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First record of a bilateral gynandromorph of *Danaus chrysippus* (Linnaeus, 1758) from Mallorca (Balearic Islands, Spain) (Lepidoptera: Nymphalidae)

F. Truyols-Henares, M. Cerrato, A. Ribas-Serra & S. Pinya

Abstract

Danaus chrysippus (Linnaeus, 1758) was firstly reported in the Balearic Islands during the 1980s in Menorca, and in the 1990s in Mallorca. Since then several continuous reports have been documented over time. Here, in a new locality of distribution of the species in Mallorca (Balearic Islands, Spain), the first record of a bilateral gynandromorph of this species is described.

KEY WORDS: Lepidoptera, Nymphalidae, first record, bilateral gynandromorph, *Danaus chrysippus*, Balearic Islands, Spain.

Primer registro de un ginandromorfo bilateral de *Danaus chrysippus* (Linnaeus, 1758) procedente de Mallorca (Islas Baleares, España) (Lepidoptera: Nymphalidae)

Resumen

Danaus chrysippus (Linnaeus, 1758) fue documentada en las Islas Balares durante la década de los 1980 en Menorca y en los 1990 en Mallorca. Desde entonces continuos registros se han documentado a lo largo del tiempo. Aquí, en una nueva localidad de distribución de la especie en Mallorca (Islas Balares, España) se describe el primer registro de un ginandromorfo bilateral de esta especie.

PALABRAS CLAVE: Lepidoptera, Nymphalidae, primer registro, ginandromorfo bilateral, *Danaus chrysippus*, Islas Baleares, España.

Introduction

Danaus chrysippus (Linnaeus, 1758) is a cosmopolitan migrant butterfly which has been recorded in several tropical and subtropical areas ranging from Africa to Asia, reaching Australia and New Zealand (IDRIS, 2013; HAWKESWOOD & SOMMUNG, 2018). In Europe, there have been several recordings in countries of the Mediterranean basin where a settlement occurred (GIL, 2006; KOREN *et al*., 2019) and an expansion occurred (MASÓ & PÉREZ DE-GREGORIO, 1984). In mainland Spain it was reported in some localities (GONZÁLEZ-LÓPEZ *et al*., 1980; TORRES, 1981, MONTSERRAT & MONTES, 1983; OCHOTORENA, 1983) Regarding the Balearic Islands (Western Mediterranean, Spain), the first records of *D. chrysippus* were reported for the main island, Mallorca, in 1990 (ALOMAR *et al*., 1989-1990), and a private collection revision pointed out its presence as early as 1980 in Menorca (FIOL, 1991; CARRERAS *et al*., 2004). Since these first records, sparse but continuous sightings have been recorded in the island of Mallorca (PINYA *et al*., 2012; WEIR, 2018). In Europe, *D. chrysippus* inhabits bushy and rocky areas, coastal areas, agricultural areas as well as gardens (TOLMAN & LEWINGTON, 2002). It is a polyvoltine species with a continuous biological cycle, with a flying period from March to November in North Africa and from May to October to Northern and Eastern Mediterranean basin (TOLMAN & LEWINGTON, 2002).

In the Balearic Islands, as well as in the mainland Spain, *D. chrysippus* occurrence has been associated to migration and dispersion events, escaped individuals and sporadic reproductive success (ALOMAR *et al*., 1989-1990; CARRERAS *et al*., 2004; FERNÁNDEZ-HAEGER, 1999). As occurs in other areas, naturalization events seem to be mainly related to the presence of several nutritious plant species of the Asclepiadaceae family (GIL, 2006; HAWKESWOOD & SOMMUNG, 2018). In Mallorca, the occurrence of the alien *Gomphocarpus fruticosus* (L.) Ait. has been pointed out as the main source of nourishment allowing *Danaus* species to establish (ALOMAR *et al*., 1989-1990; ENCINAS & VICENS, 2008). *Asclepias curassavica* L. is also reported from Mallorca as nutritious plant species (ALOMAR et al., 1989-1990), but is not recorded among the alien species capable of constituting natural populations (MORAGUES & RITA, 2005). Other potential nutritious plant species such as *Cynanchum acutum* L. and *Calistegia sepium* R. Br. also occur in Mallorca Island (PLA et al., 1992), and they could had also contributed to its establishment, but as far as we are concerned no records of larvae feeding on these plant species have been reported.

Morphological variability has been studied among subspecies and individuals from *D. chrysippus* (IDRIS, 2013 and references therein), but information regarding morphological abnormalities are scarce. Among these, gynandromorphy is a well-known abnormality with several examples in Lepidoptera species (FUENTES *et al*., 2002; CERVELLÓ & ZSOLT, 2007; VIDAL, 2015). Gynandromorphy is defined as the presence of both male and female morphological traits in the same individual (FUENTES *et al*., 2002). Two types of gynandromorphy can be distinguished: a bilateral one, when male and female traits are scattered each at the wings of one side (right or left); and in mosaic, when abnormalities are only displayed on one part of the wings (FUENTES *et al*., 2002). As these abnormalities are rare or sometimes hard to perceive, any observation is regarded as of great interest and considered under need to be reported (PEIGLER, 1993; VIDAL, 2015).

A population of *D. chrysippus* from the Puig de Son Vila locality, between Sa Pobla and Alcudia municipalities (Mallorca, ETRS89, 31 S 503084 4407190, 250 masl) was surveyed on 9-IX-2019. Further field work allowed to spot several caterpillars feeding on *G. fruticosus* plants. This plant species is locally abundant, with hundreds of adult plants distributed in two main subpopulations (see RIBAS *et al*., 2019 for more details). Fifteen caterpillars were collected in early September (7-IX-2019). During the subsequent breeding attempts under glasshouse conditions (temp: 25ºC, humidity: 75 %), one specimen of the first generation was observed to display an unusual morphological pattern that could be identified as a case of bilateral gynandromorphy. This specimen was preserved in the Interdisciplinary Ecology Group entomological collection with the inventory code EI-1116 (University of the Balearic Islands, Palma de Mallorca, Spain).

Considering the previous statements, and as part of a deeper study on the ecology of different Lepidoptera species, here we report the first record of a bilateral gynandromorph within *D. chrysippus*.

The specimen showed a bilateral gynandromorph displaying female traits in the left side and male traits in the right side (obverse view and inverted for reverse view) (Figure 1). Regarding colour, black and white spots displayed with equal intensity as occurs between males and females. In the case of the orange tonality, the male side (right) exhibited a brighter orange that contrasted with the darker tonality displayed at the female side (left). However, colour intensity has been indicated to be variable among male and female individuals, depending further of the region and season (TOLMAN & LEWINGTON, 2002).

Figure 1.– A gynandromorph of *Danaus chrysippus* (L.) observed (Mallorca, Balearic Islands, Spain). Dorsal view is represented with **A** picture, while ventral view is represented with **B** picture.

Concerning those distinctive patterns that do allow a proper distinction and assignment of both male and female sides, these are mainly indicated by the hindwings. In the case of the obverse view of the hindwings, the male side displayed three small black spots accompanied with an additional larger black spot, identified as the androconia which is distinctive of male adults. In contrast, the female side only displayed the three small spots lacking the so-called androconia. In the case of the reverse view of the hindwing, a distinctive white spot with black outline could be appreciated in the male side, and as occurs in female individuals, it was absent in the female side. Regarding the forewings, the only contrasting traits between both sides could be appreciated in the relative size of the white spots that conforms *D. chrysippus* colour patterns. In the case of the male forewing these spots could often be larger in comparison with the female forewing. This trait could also be appreciated in a lesser degree for hindwings, specifically in the external side spots in the reverse view and the small spots at the base of the obverse view.

Furthermore, the locality where *D. chrysippus* was recorded constitutes a new locality for the species distribution at Mallorca island once the literature about *D. chrysippus* distribution were consulted (ALOMAR *et al*., 1989-1990; PINYA *et al*., 2012; WEIR, 2018) as well as after consulting the public distribution species database Bioatles from the Balearic Islands Government (https://www.bioaltes.caib.es) and the public biodiversity database BiodiBal from the University of the Balearic Islands linked to GBIF (https://www.biodibal.uib.cat).

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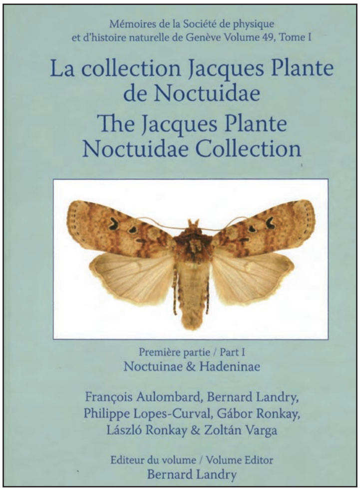

Mémoires de la Société de physique
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La collection Jacques Plante
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Première partie / Part I
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Bernard Landry

Bajo la coordinación para la edición de esta serie de Bernard Landry, nos encontramos ante la primera parte, formada por dos volúmenes, de los Noctuidae de las regiones Paleártica y Oriental del siglo XX, que se encuentran en la colección de Jacques Plante (1920-2003) y que ahora se halla depositada en el Museo de Historia Natural de Ginebra (Suiza), estando formada por 62.688 ejemplares; si bien la obra ya es importante por su contenido, el que se describan 4 géneros, 21 especies y 21 subespecies nuevas, aumentan notablemente su valor científico y el que se encuentre escrita en francés e inglés, no hay duda qué será de gran difusión.

La obra, después de los datos biográficos de Jacques Plante escritos por Françoise Aulombard y Philippe Lopes Curval, nos ofrecen un listado de la bibliografía del autor y de sus taxones descritos, así como de las 16 especies que llevan su nombre, nos detallan los géneros y las nuevas especies y subespecies descritas, así como el estatus revisado de otras especies, los diferentes cambios nomenclaturales y las nuevas sinonimias. Continúan los autores con un listado de los Noctuidae que forman la colección y entramos en las descripciones de los nuevos taxones de las regiones Paleártica y Oriental, donde nos hablan sobre el material tipo, datos taxonómicos, descripción, bionomía y distribución, así como sobre su etimología.

Todas las especies que forman la colección, así como las nuevas especies, se encuentran perfectamente fotografiadas a todo color, a lo largo de 147 planchas y en 54 planchas adicionales, en blanco y negro, podemos apreciar las microfotografías de las genitalias de los machos y hembras de las nuevas especies y las especies próximas, cuando es necesario aclarar dudas, acabando la obra con los agradecimientos, las bibliografía y el índice.

No podemos terminar estas palabras sin felicitar a los autores por este excelente trabajo y a la Editorial por la calidad de la impresión, a la que nos tiene acostumbrados, por lo que recomendamos esta obra vivamente, para todos aquellos interesados por los Noctuidae del viejo mundo.

El precio de este libro es de 115,50 euros más gastos y los interesados deben dirigirse a:

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Dichagyris (Albocosta) batanga Gyulai & Saldaitis, sp. n. from China (Lepidoptera: Noctuidae)

P. Gyulai & A. Saldaitis

Abstract

The diagnosis and description of a new species *Dichagyris (Albocosta*) *batanga* Gyulai & Saldaitis, sp. n. is given, with four colour figures and four genitalia figures.

KEY WORDS: Lepidoptera, Noctuidae, *Dichagyris*, new species, China.

Dichagyris (Albocosta) batanga **Gyulai & Saldaitis, sp. n. de China**
(Lepidoptera: Noctuidae)

Resumen

Se da la diagnosis y descripción de una especie nueva *Dichagyris (Albocosta*) *batanga* Gyulai & Saldaitis, sp. n., con cuatro figuras en color y cuatro figuras de genitalia.

PALABRAS CLAVE: Lepidoptera, Noctuidae, *Dichagyris*, nueva especie, China.

Introducción

For the most recent revision of the subgenus *Albocosta* Fibiger & Lafontaine 1997 of the genus *Dichagyris* Lederer, 1857, with checklist of taxa, distribution, taxonomic interpretation, and new descriptions see GYULAI (2021). The further dissections of the late autumnal (from the second half of September to the end of November) *Albocosta* specimens from China, led to the recognition of a new species, was collected by the second author near Batang, Sichuan. The new one is the sister species of the *Dichagyris* (*Albocosta*) *stentzi* (Lederer, 1853), which is a widely distributed species in Asia (Russia (Altai, Tuva, Sayan and Baikal area, Transbaikalia, Amur region, Primorye territory, Sakhalin, Kuriles; pers. comm. V. Kononenko), Kazakhstan, Kyrgyzstan, Mongolia, Korea, China, Tibet, Nepal, India, Pakistan). All of the further *Albocosta* species dissected from late autumnal materials from China proved to *Dichagyris* (*Albocosta*) *triangularis sinangularis* Gyulai, 2021.

Abbreviations

AFM = Alessandro Floriani (Milan, Italy)
HNHM = Hungarian Natural History Museum (Budapest, Hungary)
PGYM = collection of Péter Gyulai (Miskolc, Hungary)
GYP = genitalia slide of Péter Gyulai
HT = holotype

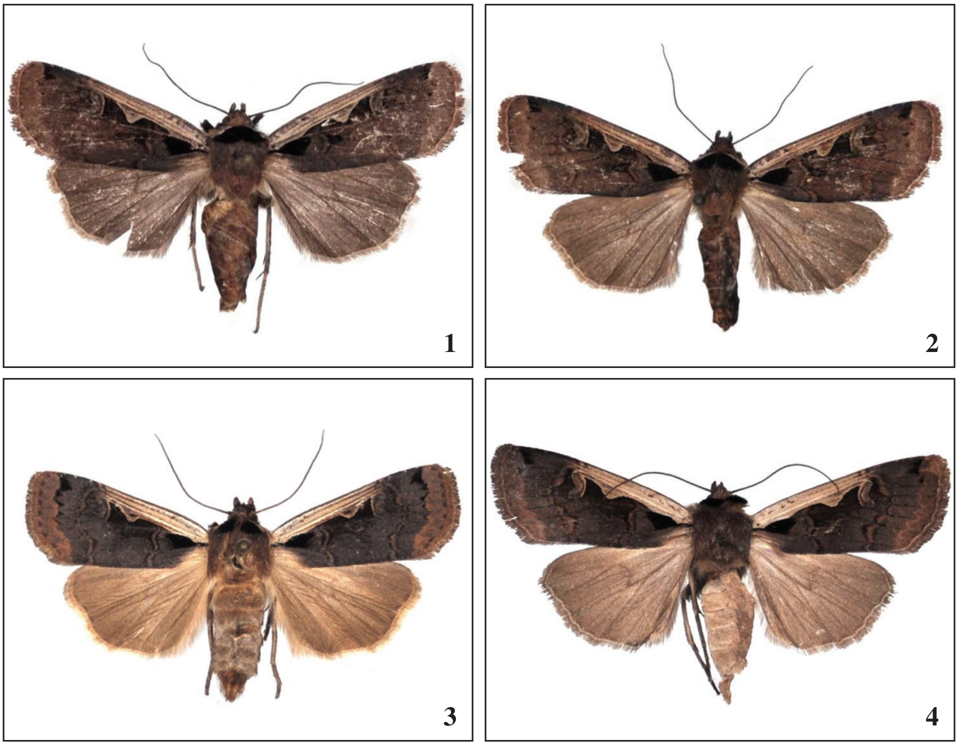
PT = paratype
f = female

Description of new taxa

Dichagyris (Albocosta) batanga Gyulai & Saldaitis, sp. n. (Figs 1-2, 5-6)

Holotype 1 ♀ (Fig. 1): CHINA, W Sichuan, 25 km N from Batang, 3100 m, dry valley, 30º12,049’N, 99º14,078’E, 19-20-IX-2007, leg. A. Saldaitis, slide no. GYP 5350 (coll. PGYM, later to be deposited in the HNHM). Paratype: 1 ♀, with same data, slide no. GYP 5367 (coll. AFM).

Diagnosis: The females of the new species (Figs 1-2) are slightly larger than most of the females of the closest relative *D.* (*A.*) *stentzi* (Figs 3-4); forewing length is 18-19 mm wingspans 37-38 mm, versus 15-19 mm and 30-38 mm. The new species differs in its broader triangular basal black dash, darker costal area, less elongate orbicular stigma costally and slightly less sinuous subterminal line in the forewings and darker, fuscous, unicolourous hindwings.



Figures 1-4.– *Dichagyris (Albocosta)* spp., adults. **1.** *D. (A.) batanga* Gyulai & Saldaitis, sp. n., HT, ♀, China, Sichuan (coll. PGYM); **2.** *D. (A.) batanga* Gyulai & Saldaitis sp. n., PT, ♀, China, Sichuan (coll. AFM); **3.** *D. (A.) stentzi* (Led.), ♀, Russia, Far East, Vladivostok distr., Nachodka (coll. PGYM); **4.** *D. (A.) stentzi* (Led.), ♀, China, Sichuan, Chuan Zhusi/Huang Long, Juraka pass, (coll. PGYM).

In the female genitalia (Figs 5-6), the most conspicuous difference is the large lateral diverticulum in the inner side of the appendix bursae, which is very unique and well differs from that section of the *D.* (*A.*) *stentzi* (Figs 7-8) and those of the further relative species (see: GYULAI, 2021), as well. The appendix bursae of the holotype is affected in shape by the presence of spermatophores, however the large lateral diverticulum is well defined, too.

Description (Figs 1-2): Forewing length 18-19 mm wingspans 37-38 mm. Palpi covered with dark red-brown scales, third segment tiny. Vertex light brown, collar blackish brown with broad light brownish-ochreous base; vesture of thorax and legs dark reddish-brown, that of abdomen brown. Forewings triangular, apex pointed. Ground colour of forewings dark reddish-brown, slightly lighter in the marginal area. Costa broadly pale brownish-ochreous until the tip of the reniform stigma, conjoining with the same-coloured orbicular macula and the light brownish reniform stigma; claviform stigma small, blackish. Basal dash black, broadly triangular. Transverse lines faint, antemedian line wavy, postmedian line evenly arcuate, subterminal line finely lacy with a small black dash in the costa; fringe brown. Hindwings evenly fuscous brown, discal spot a fine arch; fringe pale brown.

Female genitalia (Figs 5-6): The main characters are the followings: setose, quadrangular papillae anales, short apophyses anteriores and much longer apophyses posteriores; sclerotized, broadly V-shaped antrum with more sclerotized, pincer-like, bilateral, symmetrical lobi; tubular, membranous, posteriorly broaden, longitudinally wrinkled ductus bursae; saccate appendix bursae and corpus bursae with numerous fine longitudinal wrinkles; the former one bears a large lateral diverticulum in the inner side.

Bionomics and distribution: Two females were collected at ultraviolet light during two nights on 19-20-IX-2007 in remote part of west China Sichuan province near the Batang. *Dichagyris (Albocosta) batanga* was collected at altitude ranging 3100 meters in mountain river dry valley rarely covered by mixed forests dominated by various deciduous trees and bushes.

Etymology: The specific epithet refers to the type locality.

Acknowledgements

The authors are grateful to V. S. Kononenko (Laboratory of Entomology, Vladivostok, Russia) for information on the distribution of *Albocosta* in Russia; to Adrienne Gyulai-Garai (Miskolc, Hungary) for much help in computer works and Alessandro Floriani (Milan, Italy) for access to his rich private collection provided.

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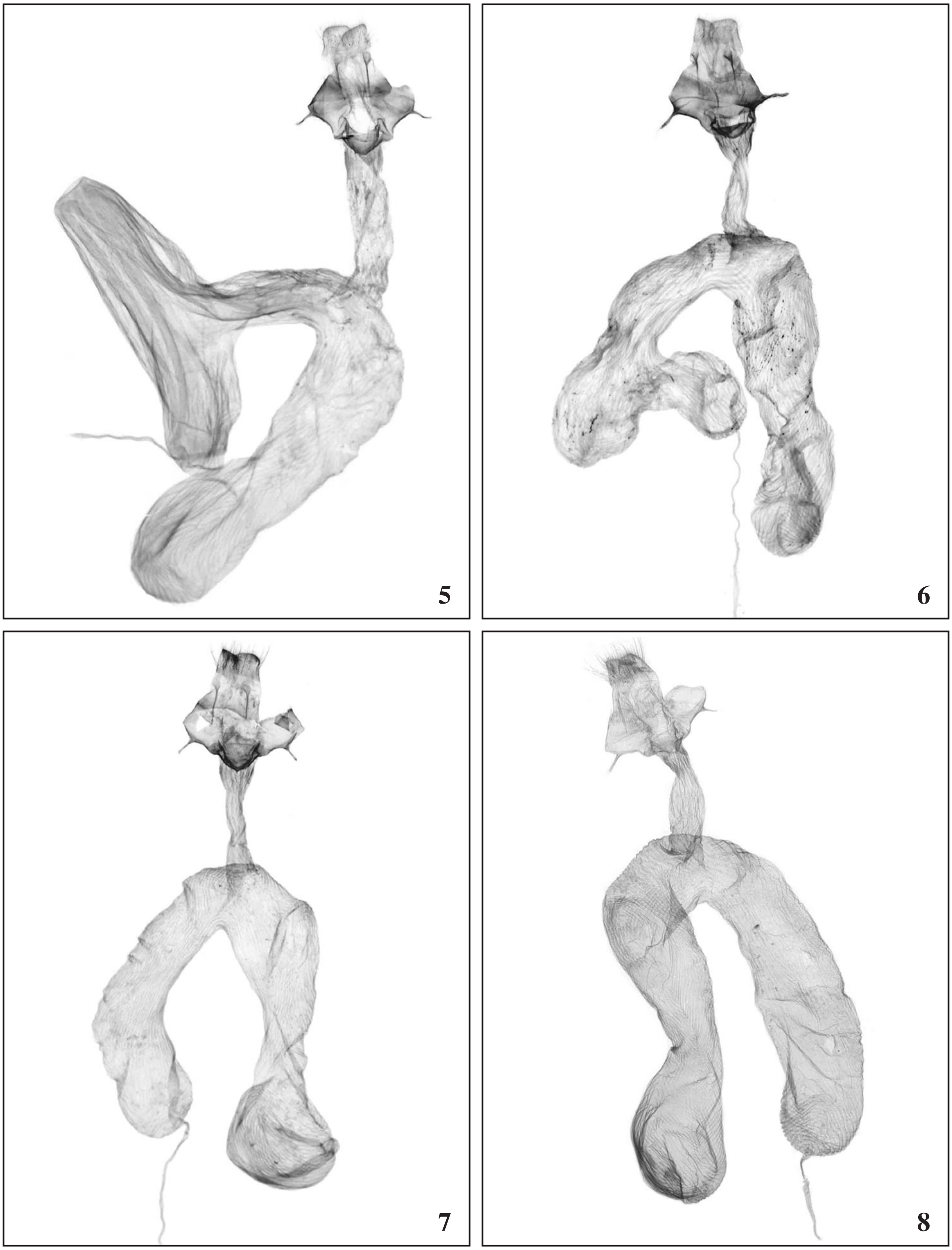

Figures 5-8.– *Dichagyris (Albocosta)* spp., female genitalia; **5.** *D. (A.) batanga* Gyulai & Saldaitis, sp. n., HT, China, Sichuan, GYP 5350 (coll. PGYM); **6.** *D. (A.) batanga* Gyulai & Saldaitis, sp. n., PT, China, Sichuan GYP 5367 (coll. AFM); **7.** *D. (A.) stentzi* (Led.), Russia, Far East, GYP 5432 (coll. PGYM); **8.** *D. (A.) stentzi* (Led.), China, Sichuan GYP 3269 (coll. PGYM).

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A review of the genus *Holcophora* Staudinger, 1871, with description of three new species and new data on the taxonomy of the genus (Lepidoptera: Gelechiidae)

O. Bidzilya, J. Gastón, O. Karsholt, K. Sattler & A. Vives Moreno

Abstract

The genus *Holcophora* Staudinger, 1871, is revised. Three species are described as new: *Holcophora hispanica* Gastón & Vives sp. n. (Spain), *Holcophora rostrella* Bidzilya & Sattler, sp. n. (Mongolia, Turkmenistan) and *Holcophora centralasiae* Bidzilya & Karsholt, sp. n. (Afghanistan, Pakistan). The genera *Epimesophleps* Rebel, 1907, syn. n., *Spermanthrax* Meyrick, 1936, syn. n., are synonymized with *Holcophora* Staudinger, 1871. *Aponaea* (sic.!) *pruinosella* Chrétien, 1915, syn. n. and *Spermanthrax pycnostoma* Meyrick, 1936, syn. n. are synonymized with *Holcophora obtusipalpis* Walsingham, 1905. Three new combinations are proposed: *Holcophora molitor* (Walsingham, 1906), comb. n., *Holcophora symmocella* (Rebel, 1907), comb. n. and *Holcophora aphiridias* (Meyrick, 1925), comb. n. *Holcophora inderskella* (Caradja, 1920) is re-described, as the re-description by ADAMSKI & SATTLER (2019) refers to *H. rostrella* Bidzilya & Sattler, sp. n. The male and female genitalia of *H. molitor* and *H. symmocella* are described for the first time. *H. obtusipalpis* is recorded for the first time from Spain (Canary Islands) and Egypt, *H. inderskella* from Turkmenistan and Tadzhikistan, and *H. molitor* from Bahrain, Saudi Arabia, United Arab Emirates and Iran.

