

## Notes on the identity of the male paralectotype of *Thecla heodes* and description of a new species: *Strymon cryptodes* sp. nov. from northern Peru (Lepidoptera: Lycaenidae)

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**Abstract.** A new species, *Strymon cryptodes* sp. nov. is described from puna grasslands of northern Peru. Its phenotype corresponds with the male paralectotype of a congeneric species originally described as *Thecla heodes* Druce, 1909, which, in consequence, turns out to be a mixture of two biological species. Males of *S. heodes* have conspicuous scent patches, absent in *S. cryptodes* sp. nov. The new species is known from four individuals recently collected in the vicinity of the city of Cajamarca and two historical specimens from other localities in the department of Cajamarca. Based on wing colour patterns and other morphological characters *S. cryptodes* sp. nov. is placed in the *Strymon istapa* species-group defined by Robbins & Nicolay (2002), although the presence or absence of male androconial patch and genitalia brush organ are demonstrated not to be a valid diagnostic infrageneric character.

**Keywords.** Andes, Cajamarca, male androconial patch, new species, Peru, syntype.

### INTRODUCTION

*Thecla heodes* Druce, 1909, was described on the basis of two syntypes, a supposed male from „Uramarca” (=Yuracmarca, Ancash) and a supposed female from „San Marcos” (in all probability San Marcos, 50 km SE of the city of Cajamarca, approximately 2250 m). The „male” of *Thecla heodes* turned out to be a female and was selected as the lectotype of this species (Johnson *et al.* 1992). Accordingly, the second specimen became automatically a paralectotype. The genitalia of both type specimens were also figured (Johnson *et al.*, op. cit., figs. 14a, 14b). The identity of *Thecla heodes* was again recently discussed, its placement in the genus *Strymon* was

confirmed, and the type material was briefly reviewed (Bálint & Benyamini, 2017). It was suggested that the labels of these two type specimens have been inadvertently changed (see D’Abrera 1995). Although, the first author (ZB) suspected that the male paralectotype of *Thecla heodes* represents another, by then undescribed species, this was not expressed in the paper, because no evidence could have been presented due to the difficulty in acquiring necessary information on the specimen. During recent sampling in cloud forests and puna habitats of the Andes in northern Peru three males and one female of an unrecognized *Strymon* species were collected. Their phenotype appeared to match perfectly that of the male paralectotype of *Thecla heodes*, thus it

became obvious that the syntypes of *Thecla heodes* are, actually, a mixture of two biological species, one of them so far unnamed.

## MATERIALS AND METHODS

A total of 600+ specimens of *Strymon* were examined in the Hungarian Natural History Museum, Budapest, Hungary (HNHM), ~150 specimens in the Nature Education Centre, Jagiellonian University, Kraków, Poland (CEP-MZUJ), and ~300 specimens in the collection of Pierre Boyer, Le Puy Sainte Réparate, France (PBF) (to be deposited in CEP-MZUJ). Additional material of the genus *Strymon* was examined in the Natural History Museum (UK, London) (NHMUK) by the first author (ZB).

Field work methods consisted in sampling with the use of standard entomological nets, with 1,5–2,5 m extension tubes. Collecting sites coordinates and altitude above sea level were recorded with a GPS.

Laboratory studies included standard entomological techniques (Winter 2000). Terminal parts of the abdomen were removed and soaked in 10% KOH solution for 5–10 minutes. Subsequently, abdomens were preliminarily cleaned out of soft tissue in water in order to expose genital parts. Dissected genitalia were cleaned out of water by using ethanol 90% and 95% solutions. Female abdomen was stained in chlorazole black in order to identify soft genital parts. Nikon digital camera DS-Fi1 and Olympus SZX9 stereomicroscope were used for taking pictures of the dissections, which were then processed in Combine ZP and Corel PHOTO-PAINT X3 programs to enhance focus and improve quality. Genital dissections were kept in glycerol in microvials pinned under corresponding specimens. In the HNHM an Olympus 70SZX12 optical stereo microscope was used to examine specimen anatomy and for digitalisation an Olympus DP70 digital camera attached to the microscope has been used. In CEP-MZUJ Nikon digital camera DS-Fi1 and Olympus SZX9 stereomicroscope were used for taking pictures of the dissections, which were then pro-

cessed in Combine ZP and Corel PHOTO-PAINT X3 programs to enhance focus and improve quality.

Nomenclature of wing colour patterns and genitalia are compatible with papers dealing with *Strymon* by Robbins & Nicolay (2002), and Nicolay & Robbins (2005).

