



## A new genus and new species of metalmark moths (Lepidoptera: Choreutidae) from Costa Rica

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### Abstract

*Alasea*, new genus, is described and illustrated. As currently defined, *Alasea* is monotypic with the single species *A. corniculata*, **n. sp.**, from Heredia, Limón, and Puntarenas provinces in Costa Rica. The new genus is assigned to the subfamily Choreutinae based on morphological and molecular data. As in other choreutines, *Alasea* has a bluntly pointed forewing and hindwing (in Brenthiinae the wings are obtuse); the basal segment of the labial palpus is parallel-sided (in Brenthiinae it is narrowed basally); and the basal flagellomeres of the antenna are heavily scaled (in Brenthiinae such scaling is never present). The immature stages and the biology of *A. corniculata* are unknown. Additionally, the terminology and homology of genitalic characters used in descriptions of Choreutidae are reviewed, and suggestions for more consistent usage are provided.

**Key words:** *Alasea corniculata*, biodiversity, Brenthiinae, Choreutinae, microlepidoptera, Neotropical

### Introduction

Metalmark moths (Choreutidae) are a little known microlepidopteran family with about 406 described species in 19 genera (Rota 2003). Although choreutids are found in all biogeographic regions, they are most diverse in the New and Old World tropics, and as suggested by extensive sampling within Costa Rica, much of that diversity is still unknown. About 40% of Costa Rican choreutid species represented in collections worldwide are undescribed (Rota 2003).

Over the past two decades, two large-scale projects have been conducted in Costa Rica focusing on documenting the biodiversity of this small Central American country: Dan Janzen's caterpillar-rearing project in the Area de Conservación Guanacaste (Janzen and Hallwachs 2008) and the Arthropods of La Selva Project (ALAS) (Colwell and Longino 2008). While the former is ongoing, the latter project involved an inventory of various insect groups at the La Selva Biological Station reserve and the adjacent Braulio Carrillo National Park from 1991 to 2005. As a result of these projects, many new taxa have been discovered and described (e.g., Brown and Nishida 2003, Erwin 2004), and our understanding of arthropod diversity has grown significantly.

In this paper I describe a new monotypic genus from Costa Rica. Specimens were first collected during the ALAS project, and these were assigned provisionally to *Caloreas* Heppner. However, further examination of their adult morphology and molecular markers shows that this species requires placement in a new genus. Problems involving the homology of certain genitalic characters within Choreutidae are discussed in the section that follows. There is some confusion as to which terms should be applied to what structures due to the use of different terms for the same structure by different (and sometimes even the same) authors. Based on definitions of Klots (1970), I provide a brief review of widely used terms and suggest which terms may be most appropriate for the structures in question in Choreutidae.

## Material and methods

Wing slides were prepared according to Zimmerman (1978). The following protocol was used for the dissection of genitalia: an abdomen was placed into ~10% KOH overnight; it was then warmed up for an hour on a hot plate; then it was transferred into water, where initial cleaning was undertaken and the genitalia were separated from the pelt. Further cleaning was done in cellusolve; clean genitalia were stained with chlorazol-black and then transferred into a graded ethanol series (70-95%). Finally, the genitalia and the pelt were slide-mounted using Euparal. To avoid the distortion of structures, valvae of male genitalia were not spread. It is important to note that such mounting of genitalia results in the inverted placement of ventral and dorsal sides of the valvae from the usual (see Klots 1970 for the usual arrangement). The spermatophore in mated females was left *in situ*. Measurements were made with an ocular micrometer in a stereomicroscope. Wing venation was illustrated using a camera lucida. Genitalic slides and adult specimens were photographed using a Microptics digital imaging system and enhanced in Adobe Photoshop©.