KEY WORDS: Lepidoptera, Gelechiidae, *Holcophora*, new species, new combinations, Afghanistan, Iran, Mongolia, Pakistan, Turkmenistan, Spain.

Revisión del género *Holcophora* Staudinger, 1871, con descripción de tres especies nuevas y nuevos datos sobre la taxonomía del género (Lepidoptera: Gelechiidae)

Resumen

Se revisa el género *Holcophora* Staudinger, 1871. Se describen tres especies nuevas: *Holcophora hispanica* Gastón & Vives, sp. n. (España), *Holcophora rostrella* Bidzilya & Sattler, sp. n. (Mongolia, Turkmenistán) y *Holcophora centralasiae* Bidzilya & Karsholt, sp. n. (Afganistán, Irán, Pakistán). Se pasa a sinonimia el género *Epimesophleps* Rebel, 1907 y *Spermanthrax* Meyrick, 1936 con *Holcophora* Staudinger, 1871. Se pasa a sinonimia a *Aponaea* (sic.!) *pruinosella* Chrétien, 1915 y *Spermanthrax pycnostoma* Meyrick, 1936 con *Holcophora obtusipalpis* Walsingham, 1905. Se proponen tres nuevas combinaciones: *Holcophora molitor* (Walsingham, 1906) comb. n., *Holcophora symmocella* (Rebel, 1907) comb. n. y *Holcophora aphridias* (Meyrick, 1925), comb. n. Se redescribe *Holcophora inderskella* (Caradja, 1920), como la redescripción por ADAMSKI & SATTLER (2019) referente a *H. rostrella* Bidzilya & Sattler, sp. n. Se describen por primera vez la genitalia del macho y de la hembra de *H. molitor* y *H. symmocella*. Se registra por primera vez para España (Islas Canarias) y Egipto a *H.*

obtusipalpis, *H. inderskella* de Turkmenistán y Tayikistán y *H. molitor* de Baréin, Arabia Saudí, Emiratos Árabes Unidos e Irán.

PALABRAS CLAVE: Lepidoptera, Gelechiidae, *Holcophora*, nuevas especies, nuevas combinaciones, Afganistán, Irán, Mongolia, Pakistán, Turkmenistán, España.

Introduction

From the time of its description almost to the present the genus *Holcophora* Staudinger, 1871, with the type species *H. statices* Staudinger, 1871, was considered as monotypic. Recently, *Aponoea* Walsingham, 1905 (type species *Aponoea obtusipalpis* Walsingham, 1905) was synonymized with *Holcophora*, and *Blastobasis inderskella* Caradja, 1920, was transferred to that genus (ADAMSKI & SATTLER, 2019). These updates encouraged us to have a closer look at rich material of related taxa from different regions that was provisionally associated with *Holcophora*/*Aponoea*. Our study resulted in establishing two new generic synonyms: the monotypic *Spermanthrax* Meyrick, 1936 (type species *S. pycnostoma* Meyrick, 1936) syn. n. and the genus *Epimesophleps* Rebel, 1907 (type species *E. symmocella* Rebel, 1907), syn. n. as congeneric with *Holcophora* Staudinger, 1871. Based on the diagnosis of *A. obtusipalpis* provided by ADAMSKI & SATTLER (2019) we established that the northern African species *Aponaea* (sic!) *pruinosella* Chrétien, 1915, syn. n., and *S. pycnostoma* Meyrick, 1936, syn. n., are new synonyms of *A. obtusipalpis* whilst specimens from mainland Spain, although closely related to *H. obtusipalpis,* represent a separate species - *Holcophora hispanica* Gastón & Vives, sp. n. Our study of the holotype and other specimens of *Gelechia molitor* Walsingham, 1906, indicated the assignment of this species to *Holcophora*: *Holcophora molitor* (Walsingham, 1906) comb. n. We show that the re-description of *H. inderskella* by ADAMSKI & SATTLER (2019) refers to *H. rostrella* Bidzilya & Sattler, sp. n. Additionally, a new species, *Holcophora centralasiae* Bidzilya & Karsholt, sp. n., is described from Afghanistan and Pakistan. The diagnosis of *Holcophora* is improved by consideration of additional characters, and the systematic position of that genus within the subfamily Gelechiinae is briefly discussed. All eight species currently associated with *Holcophora* are diagnosed, and the data on their distribution and biology are summarised. Additional we briefly deal with *Epimesophleps aphridias* Meyrick, 1925, and formally transfer it to *Holcophora*. However, due to lack of material we are unable to discuss it in detail. We provide keys for species identification based on external and genitalia characters.

Materials and methods

Moths examined included type specimens as well as non-type specimens from the institutional and private collections listed below. Data from holotypes are cited exactly as on the labels of the specimens, whereas other material is organised in a standardized format rather than verbatim, viz., alphabetic after country and province, region etc.; material from the same province is listed chronologically. The photographs of the male genitalia are provided both in traditional ventral view and “unrolling” except for *H. symmocella*.

OB photographed pinned specimens and their genitalia as described by BIDZILYA *et al*. (2017).

Our terms for the male and female genitalia follow HODGES (1986) and PONOMARENKO (2008, 2009).

Our arrangement of the species within the genus *Holcophora* is based principally on similarities of the male genitalia.

Abbreviations of collections

MfN	Museum für Naturkunde, Berlin, Germany
MNCN	Museo Nacional de Ciencias Naturales, Madrid, Spain
MNHN	Muséum National d’Histoire Naturelle, Paris, France

NHMUK	Natural History Museum, London, United Kingdom
NHMB	Hungarian Natural History Museum, Budapest, Hungary
NHMV	Naturhistorisches Museum, Vienna, Austria
NMPC	National Museum, Prague, Czech Republic
RCFG	Research collection Friedmar Graf, Bautzen, Germany
RCJG	Research Collection Javier Gastón, Getxo, Vizcaya, Spain
RCMD	Research Collection Marek Dvořák, Smrèná, Czech Republic
RMHN	Naturalis Biodiversity Center, Leiden, The Netherlands
SMNK	State Museum of Natural History Karlsruhe, Karlsruhe, Germany
ZIN	Zoological Institute, Russian Academy of Sciences, Sankt-Petersburg, Russia
ZMKU	Zoological Museum, Kyiv Taras Shevchenko National University, Kyiv, Ukraine
ZMUC	Zoological Museum, Natural History Museum of Denmark, Copenhagen, Denmark

Other abbreviations

AV	Antonio Vives
comb. n.	new combination
gen. slide	genitalia slide
JG	Javier Gastón
KS	Klaus Sattler
OB	Oleksiy Bidzilya
OK	Ole Karsholt
syn. n.	new synonym
TL	Type locality
TS	Type species

Abbreviations on figures
cc - cucullus; gn - gnathos; sc - sacculus; cul - culcitula; tg pr - process of tegumen; un - uncus

Results

Check list of the species of *Holcophora*

Holcophora hispanica Gastón & Vives, **sp. n.**
Holcophora obtusipalpis (Walsingham, 1905)
  = *Mesophleps cinerellus* Turati, 1930
  = *Aponaea* (sic!) *pruinosella* Chrétien, 1915, **syn. n.**
  = *Spermanthrax pycnostoma* Meyrick, 1936, **syn. n.**
Holcophora statices Staudinger, 1871
Holcophora inderskella (Caradja, 1920)
Holcophora centralasiae Bidzilya & Karsholt, **sp. n.**
Holcophora rostrella Bidzilya & Sattler, **sp. n.**
Holcophora molitor (Walsingham, 1906), **comb. n.**
Holcophora symmocella (Rebel, 1907), **comb. n.**
Holcophora aphridias (Meyrick, 1925), **comb. n.**

Generic descriptions

Holcophora Staudinger, 1871. *Berl. ent. Z.,* **14**(3/4): 313
TS: *Holcophora statices* Staudinger, 1871. *Berl. ent. Z.,* **14**(3/4): 313-314, by monotypy

= *Aponoea* Walsingham, 1904. *Entomologist's mon. Mag*., **40**: 216, nomen nudum
= *Aponoea* Walsingham, 1905. *Entomologist's mon. Mag*., **41**: 125

TS: *Aponoea obtusipalpis* Walsingham, 1905. *Entomologist's mon. Mag*., **41**: 125, by original designation and monotypy. (Synonymized by ADAMSKI & SATTLER, 2019: 18)

= *Epimesophleps* Rebel, 1907. *Lepid. Südarabien u. Insel Sokótra*: 95. **Syn. n.**

TS: *Epimesophleps symmocella* Rebel, 1907. *Lepid. Südarabien u. Insel Sokótra*:, 95, fig. 40, by monotypy

= *Aponaea*; Chrétien, 1915. *Ann. Soc. ent. Fr*., **84**: 330, *lapsus calami*
= *Spermanthrax* Meyrick, 1936. *Exotic Microlepid*., **4**(20): 624. **Syn. n.**

TS: *Spermanthrax pycnostoma* Meyrick, 1936. *Exotic Microlepid*., **4**(20): 625, by monotypy

Generic diagnosis: The species of *Holcophora* are distinguished externally by a long labial palpus (up-curved or more or less porrect) with segment 3 usually shortened (1/5-1/3 length of segment 2), and segment 2 with brush of raised scales on its dorsal surface (Figs 1-12). The predominantly plain grey or pale forewing with indistinct markings and groups of raised scales (Figs 21-23) in conjunction with a weakly excavated hindwing termen are also diagnostic. The male genitalia of *Holcophora* usually are strongly modified. A tendency towards asymmetry in the dorsal sclerites of the male genitalia (uncus displaced laterally and turned anti-clockwise, tegumen bearing lateral process of irregular shape) is characteristic for most species. Additional diagnostic characters of the male genitalia are the presence of membranous lobes covered with long setae on both sides of the uncus base (culcitula), the usually shortened tegumen, the strongly reduced gnathos, anteromedially strongly broadened sacculus, weakly sclerotized distal part of the phallus with distinct lateral rod ending in short sclerite or long, strongly recurved apical process, and very long bulbus ejaculatorius. The female genitalia are characterized by the weakly modified, evenly sclerotized (except anterior margin) segment VIII with sternum usually deeply emarginated both anteriorly and posteriorly, the short, tubular colliculum, short apophyses anteriores and posteriores and the *Gelechia*-type signum.

Remarks: The systematic position of *Holcophora* within the Gelechiidae is uncertain and somewhat controversial. That is due to the strongly modified male genitalia and in parts still unresolved system of the family in general.

Staudinger placed the genus *Holcophora* originally between *Anarsia* Zeller, 1839, and *Hypatima* Hübner, [1825] ("*Chelaria* Haworth, 1828"); it was subsequently included by MEYRICK (1925) in the *Dichomeris* group (now Dichomeridinae). In some regional catalogues and faunistic lists (KARSHOLT *et al*., 1996; ELSNER *et al*., 1999) it was tentatively placed in the tribe Chelariini, subfamily Gelechiinae, but no characters were given in support of that position. PONOMARENKO (2009) treated *Holcophora* as a member of the tribe Gelechiini within the subfamily Gelechiinae based on her study of the functional morphology of the male genitalia, and that concept was accepted by ADAMSKI & SATTLER (2019).

The subfamily Gelechiinae is considered as monophyletic based on the presence of mediobasal processes of the valva and on glands of the genital segment (PONOMARENKO, 2005: 73, 74, 90). KARSHOLT *et al*. (2013) following HUEMER & SATTLER (1995) recognized Gelechiinae based on the horizontal division of the male pregenital abdominal segment VIII into free dorsal and ventral flaps that permit wider opening of that segment for the extrusion of the genitalia during copulation. Although different authors proposed a different suite of autapomorphies, the monophyly of Gelechiinae (with tribes Gelechiini, Gnorimoschemini and Litini) is well supported by a molecular analysis (KARSHOLT *et al*., 2013: 344), and the subfamily in this sense may be considered satisfactorily defined both morphologically and molecularly. Within Gelechiinae, the tribes Litini and Gnorimoschemini are considered as monophyletic by all authors. The third tribe, Gelechiini, is clustered with Gnorimoschemini based on the laterally dilated vinculum (PONOMARENKO, 2005). According to a molecular analysis Gelechiini are paraphyletic with respect to Litini and Gnorimoschemini (KARSHOLT *et al*., 2013: 345). Thus, the monophyly of Gelechiini still remains unresolved.

Amongst characters that justify the placement of *Holcophora* as a member of Gelechiini, PONOMARENKO (2009: 140) listed the ridge-shaped tegumen without a ventral wall, the basally broadening valva and the well-developed muscle m 22 in the male genitalia. In our opinion the first two characters are rather vague: the degree of “broadening” of the valva is subjective and difficult to estimate. The “ridge-shaped tegumen” seems also present in some genera of other tribes and can hardly be considered as phylogenetically significant. The reduced muscle m 22 is considered as one of the diagnostic character for Gelechiini (PONOMARENKO, 2005: 74), and its presence in *Holcophora* would contradict the placement of the genus in that tribe. However, Ponomarenko seems to contradict herself with regard to muscle m 22 the reduction of which she considers as a Gelechiini character in 2005 whereas in 2009 it is the well-developed m 22. Nevertheless, we agree with Ponomarenko that *Holcophora* cannot be placed in Dichomeridinae (including Chelariini) as proposed earlier but should be assigned to Gelechiini, a position that is supported by the characteristic *Gelechia*-type signum bursae. In view of the strongly modified male genitalia we are still unable to assign *Holcophora* to a convincing place within that tribe.

In Gelechiidae asymmetry in the male genitalia is known in a number of genera, e.g. *Caulastrocecis* Chrétien, 1931, *Horridovalva* Sattler, 1967 (Anomologinae), *Anarsia* Zeller, 1839 (Chelariini), *Coleotechnites* Chambers, 1880 (Litini), *Chionodes* Hübner, [1825], *Photodotis* Meyrick, 1911 (Gelechiinae), *Thiotricha* Meyrick, 1886 (Thiotrichinae) etc. In all these genera the asymmetry affects mainly the valvar complex, but the asymmetry in the uncus and tegumen of *Holcophora* appears to be unique in the family Gelechiidae. A reduced gnathos, characteristic of *Holcophora*, is found in many unrelated genera but most commonly in Anomologinae, Apatetrinae, and Litini of the Gelechiinae; it has not yet been found amongst Gelechiini. Another unique character of *Holcophora* is the rounded, densely setose lobes of the posterior margin of the tegumen on both sides of the uncus (Figs 65, 67, 76). Somewhat similar structures are known in some species of *Anarsia*, e.g. *A. spartiella* (Schrank, 1802) (Chelariini), and *Platyedra subcinerea* (Haworth, 1828) (Pexicopiini), however, their homology is uncertain. Ponomarenko suggested that these in *Holcophora* can be interpreted as the modified culcitula, a structure commonly present in some related genera of Gelechiini.

H. molitor and *H. symmocella* share a phallus with an unusually long, narrow, strongly recurved apex and uniquely modified, possibly androconial, scales on the apex of the sacculus (Figs 74-77). Similarly specialised scales were otherwise observed in Gelechiidae only in some species of *Anarsia* Zeller, 1839.

The long, strongly recurved process at the apex of the phallus in *H. molitor* and *H. symmocella* is a unique specialisation that indicates a closer relationship of these two species vis-à-vis the rest of the genus. The short ring-like male abdominal segment VIII in *Holcophora* (Figs 51-52) with laterally fused sternum and tergum is not characteristic for Gelechiinae, but was also observed in *Athrips* Billberg, 1820, the assignment of which to that subfamily is commonly accepted (HUEMER & KARSHOLT, 1999; PONOMARENKO, 2004; BIDZILYA, 2005). The raised scales on the forewing are found in all tribes of Gelechiinae, but occur also in some Pexicopiini (e.g. *Sitotroga exquisita* Bidzilya & Mey, 2011) and Dichomeridinae (*Dichomeris alacella* (Zeller, 1839)).

It appears that an appropriate position of *Holcophora* within the Gelechiidae cannot be satisfactorily established based alone on traditional morphological characters or on the functional morphology of the male genitalia. However, that genus shares more diagnostic characters (valva divided into cucullus and basally broadening sacculus, free phallus, *Gelechia*-type signum, raised scales on forewing) with Gelechiinae (Gelechiini) than with any other currently recognised Gelechiidae subfamily. The location of *Holcophora* within Gelechiini remains uncertain at this stage.

Description: Adult. Head smoothly scaled except dishevelled lateral tufts on neck and on base of antennae, scales plain grey or grey with brown tip; ocelli present; labial palpus (Figs 1-12) long, more or less porrect or moderately up-curved, segment 2 2 to 5 times as broad as segment 3, with distinct tuft of raised scales on dorsal surface (absent in *H. centralasiae* sp. n.), more or less uniformly coloured without distinct rings on outer surface, segment 3 usually short, 1/4-1/5 length of segment 2 (1/3-1/2 in *H. centralasiae* sp. n.), slender, acute; proboscis long; in *H. rostrella* sp. n. frons strongly modified, bearing crater-like structure with long, pointed central process (ADAMSKI & SATTLER, 2019: figs 10-13); antennal scape without pecten, 1.5-2 times as broad as adjacent part of flagellum, flagellomeres dark, grey to brown or black with white rings, denuded (*H. centralasiae* sp. n.), with short (*H. statices*) or longer (*H. obtusipalpis*, *H. hispanica* sp. n.) cilia in some species (Figs 13-17); thorax and tegulae concolorous with head; forewing usually plainly coloured, pale, light grey to brown, scales with black tips, pattern, if present, represented by oblique basal fascia and diffuse markings in cell, in *H. statices* with more distinct black spots and streaks, raised scales usually gathered in small tufts distal to basal fascia and in middle of cell (Figs 21-23); fringe concolorous with ground colour of forewing; hindwing usually light grey to almost white, but dark, blackish-brown in *H. hispanica* sp. n. frenulum simple in male, composed of three acanthi in female (Fig. 20); anal zone of hindwing and dorsolateral surface of metathorax with brushes of androconial scales (Figs 18-20).

Abdomen: Male segment VIII as long as or slightly longer than segments III-VII (Figs 51-52), with tergum and sternum fused laterally, forming ring with posterior part of vinculum and anterior margin of tegumen; in female segment VII 1.5 times to twice as broad as segments II-VI; tergum I broader than long, stronger sclerotized in distal part; sternum II longer than broad, with distinct venulae and long apodemes (Figs 53-55); all segments bearing short hairs in addition to scales (Fig. 56). Male genitalia. Uncus short, triangular, bearing long setae (*H. hispanica* sp. n., *H. obtusipalpis*) or displaced laterally, narrow, hook-shaped, or long, narrow or moderately broad process, usually bent over posterior margin of tegumen; gnathos membranous lobe with straight posterior margin and reduced medial sclerite (*H. hispanica* sp. n., *H. obtusipalpis, H. statices*) or completely reduced; tegumen usually broader than long (except in *H. rostrella* sp. n.), with paired rounded lobes on distal margin at both sides of uncus densely covered with long setae (culcitula) in most of species, anteromedial emargination large, broadly rounded, lateral margins usually bearing processes of irregular shape; cucullus slender, straight or weakly curved, broadening apically in *H. rostrella* sp. n., strongly broadening in basal half (except in *H. rostrella* sp. n.) and fused basally with sacculus; sacculus broader than cucullus (except in *H. rostrella* sp. n.), its basal part distinctly broadening to form medially fused dorsal processes (transtilla), and weakly inflated ventral sclerites fused with vinculum anteriorly and with base of cucullus laterally, apex of sacculus simple or bifurcated, with specialized (?androconial) scales in *H. symmocella* and *H. molitor*; vinculum narrow, band-like; saccus stout, broad, long, triangular to sub-rectangular; phallus with distinctly swollen caecum, distal part membranous except for strongly sclerotized lateral rod(s) ending in short apical sclerite or long, strongly recurved process in *H. symmocella* and *H. molitor*, bulbus ejaculatorius long, anterior part of ductus ejaculatorius in some species with small ring-like sclerotization.

Female genitalia: Papillae anales ovate or sub-triangular, covered densely with short setae; apophyses posteriores slender, slightly longer than papillae anales, with distinctly swollen apex in *H. rostrella* sp. n.; apophyses anteriores 1/4-1/2 length of sternum VIII, straight, with broadening base in *H. statices*; tergum VIII sub-rectangular, evenly sclerotized except for strongly edged anterior margin, with deep broadly anteromedial emargination; sternum VIII weakly sclerotized, medially membranous, pair of spiracular openings present, anterior margin strongly sclerotized, narrow band-shaped or moderately broadening, straight or projecting anteriorly, with more or less distinct sclerites on both sides of ostium in some species; ostium opening near anterior margin of sternum VIII; antrum short, tubular or funnel-shaped, posterolaterally sclerotized, with medial sclerite in *H. obtusipalpis*, with indistinct transition to ductus bursae or well separated (*H. obtusipalpis*, *H. molitor*, *H. symmocella*) from it; ductus bursae long, slender, weakly broadening towards corpus bursae, or moderately broad (*H. molitor*, *H. symmocella*), ductus seminalis slender, arising from border between antrum and ductus bursae; corpus bursae egg-shaped to rounded, varying in size; signum plate rounded to rhomboid or sub-hexagonal, with serrated margins, medial zone varying considerably in width from narrow slit (*H. centralasiae* sp. n.) to large rounded plate occupying almost entire surface of signum plate (*H. rostrella* sp. n.), in *H. hispanica* sp. n. signum long lanceolate plate with serrated borders, pointing towards fundus bursae, and fixed by cylindrical process to wall of corpus bursae.

Notes: Despite some superficial similarity, most species of *Holcophora* can be distinguished by their wing pattern as well as colour and shape of the labial palpus. The female genitalia of *Holcophora* species have a rather similar ground plan. The most constant characters for species separation are found in the shape of the antrum, presence or absence of subostial sclerites (colliculum) and the comparative length of the ductus bursae and corpus bursae. The signum is also diagnostic for most species, especially for *H. hispanica* sp. n. However, this structure varies considerably in some species and in such cases can only be used for species diagnosis in combination with other characters. Contrary to the rather uniform external appearance and female genitalia, the male genitalia of *Holcophora* show rather broad variation. Two species with symmetrical genitalia and a short triangular uncus (*H. hispanica* sp. n. and *H. obtusipalpis*) are in contrast to all other species which are characterized by the strong asymmetry of tegumen and uncus. *H. molitor* and *H. symmocella* can easily be recognized by the modified (? androconial) scales on the apex of the sacculus and by the phallus with a long, narrow, strongly recurved apex. All other species are easily distinguished by the shape of the uncus, processes of tegumen, phallus and other characters. Despite some considerable morphological variation the male genitalia of *Holcophora* species follow an identical ground plan that justifies their treatment as members of one genus. It is the reason for considering the monotypic *Spermanthrax* Meyrick, 1936 (type species *S. pycnostoma* Meyrick, 1936) and the genus *Epimesophleps* Rebel, 1907 (type species *E. symmocella* Rebel, 1907) as congeneric with *Holcophora* Staudinger, 1871.

Molecular data are available only for *H. obtusipalpis* and *H. hispanica* sp. n. (HUEMER *et al*., 2020: suppl. data 2).

Biology: Host-plants: *Limoniastrum guyonianum* Durieu ex Boiss., *Limonium dichotomum* (Cav.) O. Kuntze, *Limonium meyeri* (Boiss.) O. Kuntze, and *Limonium pruinosum* (L.) Chaz. (Plumbaginaceae). Known for three of the eight species of *Holcophora*. The larva lives quite exposed on its host-plant.

The currently known *Holcophora* species occur in open country - grasslands, mountain steppe slopes, semideserts and deserts up to 2300 m in mountains of Central Asia.

Distribution: Palaearctic and Afrotropical regions.