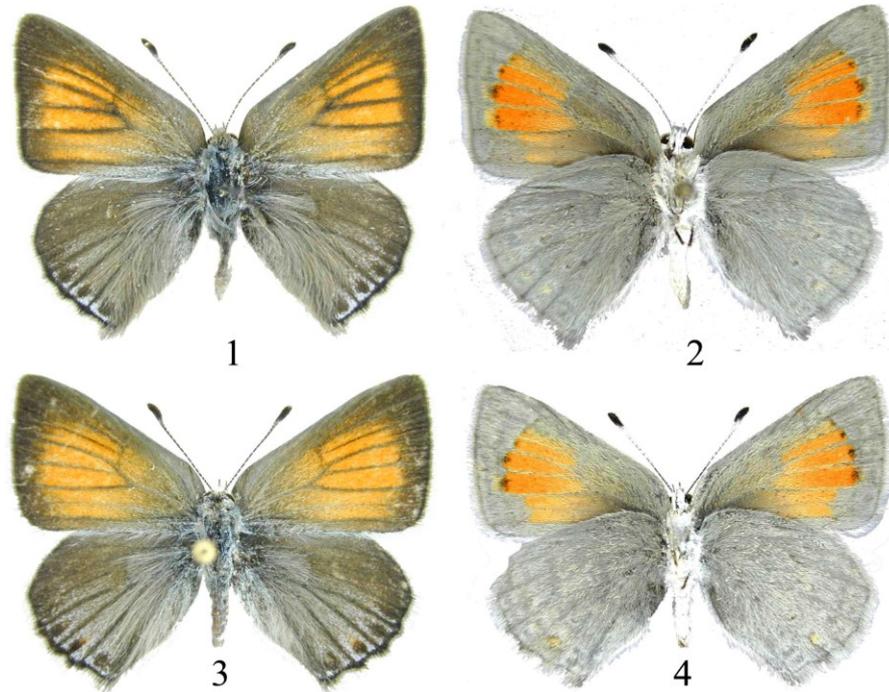
## RESULTS

### *Strymon cryptodes* sp. nov. Bálint, Cerdeña Gutierrez, Boyer & Pycrz

(Figures 1–13)

*Type material. Holotype* (♂): forewing length 13 mm, Aylambo, au dessus de Cajamarca, 3200 m, S 07°14'25" / W 78°29'20", Cajamarca, Pérou, 17/6/2018 (white label), currently in PBF, to be deposited in Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima (MUSM). *Paratypes* (4 ♂ and 1 ♀): 1 ♂: same data as the holotype, in HMNH, prep. genit. Bálint no. 1645 (paratype no. 1); 1 ♀: same data as the holotype, prep. genit. Bálint no. 1646, in PBF (paratype no. 2); 1 ♂: Peru, Depto. Cajamarca, Cajamarca, Aylambo, 3200–3250 m, 17. VI.2018, leg. T. Pycrz (white label) prep. mol. 391/26.08.2018 (green label); prep. genit. 1375, 31.08.2018/K. Florczyk (white label), Peru, Delegacja CEP-MZUJ 22/2018 (blue label), in CEP-MZUJ (paratype no. 3); 1 ♂: „San Marcos” (= San Marcos, Cajamarca; Lamas, pers. comm.), paralectotype of *Thecla heodes* (see: Fig. 12) (paratype no. 4.), in NHMUK; 1 ♂: „Guarapunga” (= Huayrapongo, Cajamarca; Lamas, pers. comm.), Simons, November 1899 (see Fig. 12), in NHMUK (paratype no. 5).

*Classification and generic placement.* All the species of Lycaenidae of the tribe Eumaeini possess the following three diagnostic characters: (1) ten forewing veins; (2) „greyhound shaped” male genitalia without a sclerotized juxta; (3) male foretarsus fused, used for walking, and stubby tipped (Eliot, 1973). All the species belonging to the genus *Strymon*, including the new species, have setae on the dorsal valva surface



**Figures 1–4.** *Strymon cryptodes* type material, in dorsal and ventral views. 1–2 = male holotype, 3–4 = female paratype no. 3. (in same magnification; holotype forewing costa length: 13 mm).

modified into anteriorly pointing teeth (*cf.* Fig. 6) and most of them have brush organs on the dorsal vinculum (Robbins & Nicolay 2002). The new species is assigned to the *Strymon istapa* species group because: (1) it has no basal patch of white scales on the ventral surface of the hindwing; (2) aedeagus tip is down-turned with a single slender cornutus; (3) ductus bursae is simple with a sclerotized loop; (4) ductus seminalis arises from the unsclerotized posterior end of the ductus bursae; and (5) female's 8<sup>th</sup> tergum is furrowed and with imbedded presumed vestigial spiracles (*cf.* Fig. 11) (Robbins and Nicolay 2002).