Terminology for wing venation follows Common (1990). Genitalic terminology in usage by lepidopterists is complex and homologies are not clear (e.g., compare descriptions of different families in Kristensen 1998). Even in a relatively small family such as Choreutidae, in which there have been only a few major workers, there is some inconsistency in the term(s) applied to the same structure. In order to minimize ambiguity, I here define my usage of various terms. In general, I follow Klots (1970): the tegumen is a dorsal hood-like structure; the vinculum is a ventral, variously shaped, complementary structure to the dorsal tegumen; together the tegumen and the vinculum form a continuous sclerotized ring to which the valvae are attached; the saccus is a blind sac extending cephalad from the vinculum; the juxta is a sclerotized plate ventrally attached to the phallus; the phallus consists of phallobase and aedoeagus; and the cornutus is a sclerotized spine or scobinate patch on the vesica (the invaginated distal end of aedoeagus). The dorsal edge of the valva is referred to as the costa and ventral edge as the sacculus. Papillae anales are external lobes around the anal opening and ovi-porus; apophyses anteriores and posteriores are sclerotized apodemes of the 8<sup>th</sup> and 9–10<sup>th</sup> segment, respectively; the ostium bursae is the opening leading into the ductus bursae; the ductus bursae is a duct leading from the ostium to the corpus bursae; and the signum is a sclerotized structure on the wall of the corpus bursae.

One of the problematic terms in choreutid descriptions is socius, defined by Klots (1970) as one of paired structures arising from the caudal margin of the tegumen that is usually blunt, soft, and densely hairy. In *Prochoreutis* Heppner this structure was considered the subscaphium by Arita (1987); the socius by Diakonoff (1986), Danilevsky and Kuznetsov (1989), and Heppner (1991a); and a socius-like setaceous area by Heppner and Duckworth (1981). Because it is unclear whether this setaceous area is homologous with the socius, I follow Heppner and Duckworth (1981), using their descriptive term socius-like setaceous area.

Similar confusion exists in the usage of anellus and juxta. These two terms have been applied to the same structure by different authors: anellus by Diakonoff (e.g., 1986) and Heppner (e.g., 1991b), anellus-juxta by Heppner (e.g., 1991a), and juxta by Danilevsky and Kuznetsov (1989). As defined by Klots (1970), the anellus is a fold of the diaphragma (a transverse membranous sheet closing the posterior end of the abdomen) around the phallus, and the juxta is the shield-shaped structure in the ventral region of the diaphragma. I use the term juxta.

Institutional abbreviations for deposition of type material are as follows: BMNH = The Natural History Museum, London, Great Britain; INBio = Instituto Nacional de Biodiversidad, Santo Domingo, Costa Rica; RMNH = Nationaal Natuurhistorisch Museum, Leiden, the Netherlands; UCMS = University of Connecticut Insect Collection, Storrs, CT, U.S.A.; USNM = National Museum of Natural History, Washington, DC, U.S.A.

Additional abbreviations are as follows: DC = discal cell; FW = forewing; HW = hindwing.