Key to the species of *Holcophora* based on external characters

1. Head with prominent frontal modification (Fig. 46) .... *H. rostrella* sp. n.
- Head unmodified 2
2. Segment 2 of labial palpus dorsally with large triangular tuft of raised scales (Figs 1-4) 3
- Segment 2 of labial palpus dorsally unmodified or with short brush of raised scales in distal 1/3 (Figs 5-8, 10-12) 4
3. Forewing grey with randomly spread black scales, hindwing light grey (Figs 30-35) .... *H. obtusipalpis*
- Forewing dark grey with black scales concentrated mainly along veins, hindwing dark brown (Figs 24-29) .... *H. hispanica* sp. n.
4. Segment 2 of labial palpus covered dorsally with smooth scales (Fig. 7) ... *H. centralasiae* sp. n.
- Segment 2 of labial palpus dorsally with short brush of raised scales in distal 1/3 5
5. Forewing dark grey, contrasting, veins and fold mottled with light brown, black markings distinct, hindwing dark grey (Figs 36-38) .... *H. statices*
- Forewing light grey to light brown, plain, without light brown irroration along veins, black markings indistinct (Figs 42-44, 47-50) 6
6. Segment 2 of labial palpus weakly curved, far protruded forwards, 3 times as broad as segment 3 (Fig. 8) .... *H. inderskella*
- Segment 2 of labial palpus distinctly turned upwards, segment 2 twice breadth of segment 3 (Figs 10-12) 7
7. Apex of hindwing broadly rounded or just weakly pointed (Fig. 47) .... *H. symmocella*
- Apex of hindwing more pointed (Figs 48-50) .... *H. molitor*

Key to the species of *Holcophora* based on male genitalia

1. Genitalia symmetrical (Figs 57-62) 2

- Genitalia asymmetrical (Figs 63-77) 3
2. Anteromedial emargination of tegumen extending to 1/3 length of tegumen, cucullus about same width of sacculus (Figs 57-59) .... *H. hispanica* sp. n.
- Anteromedial emargination of tegumen extending to 1/2-2/3 length of tegumen, cucullus distinctly narrower than sacculus (Figs 60-62) .... *H. obtusipalpis*
3. Uncus placed medially, tegumen longer than broad (Figs 71-73) .... *H. rostrella* sp. n.
- Uncus placed on left corner of tegumen, tegumen as long as broad or broader than long 4
4. Sacculus covered apically with modified scales, apical sclerite of phallus long strongly recurved (Figs 74-77) 5
- Sacculus apically without modified scales, apical sclerite of phallus short, straight 6
5. Uncus rounded apically, without dorsal process, sacculus 3 times as broad as cucullus, saccus parallel-sided to 3/4 length (Fig. 77) .... *H. symmocella*
- Uncus pointed apically, with dorsal process, sacculus twice as broad as cucullus, saccus triangular (Figs 74-76) .... *H. molitor*
6. Uncus short, twice as long as broad, process on left margin of tegumen long, apex of phallus with two sclerites facing in opposite direction (Figs 68-70) .... *H. inderskella*
- Uncus long, considerably longer than broad, process on left margin of tegumen short or absent, apex of phallus with one sclerite (Figs 63-67) 7
7. Uncus sharply pointed, tegumen with short process on left margin and longer process on right margin, sacculus 3 times as broad as cucullus (Figs 65-67) .... *H. statices*
- Uncus not pointed, tegumen without process on left margin but short process on right margin, sacculus almost length of cucullus (Figs 63-64) .... *H. centralasiae* sp. n.

Key to the species of *Holcophora* based on female genitalia

1. Signum triangular (Figs 78-80) .... *H. hispanica* sp. n.
- Signum rhomboid, sub-hexagonal, ovate or rounded (Figs 81-95) 2
2. Signum of *Gelechia*-type, large, hexagonal, opposing edges strongly bent upwards and inwards (Figs 81-83) .... *H. obtusipalpis*
- Signum rounded, ovate or rhomboid (Figs 84-95) 3
3. Ductus bursae three times length of corpus bursae, signum rounded, with spiny edge (Figs 91-92) .... *H. rostrella* sp. n.
- Ductus bursae at most twice length of corpus bursae, signum different, if rounded, opposing edges bent moderately upwards and inwards (Figs 84-90, 93-95) 4
4. Signum rhomboid, edge with distinctive spine pointing towards fundus bursae (Figs 88-90) .... *H. centralasiae* sp. n.
- Signum ovate or rounded, posterior part narrow with serrated margin (Figs 86-87, 93-95) 5
5. Signum rounded with broad medial zone, antrum distinctly broader than adjacent part of ductus bursae, with short posteromedial sclerite, signum rounded (Figs 86-87) .... *H. inderskella*
- Signum ovate or rhomboid with narrow medial zone, antrum narrower or slightly broader than adjacent part of ductus bursae, without short posteromedial sclerite (Figs 84-85, 93-95) 6
6. Signum slightly broader than adjacent part of ductus bursae, anterior margin of sternum VIII comparatively broad, distinctly projecting anteriorly, corpus bursae 1/2 length of ductus bursae (Figs 84-85) .... *H. statices*
- Signum distinctly narrower than adjacent part of ductus bursae, anterior margin of sternum VIII narrow, weakly projecting anteriorly, corpus bursae about length of ductus bursae (Figs 93-95) .. 7
7. Sternum VIII with distinct anteromedial folds, medial ridge of signum of even width (Fig. 93) .... *H. molitor*
- Sternum VIII without anteromedial folds, medial ridge of signum constricted in middle (Figs 94-95) .... *H. symmocella*

Review of species

Holcophora hispanica Gastón & Vives, sp. n.

(Figs 1-2, 13, 24-29, 57-59, 77-79)

(= *Aponoea obtusipalpis* sensu Vives, 1992)

Material examined: Holotype 1 ♂, SPAIN, Madrid, El Regajal, Aranjuez, 489 m, 14-IX-1980, A. Vives leg. (gen. slide 1619AV), deposited in the collection AV/MNCN.

Paratypes: SPAIN, Alicante, La Marina, 6 m, 1 ♀, 15-22-IX-1999, J. Wolschrijn leg. (gen. slide 4068AV); La Marina, Platje el Pinet, 6 m, 1 ♀, 22-25-IX-2000, J. Wolschrijn leg. (gen. slide 4073AV); La Marina, Platje el Pinet, 6 m, 1 ♀, 16-IX-2001, J. Wolschrijn leg.; Santa Pola, Salt marsches, 1 km S of Balsares, 50 m, 1 ♀, 26-27-IX-2005; 1 ♂, 1 ♀, 12-VI-2007, J. Šumpich leg. (gen. slide 4070AV, 4072AV); Sierra de Orcheta, Finestrat env., 1 ♂, 28-IX-2005, J. Šumpich leg. (gen. slide 4071AV) (all AV/MNCN); Torrevieja, Lago Jardín, 1 ♀, 28-VI-1989, B. Bengtsson leg. (ZMUC); La Marina, Platje el Pinet, 1 ♂, 14-X-1998, J. Wolschrijn leg. (gen. slide 6539 H. Hendriksen); same data but 2 ♀♀, 10-16-IX-2001; same data 1 ♂, 2-X-2006 (all ZMUC); Santa Pola, 1 km South of Balsares, 50 m, 26-27-IX-2005, 5 ♂♂, 4 ♀♀, J. Šumpich leg. (all NMPC); same data but 27-IV-2008, 3 ♂♂, 1 ♀, J. Šumpich leg. (NMPC); same data but 1 ♂, 3 ♀♀, 21-X-2009, J. Šumpich leg. (NMPC); same data but 12-VI-2007, 2 ♀♀, J. Šumpich leg. (NMPC); Route 8 km North of Albatera, 300 m, 4-VIII-2010, 1 ♂, 3 ♀♀, J. Šumpich leg. (NMPC). Almería, Pozo del Esparto, 0 m, 1 ♀, 10-IV-1979, J. Calle leg. (gen. slide 1492AV); Tabernas. env. Agüilla Salada [Alhamilla], 420 m, 2 ♂♂, 2-3-V-2008, J. Šumpich leg. (gen. slide 4064AV) (all AV/MNCN); Rambla de Tabernas, 300 m, 1 ♂, 28-V-2018, J. Gastón leg. (gen. slide 7268JG); same data but 2 ♂♂, 2 ♀♀, 25-X-2019, J. Gastón leg. (gen. slide 8021JG, 8022JG); same data but 2 ♀♀, 2-V-2017, J. Gastón leg. (gen. slide 8023JG) (all RCJG); Mini Hollywood, 230 m, 3 ♂♂, 6 ♀♀, 14-15-X-1992, M. Fibiger leg. (gen. slide 87/20OB, 1365, 1405 H. Hendriksen, 69958, 69959 M. Ponomarenko) (ZMUC); 5 km N Carboneras, 10 m, 1 ♂, 16-X-1992, M. Fibiger leg.; 4 km SW Tabernas, 500 m, 2 ♀♀, 5-V-1997, P. Skou leg.; same data but 5 km SW Tabernas, 200 m, 1 ♂, 28-V-1998; same data but 1 ♂, 1 ♀, 18-25-IV-2000, B. Skule and P. Skou leg.; 3 km W Tabernas, Rambla de Tabernas, 400 m, 8 ♂♂, 20 ♀♀, 3-V-2000, P. Skou leg., genitalia slide 4444 H. Hendriksen; same data but 3.5 km SW Tabernas, 350 m, 1 ♂, 30-X-2005, B. Skule and P. Skou leg.; same data but 2 km W Tabernas, 400 m, 1 ♂, 15-V-2006, P. Skou leg.; above Tabernas, 600 m, 1 ♀, 23-VI-2008, G. Jeppesen leg. (all in ZMUC); Tabernas, 380 m, 3 ♂♂, 6-8-VII-2007, G. Jeppersen leg.; El Pozo de Esparto, 20 m, 1 ♀, 22-26-IV-2001, Skule and Skou leg.; same data but 1 ♀, 1-XI-2005; same data but 10 m, 2 ♀♀, 7-8-IV-2007, P. Skou leg.; same data but 4 ♂♂, 12-IX-2009, P. Skou leg.; El Pozo de Esparto, 20 m, 1 ♀, 22-26-IV-2001, B. Skule and P. Skou leg.; same data but 1 ♀, 1-XI-2005; same data but 10 m, 2 ♀♀, 7-8-IV-2007, P. Skou leg.; same data but 4 ♂♂, 12-IX-2009, P. Skou leg. (all ZMUC); Tabernas, 380 m, N37º 02’, W002º 23’, 1 ♂, 6-8-VII-2007, G. Jeppersen leg. (gen. slide 86/20OB) (RCOB); 3 km W Tabernas, 1 ♂, 1 ♀, 30-IX-2001, C. Gielis leg. (RMHN); Tabernas, Trockental, 342 m, 1 ♂, 1 ♀, 16-VI-2019, F. Graf leg. (RCFG) (Fig. 24-26); Tabernas environs, Rambla de Tabernas, 400 m, 7 ♂♂, 7 ♀♀, 2-3-V-2008 J. Šumpich leg. (NMPC); same data but 1 ♂, 1 ♀, 3-VIII-2010; same data but 18-19-X-2009, 1 ♂, M. Dvořák leg. (NMPC); same data but 29-IV-4-V-2009, 12 ♂♂, 31 ♀♀, M. Dvořák leg. (NMPC; RCMD); Sierra de Alhamilla, vicinity of Huebro, 700 m, 1 ♂, 20-21-V-1999, J. Šumpich leg. (NMPC); same data but 29-IV-2008, 11 ♂♂, 10 ♀♀, J. Šumpich leg. (NMPC); Sierra de Alhamilla, vicinity of Níjar, 560 m, 13-14-VI-2007, 1 ♂, J. Šumpich leg. (NMPC); same data but 9-V-2005, 6 ♀♀, J. Šumpich and M. Dvořák leg. (NMPC); Sierra Cabrera, Mojacar env., El Agua del Medio, 50-150 m, 2 ♀♀, 4-V-2008, J. Šumpich leg. (NMPC). Granada, Cam. Baza-Benamaurel, 15 km de Baza, 3 ♀♀, 16-VII-[19]87, G. Baldizzone and E. Traugott-Olsen leg. (gen. slide 3697AV, 3698AV, 3699AV) (AV/MNCN); 110 km NE Granada, Baza, 1 ♀, 18-IX-1973, M. and W. Glaser leg.; same data but 1 ♂, 1 ♂, 19-IX-1973, gen. slide 290/08OB (SMNK); same data but 1 ♂, 2 ♀♀, 25-26-IX-1973 (all ZMUC); Barranco del Espartal, Baza, 750 m, 1 ♀, 22-VIII-1999, J. Gastón leg. (gen. slide 7180JG) (RCJG). Madrid, Aranjuez, 1 ♀, 480 m, 1 ♀, 9-VI-2001, C. Gómez leg., ex l. *Limonium* (gen. slide 188AV); El Regajal, Aranjuez, 489 m, 2 ♂♂, 3 ♀♀, 14-IX-1980, A. Vives leg.; Sotomayor, Aranjuez, 4 ♂♂, 2 ♀♀, 23-VIII-2002, A. Vives leg. (gen. slide 4065AV) (all AV/MNCN); Colmenar de Oreja, Valle de San Juan, 600 m, 1 ♂, 2 ♀♀, 12-13-X-2009, J. Šumpich leg. (NMPC). MÁLAGA, Camino de Ojén, 150 m, 1 ♀, 6-VI-1986, E. Traugott-Olsen leg. (ZMUC). MURCIA, Ajauque y Rambla Salada, Fortuna, 150 m, 1 ♂, 1-V-2019, M. Garre leg. (gen. slide 4067); Saladares del Guadalentín, Alhama de Murcia, 160 m, 1 ♀, 10-VII-2017, M. Garre leg. (gen. slide 4066AV) (all AV/MNCN); Alhama de Murcia, 30 m, 1 ♀, 9-X-1977, M. and W. Glaser leg. (gen. slide 291/08OB); same data but 1 ♀, 10-VI-1976, M. and W. Glaser leg. (gen. slide 164/19OB); same data but, 1 ♂, 2-X-1977 (gen. slide 120/20OB), Alhama de Murcia, Sierra Espuña, 2 ♀♀, 28-IX-1973, M. and W. Glaser leg. (gen. slide 170/19OB, 92/20OB); same data but, 1 ♂, 13-VI-1974 (gen. slide 93/20OB) (all in SMNK); 4 km W Águilas, 5 m, 1 ♂, 20-22-IX-1995, H. van der Wolf leg.; 1 ♂, same data but 15-IX-1997; 5 km W Águilas, 5 m, 4 ♂♂, 2 ♀♀, 15-IX-1999, C. Gielis leg.; 1 ♂, same data but 9-IV-2000; 2 ♂♂, same data but 27-IX-2001 (RMNH, ZMUC); 2 km S. of Bolnuevo, 5 m, 2 ♀♀, 28-30-IV-2000, P. Skou leg. (gen. slide 82/20OB); Bolnuevo by Mazarrón, 10 m, 1 ♂, 15-IV-2001, P. Skou and B. Skule leg. (gen. slide 81/20OB) (ZMUC).

Diagnosis: *H. hispanica* sp. n. can be recognized externally by the grey forewing with black suffusion along the veins in combination with the long porrect segment 2 of the labial palpus that bears a large triangular brush of raised scales on its dorsal surface. *H. obtusipalpis* differs in the lighter grey head, thorax and forewing with black scales randomly spread over the wing surface rather than concentrated along the veins as in *H. hispanica* sp. n. These species can also be separated by the hindwings that are dark brown in *H. hispanica* sp. n. but light grey in *H. obtusipalpis*. The symmetrical male genitalia with the triangular tegumen ending in a short uncus are characteristic. The main differences from the very similar *H. obtusipalpis* are the shorter anteromedial emargination of the tegumen extending to 1/3 of its length (to 1/2-2/3 in *H. obtusipalpis*), the cucullus that is wider than the sacculus (distinctly narrower in *H. obtusipalpis*), and the phallus with an egg-shaped rather than round caecum and with a distinct, though short apical arm (absent in *H. obtusipalpis*). The female genitalia are easily recognizable by the narrow triangular signum that is unique in the genus *Holcophora*.

Description: Adult (Figs 24-29). Head with labial palpus, thorax and tegulae covered with grey brown-tipped or black-tipped scales, frons lighter, grey; segment 2 of labial palpus long, porrect with large triangular brush of raised scales on upper surface, segment 3 about 1/5-1/4 length and 1/4-1/3 width of segment 2, acute, with white tip (Figs 1-2); antennal scape brown densely mixed with white, flagellomeres brown with narrow white rings, densely ciliated on ventral surface in male (Fig. 13); wingspan 14-20 mm, forewing covered with grey brown-tipped or black-tipped scales, latter usually weakly raised and concentrated mainly along veins, in fold and along termen; some specimens with additional white irroration in fold and along veins; fringe grey, black-tipped; hindwing and fringe dark brown.

Male genitalia (Figs 57-59): Uncus short, triangular, pointed, margins with few very long setae; gnathos lobe membranous; lobes of culcitula small, rounded, covered with long setae; tegumen triangular, with indistinct transition to uncus, anteromedial emargination very broad, rounded, extending to 2/3 length of tegumen; cucullus broad at base, distal part narrow, densely setose, slightly exceeding tip of uncus, apex rounded or weakly pointed; sacculus slightly shorter, at base distinctly broader than cucullus, distal half 1/2 width of basal half and 1.5x width of cucullus, outer margin evenly curved, apex setose, weakly bifurcated; vinculum narrow; saccus stout, broad, tapered towards rounded apex; phallus as long as tegumen and uncus, caecum strongly swollen, egg-shaped, half as long as phallus, distal part parallel-sided, 1/2-1/3 width of caecum, with lateral sclerotized rod ending in narrow apical sclerite (apical arm), bulbus ejaculatorius twice as long as phallus, broadening anteriorly.

Female genitalia (Figs 77-79): Papillae anales sub-triangular, covered densely with setae; apophyses posteriores slender, slightly longer than papillae anales; apophyses anteriores 1/2 length of segment VIII and apophyses posteriores, straight; tergum VIII broadly emarginated anteriorly, anteromedial emargination broad, strongly edged, extending to 1/2 length of tergum VIII; sternum VIII with distinctly sclerotized, narrow, anteriorly emarginated anterior margin, subostial sclerites distinct, triangular; antrum short, funnel-shaped, with indistinct transition to long ductus bursae that widens towards variously shaped corpus bursae; signum 1/3-1/2 length of corpus bursae, triangular, with serrated margins, fixed by short process to small rounded or elongated basal plate, sometimes with two anteriorly projecting processes on wall of corpus bursae.

Biology: The host-plant is *Limonium dichotomum* (Cav.) O. Kuntze (Plumbaginaceae) (GÓMEZ DE AIZPÚRUA, 2007). The larvae were observed feeding quite exposed on that plant and ready to "jump" off of disturbed. Adults fly from April to July and in September-October, probably in two generations.

Distribution: Only known from Spain, present in the provinces of Alicante, Almería, Granada, Madrid and Murcia.

Etymology: Named after the place of collecting of the type series "*Hispanica*" (Spanish).

Holcophora obtusipalpis (Walsingham, 1905)
(Figs 3-4, 14-15, 20, 23, 31, 36-41, 60-62, 80-82)
Aponoea obtusipalpis Walsingham, 1905. *Entomologist's mon. Mag.*, **41**: 125
TL: Biskra, ALGERIA
= *Mesophleps cinerellus* Turati, 1930. *Atti Mus. Civ. Hist. Nat. Milano*, **69**(1): 80, pl. 2, fig. [unnumbered] (synonymized by LI & SATTLER, 2012)
TL: Barce, Bengasi, LIBYA
= *Aponaea* (sic!) *pruinosella* Chrétien, 1915. *Ann. Soc. ent. Fr.*, **84**: 330. **Syn. n.**
TL: Gafsa, TUNISIA
= *Spermanthrax pycnostoma* Meyrick, 1936. *Exotic Microlepid.*, **4**(20): 625. **Syn. n.**
TL: El Goléa, ALGERIA

Material examined: ALGERIA, Lectotype of *Aponoea obtusipalpis* ♀, Biskra, 7-III-1903 (Walsingham, nº 96644) (NHMUK). Hammam-es-Salahin, 1 ♂, 16-V-1903, Walsingham leg. (SMNK). Hammam-es-Salahin, 14-V-1903, 1 ♂, Walsingham leg., 89897, Walsingham Collection, 1910-427. Photo/Gen. prep. J. Šumpich 18/025 (NHMB). Biskra, ex *Limoniastrum*, 16-IV-1906, Walsingham leg., 1 ♂, Walsingham Collection, 1910-427. Photo/Gen. prep. J. Šumpich 18/024 (NHMB); "St. Germain", 1 ♂ (gen. slide 35/05OB) (MNHN). EGYPT, Mersa Matruh, Light Trap, Egypt Ministry of Agriculture, coll. Kasim, 1 ♀, 27-VIII-1935, *Nothris albidella* Rbl., ♀, Type (NHMV), Type photo 2013 (NHMV). LIBYA, Lectotype of *Mesophleps cinerellus* ♂, Cyrenaica, Banghâzi ("Bengasi"), 21-III-1922, Krüger leg. (NHMUK); LIBYA, Cyrenaica, 1 ♂, III, G. C. Krüger leg.; Gharian, Wadi El Hira, 3 ♂♂, 1 ♀, 22-III-22-IV-1982, U. Seneca leg. (all ZMUC). SPAIN, Gran Canaria, Teide, 2 ♀♀, XI-1958, Pinker leg. (gen. slide 151/19OB) (SMNK). TUNISIA, Gafsa, ex *Statice pruinosa* L., V-VI em VII (CHRÉTIEN, 1915) (MNHN); Oase Tozeur, 3 ♂♂, 3 ♀♀, 28-IV-11-V-1981, M. and W. Glaser leg.; Oase Tozeur, 3 ♂♂, 2 ♀♀, 28-IX-10-X-1980, M. and W. Glaser leg. (gen. slide 78/20OB ♀, 80/20OB ♂, 119/20OB ♂, 29/21OB ♂); 15 km S v. Hammamet, 1 ♀, 11-13-VII-1979, M. and E. Arenberger leg. (gen. slide 179/19OB) (all SMNK); Nefta area, 8 ♂♂, 1 ♀, 14-16-III-1986 (gen. slide 972OB ♂, 100/20OB ♀; same data but 4 ♂♂, 12 ♀♀, 1-4-V-1988, O. Karsholt leg. (gen. slide 66/20OB ♀, 71/20OB ♂, 4429 H. Hendriksen); Douz, 1 ♂, 15-IV-1983, J. Sunesen leg. (all in ZMUC).

Diagnosis: *H. obtusipalpis* can be recognized externally by the greyish-white forewing densely mixed with brown, usually without distinct markings, in combination with the long porrect segment 2 of the labial palpus bearing a large triangular brush of raised scales on its dorsal surface. *H. hispanica* sp. n. has a similar labial palpus but differs in having a dark greyish black rather than light grey forewing with black-tipped scales concentrated along the veins (randomly spread over the wing surface in *H. obtusipalpis* - but see remarks under Variation). Furthermore, the hindwing in *H. hispanica* sp. n. is dark brown in contrast to light grey in *H. obtusipalpis.* The male genitalia are recognizable by the triangular symmetrical tegumen and the short triangular uncus. For differences from *H. hispanica* sp. n. see under that species. In the female the ductus bursae is clearly separated from the antrum/colliculum, and the large signum is of typical *Gelechia* structure with the opposite edges raised and curved inwards to form a medial groove. In *H. symmocella* and *H. molitor* the antrum/colliculum is similarly separated from the ductus bursae; however, their signa, although also of the *Gelechia* type, are smaller and of a different shape.

Description: Adult (Figs 30-35). Head with labial palpus, thorax and tegulae covered with white brown-tipped scales, frons white with slight light brown shade, segment 2 of labial palpus long, porrect with large triangular brush of raised scales on upper surface, segment 3 about 1/5-1/4 length and 1/4-1/3 width of segment 2, acute, with white tip, scape brown densely mixed with white (Figs 3-4), flagellomeres ringed brown and white, in male densely ciliated on ventral surface (Fig. 14-15); wingspan 16-21 mm, forewing uniformly covered with white to cream or light grey scales with dark brown or black tips, diffuse brown spots in fold, along termen and/or in cell corner; indistinct light brown oblique fascia from ⁄ of costal margin to middle of fold expressed in some specimens, fringe grey brown-tipped; hindwing and fringe light grey.

Variation: There is extensive variation in the degree of brown of the basal fascia and the number of dark-tipped scales. The latter are usually spread randomly over the wings, but in some specimens they are concentrated along the veins.

Male genitalia (Figs 60-62): Uncus short, triangular, pointed, margins covered with long setae; gnathos lobe membranous, with straight posterior margin; culcitula absent; tegumen triangular, with indistinct transition to uncus, anteromedial emargination broad, rounded, extending to 1/2-1/3 length of tegumen; cucullus broad at base, distal part narrow, straight or weakly curved, densely setose, slightly exceeding top of uncus, apex rounded or pointed; sacculus at base distinctly broader than cucullus, distal half 1/2 width of basal half, slightly narrower than cucullus, extending to about top of cucullus, outer margin gradually bent, apex setose, weakly bifurcated, pointed; vinculum narrow; saccus stout, at base very broad, gradually narrowed towards rounded or pointed apex, far exceeding top of pedunculus; phallus as long as tegumen plus uncus, caecum strongly swollen, rounded, half as long as phallus, distal part parallel-sided or tapered, 1/2-1/3 width of caecum, with lateral sclerotized rod ending in narrow triangular apical arm, bulbus ejaculatorius 2-3 times as long as phallus.

Female genitalia (Figs 80-82): Papillae anales ovate to sub-triangular, covered densely with short setae; apophyses posteriores slender, slightly longer than papillae anales; apophyses anteriores 1/2 length of sternum VIII and 1/2-1/3 length of apophyses posteriores, straight, with weakly broadened base; tergum VIII broadly emarginated anteriorly, anteromedial emargination broad, strongly edged, extending to 1/2 length of tergum VIII; sternum VIII with distinctly sclerotized, narrow, weakly projecting anterior margin; antrum tubular, sclerotized posteriorly, with triangular medial sclerite, distinctly separated from ductus bursae which is gradually broadening towards rounded or ovate corpus bursae; signum plate sub-hexagonal, divided by narrow, medially constricted ridge into short posterior and long anterior parts.

