucia undescribed sp. – Argentina: San Juan (Guanaquero).
Pseudolucia undescribed sp. – Argentina: San Juan (Ansilta, Mercedario).
Pseudolucia undescribed sp. – Argentina: San Juan (Bramadero, Paso Picheraguas, El Pachon mine).

Pseudolucia sibylla species subgroup

Pseudolucia aureliana Bálint et Johnson, 1995 – Chile: Atacama.
Pseudolucia maricunga sp. n. – Chile: Atacama.
Pseudolucia oligocyanea (Ureta, 1956) – Chile: Antofagasta.
Pseudolucia sibylla (Kirby, 1871) – Chile: Coquimbo.
Pseudolucia undescribed sp. – Argentina: San Juan (Calingasta).

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