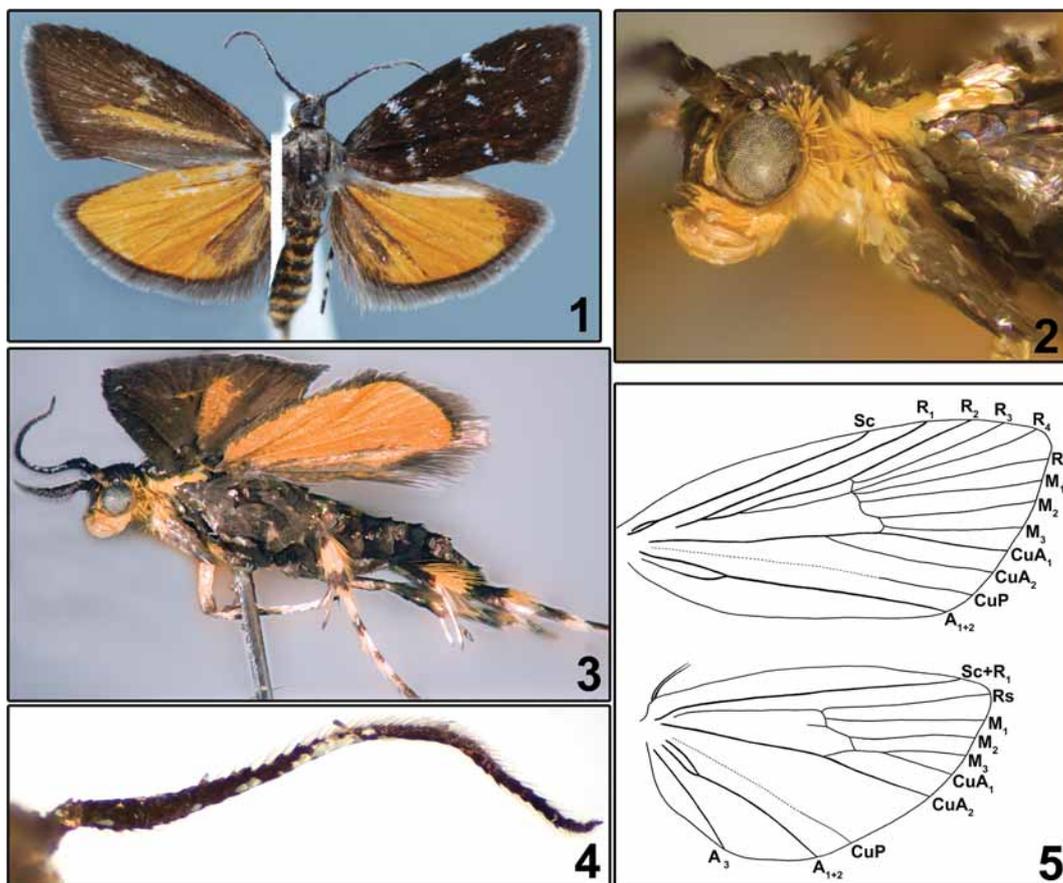
## Systematics

### *Alasea* Rota, new genus

Figs. 1–8

**Type species:** *Alasea corniculata* Rota, new species.

**Diagnosis:** *Alasea* can be easily distinguished from the New World genera *Anthophila* Haworth, *Caloreas*, *Melanoxena* Dognin, *Prochoreutis*, *Tebenna* Billberg, and *Tortyra* Walker based on wing shape and wing pattern. The combination of an almost black forewing with metallic specks and an orange-yellow hindwing with a narrow black border is unique (Fig. 1) among these genera. In *Choreutis* Hübner the labial palpus is dilated distally and the corpus bursae has a signum (in *Alasea* the labial palpus is pointed distally and the corpus bursae has no signum). *Rhobonda* Walker has a much greater forewing length (8 mm vs. 5 mm in *Alasea*). *Hemerophila* Hübner species have much broader wings (length to width ratio ca. 1.9:1 for forewing and 1.3:1 for hindwing vs. 2.3:1 and 1.9:1 of *Alasea*), differently shaped valvae (long and narrow, with costa and sacculus similarly developed vs. short and wide, with long horn-like projection of costa in *Alasea*), and a corpus bursae with a signum (absent in *Alasea*). In *Zodia* Heppner the wings also are broader than in *Alasea*, there is no saccus, and a signum is present.



**FIGURES 1–5.** Morphological features of *Alasea corniculata*. 1. Adult male holotype; upperside on right, underside on left; 2. Head, lateral view; 3. Adult male holotype, lateral view; 4. Antenna of the male holotype; 5. Wing venation (JR2003-1, INBio).

**Description.** *Head:* Frons smooth, with metallic sheen. Vertex with loosely appressed piliform scales. Eye bordered by piliform scales ventrally and laterally (Fig. 2). Labial palpus upturned, smooth-scaled; length

ca. 1.3 times horizontal diameter of compound eye (Fig. 2). Haustellum well developed, basally with two rows of scales thickly arranged. Antenna ca. 0.5 times length of FW; basal 5–7 flagellomeres heavily scaled dorsally; sensillae ca. 1.5 times flagellomere diameter in male, ca. 0.5 times in female (Fig. 4). Ocellus large. Chaetosema absent.

*Thorax:* Smooth-scaled, with metallic sheen. Legs with tibial spur pattern 0-2-4; long piliform scales on tibia of meso- and metathoracic leg (Fig. 3). FW with apex bluntly pointed, tornus rounded; length ca. 2.3 times width; DC length ca. 0.55 times FW length; width of DC ca. 0.18 times DC length;  $CuA_2$  originating ca. 0.8 along length of DC;  $R_4$  and  $R_5$  connate, all other veins separate beyond DC; chorda present;  $M_3$  and  $CuA_1$  approximate at cell; apical 0.33 of CuP present (Fig. 5). Hindwing elongate, apex bluntly pointed, anal region rounded. Length ca. 1.9 times width; length of DC ca. 0.5 times HW length; width of DC ca. 0.2 times DC length;  $Sc+R_1$  at costa before apex;  $R_s$  to costa at apex; vestigial M vein present in cell;  $M_3$  and  $CuA_1$  stalked ca. 0.3 distance; apical 0.25 of CuP present (Fig. 5).