Biology: The host-plants are *Limonium pruinosum* (L.) Chaz. ("*Statice pruinosa*") (CHRÉTIEN, 1915: 330) and, probably, *Limoniastrum guyonianum* Durieu ex Boiss. (Plumbaginaceae) (WALSINGHAM, 1905: 126; CHRÉTIEN, 1917: 480). Adults were collected from March to April, in July and again in September-October, probably in two or three generations.

Distribution: Spain: Canary Islands (new record), Algeria, Tunisia, Libya and Egypt (new record).

Remarks: *Aponoea obtusipalpis* was described by Walsingham from male and female collected in Biskra. The female "Type ♀ (96644)" was designated as the lectotype (ADAMSKI & SATTLER, 2019: 23). *Aponaea* (sic!) *pruinosella* Chrétien, 1915, was described from an unspecified number of specimens from Gafsa in Tunisia, bred from larvae feeding in May and June on *Limonium pruinosum* (L.) Chaz., the adults emerging in July. *Spermanthrax pycnostoma* Meyrick, 1936, was described from a single specimen collected by the "Comandant D. Lucas" from El Goléa in Algeria.

Nothris albidella Rebel is an unavailable manuscript name only found in the NHMV collection. A type was labelled by Rebel but the name was never made nomenclaturally available.

Holcophora statices Staudinger, 1871
(Figs 5-6, 16, 19, 27, 29, 32, 36-38, 65-67, 84-85)
Holcophora statices Staudinger, 1871. *Berl. ent. Z.,* **14**(3/4): 313-314
TL: Sarepta [Volgograd, Krasnoarmeysk], RUSSIA

Material examined: UKRAINE, Odessa region, Tatarbunary distr., 3 km N of Lebedivka vill., 45º50’52’’N 30º8’22’’E, 2 ♂♂, 1 ♀, 9-V-2020, E. Khalaim leg.; Ukraine, Odessa region, Tatarbunary distr., 6 km SE of Prymos’ke vill., 45º40’30’’N 29º52’11’’E, 2 ♂♂, 12-VIII-19, E. Khalaim leg.; Donetsk region, Khomutovskaya Steppe Nature Reserve, 5 ♂♂, 11-12-14-V-1996, O. Bidzilya leg. (gen. slide 25/21OB ♂); Donetsk region, Novoazovsk, sea shore, 1 ♂, 8-V-1996, O. Bidzilya leg.; Zaporizhzhaya region, Melitopil distr., vil. Troitske env., 1 ♂, 8-IV-2016, at light, A. Zhakov leg.; Zaporizhzhaya region, Priazovskiy distr., Stepanovka 1-ya, 1 ♂, 28-VIII-2011, at light, A. Zhakov leg.; Zaporizhzhaya region, Priazovskiy distr., Stepanovskaya kosa, 1 ♂, 9-V-1998, A. Zhakov leg.; Crimea, Chauda, 40 km E of Pheodosia, e.la. *Limonium meyeri*, 2 ♂♂, 3 ♀♀, 17-VI-2002, 22-VII-2002, Yu. Budashkin leg. (gen. slide 51/030OB ♀, 27/210OB ♀) (all ZMKU). RUSSIA, Lectotype, S Russia, Volgograd, Krasnoarmeysk (“Sarepta”), 1 ♂, H. Christoph leg. (MfN); Lower Volga reg., prov. Volgograd, distr. Pallasovka, lake Elton, loc. Tschernavka, 1 ♂, 3-8-V-2004, E. Rutjan leg.; Volga reg., prov. Saratov, distr. Krasnyi Kut, prope pag. Djakovka, vall. fl. Ersulan, 1 ♂, 12-13-V-2004, E. Rutjan leg.; Stavropolskiy krai, Neftekumsk env., 44º 40’ N, 44º 54’ E, 1 ♂, 21-VI-2004, at light, I. Kostjuk leg. (gen. slide 123/20OB) (all ZMKU); Dagestan, Temir-Goi, Temir-Khan-Sh. Okrug, saline near lake, at light, 1 ♀, 5-VIII-1924, M. Rjabov leg. (gen. slide 101/20OB) (ZIN); Orenburg district, near Burannoe village, 2 ♂♂, 20-VI-1999, K. and T. Nupponen leg. (ZMUC).

Diagnosis: A rather variable species. Specimens with contrasting brown irroration along veins and black markings can easily be recognized. Paler, uniformly greyish brown specimens may be confused with worn specimens of *H. inderskella* when occuring sympatrically in western Kazakhstan. In that case the darker head and tegulae in combination with the longer cilia on the male antennae in *H. statices* (Fig. 16) are diagnostic. The male genitalia are distinguished by the strong, narrow, hook-shaped uncus bent over the tegumen, in combination with the broad sacculus and slightly asymmetrical saccus. Other species of *Holcophora* have a less sclerotized uncus and a sacculus that is less than 4-5 times as broad as the cucullus. The very short and basally broadened apophyses anteriores, the shortly sclerotized antrum and broad anterior margin of sternum VIII are characteristic for the female genitalia of *H. statices* and unique in *Holcophora*.

Description: Adult (Figs 36-38). Head, thorax and tegulae dark, covered with brown grey-tipped scales, labial palpus weakly upturned, dark brown densely mixed with white, without white rings, with brush of raised scales in distal half, segment 3 1/4 length and 1/2-1/3 width of segment 2, acute with white tip (Figs 5-6); scape dark brown, flagellomeres brown and white ringed, densely pubescent ventrally in male (Fig. 16); wingspan 18-21 mm, forewing greyish brown to greyish black, veins distinctly mottled with light brown and more sparsely with black or white, two black streaks in fold, at 1/3 under costal margin, and in cell, termen black-spotted, fringe grey, brown-tipped with brown medial line; hindwing greyish black with grey fringe.

Variation: Specimens may look uniformly greyish brown or more contrasting depending on the degree of light brown or black suffusion along the veins.

Male genitalia (Figs 65-67): Uncus strong, hook-shaped, pointed, placed on left posterolateral corner of tegumen, bent over posterior margin of tegumen; gnathos belt-shaped, well sclerotized, with short triangular medial sclerite; lobes of culcitula large, rounded, covered with long setae; tegumen trapezoid, about as long as broad at base, posterior margin with distinct medial emargination; digitate process at 3/4 on left margin and longer process at 1/3-1/2 of right margin, anteromedial emargination broadly rounded, extending to about 1/2 length of tegumen; sacculus in middle 4-5 times as broad as cucullus, slightly narrowed basally and towards strongly sclerotized bifurcated pointed apex, extending to top of cucullus; cucullus slender, weakly curved, vinculum narrow; saccus broad, sub-triangular to parallel-sided to about 3/4 length, extending beyond top of pedunculus; phallus slightly shorter than tegumen, caecum rounded, moderately swollen, 1/3 length of phallus, distal part straight, with sclerotized rod along one side ending in sub-triangular apical arm, bulbus ejaculatorius slightly longer than phallus.

Female genitalia (Figs 84-85): Papillae anales sub-triangular, elongated, covered densely with short setae; apophyses posteriores slender, 1.5-2 times as long as papillae anales; apophyses anteriores very short, 1/4-1/3 length of sternum VIII, straight, with strongly broadened basal half; tergum VIII broadly emarginated anteriorly, anteromedial emargination broad, strongly edged, extending to 1/2 length of tergum VIII; sternum VIII with distinctly sclerotized, broadening anterior margin with broad triangular anteromedial projection; antrum short, funnel-shaped, shortly sclerotized posteriorly with gradual transition to ductus bursae; ductus bursae long, slender, gently widening towards corpus bursae, coiled before its entrance; corpus bursae rounded or ovate; signum plate ovate to rhomboid, with weakly serrated margins, medial ridge displaced posteriorly, separated by very narrow posterior part from broad anterior part that bears short medial sclerite at posterior margin, sometimes medial ridge absent but substituted by narrow median transverse fold.

Biology: The larvae were recorded feeding without a shelter on leaves and flowers of *Limonium meyeri* (Boiss.) O. Kuntze (Plumbaginaceae) in the Crimea. Pupation takes place without a cocoon in leaf-litter, with the pupa fixed at its posterior end to the substrate. Adults occur predominantly in halophytic habitats in May-June and again from the end of July to September in two generations (BUDASHKIN, 2014: 20).

Distribution: Across the Palaearctic Region from S France, Hungary, Rumania, S Ukraine, Russia: S and E of European part, Omsk region (PONOMARENKO & KNYAZEV, 2020: 281), W Kazakhstan (CARADJA, 1920: 115), Iran (WIESER *et al*., 2002) to W China.

Remarks: *H. statices* was described by Staudinger from 15 specimens of both sexes, which he had received from H. Christoph under the manuscript name *Ypsolophus statices*. As there was only one female amongst the 15 specimens caught Staudinger concluded that Christoph might not have bred the species but collected the adults from *Limonium* "*Statice*" flowers.

Holcophora inderskella (Caradja, 1920)
(Figs 8, 18, 42-44, 68-70, 86-87)
Blastobasis inderskella Caradja, 1920: 122. *Dt. ent. Z., Iris*, **34**(1-2): 122
LT: Oz Inder [Salt Lake Inderbora], KAZAKHSTAN

Material examined: KAZAKHSTAN, Lectotype ♂ [damaged], Oz Inder ['Indersky Salzsteppe'], 22-VI-1907, [Bartel leg.], designated by Popescu-Gorj (1992: 156) (MGAB); Paralectotype, ♀ [damaged], same data (MGAB); 20 km S Kzyl-Orda, 1 ♀, 6-IX-2000, P. Ustjuzhanin leg. (gen. slide 50/03OB); 145 km NW Alma-Ata, Ili river right bank, Mynbulak, 2 ♀♀, 18-VI-1998, M. Falkovitsh leg. (gen. slide 184/19OB); same data, 3 ♀♀, but 28-V-1990, "physophora" (gen. slide 77/20OB); SE Kazakhstan, Uigur distr., 15 km NW Chundzha, Yasenevaya roshcha loc., at light, 1 ♂, 15-V-1991, P. Ustjuzhanin leg. (gen. slide 48/03OB) (all ZMKU); Charyn Valley, 1080 m, 1 ♂, 18-V-2003, U. Jürivete and A. Potoski leg.; NW of Uch-Aral, 400 m, 1 ♂, U. Jürivete and A. Potoski leg. (all ZMUC) KYRGYZSTAN, Naryn River Valley, 1619 m, 1 ♂, 1 ♀, 3-VIII-2010, A. Potoski leg. (gen. slide 5373OK) (ZMUC). TADZHIKISTAN, Staraya Pristan', 12 km S of Dzhilinkul' on the Vahsh river, at light, 3 ♂♂, 2 ♀♀, 25-29-V-1949, Yu. Shchetkin leg. (gen. slide 98/20 ♂; 121/20OB ♂); same data, 1 ♀, but 28-V-1949 (all ZMKU); Gissarskiy khrebet, Dzhar-Kurgan vic., Surhandarya river bank, at light, 1 ♀, 14-IV-1966, A. Danilevskiy leg. (ZIN). TURKMENISTAN, Ispas, 70 km NW Tchardzhou, 1 ♀, 2-VI-1965, M. Falkovitsh leg. (ZIN)

Diagnosis: The species is characterized by a creamy grey forewing with veins distinctly mottled with dark and an oblique white basal fascia edged outwardly with brown. *H. inderskella* is similar to the sympatrically occuring *H. rostrella* sp. n., but differs in the unmodified head, shorter segment 3 of the labial palpus (1/4 length of segment 3 in contrast to 3/4 in *H. rostrella* sp. n.), presence of raised scales on the upper surface of segment 2, and the usually less distinct brown pattern distal of the basal fascia. *H. molitor* and *H. symmocella* can be separated by the upcurved rather than almost straight and forward-directed segment 2 of the labial palpus and the shorter, narrower segment 3. The male genitalia are easily recognizable by the broad, straight uncus, long left and right processes of the tegumen, the asymmetrical valva and the phallus with paired narrow apical processes. The antrum that is broader than the ductus bursae and the big (longer than ductus bursae) corpus bursae are diagnostic in the female genitalia.

Description: Adult (Figs 42-44). Head covered with white brown-tipped scales, frons almost white; segment 2 of labial palpus weakly curved, white densely mixed with brown, lower surface entirely white with raised white or white brown-tipped scales in distal 1/3; segment 3 short, straight, about 1/4 length and 1/3 width of segment 2, white mixed with brown, apex white, acute (Fig. 8); scape brown with white apex, flagellomeres white and brown-ringed; thorax and tegulae concolorous with head; wingspan 15-19 mm, ground colour of forewing white with weak cream or light brown shade, veins mottled with black to dark brown, black scales form diffuse small spots or short streaks in fold, in cell and along termen, an oblique white fascia broadly edged outwardly with light brown from 1/3 of costal margin to middle of fold; fringe white and brown-tipped; hindwing greyish brown, fringe light brown at base, distally light grey to white.

Male genitalia (Figs 68-70): Uncus lobe comparatively broad, elongate, densely covered with setae, situated on left posterolateral corner of tegumen; culcitula reduced to very short membranous humps with some setae; gnathos an indistinct membranous ring; tegumen as broad at base as long, sub-rectangular in posterior part, with distinct digitate process at 1/2 on left margin and large triangular lobe extending from right posterolateral corner; anteromedial emargination broad, extending to about 1/2 length of tegumen, posterior margin straight; valva with asymmetrical cucullus: right one slightly broader than left one, with pointed apex and short subapical triangular tooth on inner margin; sacculus in distal part about twice as broad as cucullus, with bifurcated apex extended to top of cucullus, basal part distinctly broadened; vinculum narrow; saccus broad, almost entirely parallel-sided, apex rounded, extended far beyond top of pedunculus; phallus as long as tegumen, caecum rounded, moderately swollen, 1/2 length and slightly broader than phallus, distal part straight, with distinct sclerotized paired rod along one side ending posteriorly in short triangular process on left side and longer, narrower process on right side, bulbus ejaculatorius twice as long as phallus.

Variation: One male from Tadzhikistan (gen. slide 98/20OB) differs in the basally constricted uncus, and the considerably broader right cucullus.

Female genitalia (Figs 86-87): Papillae anales ovate, covered densely with setae; apophyses posteriores slender, about same length as papillae anales; apophyses anteriores 1/3 length of sternum VIII, straight; tergum VIII broadly emarginated anteriorly, anteromedial emargination broad, strongly edged, extending to 1/2 length of tergum VIII; sternum VIII with distinctly sclerotized, weakly broadened anterior margin slightly projecting anteriorly with two short triangular humps; antrum broad with distinct lateral sclerotization, broader than adjacent part of ductus bursae; ductus bursae moderately broad, of even width; corpus bursae weakly or considerably elongated, longer than ductus bursae; signum plate rounded, with distinctly serrated margins, medial zone from 1/3 to 3/4 width of sigum.

Biology: Early stages and host-plant unknown. One of the examined specimens bears an additional label "physophora". It is unclear whether this name refers to a larval host-plant (*Suaeda physophora* Pall.) or something else. Adults were collected from mid-April to mid-June and again in early September, probably in two generations.

Distribution: Kazakhstan, Tadzhikistan, Turkmenistan.

Remarks: *Blastobasis inderskella* was described by Caradja from two "males" from "Oz Inder" ("Indersky Salzsteppe") - now Salt Lake Inderbora (Indersky Salt Lake) in the Atyrau region of West Kazakhstan (for details see ADAMSKI & SATTLER, 2019). The type specimens are pale, greyish brown (ADAMSKI & SATTLER, 2019: figs 14-15) and match better the above cited specimens from Kazakhstan, Turkmenistan and Tadzhikistan rather than the more contrasting greyish-black specimens from Mongolia figured as *H. inderskella* in ADAMSKI & SATTLER (2019: figs 9-13). Moreover, the Mongolian specimens have a prominent frontal modification of the head. Both lectotype and paralectotype of *B. inderskella* lack the heads, so that it is impossible to confirm the presence or absence of a head modification in those specimens. However, it may be significant that this rather prominent structure was not mentioned in the original description. This fact may serve as an additional argument for considering the externally similar specimens without head modification to be conspecific with *B. inderskella*. The specimens with modified head from Mongolia and Turkmenistan are described below as a new species.

Holcophora centralasiae **Bidzilya & Karsholt, sp. n.**

(Figs 7, 17, 39-41, 63-64, 88-90)

Material examined: Holotype 1 ♀, AFGHANISTAN, 10 km NW v. Kabul, 1900 m, 25-VI-1965, F. Kasy and E. Vartian leg. (NHMV).

Paratypes: same data as for holotype, 1 ♂ (SMNK); same data as for holotype but 14-VI-1965, 2 ♂♂, 2 ♀♀ (gen. slide 55/18OB ♂; 124/20OB ♂) (SMNK, NHMV); 40 km SW v. Kabul, 2300 m, 1 ♀, 29-VI-1965, F. Kasy and E. Vartian leg. (NHMV); Kabulschlucht, 22 km östl. Kabul, 1650 m, 1 ♀, 5-12-VI-1966, H. Amsel leg. (gen. slide 64/18OB) (SMNK). PAKISTAN, 80 km NW v. Quetta, 2100 m, 1 ♀, 15-V-1965, F. Kasy and E. Vartian leg. (gen. slide 359/19OB) (all SMNK).

Material not included in the type series: IRAN, Eifandagheh-Dji., Loft, 1 ♀, 20-IV-1977, Saf.-Zairi (gen. slide 32/21OB) (SMNK).

Diagnosis: A rather variable species that can be recognized by its narrow light grey forewing with dense brown suffusion and absence of distinct fasciae, tufts of scales and other markings that are usually characteristic for other *Holcophora* species. A slender segment 2 of the labial palpus without dorsal brush of raised scales is also diagnostic. A weakly curved uncus of even width, the sacculus of almost the same length as the cucullus and the tegumen with a short right lateral process are characteristic for the male genitalia. The female genitalia can easily be distinguished by its rhomboid signum with an extremely narrow medial ridge and broad posterior and narrow, elongated anterior part.

Description: Adult (Figs 39-41). Head, thorax and tegulae covered with white brown-tipped scales; labial palpus almost straight or slightly curved, directed upwards, white densely mixed with brown, segment 2 with diffuse white basal, medial and apical ring, upper surface white; segment 3 with white apex, acute, about 1/3 length and 1/2 width of segment 2 (Fig. 7); scape light brown densely mixed with white, flagellomeres brown, broadly white ringed; wingspan 15-18.5 mm, ground colour of forewing white to light grey with brown-tipped scales forming dense irroration along veins, in middle of cell and under fold, an indistinct brown dot at 1/2 of fold, two dots in middle of cell, fringe white and brown-tipped; hindwing light grey with brown suffusion along margins and veins, fringe grey.

Variation. Some specimens look almost uniformly brown with white irroration in fold and under costal margin.

Male genitalia (Figs 63-64): Uncus long, weakly bent, of even width with slightly pointed apex, placed on left posterolateral corner of tegumen; gnathos as narrow sclerotized ring, without medial sclerite; culcitula reduced; tegumen trapezoid, about as long as broad at base, posterior margin straight, short inwardly curved fold at 1/3 on left margin and short triangular process at 1/3 of right margin, anteromedial emargination broadly rounded, extending to about 1/2 length of tegumen; cucullus inflated at base, distal part slender, of even width, slightly narrower than sacculus; sacculus gradually bent, weakly narrowing towards strongly sclerotized bifurcated pointed apex extending to top of cucullus; vinculum narrow; saccus broad, sub-triangular to parallel-sided to 1/2 length, extending far beyond top of pedunculus; phallus as long as tegumen, caecum rounded, moderately swollen, 1/2 as long and 1.5 times as broad as phallus, distal part straight, with sclerotized apically weakly broadening rod along one side; bulbus ejaculatorius as long as phallus.

Female genitalia (Figs 88-90): Papillae anales ovate to sub-triangular, covered densely with short setae; apophyses posteriores slender, slightly longer than papillae anales; apophyses anteriores 1/3 length of sternum VIII, straight; tergum VIII broadly emarginated anteriorly, anteromedial emargination broad, strongly edged, extending to 1/2 length of tergum VIII; sternum VIII with distinctly sclerotized, weakly projecting anterior margin; antrum short, tubular with indistinct transition to ductus bursae; ductus bursae long, slender, weakly broadening towards corpus bursae; corpus bursae ovate, elongated, comparatively narrow; signum plate rhomboid, with distinct spike pointing towards fundus bursae.

Biology: Early stages and host-plant unknown. Adults were collected from late April to late June at altitudes up to 2100 m a.s.l.

Distribution: Afghanistan, Pakistan, Iran (?).

Remarks: A single female from Iran matches externally the type specimens but is excluded from the type series due to the small rounded rather than rhomboid signum (Fig. 90).

Etymology: The specific name reflects the distribution of this new species in some countries of Central Asia.

Holcophora rostrella Bidzilya & Sattler, sp. n.

(Figs 9, 21-22, 28, 30, 45-46, 71-73, 91-92)

(= *Holcophora inderskella* sensu Adamski & Sattler, 2019)

Material examined: Holotype 1 ♂, Mongolia, Gobi Altaj aimak, Zachuj Gobi, 10 km N von Chatan chajrchan Gebirge, 1150 m, Exp. Dr. Z. Kaszab, 1966 | Nr. 594, 27-VI-1966 (NHMB). Paratypes: 2 ♂♂, 1 ♀, same data as for holotype (gen. slide 72/20OB ♀, 73/20OB ♂) (NHMB); Gobi Altaj aimak, Zachuj Gobi, 10 km N of Chatan, Chajrchan mountains, 1150 m, 27-VI-1966, Z. Kaszab leg., 2 ♂♂ (gen. slide no. 14883) (NHMUK). Turkmenistan, Repetek, SE Karakumy, 19-VI-1982, at light, V. Krivohatskiy leg., 1 ♂ (gen. slide 91/11OB); Repetek, at light, 2-VIII-1983, V. Krivohatskiy leg., 1 ♀ (gen. slide 91/11OB); same data, but 12-V-1983, Falkovitsh leg., 1 ♂ (gen. slide 122/20OB); same data but 1-V-1983, 1 ♂ (gen. slide 30/21OB) (ZIN).

Diagnosis: This species is characterized by the creamy grey forewing with dark veins and a greyish brown patch in the middle of the cell. The distinct modification of the frontal part of the head is the most prominent feature for separating *H. rostrella* sp. n. from the externally similar *H. inderskella*. For additional differences from *H. inderskella* see under that species. The male genitalia can unmistakably be recognized by the elongated tegumen with gradual transition to the medially placed uncus, the right process of the tegumen that is fused with the uncus, the long and slender cucullus and the phallus with the bent distal part and long bulbus ejaculatorius. The distally club-shaped apophyses anteriores and posteriores, a long (3x length of corpus bursae) and twice coiled ductus bursae and rounded signum with a large rounded medial zone are characteristic for the female genitalia. The ductus bursae of other *Holcophora* species is shorter, up to twice the length of the corpus bursae, the apophyses anteriores and posteriores are distally not or at most slightly club-shaped and the medial zone of the signum is smaller.

Description: Adult (Figs 45-46). Head covered with white brown-tipped scales, frons white with distinct modification (for details see ADAMSKI & SATTLER, 2019: 19, figs 10-13); segment 2 of labial palpus slightly curved, covered with white brown-tipped scales, diffuse white ring at base, in middle and at apex, upper surface entirely white; segment 3 about fl length and 2/3 width of segment 2, white densely mixed with brown, apex white, acute (Fig. 9); scape brown with white apex, flagellomeres white and brown-ringed; thorax and tegulae concolorous with head; wingspan 16-21 mm, ground colour of forewing white to pale white with weak cream shade, veins mottled with brown, oblique brown fascia edged inwardly with white from 1/3 of costal margin to middle of fold bearing four tufts of brown scales, short basal oblique fascia with two tufts of brown scales, additional paired tufts of scales in middle and in corner of cell (Fig. 22), greyish brown pattern of irregular shape from outer border of middle fascia along middle width to 1/2 length; cilia white brown-tipped; hindwing greyish brown, with elongate patch of dark brown scales in middle length under costal margin in male (Fig. 21), fringe light brown at base, light grey to white in distal part.

Male genitalia (Figs 71-73): Uncus sub-rectangular, twice as long as broad, posterior margin distinctly sclerotized; gnathos reduced; culcitula absent; tegumen elongated, twice as long as broad at base, with gradual transition to uncus, left margin with sclerotized inwardly curved fold in distal 2/3, long digitate process at 2/3 on right margin, posteromedial emargination rounded, extending to 1/3 length of tegumen; cucullus slender to 3/4 length, apex distinctly widened and densely covered with setae, extending to top of uncus; sacculus slender, straight, extending to 2/3 of cucullus; vinculum narrow; saccus broad, triangular, extending far beyond top of pedunculus; phallus as long as tegumen, caecum distinctly swollen, rounded, 1/2 length and 2-3 times width of phallus, distal part slightly curved, with sclerotized rod along one side and distinct apical spine, bulbus ejaculatorius three times length of phallus.

