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New and interesting geometrid moths from the Cape Verde islands (Lepidoptera: Geometridae)

A. Hausmann

Abstract

New and interesting records of ten Geometridae species from the Cape Verde islands are presented. The analysis is based on both morphological and molecular traits. Two species are described as new: *Microloxia aistleitneri* Hausmann, sp. n., and *Gymnoscelis daniloi* Hausmann, sp. n.

KEY WORDS: Lepidoptera, Geometridae, new species, Cape Verde islands.

Nuevos e interesantes geométridos de las islas de Cabo Verde (Lepidoptera: Geometridae)

Resumen

Se presentan citas de diez especies de Geometridae procedentes de las islas de Cabo Verde. El análisis está basado tanto en aspectos morfológicos como moleculares. Se describen dos nuevas especies: *Microloxia aistleitneri* Hausmann, sp. n. y *Gymnoscelis daniloi* Hausmann, sp. n.

PALABRAS CLAVE: Lepidoptera, Geometridae, nuevas especies, Cabo Verde.

Introduction

Very interesting new material of Geometridae from Cape Verde islands has been collected in the years 2000-2007 by Eyjolf Aistleitner (Feldkirch, Austria / Cape Verde Islands), yielding a total of 950 + specimens and 10 species.

Material and methods

Species identification was performed by both morphometrical (incl dissections, standard method) and molecular analysis. The latter was based on a representative selection of 94 specimens examined with a mtDNA-marker, the COI 5' barcode fragment, 90 of them successfully sequenced at CCDB, University of Guelph (Paul Hebert) using standard high-throughput protocol (IVANOVA *et al.*, 2006) and analysed in the Barcode of Life Datasystems (BOLD 2008; RATNASINGHAM & HEBERT, 2007).

Images, neighbour joining tree, and further details such as voucher hosting institution, GPS coordinates and trace files can be obtained online from BOLD (2008), and from the webpage of the Cape Verde geometrids (HAUSMANN & AISTLEITNER, 2008). That strategy of multimedial publication was chosen for accelerating taxonomy (see HAUSMANN & HEBERT, 2009; HAUSMANN *et al.*, 2009a; 2009b).

Abbreviations and conventions

ZSM = Bavarian State Collection of Zoology, Munich; CV = Cape Verde islands; “the terms sequence variation” and “genetic difference” refer to the analysis of the COI 5' barcode fragment (648 bp) with Kimura 2 Parameter; at the head of the texts the islands are mentioned from which new material was recently collected by Eyjolf Aistleitner.

Systematic account

Geometrinae Comibaenini

Comibaena leucospilata (Walker, 1863)

Brava. Intraspecific sequence variation high in the CV population (max. divergence 1.6%). Populations from CV showed almost no genetic difference (0.3% minimum pairwise distance) from an examined specimen of “*Comibaena rufitornus* Prout, 1916” from Yemen which suggests a possible synonymy of *rufitornus* (locus typicus Kenya) with *leucospilata* (locus typicus South Africa, Natal). The question needs to be answered after examination of type specimens.

Hemistolini

Thalassodes quadraria (Guenée, 1858)

Brava, Fogo. Intraspecific sequence variation very low (max. divergence 0.0%; n = 10 from both islands). Sequence variation low between populations of CV and Yemen (max. divergence under 1%).

Hemitheini

Phaiogramma faustinata vermiculata (Warren, 1897)

Brava, Fogo, Sal. Intraspecific sequence variation very low (max. divergence 0.0%; n = 7 from three different islands). Sequence variation low between populations of CV, Levant and Yemen (max. divergences under 1%).

Microloxiini

Microloxia ruficornis Warren, 1897

Recorded in HERBULOT (1957: “*Microloxia herbaria*”) and BÁEZ & GARCÍA (2005: 87), but not yet collected by Eyjolf Aistleitner. Literature data possibly referring to the next species. In coll. ZSM/Herbulot no voucher.

***Microloxia aistleitneri* Hausmann, sp. n. (fig. 1)**

Holotype: ♂, Cabo Verde, Illa do Fogo, Cha das Caldeiras, Portela, 1720 m, 2-I-2005, leg. E. Aistleitner, coll. ZSM, gen. prp. no. ZSM G 11845, DNA barcode BC ZSM Lep 11579.

Paratypes: 2 ♀♀, id., 3-III-005, DNA barcodes BC ZSM Lep 11600 / 11601, gen. prp. ZSM G 11809.