*Abdomen:* Male genitalia (Fig. 6) with tegumen large, 1.5 times longer than vinculum, V-shaped with rounded dorsum. Small socius-like setaceous area subdorsal on tegumen. Vinculum triangular; saccus broad, short. Valva short, wide in basal 0.5; distal 0.5 represented primarily by curved horn-like projection from costa, extending beyond sacculus; costal horn-like projection with spine at distal end; sacculus convex; valva with sparse setae scattered throughout, except in mesal portion. Juxta vase-shaped, narrowing dorsally. Phallus ca. 2 times length of costa of valva; basal 0.67 represented by phallobase, distal 0.33 by aedoeagus; both parts of similar width; vesica with sclerotized plate distally (=cornutus?) (Fig. 7). Female genitalia (Fig. 8) with papilla analis typical for the family; setaceous on lateral and posterior margins. Cone-shaped sclerotization between papillae anales, around oviporus. Apophysis posterioris slender throughout; ca. 1.5 times as long as anterioris and about 0.33 as thick. Apophysis anterioris greatly enlarged posteriorly, tapering anteriorly; posterior 0.5 not free from membrane. Ostium on membrane between segments 7 and 8. Ductus bursae 0.17 as wide as long; posterior 0.25 slender, uniform in width almost to corpus, then broadened slightly just before junction with corpus; with slight twist less than one revolution. Corpus bursae ovate; small, about twice as broad as ductus in mated females (no unmated females examined); anterior 0.5-0.7 spiculate; without signum.

**Etymology:** The generic name is derived from the name for the ALAS project, during which this genus was discovered; it is female in gender.

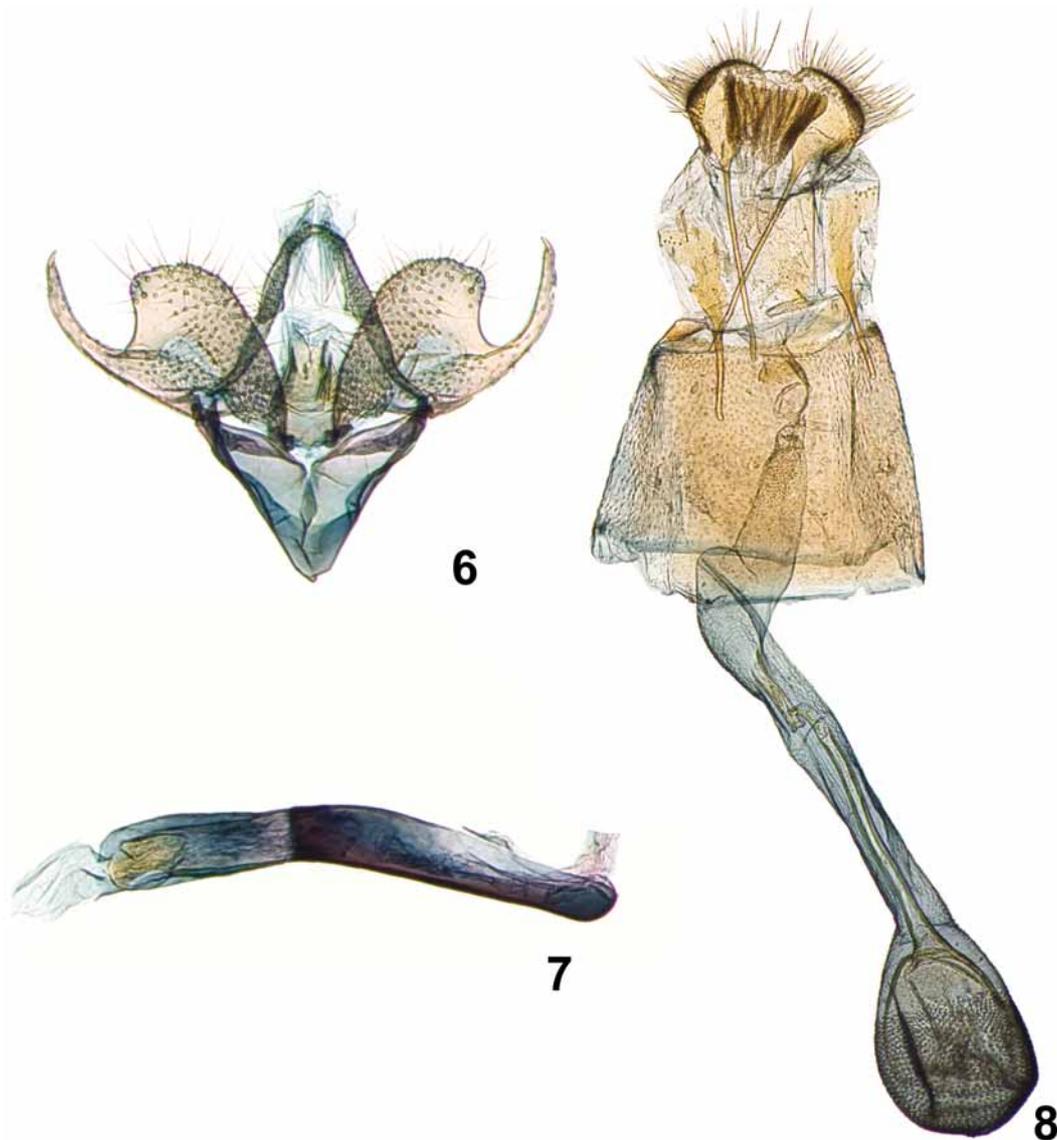
### *Alasea corniculata* Rota, new species