Female genitalia (Figs 91-92): Papillae anales ovate, covered densely with short setae; apophyses posteriores slender, twice as long as papillae anales, distinctly club-shaped distally; apophyses anteriores 1/2 length of segment VIII, straight, rod-shaped; tergum VIII broadly emarginated anteriorly, anteromedial emargination broad, strongly edged, extending to 1/2 length of tergum VIII; sternum VIII with distinctly sclerotized, broadening anterior margin weakly projecting anteriorly; antrum short, colliculum tubular, transition to ductus bursae gradual; ductus bursae long, slender, twice coiled and gently widening towards spherical corpus bursae; signum plate simple, rounded, edged with strong spines.

Biology: Host-plant unknown. Adults were collected from mid-May to early August.

Distribution: Turkmenistan and Mongolia.

Remarks: A very detailed description of the adults, accompanied by SEM scans of the head of this species was provided by ADAMSKI & SATTLER, 2019 (as *H. inderskella*).

Etymology: The specific name derives from Latin "*rostrum*" meaning beak, snout, and reflects the beak-shaped frontal part of the head of this new species.

Holcophora molitor (Walsingham, 1896), **comb. n.**
(Figs 10, 48-50, 74-76, 93)
Gelechia molitor Walsingham, 1896, *in* Walsingham & Hampson. *Proc. zool. Soc. Lond.*, **1896**: 278
TL: Aden, YEMEN

Material examined: Holotype of *Gelechia molitor* ♂, Aden, 12-4-[18]95 | Type | 2239, Wlsm. 1896 | Gelechia molitor Wlsm., Proc. Zool. Soc. Lond., 1896, 278, Type, ♂ | B.M. Genitalia slide No. 7071, ♂ (NHMUK). IRAN, Dalaki, 130 m, 4 ♂♂, 4 ♀♀, 20-III-1973, H. Amsel leg. (gen. slide 168/19 ♂, 169/19 ♀; 83/20 ♂, 84/20 ♀; 85/20 ♂. BAHRAIN, Jurdeh, desert. No 1031 ♂, 23-IV-1960, E. Wiltshire leg. (gen. slide 94/20OB) (SMNK). SAUDI ARABIA, Jeddah, Northern Creek, 2 ♀♀, IX-XII-1979, U. Seneca leg.; same data but 1 ♂, 2 ♀♀, 15-IV-1980 (gen. slide 5370OK) (all ZMUC). UNITED ARAB EMIRATES, 8 km N Fujairah, 0 m, 1 ♂, 1 ♀, 22-II-2006, leg. C. Gielis, genitalia slide 6060, 6061 H. Hendriksen (RMNH, ZMUC).

Diagnosis: *H. molitor* is a light, yellowish brown species, with usually distinct light brown basal oblique fasciae, two brown spots in the cell and a comparatively large number of black-tipped scales scattered over the wing. For the differences from the externally most similar *H. symmocella* see under that species. The male genitalia are characterized by the long bent uncus, the sacculus covered apically with modified scales, and the phallus with a long, strongly curved apical arm. *H. symmocella* shares with *H. molitor* the above characters but can be separated by the apically rounded rather than pointed uncus without process, the narrower sacculus, longer and narrower saccus and differently shaped sclerite in the bulbus ejaculatorius. The female genitalia can be recognized by the presence of lateral folds in the membranous zone of sternum VIII in combination with triangular subostial sclerites and a corpus bursae that is longer than the ductus bursae. *H. symmocella* is most similar in the female genitalia but can be separated by the absence of anteromedial folds on sternum VIII and a narrower corpus bursae.

Description: Adult (Figs 48-50). Head, thorax and tegulae covered with brown-tipped scales; labial palpus recurved, white densely mixed with brown, segment 3 about 1/4 length and 1/3 width of segment 2, acute, segment 2 with group of raised white brown-tipped scales in distal half on upper surface (Fig. 10); scape white mixed with brown, flagellomeres white and brown-ringed; thorax and tegulae concolorous with head; wingspan 14.5-17 mm, forewing covered with white scales with light brown tips, fold lighter, almost white, diffuse oblique light brown fascia from 1/4 of costal margin to end of fold, two diffuse brown spots in cell, black-tipped scales usually randomly spread over wing, but forming indistinct small black spots in fold, two black spots under basal 1/3 of costal margin and some black spots at apex of wing in some specimens, fringe white, brown-tipped; hindwing white, shaded with light brown along margins, fringe white.

Male genitalia (Figs 74-76): Uncus long, slender, broadest in middle, with short subapical process, bent over posterior margin of tegumen; gnathos reduced; lobes of culcitula distinct, rounded, covered with long setae; tegumen trapezoid, about as long as broad at base, left margin with distinct inwardly curved sclerotized fold extending anteriorly from base of uncus to about anterior margin of tegumen narrow apically rounded digitate process at 1/3 on left margin and slightly longer process at 1/3 of right margin, short triangular process at right posterior corner, anteromedial emargination broadly rounded, extending to middle of tegumen about 1/2 length of tegumen; cucullus slender, straight, slightly narrowing apically, sacculus in middle about twice as broad as cucullus, extending to 2/3 length of cucullus, with medially curved inner and basally curved outer margin, apex narrowing, densely covered with modified scales; vinculum narrow; saccus broad, sub-triangular, apex rounded, extending beyond tip of pedunculus; phallus as long as tegumen, caecum rounded to ovate, distinctly swollen, slightly less than 1/2 length of phallus, distal part straight, about 1/2 width of caecum, with paired sclerotized rod along one side ending in sub-triangular apical sclerite and long thin almost circular apical arm, bulbus ejaculatorius twice as long as phallus.

Female genitalia (Fig. 93): Papillae anales sub-triangular, covered densely with short setae; apophyses posteriores slender, slightly longer than papillae anales; apophyses anteriores 1/2 length of segment VIII, straight; tergum VIII broadly emarginated anteriorly, anteromedial emargination broad, strongly edged, extending to 1/2 length of tergum VIII; sternum VIII with distinctly sclerotized, narrow straight anterior margin with paired triangular sclerite on both sides of ostium and distinct anteromedial folds; antrum short, tubular, distinctly sclerotized colliculum, with distinct transition to ductus bursae; ductus bursae short, moderately broad, gently widening towards corpus bursae; corpus bursae large, rounded, longer than ductus bursae; signum plate rounded weakly prolonged, with finely serrated margins, medial zone ovate, 1/3 width of signum plate.

Biology: Host-plant unknown. Adults were collected from March to April and from September to December, probably in two generations.

Distribution: Palaearctic and Afrotropical regions: Bahrain (new record), South Iran (new record), Saudi Arabia (new record), United Arab Emirates (new record), Yemen.

Remarks: *Gelechia molitor* was described from a single male collected on 12th April 1895 in Aden (Yemen).

Holcophora symmocella (Rebel, 1907), **comb. n.**

(Figs 11-12, 47, 77, 94-95)

Epimesophleps symmocella Rebel, 1907. *Lepid. Südarabien u. Insel Sokótra*: 95, fig. 40 [1931. *Denkschr. Akad. Wiss. Wien, Math.-naturwiss. Kl.,* **71**(2): 125, fig. 40.]

TL: Socotra, [Maaleh], Djebel Bedu, YEMEN

Material examined: SOCOTRA ARCHIPELAGO, Abd al Kuri Island, Towanie vol. env., 12º 10’N, 52º 13’ E, 1 ♂, 8 ♀♀, 25-27-II-2008, A. Saldaitis leg. (gen. slide 94/11OB ♂, 175/19OB ♀); Samha island W, 12º 09’N, 052º 59’ E, 1 ♀, 23-24-II-2008, A. Saldaitis leg. (all ZMKU).

Diagnosis: *H. symmocella* is well distinguished externally by the light yellowish white forewing with two large diffuse yellowish brown spots in the cell and the rounded apex of the hindwing. *H. molitor* is very similar externally but can be separated by the more pointed apex of the hindwing, the usually distinct oblique basal facia, the smaller brown (rather than large yellowish brown) spots in the cell, the darker, brown (rather than yellowish brown) suffusion along the veins, and the usually larger number of black-tipped scales. The male genitalia are characterized by the long bent uncus, the sacculus that is covered apically with modified scales, and the phallus with a long strongly curved apical arm. For differences from *H. molitor* see under that species. The female genitalia can be recognized by the moderately broad ductus bursae with a distinct transition to the antrum and the large (longer than ductus bursae) corpus bursae. *H. molitor* differs in the presence of anteromedial folds on sternum VIII and the bigger, spherical rather than oval corpus bursae.

Description: Adult (Fig. 47). Head and thorax white, tegulae white to light yellow; labial palpus slightly curved, white with diffuse narrow rings formed by brown-tipped scales, segment 3 about 1/4 length and 1/3 width of segment 2, acute, segment 2 with group of raised scales in distal half on upper surface (Figs 11-12); scape white, flagellomeres with with indistinct greyish brown apical rings; wingspan 13-14 mm. Forewing light, yellowish white, fold, veins in apical 1/3 and costal area slightly darker, yellowish brown, two diffuse yellowish brown spots in cell; fringe yellowish white, brown-tipped; hindwing and fringe white.

Variation. Some specimens with slightly raised black-tipped scales randomly scattered over the wing.

Male genitalia (Fig. 77): Uncus long, slender, broadening distally, with rounded apex, placed on left posterolateral corner of tegumen, bent over posterior margin of tegumen; gnathos reduced; lobes of culcitula rounded, covered with long setae; tegumen trapezoid, about as long as broad at base, left margin with distinct inwardly curved sclerotized fold extended anteriorly from base of uncus to about half length, narrow, apically rounded digitate process at 1/2 on left margin and twice length of process at middle of right margin, long triangular process at right posterior corner of tegumen, anteromedial emargination broad with straight posterior edge, extending to about 1/2 length of tegumen; cucullus slender, straight, sacculus in middle about twice as broad as cucullus, extended to 3/4, with medially bent inner and basally bent outer margin, narrowed apex densely covered with modified scales; vinculum narrow; saccus elongated, parallel-sided to 3/4, then narrowing towards rounded apex, extending far beyond the top of pedunculus; phallus as long as tegumen, caecum rounded, distinctly swollen, about 1/2 length of phallus, distal part straight, about 1/2 width of caecum, with paired sclerotized rod along one side ending in long narrow almost circular apical arm, bulbus ejaculatorius twice length of phallus.

Female genitalia (Figs 94-95): Papillae anales sub-triangular, covered densely with short setae; apophyses posteriores slender, slightly longer than papillae anales; apophyses anteriores 1/2-1/3 length of segment VIII, straight; tergum VIII broadly emarginated anteriorly, anteromedial emargination broad, strongly edged, extending to fi length of tergum VIII; sternum VIII with distinctly sclerotized, slightly widening anterior margin and distinct triangular sclerites on both side of ostium; antrum short, with tubular, distinctly sclerotized colliculum; ductus seminalis leaving ductus bursae distant from antrum/colliculum; ductus bursae short, moderately broad, slightly widening towards corpus bursae; corpus bursae large, ovoid, longer than ductus bursae; *Gelechia*-type signum ovoid to rhomboid, with serrated margin, raised opposite edges moderately curved inwards, leaving medial groove about 1/3 width of signum.

Biology: Host-plant unknown. Adults were collected in January and late February. The type series was found by sweeping in grassy places (REBEL, 1907: 125).

Distribution: Only known from the Socotra archipelago (Yemen).

Remarks: *Epimesophleps symmocella* was described from three males and one female collected by O. Simony on 12th January 1899 on the island of Socotra. The type-specimens could not be traced in Rebel's collection in NHMV.

Appendix: Unresolved taxon

Holcophora aphridias (Meyrick, 1925), **comb. n.**
Epimesophleps aphridias Meyrick, 1925, *Bull. Soc. ent. Egypte,* **9**: 210
TL: Wadi Gerrawi, EGYPT

Remarks: The status of this species is dubious. *Epimesophleps aphridias* was described by Meyrick from a single female collected by Alfieri in April amongst *Astragalus*. The holotype could not be traced; it is not found in Meyrick's collection. GAEDE (1937: 424), followed by *The Global Lepidoptera Index*, erroneously attributed the authorship of *Epimesophleps aphridias* to Rebel.

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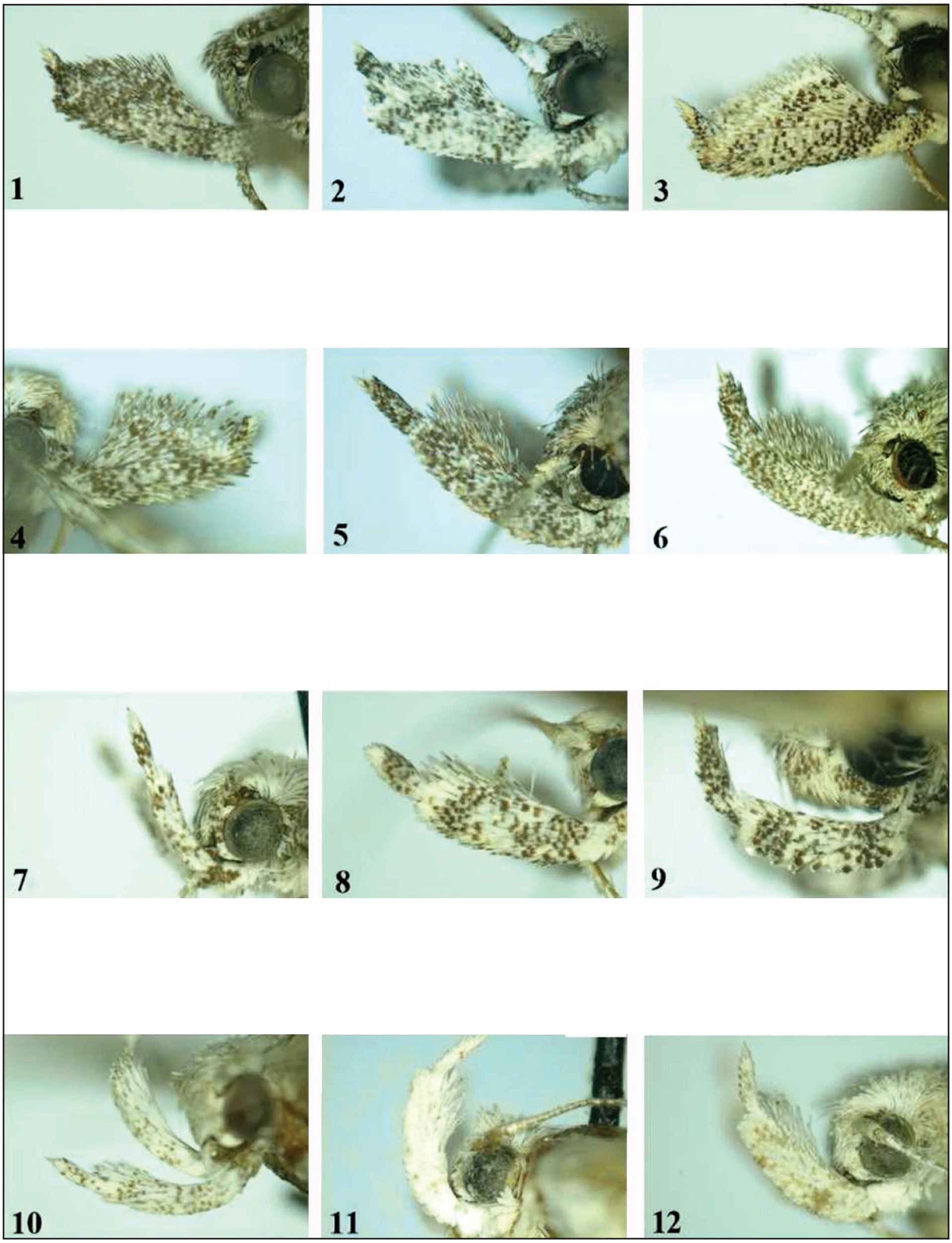

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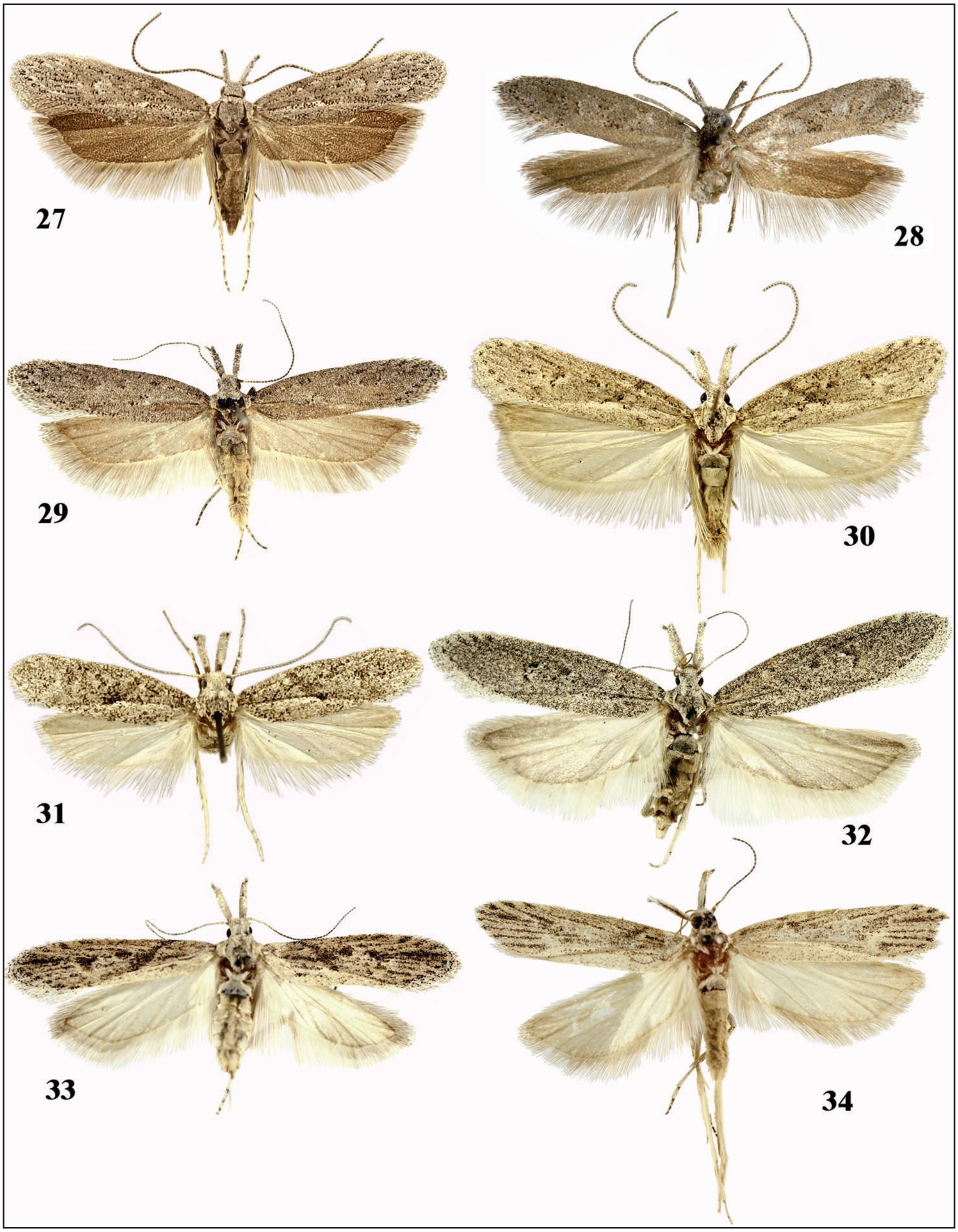

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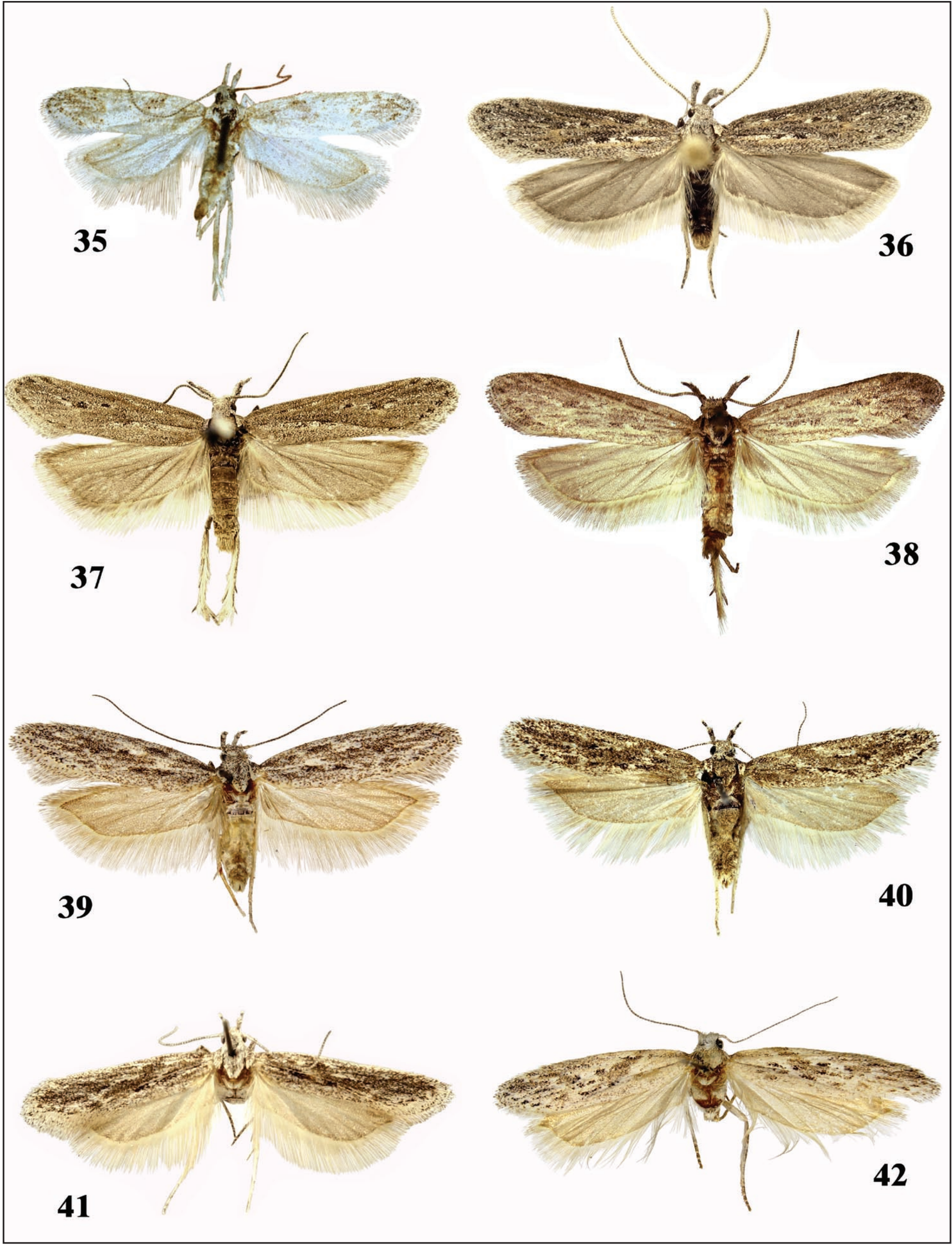