**Diagnosis.** *Strymon cryptodes* sp. nov. is distinguished from other *Strymon istapa* group species by a combination of the following characters: (1) no scent patch (*S. nivea* (Johnson, Miller & Herrera, 1990), *S. oribata* (Weymer, 1890), *S. patagoniensis* Johnson, Miller & Herrera, 1992 (regraded as a junior subjective synonym of *S. rana*; see Warren *et al.* 2017), and *S. rana* (Schaus, 1902) have no scent patch, but all these species have all brown wings dorsal surface); (2) male

with wide forewing orange patches (*S. bicolor* (Philippi, 1859), *S. flavaria* (Ureta, 1956), *S. heodes* and *S. wagenknechti* (Ureta, 1947), are similar in this respect, but they all have a large scent patch); (3) an ash-grey, almost patternless hindwing ventral surface.

**Description.** Male (Figs. 1–2) and female (Figs. 3–4) are externally similar, sexual dimorphism is limited to wingshape: male forewing outer margin is straight, female forewing outer margin is slightly convex. Forewing costa length 13 mm (n=5). **Dorsal wingsurface** (Figs. 1, 3): Forewing postdiscal area orange, no scent patch. Costa, outer and submargin area dark brown or black, veins covered by black scales; fringes white. Basal area and inner margin covered by long hairs. Hindwing ground colour same as the forewing costal and marginal areas with black submarginal spots with dusting of blue scales between veins M3 and 2V. Basal and discal area covered by long hairs. Outer margin without tail-like extensions. Fringes white. **Ventral wingsurface** (Figs 2, 4): Forewing postdiscal area orange with faint intercellular spots between



**Figures 5–9.** *Strymon cryptodes* male genitalia. 5 = genitalia capsule in lateral view (holotype), in the lower valval edge with anteriorly pointed setae traces well visible, pointed by the arrow (better seen under larger magnification) (scale bar: 2 mm), 6 = genitalia capsule in lateral view (aedeagus removed) (paratype no. 1), 7 = aedeagus in lateral view (paratype no. 1.), 8 = genitalia capsule in dorsal view (aedeagus removed) (paratype no. 1.), 9 = aedeagus in dorsal view (paratype no. 1.) (scales as indicated).

**Figures 10–11.** *Strymon cryptodes* female genitalia. 10 = ductus and bursa (scale bar: 1 mm), 11 = 8th tergite, the furrowed area pointed by the arrow (better seen under larger magnification) (scale as indicated).

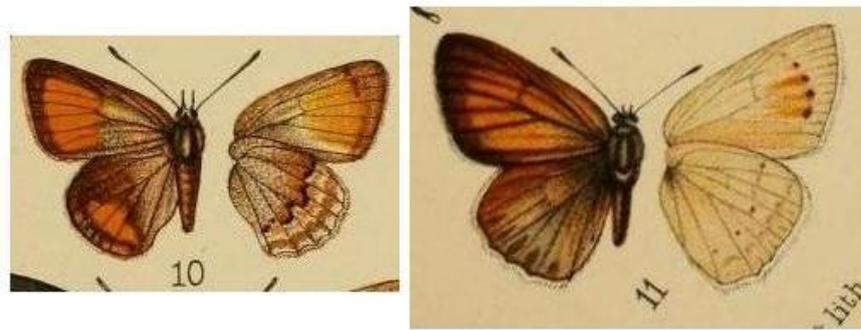
veins M1-Cu1. Costa, outer and inner margin ash grey. Fringes white. Hindwing also ash grey, with pattern hardly visible. Fringes white. *Head*: Frons grey with dark piliform scales intermixed. Antenna black dorsally, ash grey ventrally, with about 18 white-ringed segments and a club with about 15 segments. Nudum confined to club. *Genitalia* (Figs. 5–11): Male genitalia typical of *Strymon istapa* group with a downturned aedeagus bearing a single cornutus, but without a brush organ. Female genitalia also typical of *Strymon istapa* group with no bursal sclerotization at the antrum, with a simple loop of ductus.