Figs. 1–8

**Description. Male. Head:** Frons and vertex dark fuscous with metallic blue-green sheen. Eye bordered by orange-yellow scales mesally, ventrally, and laterally (Fig. 2). Labial palpus orange-yellow laterally and pale yellow mesally, with dark fuscous tip (in some specimens reduced to a few fuscous scales) (Fig. 2). Proboscis with pale yellow scales basally. Antenna fuscous with metallic purple sheen, flagellomeres from about 0.3 to 0.7 length of antenna with patches of silvery-white scales (Fig. 4).

*Thorax:* Dark fuscous with metallic blue-green sheen; ventrally with large creamy-yellow scales anteriorly; creamy-yellow band from head towards wing base (Fig. 3). Legs with alternating fuscous and orange-yellow bands on tibia; tarsus with alternating fuscous and white bands; each of these light-colored bands on tibia and tarsus accompanied by elongate piliform scales of same color (Fig. 3). Forewing length 4.5–5.2 mm ( $n = 10$ ). Upper side dark fuscous with irregular silvery-white streaks and spots (Fig. 1). Incomplete antemedial band formed by silvery-white scales. Silvery-white streak at 0.6 costa curving towards apex. Underside fuscous with metallic bronze sheen; longitudinal orange-yellow streak from base towards apex to 0.75 length; orange-yellow spot above this streak approximate to wing center. Fringe light fuscous, with some pale-tipped scales, and with metallic sheen. Hindwing with upper side orange-yellow; with area of dark fuscous scales at

base, apex, and anal region; area of white scales along costal margin (Fig. 1). Black terminal band from costa, starting before apex and extending to the anal area. Fringe light fuscous with metallic sheen; most scales pale-tipped. Underside similar to upper side, but dark fuscous scales absent at base and apex, present only in anal region, sometimes in streaks, sometimes covering entire anal area.



**FIGURES 6–8.** Genitalia of *Alasea corniculata*. 1. Male holotype genitalia with phallus removed and valvae not spread (slide JR2008-50, INBio); 2. Phallus (slide JR2008-50, INBio); 3. Female genitalia (slide JR2008-29, INBio).

**Abdomen:** Light fuscous with seven irregular orange-yellow annulations posteriorly on each segment; annulations more pronounced dorsally than ventrally. Genitalia (n = 8) as described for genus (Figs. 6, 7).

**Female. Head and thorax:** As described for male. Length of forewing 5.2–5.7 mm (n = 9).

**Abdomen:** Genitalia (n = 5) as described for genus (Fig. 8).

**Holotype.** Male, Costa Rica, Province Heredia, La Selva Biological Station, 50–150 m, 10°26' N, 84°01' W, 22–29 Jan 2000, at MV light, L/00/666, coll. D. Wagner, CRI002724390, genitalia slide JR2008-50. Holotype deposited in INBio.