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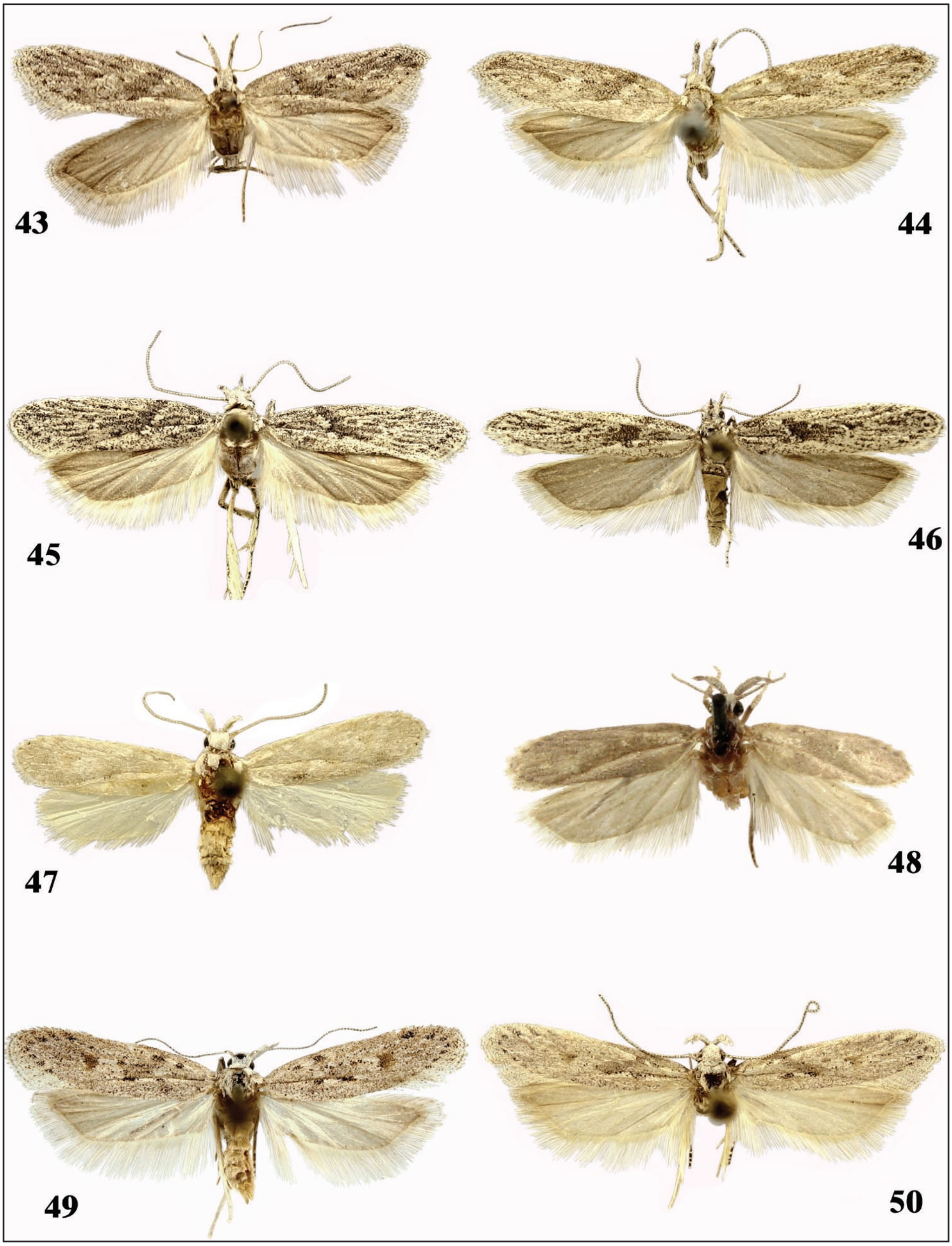

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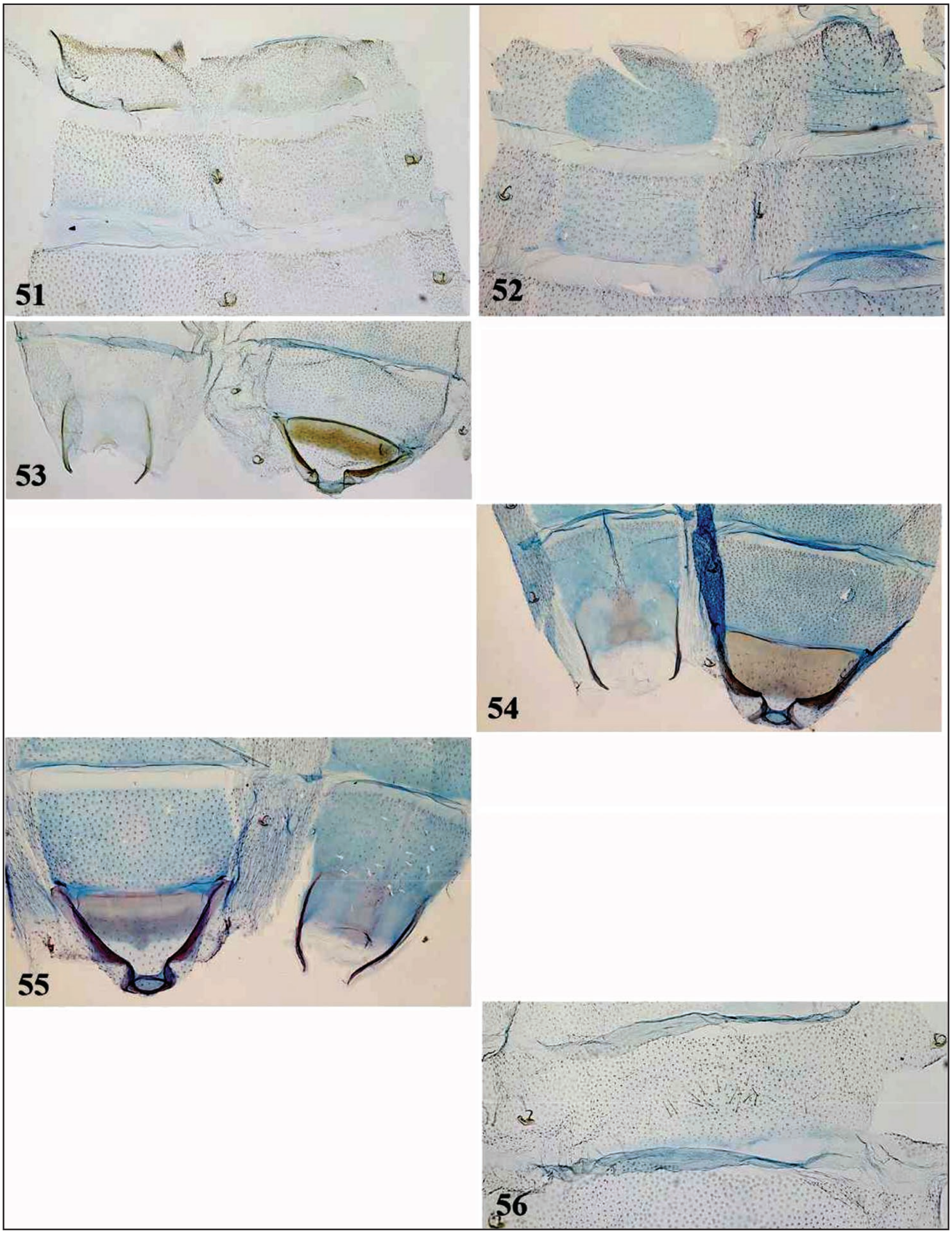

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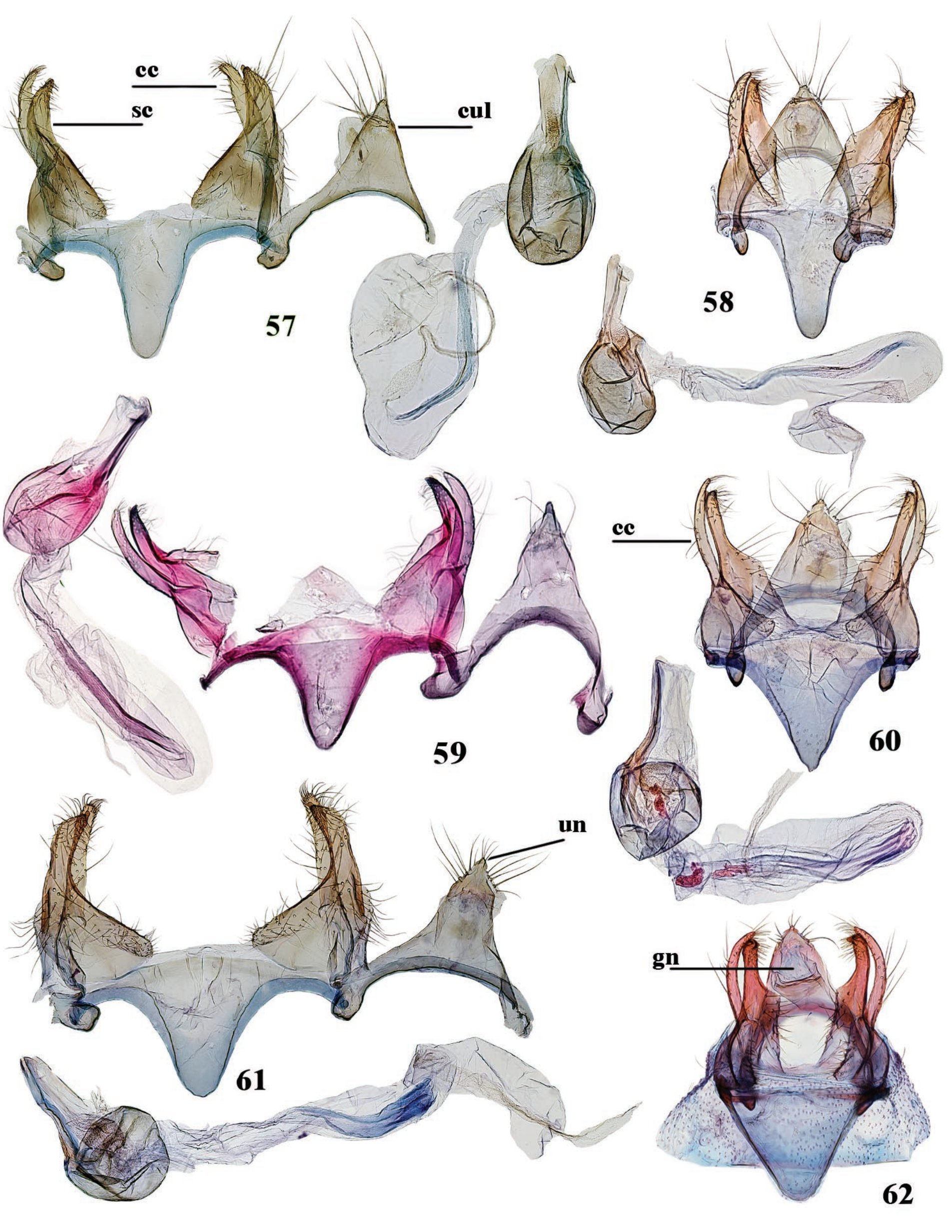

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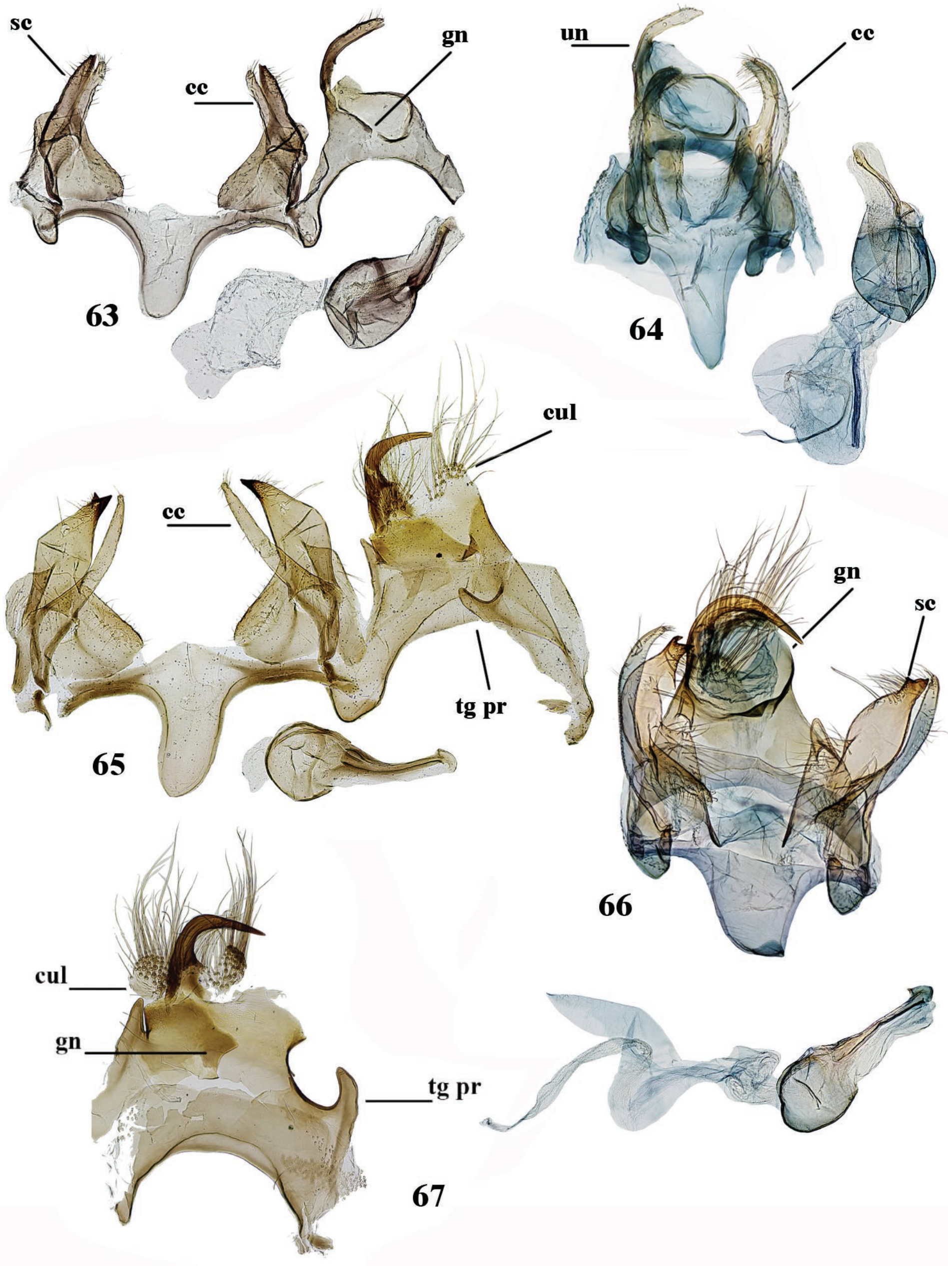

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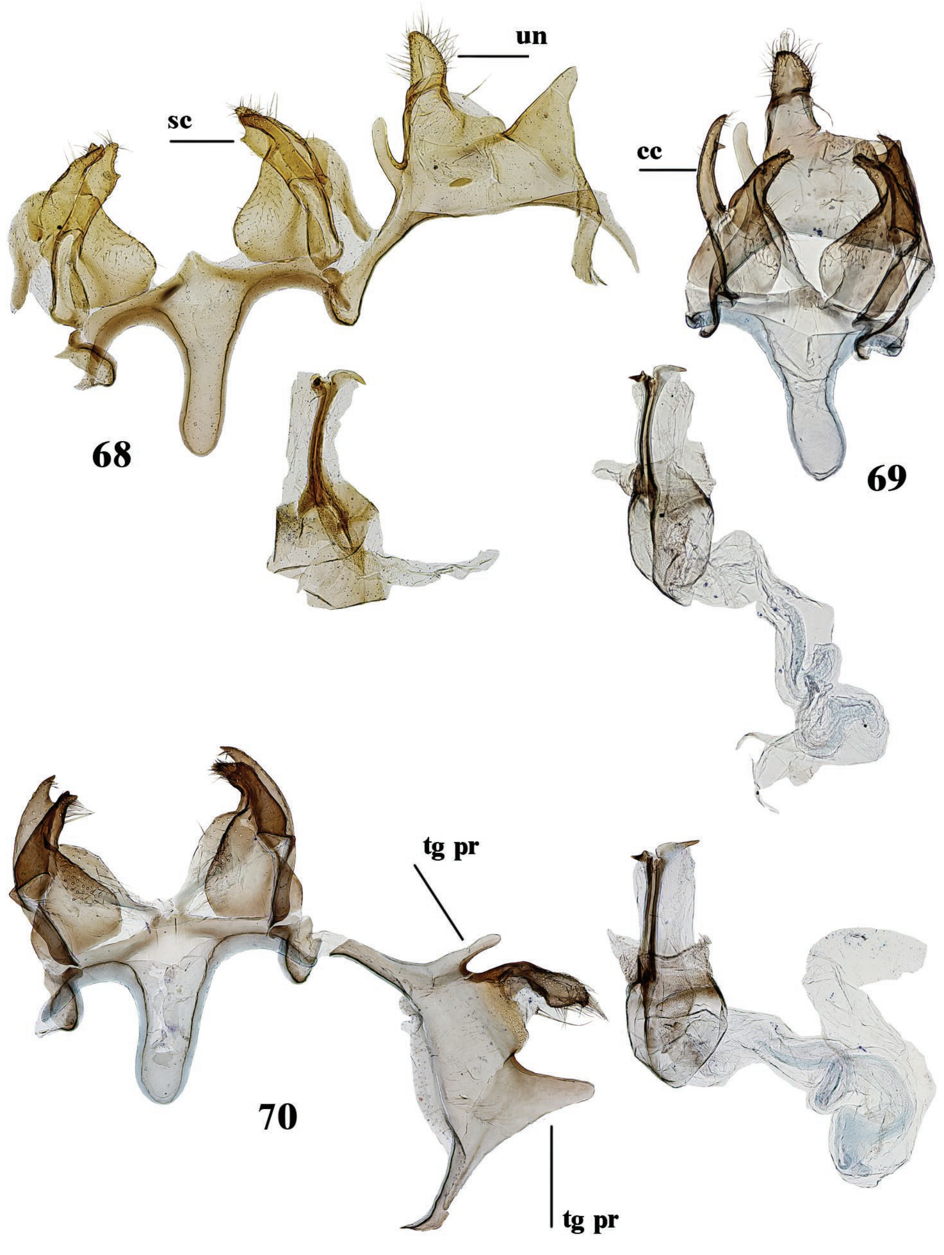

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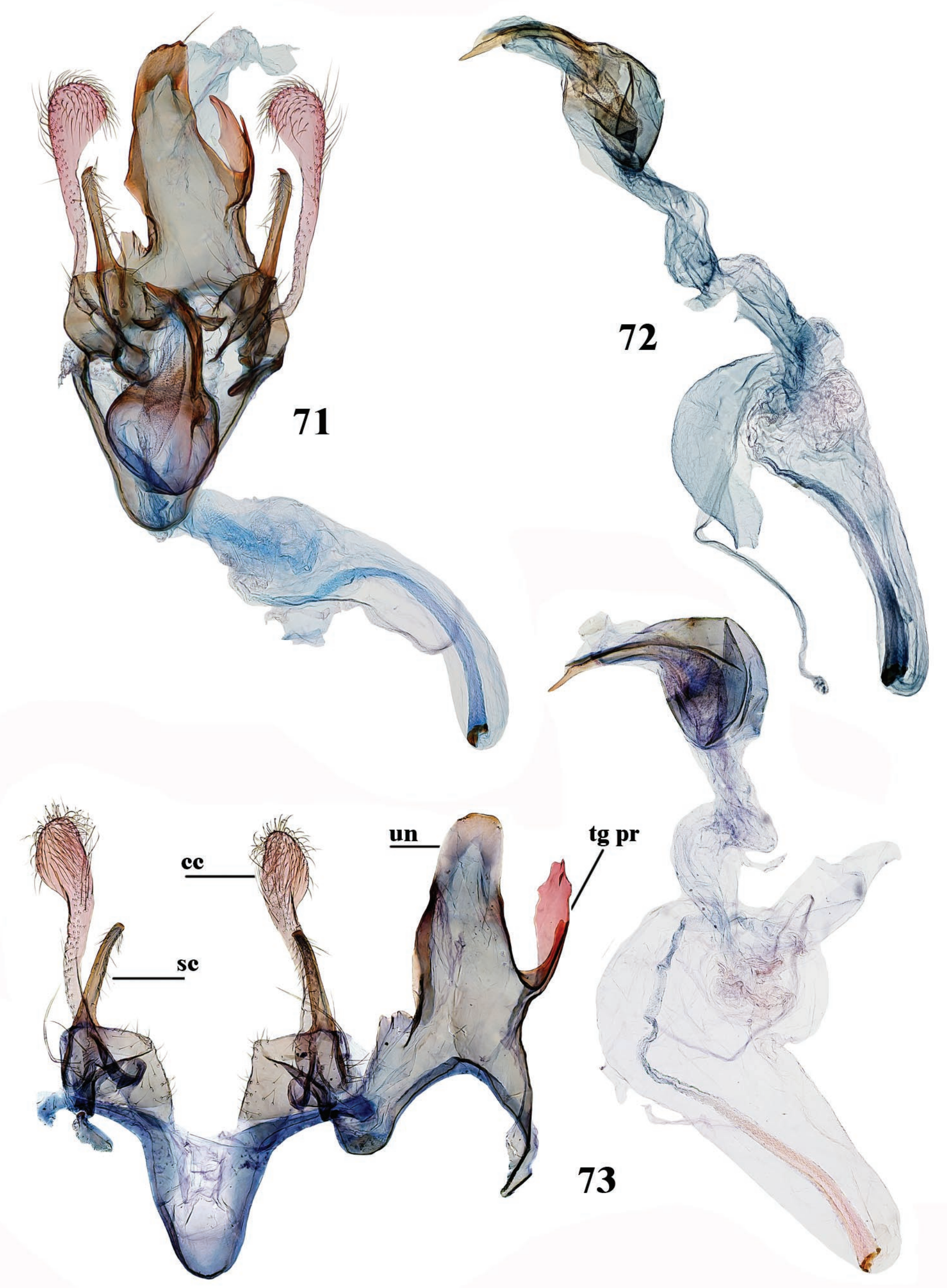

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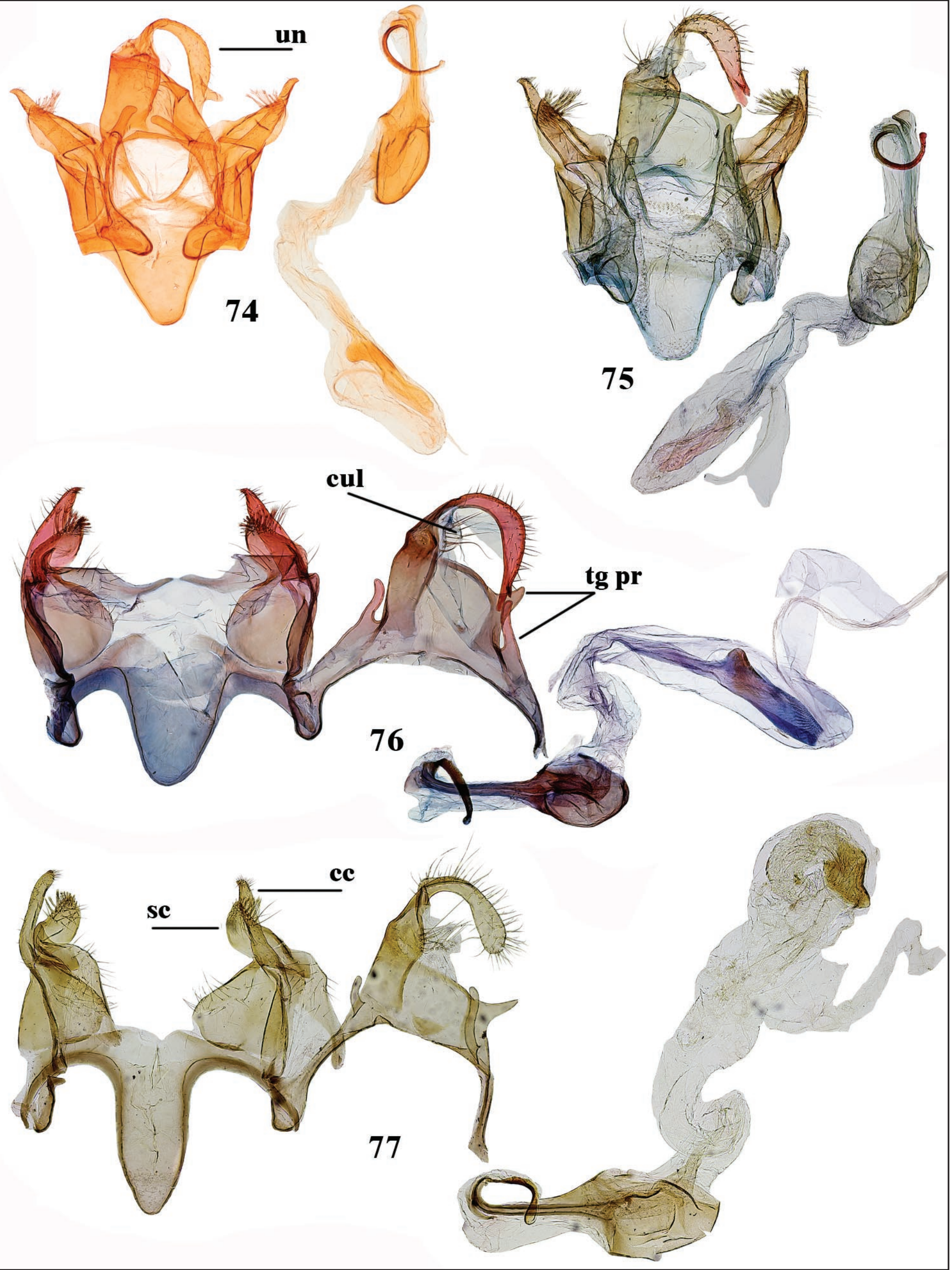

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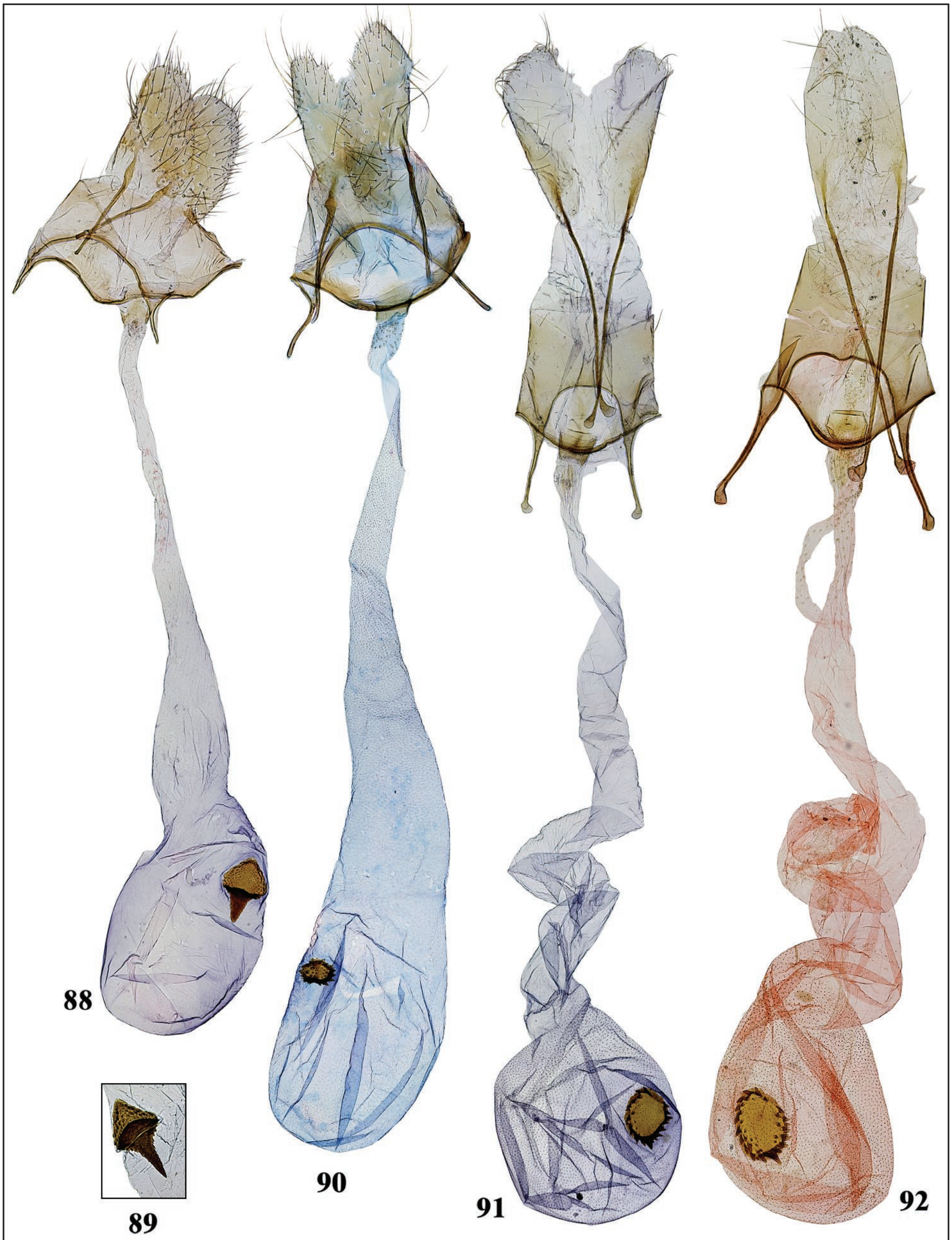

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Tinagma armeniacum Gaedike, sp. n. and a list of Douglasiidae of the Caucasus region (Lepidoptera: Douglasiidae)

R. Gaedike

Abstract

Tinagma armeniacum Gaedike, sp. n. is described from Armenia. New country records are presented for *Tinagma anchusellum griseellum* Budashkin, 2003, *Tinagma columbella* (Staudinger, 1880) and *Tinagma ocnerostomella* (Stainton, 1850). Nine species are now known from the Caucasus region.