Description: Wingspan 20-22, thus much larger than *M. ruficornis* Warren, 1897 from African mainland. Pale green, without wing pattern. Underside whitish green, towards forewing costa yellowish, at basal parts of forewing costa with red scales. Frons light brown with reddish tinge towards edges. Palpi with reddish scales, length in male approx. diameter of eye, in female approx. 1.3 times. Antennae bipectinate in male, with long branches, length approx. 7-8 times width of flagellum, total length approx. 0.7-0.8 mm, i.e. twice as long as in *M. ruficornis*. Female antennae dentate, without

branches. Male hindtibia without spurs, in female 2 spurs. Male genitalia (fig. 3) with harpe broadly sclerotised at base and a narrow, digitiform process at tip, in *M. ruficornis* continuously tapering. Juxta sclerite with larger posterior extension than in *M. ruficornis*. In female genitalia (fig. 4) corpus bursae much narrower and longer than in *M. ruficornis*, both signa reduced, almost invisible.

Intraspecific sequence variation very low (max. divergence 0.16%; $n = 3$). Large genetic distance (3.7%) between the new species and *M. ruficornis* (examined material from Tunisia, Egypt, Israel, Jordan, Oman, Yemen).

Etymology: The new species is named after Eyjolf Aistleitner, the discoverer and collector of the new species, in recognition of his great merits in the lepidopterous exploration of the Cabo Verde islands.

Sterrhinae
Scopulini

Scopula paneliusi paneliusi Herbulot, 1957

Antao, Vicente. N nominate subspecies recorded on Antao (locus typicus; HERBULOT, 1957), reputedly also on Santiago and “Fogo” (BÁEZ & GARCÍA, 2005: 87); see below under ssp. *subirrorata*. Newly collected specimens from Antao and Vicente well corresponding to 6 ♂♂ paratypes in coll. ZSM/Herbulot from Antao and much darker than material from other islands confirming subspecific sub-division. In COI analysis four subunits can be distinguished of which only one lineage (Antao, Vicente) refers to the nominate subspecies.

Scopula paneliusi subirrorata Herbulot, 1957

Brava, Fogo. According to BÁEZ & GARCÍA (2005: 87) subspecies *subirrorata* recorded on Brava (locus typicus), and reputedly also on Nicolau, and Vicente (cf. HERBULOT, 1957); the last however belonging to the nominate subspecies, see above. In coll. ZSM/Herbulot 3 ♂♂ from Brava, 5 ♂♂ from Nicolau, furthermore one male from Santiago, collected in 1984, but misidentified, true identity of the last mentioned specimen being *S. minorata*. New data suggesting both Brava (locus typicus) and Fogo populations to belong to ssp. *subirrorata*. Populations of islands Brava and Fogo showing comparatively large infrasubspecific sequence variation (max. divergence 0.94%, $n = 10$) in three “lineages”, two from Brava and one from Fogo.

Scopula minorata (Boisduval, 1833)

Brava, Antao, Vicente. Intraspecific sequence variation low (max. divergence 0.5%; $n = 9$ from all three islands). Low sequence divergence between populations of CV and Yemen (0.17%). In coll. ZSM / Herbulot one female from Santiago, mentioned also from Nicolau, and Tiago in HERBULOT (1957).

Larentiinae
Eupitheciini

Pasiphila derasata (Bastelberger, 1905)

Brava, Boavista, Nicolau. In coll. ZSM/Herbulot 4 males dissected from Santiago, identified as “*derasata*”, though published under the erroneous name “*Chloroclystis nanula*” in his earlier paper (HERBULOT, 1957). Intraspecific sequence variation comparatively large (max. divergence 1.3%; $n = 16$ from all three islands), not correlated with distribution on different islands of CV. In BÁEZ & GARCÍA (2005: 87) as “*Chloroclystis derasata*”, transferred to *Pasiphila* in HAUSMANN (2006). Small genetical distance (2.8%) to the nearest neighbour, *Pasiphila lita* (Prout, 1916), examined from Yemenite populations.