*Individual variation.* There is no significant variation in wingshape, colouration or pattern, except for the submarginal blue scaling on the hindwing dorsal surface: it is restricted to the antemarginal area, but when it is more extended,

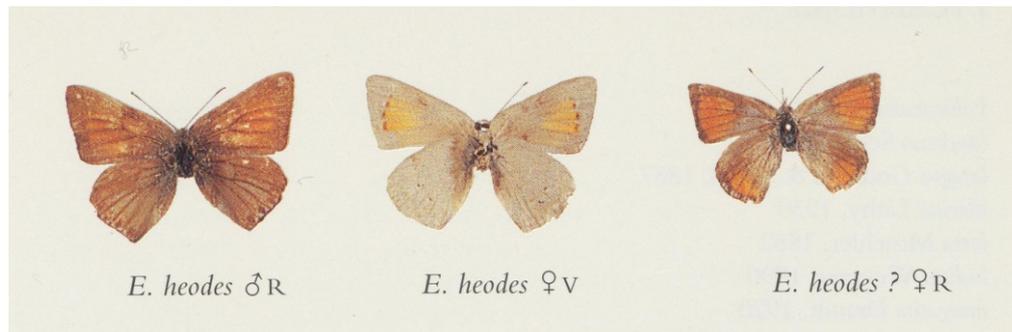
black submarginal spots are formed. Another interesting aspect is provided by the hindwing underside pattern, which is almost immaculate in the recently collected type material, but the „female” paralectotype of *Thecla heodes* shows some traces of a postmedial pattern (see: Figs. 12–13).

*Distribution.* So far this species is known only from three localities in the department of Cajamarca, Aylambo, Huayrapongo and San Marcos. The type locality is situated some 8km SSE from the city of Cajamarca centre (Fig. 14).

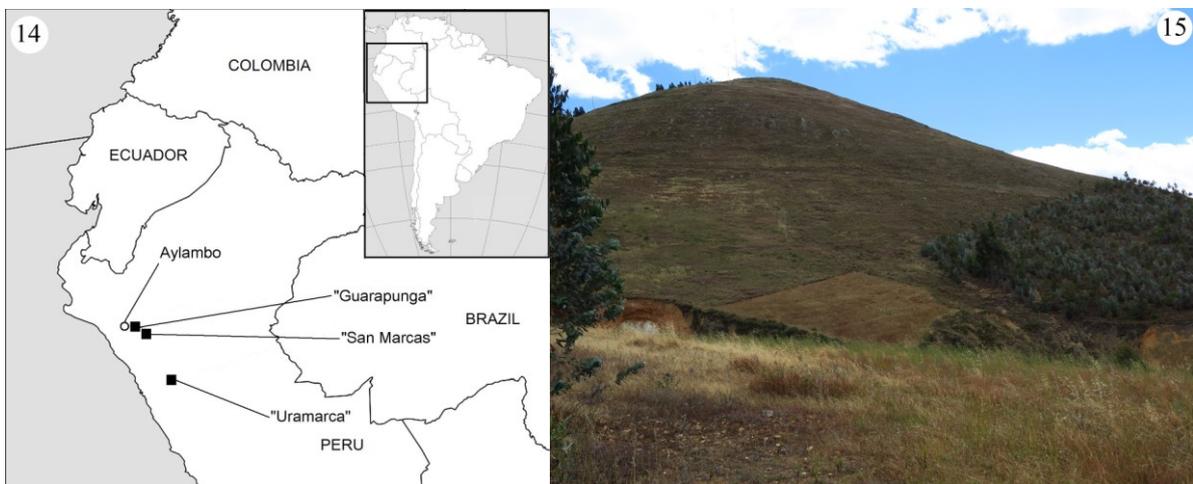
*Bionomics.* The habitat of *Strymon cryptodes* sp. nov. is dry puna sparsely covered with grasses and different kinds of bushes and perennial plants. The type locality is highly threatened by the spreading of crops (mostly potatoes) and the plantations of *Eucalyptus* (Fig. 15). This site was



**Figures 12.** Images of *Thecla heodes* in the lithographic plate of Druce 1909. Left = type „male” (= lectotype female); right = type „female” (= paralectotype male; *Strymon cryptodes* sp. n., paratype no. 4.).



**Figures 13.** Documentation of „*Eiseliaria heodes* Druce, 1909” in the folio plate of D’Abrera (1995). Left = male, „Guarapunga” (*Strymon cryptodes* paratype no. 5), middle = male, „San Marco” (= *Thecla heodes* paralectotype „female” = *S. cryptodes* paratype no. 4), right = female, „Uramarca” (= *Thecla heodes*, lectotype = *Strymon heodes*).