**Paratypes.** Costa Rica: Province Heredia: La Selva Biological Station, 50–150 m, 10°26' N, 84°01' W, 8–25 Mar 1999 (1 ♂), area laboratorios, L/00/594, CRI002739331, genitalia slide JR2008-48 (JR collection); 22–31 Mar 2001 (2 ♂), at MV/UV light, colls. D. Wagner, J. Rota, INB0003205582, genitalia slide JR2008-

49 (USNM) and INB0003205569, genitalia slide JR2008-47 (BMNH); 20 Apr 1999, bosque secundario, L/08/621, CRI001284938 (1 ♂) (RMNH) and CRI001284937 (1 ♀), wing slides JR2003-1 and JR2003-2 (INBio); 23–29 Feb 2004 (1 ♀), at MV light, coll. D. Wagner, INB0003609767, genitalia slide JR2008-51 (USNM); 9 Mar 2004 (1 ♀), canopy UV light trap, colls. G. Brehm, J. Rota, INB0003611787, genitalia slide JR2008-52 (JR collection); 10–25 Jan 1999 (1 ♂), at light, coll. D. Wagner, genitalia slide JR2008-45 (UCMS); 28 Jun 1994 (1 ♀), bosque secundario, L/06/107, CRI001243945 (INBio); 10 May 1996 (1 ♀), biblioteca, L/04/237, CRI002062296, genitalia slide JR2008-29 (INBio); 6 Apr 1999 (1 ♀), bosque primario, L/09/610, CRI001285629 (INBio). Braulio Carrillo NP, Est. Magassay, 200 m, Dec 1990 (1 ♂), L N 264600 531100, coll. M. Zumbado, CRI000228433, genitalia slide JR2008-46 (INBio); 11 km ESE La Virgen, 250–350 m, 10°21' N, 84°03' W, 17 Mar 2004 (1 ♀), 03/L/00/034, UV light trap, coll. J. Rota, INB0003611759, genitalia slide JR2008-24 (INBio). Province Puntarenas: Osa Peninsula, 200 m, bosque esquinas, Mar 1994 (1 ♂), coll. M. Segura, L S 301400\_542200, #2776, CRI001757112, genitalia slide JR2008-26 (INBio); Corcovado NP, Sirena, 15–16 Aug 1980 (1 ♀), colls. D. H. Janzen and W. Hallwachs, INB0003868490, genitalia slide JR2008-25 (INBio). Province Limon: Sector Cerro Cocori, Finca de E. Rojas, L N 286000 567500, coll. E. Rojas, 150 m, Jan 1992 (1 ♂), CRI000332924, genitalia slide JR2008-23 (INBio); Nov 1990 (1 ♀), CRI000594414, genitalia slide JR2008-29 (INBio); Mar 1992 (1 ♂), CRI000363517, genitalia slide JR2007-28 (INBio).

**Remarks.** This species is relatively uncommon; it is encountered at lights and in light traps in primary and secondary forest.

**Etymology.** The species is named for the horn-shaped projection on the valva. The word is derived from the Latin adjective *corniculatus*.

**Discussion.** Currently, *Alasea* is known only from a few localities in Costa Rica. Its biology and immature stages are unknown. *Alasea* can be assigned to Choreutinae with little question. As with other choreutines, its forewing and hindwing have an acute, bluntly pointed apex (not obtuse as in Brenthiinae) (see Arita 1987, Diakonoff 1986); the basal segment of the labial palpus is parallel-sided (not narrowed basally as in Brenthiinae) (see Arita 1987); the hindwing is orange-yellow (as in many species of *Choreutis*, *Hemerophila*, and *Rhobonda*, but not in Brenthiinae); the basal flagellomeres of the antenna are heavily scaled (no such scaling occurs in Brenthiinae). In addition, preliminary results of an analysis of molecular data (to be published elsewhere) place it convincingly within Choreutinae. *Alasea* shares the presence of a small spine at the apex of the valva with *Hemerophila*, *Rhobonda*, and *Zodia*. This spine is variably developed in these groups, and it is unclear whether it represents a synapomorphy.

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