Gymnoscelis lindbergi Herbulot, 1957

Fogo, Brava. Wingspan 13-16 mm on the aforementioned two islands. *G. lindbergi* from locus

typicus (Antao; in coll. ZSM / Herbulot 14 ♂♂ paratypes) larger (16-20 mm), with somewhat better contrasted wing pattern, but without the blackish transverse lines of the following species. Large genetic distance (5.5%) between *G. lindbergi* (examined from Brava and Fogo) and the new species described below. Intraspecific sequence variation very low within *G. lindbergi* (max. divergence 0.16%, $n = 10$ from both Fogo and Brava islands). One male from Fogo (BC ZSM Lep 11573; gen. prp. ZSM G 11950) possibly different at species level, at 2.4% genetical distance from *G. lindbergi* (Brava, Fogo) and 5.1% from the new species described below. This last mentioned specimen with wing pattern better contrasted, reminiscent of the type series of *G. lindbergi*, in male genitalia well corresponding to *G. lindbergi* of both locus typicus and Brava/Fogo populations. Requiring examination of more material. It is not excluded that "*G. lindbergi*" will need to be split into two species and that the small-sized populations of the southern islands with low- contrasted wing pattern may turn out to be another new species.

***Gymnoscelis daniloi* Hausmann, sp. n. (fig. 2)**

Holotype: ♀, Cabo Verde, Ilha do Fogo, Cha das Caldeiras, Portela, 1720 m, 2-I-2005, leg. E. Aistleitner, coll. ZSM, DNA barcode BC ZSM Lep 11575.

Paratypes: 26 ♂♂, id., 2-I-2005, 4-I-2005, 2-II-2005, 3-III-2005; 2 ♀♀, id., Cha das Caldeiras, Mte. Velha, Montinho, 1800 m, 29-XI-2005; 25 ♂♂, id., Cha das Caldeiras, Bangaeira, 1650 m, 30-XII-2004, 31-XII-2004.

Description: Wingspan 18-20 mm, thus larger than *G. lindbergi* (see above). Ground colour pale brown to brown. Both wings with numerous undulate blackish transverse lines (in *G. lindbergi* from Fogo and Brava islands transverse lines brown, not well contrasted from ground colour). Underside of wings with cell spots more conspicuous than in *G. lindbergi*. Palpi, frons and vertex brownish grey. Length of palpi approx. 1.5 times diameter of eye, in female slightly longer. Antennae filiform in both sexes, male antennal ciliation very short, cilia approx. 0.4 times width of flagellum, i.e. shorter than in *G. lindbergi* (0.6-0.7 times). Hindtibia with two spurs in both sexes. Male genitalia (fig. 5a) with longer aedeagus, length approx. 2 mm (in *G. lindbergi* 1.3-1.4 mm), cornutus much longer, 0.6 times length of aedeagus, curved and digitiform at tip (in *G. lindbergi* very short and thin). Sternum A8 (fig. 5b) with sclerotised lateral arms terminally with four lobes (three in *G. lindbergi*) and sclerotisation of tergum A8 much broader. In female genitalia (fig. 6) antrum longer than in *G. lindbergi*, lateroposterior extensions bill-shaped, ductus bursae longer, sclerotised appendix bursae shorter and its T-shaped ending stronger setose.

Large genetic distance (5.5%) between *G. daniloi* and *G. lindbergi* from Fogo and Brava. Intraspecific sequence variation very low in *G. daniloi* (max. divergence 0.0%, $n = 9$).

Etymology: named after Eurico Danilo Montrond (Cha das Caldeiras, Bangaeira, Ilha do Fogo), a very good friend of the discoverer of the new species, Eyjolf Aistleitner.

Ennominae
Macariini

Isturgia pulinda deerraria Walker, 1861

Brava, Fogo. Populations from CV showed no genetic difference from examined populations from Yemen. Intraspecific sequence variation comparatively low (max. divergence 0.80%, mean 0.29%; $n = 10$).

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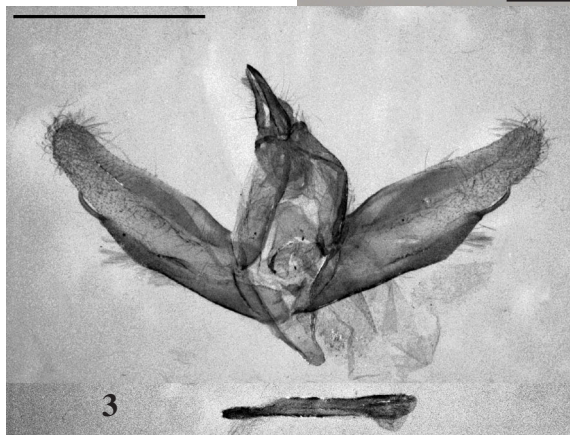
specimens. Paul Hebert (CCDB, University of Guelph, Canada) and his team kindly and professionally performed sequencing of the material in the framework of the Global Campaign DNA Barcoding Geometridae.