**Figure 14.** Known localities in department Cajamarca, Peru, where *Strymon cryptodes* has been recorded: Aylambo, type locality; „Guarapunga” = Huayrapongo, collecting site of paratype no. 5, „San Marcos” = San Marcos, collecting site of paratype no. 4 (male paralectotype of *Thecla heodes*). The type locality of *S. heodes* is also indicated as „Uramarca” (= Yuracmarca, Ancash).

**Figure 15.** The type locality of *Strymon cryptodes* in department Cajamarca, Peru: Aylambo, 8km SSE from Cajamarca, 3200 m, S 07°14'25" / W 78°29'20" (photo: Pierre Boyer).

visited 20 years ago by one of the co-authors (TWP) who observed that most of the original puna vegetation of the area was already lost. *Strymon cryptodes* flies quite rapidly, low above the ground. It was seen visiting flowers. Ovipositing was not observed. It is found in company of *Argyrophorus blanchardi blanchardi* Pyrcz & Wojtusiak, 2010 (Satyrinae), which was described from the same spot (Pyrcz & Wojtusiak 2010), and of *Euptoieta sunides* (Hewitson, 1877) (Heliconiinae), among others.

*Etymology*: The species-group name is used to signify that the identity of the species has been hidden („cryptic” = κρυπτός (*kryptós*) in Greek) for more than one century. It is a Latinized masculine noun formed in rhyme with the species-group name of the similar congener *Strymon heodes*.

## DISCUSSION

### Further historical specimens and identification

Apart from four individuals collected recently, two historical specimens were positively identified as representing the new species. However, Johnson *et al.* (1992) mentions another male of *Strymon heodes* from „Pampa Incas” (= Baños del Inca, Cajamarca; cf. Lamas 1976) in NHMUK, not examined, but considering the locality there is a possibility that it represents yet another specimen of *S. cryptodes*.

*Strymon cryptodes* is easy to identify by three distinguishing characters. The first is the lack of the male scent patch. All the species in the *Strymon istapa* group without scent patch have brown dorsal wingsurface. The other *Strymon* species without scent patch, representing other *Strymon* species groups, can be also easily discriminated on the basis of the orange coloured dorsal wingsurfaces, which was the second important character we pointed out in the diagnosis. All *Strymon* species with orange dorsal wingsurfaces have scent patch in the males and the hindwing ventral surface is patterned. The almost patternless hindwing ventral surface, the third wing

character we mentioned, typifies *Strymon ahrenholzi* Nicolay & Robbins, 2005, but that species has scent patch in the male and a dark brown dorsal wingsurface in both sexes. All the other species of neotropical *Strymon* have patterned ventral hindwing surfaces.

### Characters

Johnson *et al.* (1992) partly misdiagnosed the genus *Heodes* (type species: *Thecla heodes* Druce, 1909), indicating that „though worn, the original presence of hindwing tails is apparent on all known specimens” (*l.c.*, p. 130). However, it became evident now that *Strymon heodes* is not tailed (Bálint & Benyamini 2017). The genus-group name *Heodes* was placed in synonymy by Robbins & Nicolay (2002)

The presence or the absence of the male scent patch is a somewhat discordant character in the systematics of *Strymon*, in particular in its division into putatively monophyletic groups. According to Robbins & Nicolay (2002) the absence of dorsal forewing scent patches is a diagnostic character of the *Strymon melinus* group, which harbours six species. However, in an other group, the *Strymon martialis* group constituted only by two species, one of them have a scent patch, and one has not (Nicolay & Robbins, 2005). Furthermore, in *Strymon istapa* group, *S. oribata* (Weymer, 1890) also lacks this male sexual character, and neither *S. nivea* (Johnson, Miller & Herrera, 1992) nor *S. rana* (Schaus, 1902) possess a scent patch. In the light of the above, further research is needed on this issue.

The male genitalia of *Strymon cryptodes* have no brush organ. Although in the general diagnosis of *Strymon* Nicolay & Robbins (2005) indicated the presence of the organ in general, they pointed out elsewhere (Robbins & Nicolay 2002) that some species of the *S. istapa* group in southern North America and in Mesoamerica may also lack brush organs. They also mentioned that *S. bicolor* was variable in this respect. However, the senior author dissected ten individuals of *S. bicolor* from Chile and Argentina, and found brush organs in none of them. Similarly, no brush organ in the

specimens of *S. flavaria* and *S. heodes* were found, but *S. wagenknechti* possessed the organ. Probably, the character state of male brush organ also indicates closer interspecific relationships. Further research is needed also on this topic.

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