KEY WORDS: Lepidoptera, Douglasiidae, new species, Caucasus.

Tinagma armeniacum Gaedike, sp. n. y una lista de Douglasiidae de la región del Cáucaso (Lepidoptera: Douglasiidae)

Resumen

Tinagma armeniacum Gaedike, sp. n. se describe de Armenia. Para algunos países, se presentan nuevos registros para *Tinagma anchusellum griseellum* Budashkin, 2003, *Tinagma columbella* (Staudinger, 1880) y *Tinagma ocnerostomella* (Stainton, 1850). Ahora se conocen nueve especies de la región del Cáucaso.

PALABRAS CLAVE: Lepidoptera, Douglasiidae, nueva especie, Cáucaso.

Introduction

The kindness of my colleagues O. Karsholt, H. Roweck and N. Savenkov enabled me to study interesting material from Armenia, collected last year. As a result, it was possible to detect a new species together with some new country records. The description of this new species is presented below, together with a list of the hitherto known members of the family in the Caucasus region.

In the entire Palaearctic region 22 species of this family are now known, which is, according to REGIER *et al*. (2014) a member of an unassigned superfamily between Gracillarioidea and Hyblaeoidea.

Larvae of Douglasiidae are feeders in leaves or reproductive parts of their host plants (Boraginacae, Hydrophyllaceae, Rosaceae, Lamiaceae).

Adults can be collected at light and some species have been observed flying at dusk, in the morning and during the daytime.

Abbreviations used

coll. Roweck	Hartmut Roweck, Kiel, Germany
LT	Locus typicus

NMW	Naturhistorisches Museum, Vienna, Austria
NRM	Naturhistoriska Riksmuseet, Stockholm, Sweden
RG	Reinhard Gaedike, Bonn, Germany
SDEI	Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany
SMNK	Staatliches Museum für Naturkunde, Karlsruhe, Germany
ZMHB	Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany
ZMUC	Zoological Museum, Copenhagen, Denmark

Results

Tinagma perdicella Zeller, 1839
Tinagma perdicella Zeller, 1839. *Isis, Jena,* [**32**](III): 204
LT: Am Spitzberge, SWITZERLAND

Material examined: CAUCASUS region ["Kaukasus", leg. Haberhauer (ZMHB)] (GAEDIKE, 1974).

Tinagma matutinellum Zeller, 1872
Tinagma perdicellum var. *matutinellum* Zeller, 1872. *Stettin. ent. Ztg.,* **33**(4-6): 117
LT: Zürich, SWITZERLAND

Material examined: RUSSIA, Dagestan; Kabardino-Balkaria (BUDASHKIN, 2003).

Remark: The recent taxonomic status as a valid species was established by BUDASHKIN (2003).

Tinagma anchusellum anchusellum (Benander, 1936)
Douglasia anchusella Benander, 1936. *Opus. Ent.,* **1**: 51, fig. 1E
LT: Öland, SWEDEN

Material examined: AZERBAIJAN, ARMENIA, Hosrov Reserve (BUDASHKIN, 2003: 92).

Tinagma anchusellum griseellum Budashkin, 2003
Tinagma anchusellum griseellum Budashkin, 2003. *Proc. Zool. Mus. Nac. Univers. Tar. Chevc.,* **1**: 93, fig. 15
LT: Jagry, Nakhichevan ASSR, AZERBAIJAN

Material examined: AZERBAIJAN (BUDASHKIN, 2003); IRAN, Derbend, 25km N of Tehran, 2000 m, 15 ♂, 7-15-VI-1963; 28-30-V-1963; leg. F. Kasy & E. Vartian (NMW; SDEI): **New to the country and first record beside type series.**

The other records from Iran (Keredj (NRM) and NW-Iran, 30 km S of Rizayeh (SMNK)) need checking, but they seem to also belong to this subspecies.

***Tinagma armeniacum* Gaedike, sp. n.** (Figs 1-2)

Material examined: Holotype ♂, ARMENIA, prov. Ararat, Urtsadzor, Caucasus Wildlife reserve, Eco Lodge, 1250 m, 39º56'58"N 44º53'14"E, 22-30-V-2019, O. Karsholt, H. Roweck & N. Savenkov leg. Genitalia slide 9927RG (ZMUC). Paratypes: 1 ♂, with the same collection data, Genitalia slide 9928RG (SDEI); Vedi Urtsadzor, CWR Eco Lodge, 1250 m, 1 ♂, 20-30-V-2019, [leg.] H. Roweck & N. Savenkov. Genitalia slide 9780RG (coll. Roweck).

Description: Wingspan 10-11mm; head dark grey, scales with white tips; labial palpus whitish colored, apical segment on outside somewhat darker; antenna dark grey, underside lighter, thorax, tegulae and forewing with same coloration as the head; forewing on dorsum at beginning of fringe with white wedge-shaped patch, reaching cell; hindwing grey. One paratype (fig. 2) with lighter grey coloration.

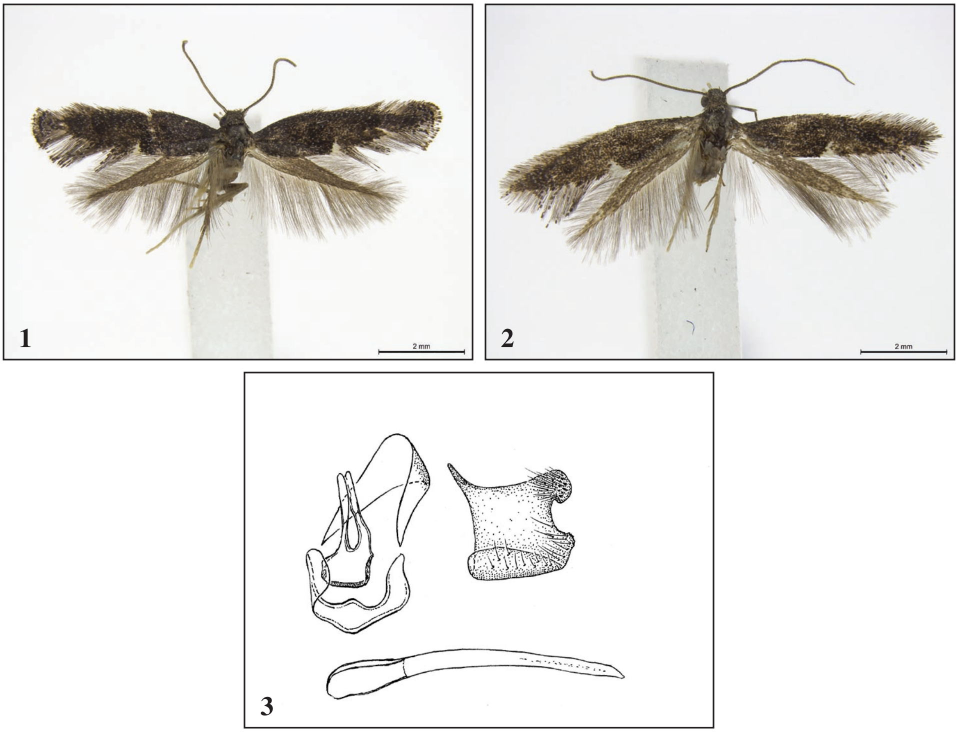
Genitalia male (Fig. 3): Tegumen band-shaped, without separate uncus; anellus basally square, apically with two long thin processes; vinculum in the middle somewhat broader than laterally; valva more or less square, at ventral edge folded, costal arm short, ending rounded, on inside bristled and with minute thorns, apical edge below costal arm concave, basal edge more or less straight, phallus more than twice as long as valva, slightly curved, basal quarter edged, with minute sclerotization on inside.

Genitalia female: Unknown.

Diagnosis: Superficially similar to *T. anchusella* (Benander, 1936), but the coloration is clearly darker, and the white patch larger. In the genitalia the shape of valva is different: costal arm in *armeniacum* short, while *anchusella* with longer and narrower costal arm.

Biology: Unknown.

Etymology: The species is named after the country of the type locality.



Figs. 1-3.– 1. *Tinagma armeniacum* Gaedike, sp. n., ♂ holotype. **2.** *Tinagma armeniacum* Gaedike, sp. n., ♂ paratype. **3.** *Tinagma armeniacum* Gaedike, sp. n., ♂, andropigio.

Tinagma caucasicum Gaedike, 2018

Tinagma caucasicum Gaedike, 2018. *SHILAP Revta. lepid*., **46**(118): 68, figs 5, 10

LT: Kabardino-Balkarskij zap. [National Park], Elbrus, Russia

Material examined: Russia, Kabardino-Balkarskij zap. [National Park], 35 km SE mt. Elbrus, alp. mead. 2500 m, 1 ♂, 15-VII-1990, J. Jalava, leg.; idem but 1 ♂, 10-VII-1990.

Tinagma columbella (Staudinger, 1880)
Douglasia columbella Staudinger, 1880. *Horae Soc. ent. Ross.,* **15**(1879): 383
LT: Kerasdere, TURKEY

Material examined: ARMENIA, Vedi Urtsadzor, CWR Eco Lodge, 1250 m, 1 ♀, 20-30-V-2019, leg. H. Roweck & N. Savenkov (coll. Roweck). **New to the country**.

Tinagma zagulajevi Budashkin, 2003
Tinagma zagulajevi Budashkin, 2003. *Proc. Zool. Mus. Nac. Univers. Tar. Chevc.,* **1**: 94, fig. 16
LT: Avadhara, ABKHAZIA

Material examined: ABKHAZIA (BUDASHKIN, 2003).

Tinagma ocnerostomella (Stainton, 1850)
Gracilaria ocnerostomella Stainton, 1850. *Proc. ent. Soc. Lond.,* **1**: 6
LT: Mickleham, Surrey, GREAT BRITAIN

Material examined: ARMENIA, Vedi Urtsadzor, CWR Eco Lodge, 1250 m, 1 ♂, 20-30-V-2019, leg. H. Roweck & N. Savenkov (coll. Roweck); same location, but 2 ♀♀, 22-30-V-2019, leg. O. Karsholt, H. Roweck & N. Savenkov (ZMUC). **New to the country**.

Klimeschia transversella (Zeller, 1839)
Tinagma transversella Zeller, 1839. *Isis, Jena,* **[32]** (III): 204
LT: Glogau, POLAND

Material examined: RUSSIA, Dagestan; ARMENIA (BUDASHKIN, 2003); ARMENIA, Vedi Urtsadzor, CWR Eco Lodge, 1250 m, 1 ♂, 20-30-V-2019, leg. H. Roweck & N. Savenkov (coll. Roweck); same collection data, 4 ♂♂, 1 ♀, but leg. O. Karsholt, H. Roweck & N. Savenkov (ZMUC).

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COMITÉ PARA LA PROTECCIÓN DE LA NATURALEZA, PROYECTO DE INVESTIGACIÓN CIENTÍFICA DE SHILAP / *COMMITTEE FOR THE PROTECTION OF NATURE, PROJECT OF SCIENTIFIC INVESTIGATION OF SHILAP*

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Reisseronia (*Reisseronia*) *hellersi* Sobczyk & Werno, sp. n. from Northern Spain (Lepidoptera: Psychidae)

T. Sobczyk & A. Werno

Abstract

A new Psychidae, *Reisseronia* (*Reisseronia*) *hellersi* Sobczyk & Werno, sp. n. is described from Northern Spain. This is the first species of this genus known from the Iberian Peninsula. The differences to *Reisseronia* (*Reisseronia*) *tarnierella* (Bruand, 1850), the species with the largest and most western distribution in Europe, are shown. Above all, the broader scales on the fore wings characterize *R*. (*R*.) *hellersi* compared to *R*. (*R*.) *tarnierella*. In addition, an overview of European *Reisseronia* species is given.

KEY WORDS: Lepidoptera, Psychidae, *Reisseronia*, new species, Spain.

Reisseronia (*Reisseronia*) *hellersi* Sobczyk & Werno, sp. n. del norte de España (Lepidoptera: Psychidae)

Resumen

Se describe del norte de España una especie nueva de Psychidae, *Reisseronia* (*Reisseronia*) *hellersi* Sobczyk & Werno, sp. Esta es la primera especie conocida del género en la Península Ibérica. Se muestran las diferencias con *Reisseronia* (*Reisseronia*) *tarnierella* (Bruand, 1850), la especie con la distribución más amplia y occidental en Europa. Sobre todo, las escamas más anchas sobre los alas anteriores caracterizan a *R. (R.) hellersi* comparada con *R. (R.) tarnierella*. Además, se da una visión general de especies europeas de *Reisseronia*.

PALABRAS CLAVE: Lepidoptera, Psychidae, *Reisseronia*, nueva especie, España.

Introduction

A determination transmits to the first author included, among others Psychidae, a *Reisseronia* species from Spain. It has already been suspected that it is an undescribed species since the genus was unknown from the Iberian Peninsula. At a first glance, the males are different to *Reisseronia* (*Reisseronia*) *tarnierella* (Bruand, 1850), the most widespread species. Eventually, a review of all the known species of *Reisseronia* revealed that these specimens belong to a so far undescribed species, which is described in this paper.

Material and methods

The genitalia slides were made according to standard procedures. After examination, the genitalia and antennae were mounted separately on a microscope slide and were embedded in Euparal.

Photos of genitalia and antennae were taken by a Bresser LCD microscope. Photograph of specimen were taken with a Canon EOS 600D and objective Canon MP-E 65 mm f/2.8 1-5x Macro.

The terminology of morphological characters follows SAUTER (1956) and SAUTER & HÄTTENSCHWILER (1999).

Interocular Index: vertical eye diameter divided by interocular distance measured just above the level on the tentorial pits.

Abbreviations

CTS	Collection Thomas Sobczyk (Germany)
GU	genital preparation
MNCN	Collection Antonio Vives / Museo Nacional de Ciencias Naturales, Madrid (Spain)
MNHN	Musée National d'Histoire Naturelle, Luxemburg (Luxemburg).
ZfBS	Center for Biodocumentation Landsweiler-Reden of the Saarland (Germany)

Results

***Reisseronia* (*Reisseronia*) *hellersi* Sobczyk & Werno, sp. n.** (Figs 1-2, 3c, d, 4)

Type material Holotype (Fig. 1) ♂: SPAIN, Castilla y León, [LEÓN], Sabero, 1200 m, 05-XI-2001, leg. M. Hellers, deposited in the MNCN. Paratypes: 3 ♂♂, same data (CTS, MNHN, ZfBS).

Description (n=4): Forewing length 3.5 mm. Wingspan 7.1-8.1 mm. Basic colouring monochrome black brown. Eyes dark grey, round, interocular index 0.65. Ocelli missing. Head hair black-brown, labial palps reduced, one-segmented, densely covered with hair like, downward, black brown (distally lighter) scales with length of twice the eye diameter. Antennae (Fig. 2) length 2.0 mm, longer than half the length of forewings (3.5 mm), a total of 17 to 18 segments. Scapus and pedicellus closely scaly, the other segments only dorsally with scales, ventrally with cilia. Scales wide, in addition to black-brown scales there are lighter brown scales. Ventrally antenna combs with cilia, which a length of 2.5 to three times the diameter of the comb teeth. The comb teeth reach in the area of the 7th-10th antennal segment almost 2.5 to three times the length of the associated antennal segment. Forewings broad, monochrome black-brown coloured, without drawings. Cover scales relatively broad, mostly two-pointed (mostly class II, occasionally class III according to SAUTER, 1956), mixed with few longer and hair-shaped scales (Fig. 3c). Forewing eight unstalked veins from the discal cell, this divided by media stem. A small intercalary cell is partly pronounced, accessory cell absent. Fringes brown-grey, ventrally partly longer, and whitish, lanceolate multi-pointed, correspond to class 2 b according HAUSER (2012) (Fig. 3d). Hindwings coloured how forewings, five unstalked veins from the discal cell. Hind wing with narrower scales, distally mostly rounded, rarely two-pointed. Fringe scales lancet-shaped, but narrower than those of the forewing fringes. Body densely covered with black-brown hair-shaped scales. Fore tibia without epiphysis, midlegs and hindlegs with apical tibial spurs.

Male genitalia (Fig. 4): GU 139-2020 Sobczyk, length 0.65 mm, typical of *Reisseronia*, rhomboid. Valvae curved, protrude beyond the rear edge of the tegumen. Tegumen laterally almost straight, distally rounded. Vinculum broad, mediolaterally slightly arched, saccus only hinted at. Phallus 0.35 mm, thick, stretched, median somewhat narrower.

Female and larval cases unknown.

Biology: Marcel Hellers (in litt.): "According to my notes, I caught the males in the morning on a dry grass that was grazed by sheep and goats and didn't look interesting. Only a few species flew here, I only have two types of Tortricidae in the collection from this location: *Cnephasia alticolana* (Herrich-Schäfer, 1851) and *Phtheochroa frigidana* (Guenée, 1845), which is common in places in this area. Unfortunately, I had not noted any other Tortricidae that I might have observed. There was surface water in places (certainly from a long downpour), but the ground at the roadside was very dry. Knud Larsen and I stayed at this location for only a short time, because at second glance it was uninteresting."

Distribution: At present *R.* (*R.*) *hellersi* Sobczyk & Werno, sp. n. is known only from the type locality. Its occurrence can be also expected at other parts of Northern Spain. The small species that flies during the day can easily be overlooked. The females are certainly wingless, and the larval cases are likely to be on the ground in the vegetation and are barely longer than one centimetre. The habitat has no peculiarities and is grazed by sheep and goats. The discovery at the foothills of the Cantabrian Mountain range and the altitude could be evidence that this species an endemic of this mountain range. For example, a large number of endemic plant species are known from the region (LOIDI *et al*., 2012).

Etymology: Named after Marcel Hellers (Luxemburg). Together with Knud Larsen (Denmark) he discovered this new species.

Diagnosis: Small, evenly dark coloured species with broad forewing scales. Wingspan 7.1-8.1 mm, male genitalia rhomboid.

Discussion

So far seventeen *Reisseronia* species / subspecies are known. *Reisseronia flavociliella* (Mann, 1864) occurs exclusively in Asia and has been described from Turkey (Brussa) (SOBCZYK, 2011). The other species have a European distribution. Most species are endemic with a small distribution area. The genus *Reisseronia* Sieder, 1956 sensu stricto, included thirteen and the subgenus *Tsikalasia* Hauser, 1996 four species. *Reisseronia* s. str. are characterized by the absence of an epiphysis on the tibia of the forelegs, so that *Reisseronia* (*Tsikalasia*) *malickyi* Hauser, 1996, *Reisseronia* (*Tsikalasia*) *tschetverikovi* Solyanikov, 1990, *Reisseronia* (*Tsikalasia*) *muscualutum* Kurz, Kurz & Zeller-Lukashort, 2006 and *Reisseronia* (*Tsikalasia*) *satanella* Kurz, Kurz & Zeller-Lukashort, 2006 can be excluded. Within the subgenus *Reisseronia* there are three species parthenogenetic: *Reisseronia* (*Reisseronia*) *gertrudae* Sieder, 1962, *Reisseronia* (*Reisseronia*) *imielinella* Malkiewicz, Sobczyk & Larysz, 2013 and *Reisseronia* (*Reisseronia*) *annae* Larysz, 2017. Furthermore species can be characterized by the greater number of antennal segments (more as 18): *Reisseronia* (*Reisseronia*) *staudingeri* (Heylaerts, 1879), *Reisseronia* (*Reisseronia*) *magna* Hättenschwiler, 1982, *Reisseronia* (*Reisseronia*) *arnscheidi* Weidlich, 2006, *Reisseronia* (*Reisseronia*) *ionica ionica* Weidlich, 2016, *Reisseronia* (*Reisseronia*) *odysseus* Weidlich, 2016 and *Reisseronia* (*Reisseronia*) *ionica lefkadensis* Weidlich, 2016. The new species is most similar to the following species. *Reisseronia* (*Reisseronia*) *pusillella* (Rebel, 1949), endemic to the Balkans, has very narrow scales on fore wings, which are usually two-pointed. They are mixed with hair-shaped scales. *Reisseronia* (*Reisseronia*) *nigrociliella* (Rebel, 1934), also a Balkan endemite, has a larger wingspan. Similarities also exist to the type species *Reisseronia* (*Reisseronia*) *tarnierella* (Bruand, 1850). According to previous knowledge, *Reisseronia* (*Reisseronia*) *tarnierella* (Bruand, 1850) was the species whose distribution extends the furthest to Western Europa. It differs from this by the wing span (*tarnierella* 6-7 mm, *hellersi* sp. n. 7-8 mm) and by the significantly wider scales of the forewings (Fig. 3a, b). For *R.* (*R.*) *tarnierella* it is stated that it is a species of the plains (0-300 m) and the males emerged at midday (WEIDLICH 2006). *R.* (*R.*) *hellersi* Sobczyk & Werno, sp. n. was collected in the morning and observed at an altitude of 1200 m.

Acknowledgements

We thank the two collectors of the new species, Marcel Hellers (Luxemburg) and Knud Larsen (Dyssegaard, Denmark), for much information and for making the material available.

Table 1.– Overview of *Reisseronia* species (males) (after ARNSCHEID & WEIDLICH 2017; WEIDLICH 2016, own knowledge).