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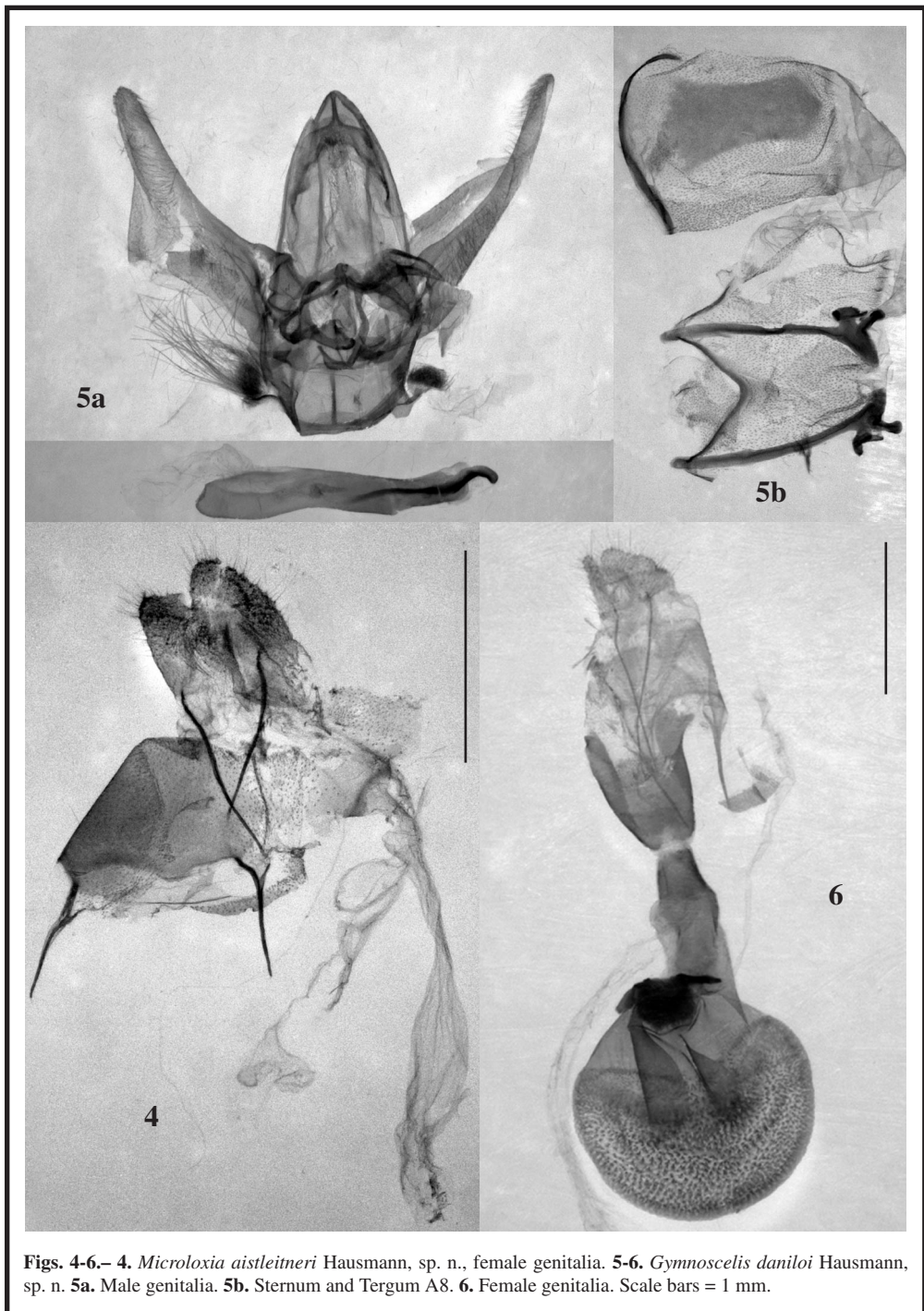
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Figs. 1-3.– 1. *Microloxia aistleitneri* Hausmann, sp. n., holotypus. Scale bar = 1 cm. 2. *Gymnoscelis daniloi* Hausmann, sp. n., holotypus. Scale bar = 1 cm. 3. *Microloxia aistleitneri* Hausmann, sp. n., male genitalia. Scale bar = 1 mm.



Figs. 4-6.— **4.** *Microloxia aistleitneri* Hausmann, sp. n., female genitalia. **5-6.** *Gymnoscelis daniloi* Hausmann, sp. n. **5a.** Male genitalia. **5b.** Sternum and Tergum A8. **6.** Female genitalia. Scale bars = 1 mm.