Reisseronia	**Distribution**	**Wingspan**	**Antennal segments**
R. hellersi Sobczyk & Werno, sp. n.	Northern Spain	7.1-8.1	16-18
R. tarnierella (Bruand, 1850)	disjunct in Central France, Netherlands, Belgium, Germany, Italy, Slovakia	6-7	16-18
R. nigrociliella (Rebel, 1934)	Balkan	9-10	15-17
R. staudingeri (Heylaerts, 1879)	Russia (Saratov and Volgograd district)	8-9	19-20
R. pusillella (Rebel, 1949)	Balkan	8-8.5	15-17
R. magna Hättenschwiler, 1982	Greece (Peloponnes)	8.5-10	23-25
R. arnscheidi Weidlich, 2006	Romania (South Carpathians)	7.5-9.5	19-20
R. malickyi Hauser, 1996	Crete	9.2-11.2	15-17
R. tschetverikovi Solyanikov, 1990	Ukraine (Crimea)	7.2-10	17
R. muscualutum Kurz, Kurz & Zeller-Lukashort, 2006	Central Italy	6-6.8	15
R. satanella Kurz, Kurz & Zeller-Lukashort, 2006	Italy (Appeninnes)	7.9-10.7	20
R. ionica ionica Weidlich, 2016	Greece (Ionian Islands, Kefalonia)	10.6-13.3	21-23
R. ionica odysseus Weidlich, 2016	Greece (Ionian Islands, Ithaka)	8.9-11.4	21-22
R. ionica lefkadensis Weidlich, 2016	Greece (Ionian Islands, Lefkada)	8.1-10	20-22
R. flavociliella (Mann, 1864)	Turkey	8-9	?

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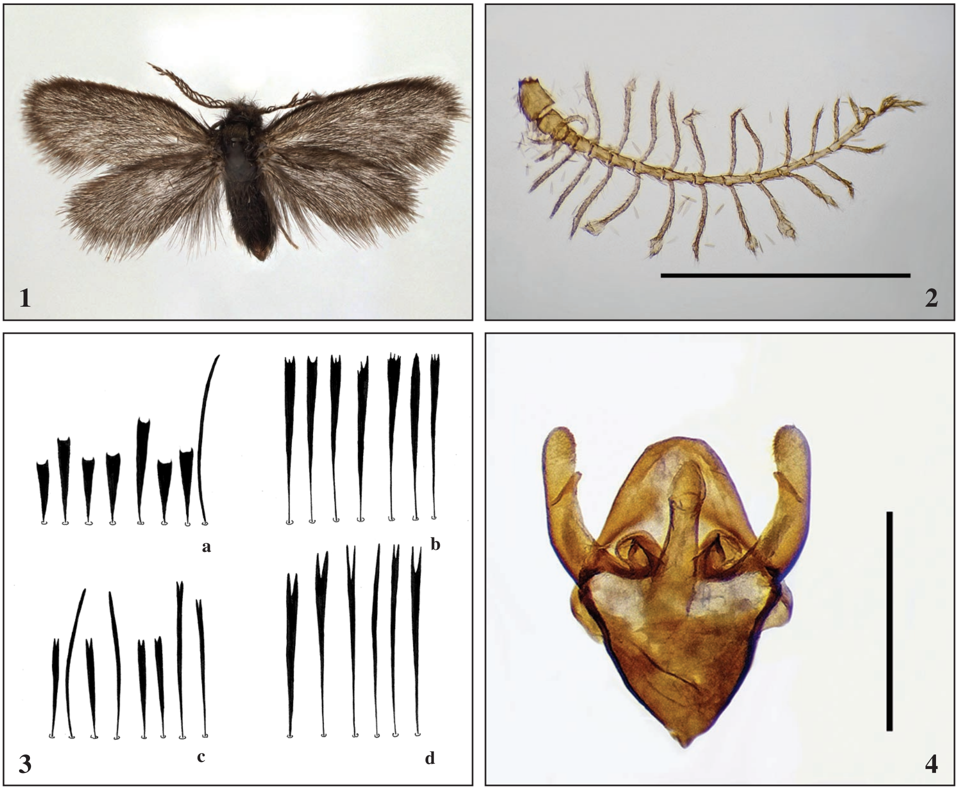

Figs 1-4.– 1-2. *Reisseronia* (*Reisseronia*) *hellersi* Sobczyk & Werno, sp. n. ♂: **1.** Holotype. **2.** Antennae paratype (scale 1.0 mm). **3.** Forewing scales between apical discal cell and termen, forewing fringes between veins r3 and m2+m3: *Reisseronia* (*Reisseronia*) *hellersi* Sobczyk & Werno, sp. n. **a.** scales, **b.** fringes; *Reisseronia* (*Reisseronia*) *tarnierella* (Bruand, 1850) **c.** scales, **d.** fringes. **4.** *Reisseronia* (*Reisseronia*) *hellersi* Sobczyk & Werno, sp. n. genitalia paratype (GU 139-2020 Sobczyk) (scale 0.5 mm).

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Contribution to an understanding of the biology and larval morphology of two taxa in the genus *Scopula* Schrank, 1802, subgenus *Glossotrophia* Prout, 1913 (Lepidoptera: Geometridae)

G. E. King & J. L. Viejo-Montesinos

Abstract

Descriptions of the larval morphology of two Iberian Sterrhinae taxa in the genus *Scopula* Schrank, 1802 subgenus *Glossotrophia* Prout, 1913 are provided: *Scopula* (*Glossotrophia*) *rufomixtaria* (Graslin, 1863): larval chaetotaxy: L_4 and *Scopula* (*Glossotrophia*) *asellaria dentatolineata* Wehrli, 1926: larval chaetotaxy: L_5. Original data is also provided on their biology which includes phenology, food-plants and parasitoids.

KEY WORDS: Lepidoptera, Geometridae, Sterrhinae, *Scopula*, larval morphology, phenology, food plants, chaetotaxy, Spain.

Contribución al conocimiento de la morfología y la biología larvaria de dos taxones del género *Scopula* Schrank, 1802, subgénero *Glossotrophia* Prout, 1913 (Lepidoptera: Geometridae)

Resumen

Se describe la morfología larvaria de dos taxones ibéricos de Sterrhinae pertenecientes al género *Scopula* Schrank, 1802, subgénero *Glossotrophia* Prout, 1913: *Scopula* (*Glossotrophia*) *rufomixtaria* (Graslin, 1863): quetotaxia larvaria de L_4 y *Scopula* (*Glossotrophia*) *asellaria dentatolineata* Wehrli, 1926: quetotaxia larvaria de L_5. Igualmente se incluyen datos de su biología relativos a la fenología, plantas nutricias y parasitoides.

PALABRAS CLAVE: Lepidoptera. Geometridae, Sterrhinae, *Scopula*, morfología larvaria, fenología, plantas nutricias, quetotaxia, España.

Introduction

The erstwhile genus *Glossotrophia* Prout, 1913 was downgraded to sub-genus status (SIHVONEN, 2005) within the sterrhine genus *Scopula* Schrank, 1802 which consists of 24 taxa in the Iberian Peninsula (REDONDO *et al*., 2009, modifications according to SIHVONEN 2005). SIHVONEN & KAILA (2004) established three synapomorphies of the genus which include: uncus on the male genitalia absent; 8° sternite with cerata and mappa which is often polymorphic (HAUSMANN, 1999); corpus bursae ovoid with signum made up of small, flat spinules (HAUSMANN, 2004). In terms of biology, the Iberian taxa are generally univoltine with the first generation before the onset of the summer drought period (ASCHMANN, 1984). The larvae tend to be oligophagous or monophagous in lower plants, for example, the labiates (WILTSHIRE, 1962; SORIA, 1987; HAUSMANN, 2004). Larval ethology includes the fact that fully-grown examples often perch in the vicinity of the food-plant rather than directly on it (EBERT & STEINER, 2001; KING & GONZÁLEZ-ESTÉBANEZ, 2015).

Scopula (*Glossotrophia*) *rufomixtaria* (Graslin, 1863)

Corology: Western Mediterranean with a distributional focus in meso-Mediterranean and thermo-Mediterranean Spain eastwards to southern France and the Franco-Italian Maritime Alps south-westwards to the Maghreb (nominotypical subspecies in Morocco); in Algeria and Tunisia is found the subspecies: *S.* (*G.) rufomixtaria sahariensis* Hausmann, 1993 (HAUSMANN, 1993; 2004).

Phenology: The species is univoltine or bivoltine according to latitude or altitude (HAUSMANN, 2004); in the lowlands (Madrid, for example) it is bivoltine with the first generation end of May-end of July, with a probable third generation (KING & VIEJO-MONTESINOS, 2010) already alluded to by HAUSMANN (2004). In the mid-Ebro valley (NE Spain) *S.* (*G.) rufomixtaria* emerges earlier at the end of April flying until end of September (REDONDO & GASTÓN, 1999; REDONDO *et al.,* 2001). The larva (Fig. 1) is associated with the carnations (Caryophyllaceae): CHRÉTIEN (1928) cited *Silene* and *Dianthus* (Caryophyllaceae); in Spain recent data describe it as monophagous in *Gypsophila struthium* L. in Loefl. (KING, 2000; REDONDO *et al.*, 2001; KING & VIEJO-MONTESINOS, 2010).

Scopula (*Glossotrophia*) *asellaria dentatolineata* Wehrli, 1926

This taxon belongs to a "ring species" complex (MAYR, 1963) with various subspecies focussed on the Mediterranean region (northern and southern shores) and the Canary Islands (Macaronesia): (*S.* (*G.) asellaria gerstbergeri* Hausmann, 1993; *S.* (*G.) asellaria lenzi* Hausmann, 1993) (HAUSMANN, 1993; BACALLADO *et al.*, 2005). The nominotypical subspecies *S.* (*G.) asellaria asellaria* (Herrich-Schäffer, 1847) is found in Corsica and Sardinia. In the Iberian Peninsula itself there are two subspecies: *S.* (*G.) asellaria dentatolineata* Wehrli, 1926 in central and southern regions and *S.* (*G.) asellaria isabellaria* Millière, 1868 in the north-east to south-west France; the subspecies *S.* (*G.) asellaria romanaria* Millière, 1869 is distributed disjunctively in Sicily, western Italy, the southern Swiss valleys, Malta and Greece. In the Maghreb there fly three subspecies: *S.* (*G.) asellaria lenzi* Hausmann, 1993 (Great Atlas, Morocco); *S.* (*G.) asellaria philipparia* Prout, 1913 (northern Algeria, Tunisia); *S.* (*G.) asellaria tripolitana* Turati, 1929 (Libya, southern Tunisia, eastern Algeria) (HAUSMANN, 1993; 2004).

More recent data suggests that the two Iberian subspecies: *S. (G.) asellaria dentatolineata* Wehrli, 1926 and *S. (G.) asellaria isabellaria* (Millière, 1868) fly sympatrically in the south-eastern Spanish province of Murcia it being pointed out by the authors that it would be a "contact zone" between the two taxa (CALLE *et al.,* 2000; ORTIZ *et al*., 2009).

Phenology: HAUSMANN (2004) indicates two generations from the end of March-May, with a second generation from the end of September-early October with an absence of data at low altitudes in the summer months. Limited data from the Ebro valley (NE Spain) REDONDO & GASTÓN (1999) suggest that it is bi-voltine: early April and then in September. ORTIZ *et al*. (2009) include data from January to May, June, July to early September suggesting that it flies throughout the year. In terms of larval food-plants, it would appear to be polyphagous in the Scrophulariaceae, Zygophyllaceae and Lamiaceae (MILLIÈRE, 1869-1874; CHRÉTIEN, 1917) with snapdragon *Antirrhinum majus* L. (Scrophulariaceae) cited in central Spain (KING & ROMERA, 2004; KING & VIEJO-MONTESINOS, 2010). The ovum and oviposition strategy of *S. (G.) asellaria dentatolineata* are described in KING & VIEJO-MONTESINOS (2016).

SHAW (2010) cites *Homolobus truncator* Say, 1828 (Hymenoptera: Braconidae; Homolobinae) as a larval parasitoid of both *S. (G.) asellaria dentatolineata* and *S.* (*G.) rufomixtaria.*

General morphological information of European *Scopula* larvae can be found in EBERT & STEINER (2001). SINGH (1951) deals with the chaetotaxy of three European sterrhine genera: *Problepsis* Lederer, 1853, *Scopula* and *Idaea* Treitschke, 1825 with *Scopula* larvae being diagnosed as follows: cephalic capsule granular; vertex almost rounded; frontal setae situated above level of pores; seta O2 alongside ocellus 1 (within complex of stemmata); O1 very near ocellus 3; lengthened abdomen (urites A1-10), granular cuticule; setae short; MD setae are microscopic; A1-A9; SD1 anterior to spiracles A1-A7; L1 posterior to spiracle and below it A1-A5; A6 and A8 at same level; anal shield (A10) is round, L1 next to L2, D1, L3 in a line; spiracles oval shaped; on A6 are bigger than those in T1; A7 and A8 are of a different size.

The aim of this present paper is to provide data on the biology of these two taxa which includes undocumented parasitoid data (Hymenoptera: Ichneumonidae, Braconidae) and to give a more detailed overview of the larva which includes larval chaetotaxy.

Materials and methods

Study area

The locality which formed the basis for the collection of imagines and of larvae in the Tagus Valley (Madrid; 590-600 m) was Ciempozuelos (Cerros de Palomera) (N40º 09’09.1 W003º 36’27.1).

The Miocenic and Triassic gypsyferous soils are relatively frequent in the Iberian Peninsula in the Tagus and Ebro basins, and the south-east Peninsular (FERRANDIS *et al*., 2005). The climate is Meso-Mediterranean, with important drought conditions from June to September. The little rain that falls does so in the spring (March to May), and in the autumn (September to November). In the winter, conditions of thermic inversion tend to prevail (IZCO, 1984). The general lack of precipitation and the corresponding aridity ensures that the influence of the gypsum soils is a constant, with a consequential effect on the vegetation which is generally understood to be included in the botanic order Gypsophiletalia.

Data collection. Collecting larvae

Larvae were collected within the confines of an intensive field study occurring January 2004 until May 2006, September 2007 until July 2008 (KING & VIEJO-MONTESINOS, 2010). *Scopula* larvae were obtained exposed on their food-plant, *Antirrhinum majus* or *Gypsophila struthium* amongst the leaves generally, but often in the immediate vicinity perched on the exposed gypsym cliff faces as described in KING & VIEJO-MONTESINOS (2010). Rearing out of larvae (and subsequent pupae) took place in plastic containers of various sizes ensuring that excess humidity did not build up which is invariably fatal for the larvae (STEHR, 1987). Pupae were left in situ in order for emergence of adults to occur.

Obtaining parasitoids

SHAW (1997) indicates how to breed out parasitoids (Hymenoptera: Ichneumonidae, Braconidae) ex ovo, ex larva (including ex pre pupal phase) or ex pupa in captive conditions, which includes the importance of associating the correct host-parasitoid, and so avoiding erroneous or improbable relations which can only slow up future studies. In the same way, it should be established in which larval instar (L1-L5) parasitoid attack occurred (or at least when the parasitoid was noted) (SHAW & HUDDLESTON, 1991). When breeding out larvae in captivity, whether a larva has been parasitised, the first sign is the wasp’s cocoon being found, for example, in the whereabouts of a moribund larva, or if the larva has already pupated, within the host’s cocoon, or if the wasp has exited the host, one finds the host’s exuvium whilst the wasp larva is seeking out its own place in which to pupate (SHAW, 1997). In any of these cases, it is imperative that all events associated with the parasitisation of the host are kept: cocoon (individual or en masse) (Hymenoptera) (with host remains) being appropriately labelled which would include (date host taken in wild, date of finding of “parasitisation event”, host food-plant, emergence date of parasitoid itself). All material thus obtained was sent to Mark R. Shaw, Royal Museum of Scotland for identification.

A collection GEK and UAM was maintained of larvae (including those that perished after field collection or those bred out under captive conditions) in 70% ethanol (in Eppendorf vials with appropriate data). A collection (Coll GEK, MNHN) was also put together of imagines which were either reared out ex larvae or of those imagines field collected in Madrid. Preparations of the genitalia mentioned in this paper were macerated initially in potassium hydroxide at c. 25% overnight and prepared in 70% ethanol in a Petri dish before being stained lightly with Chlorozol black and then dropped in DMHF (Dimethyl hydantoin formaldehyde) before a coverslip was secured in place.

SEM images of larvae (ex female or field-collected as appropriate, see captions) were obtained with material mounted on stubs with adhesive carbon discs and these were then bathed in gold using a Quorum Q150TS, the images themselves being taken with a SEM model Amray 1810 (10 kV). Images were taken either at the Universidad de Concepción (Chile) (2010) or at the Universidad Autónoma de Madrid (2011).

Terminology related to chaetotaxy was that according to HINTON (1946) and DUGDALE (1961).

Abbreviations

L1-L5	refers to the larval instars.
Coll.	collection:
Coll.	GEK Gareth Edward King, Madrid
Coll.	UAM Universidad Autónoma de Madrid
NMS	National Museum of Scotland, Edinburgh, UK
MRS	Mark R. Shaw

Results

Scopula (*Glossotrophia*) *rufomixtaria* (Graslin, 1863)

Larvae: 19-III-2005 (one larva: pupated 20-IV-05, pupa 6-V-05 (perished); 3-IV-05 (one larva); 26-III-06 (two larvae); 6-IV-08 (Fig. 1) (one larva: pupated 16-IV-08, pupa 25-IV-08, emerged 11-V-08) ♀ (slide preparation: GK1079MA; Coll. UAM); 15-V-08 (one larva).

Imagines: 1 ♀, 31-V-08 (GK1081MA);1 ♂, 8-VI-08 (GK1132MA) (GEK leg. det. Coll. UAM).

Larvae and imagines were found in gypsym outcrops with the six larvae being taken in *Gypsophila struthium* Loefl. mats (KING & VIEJO-MONTESINOS, 2010). All material belonged to the first generation.

Descriptions Larva: L1: 3.5mm (n=1) (ex ♀ 7-VII-11, Ciempozuelos) yellowish-green; faint pinkish spots ventrally; L4: (26-III-06: 17mm; n=2).

Chaetotaxy: L4 (larva 26-III-06): 17mm (n=2); cephalic capsule (Fig. 2): hypognathous; stemmata form an "scalene triangle"; ocellus 1 is 20% larger than the other ocelli; whilst, ocellus 5 is 10% smaller than the rest of the complex; ocellus 1 is positioned two ocelli from ocellus 2 whilst 2 is positioned one ocellus from ocellus 3; ocellus 3, 4 are to be found almost side by side; half an ocellus distant; ocellus 4 is positioned two ocelli from ocellus 6 which at the same time is positioned three ocelli from ocellus 5; seta O2 is positioned alongside ocellus 1; O1 alongside 3; SO2 proximo to ocellus 6; together with SO3 and O3 in a straight line from ocellus 5 they form a "triangle"; O3, ocellus 5, O1, ocellus 2, A3 form an ascendent line laterally; A1, A2, A3 form a "triangle" dorsally with A2, A3 not at the same level but with A2 more caudal and with seta A3 three ocelli from ocellus 2; labrum (Fig. 3): LR6, LR4 50% of the length of LR5; LR2, LR5 are the longest of the LR setae complex; thoracic region: T1 (Fig. 4): L1, L2 in front of spiracle; L1 fine, elongated; SD2, SD1 at the same level, SD1 fine, elongated; SV1, SV2 ventral region; abdominal region: A6 (Fig. 5): SV1, SV2, SV3 anterior area of abdominal pro-leg; SV4, V1; nine uniserial crochets (DUGDALE, 1961) (row of four, then five), divided by sole (Fig. 6); A10 (Fig. 5): anal shield rounded; D2, PP1 in apposition; distally pronounced; anterior zone with D1, SD1, abdominal pro-leg L3, CD2, L1, CP2 these setae are long, pronounced curving distally.

Parasitoids obtained: Larva L5 (3-IV-05) in *Gypsophila struthium*; *Homolobus truncator* Say, 1828; (Braconidae; Homolobinae) ex pre-pupa (L5): 7-IV-05; emerged: 1-V-05 (MRS det. deposited NMS; SHAW, 2010).

Scopula (*Glossotrophia*) *asellaria dentatolineata* (Wehrli, 1926)

All material [imagines (20); larvae (465)] was taken in gypsum outcrops (KING & VIEJO-MONTESINOS, 2010); adults resting on the rock surface whilst the larvae were collected in *Antirrhinum majus* L.; larvae were taken throughout the year with two peaks: the first in March which corresponds with those having overwintered, with adults of the first generation emerging the first half of April. Phenologically, May is the month with least larvae collected; the other peak is to be found in October with the larvae resulting from the summer generation.

Imagines: 1 ♂, 8-V-04 (preparation number: GK081MA); 1 ♀ 12-IX-04 (GK086MA); 2 ♀♀, 7-V-05 (GK101MA, GK104MA); 1 ♀, 22-V-05 (GK093MA); 1 ♂, 16-VII-05 (GK080MA); 1 ♀, 10-IX-05 (GK102MA); 1 ♀, 22-X-05 (GK105MA); 2 ♂♂, 29-IV-06 (GK976MA, GK990MA); 1 ♀, 13-V-06 (GK1201MA); 1 ♀, 20-V-06 (GK981MA); 1 ♀, 27-V-06 (GK987MA); 2 ♂♂, 12-IV-08 (GK1007MA, GK1014MA); 1 ♂, 20-IV-08 (GK1003MA); 1♂, 11-V-08 (GK1088MA); 1 ♂, 1 ♀, 15-V-08 (GK1101MA, GK1141MA); 1 ♀, 8-VI-08 (GK1152MA) all material GEK leg. det. Coll. UAM.

Descriptions Larva: L1: (ex 1 ♀, 22-V-10; Ciempozuelos) larvae eclosed: 29-V-10: (n=3) ± 3.8 mm; dorsally greenish-white, and reddish; L2: (ex 1 ♀, 22-V-10; Ciempozuelos) (n=4): 8.6 mm: overall greenish-white; A1-A5: lateral spotting reddish-black; cephalic capsule: greenish-white mottled in ochre; dorsally reddish-green; ventrally greenish-white; L3: 13 mm (n=2) (24-X-09; Ciempozuelos) larva pale ochre dorsal line absent; laterally one can appreciate a certain flattened rugosity in line with the spiracles; dorsally A2-A8 discontinuous blackish shapes; five black stigmata laterally in urites: A1, A3, A,5, A7, A8; spiracles ochre black margins; abdominal pro-legs, thoracic legs pale ochre; cephalic capsule: greyish-white; sutures black, mottled in ochre dorsally; 13 mm (n=2): (17-IV-10): greyish-white; small black spotting beneath the whitish roughened-fleshy laterals below spiracles; ventrally cuticle roughened and greyish in contrast with whiter dorsal area; thoracic, abdominal pro-legs, cephalic capsule: whitish mottled in ochre (a constant also in L5); L4: ex 1 ♀, 29-V-10): ± 15 mm (n=3): Larvae polychroic L5; greyish-green; ventrally with black maculation A2-A5; also dorsally A6-A2, these maculae alternate with blackish striping which is barely perceptible; faint dorsal line; cephalic capsule whitish mottled in ochre; in another specimen, of a greyer colour, maculation better defined; another specimen more whitish-green (Description: 22-VI-10); Larvae polychroic: dorsally pale ochre, becoming darker towards the anal shield; cephalic capsule: whitish spotted apically tawny-ochre; setae pale ochre; pro-thoracic shield: spotted pale ochre; corporal setae black; thoracic legs almost transluscent; (ex 1 ♀, 22-V-10; Ciempozuelos; description: 14-VI-10): 20.2 mm (n=3): ventrally whitish-grey; A1-A5 maculae black; A6 maculae absent; cephalic capsule: whitish; laterally maculae A1-A5, those beneath spiracles are golden with black margins; roughened-fleshy laterals A1-A10 are divided up in-between whitish and ochre tones dorsally and ventrally; dorsally pale ochre without dorsal line instead ochre irregular “diamond” shapes; setae black; another specimen ventrally whitish-bluish tones; dorsally ochre maculae A1-A7; laterally greyish ochre; a third specimen differed dorsally black maculae A5-A6 only with shapes hardly percepible on other segments; cephalic capsule: mottled in ochre; abdominal pro-legs, thoracic legs greyish-white. At time of pupation larva becomes transluscent with inter-segmental membranes green (n=1).

Chaetotaxy: Cephalic capsule (Fig. 8): hypognathous: stemmata form a rough “rectangle” (ocelli 1-5); ocellus 1 is 20% larger than ocelli 5, 6 the smallest in the complex; ocellus 5 is positioned four ocelli from ocellus 1 and two ocelli from ocellus 4; ocellus 1 is positioned two ocelli from ocellus 2; ocelli 2, 3, 4 are positioned in relative proximity 75% of an ocellus from each other in the complex; ocellus 6 is positioned two ocelli from ocellus 4 and two ocelli and-a-half from ocellus 5; seta O2 almost touches the base of ocellus 1; seta O1 is positioned in the proximity of ocellus 3 without actually touching its base; seta SO2 is positioned between ocelli 5, 6 being somewhat nearer to ocellus 6; ocelli 4, 5, in addition to seta O3 are in a horizontal plane; between setae O2, O1, O2 being thicker, with O1 being the more slender of the two distally; O3 is 75% the length of O2; setae A1, A2, A3 form a "triangle" (Fig. 8) in the latero-posterior zone of the cephalic capsule (cephalad); A1 is 25% longer than A2; A3, L1 are at the same level in an ascendent line (Fig. 8); setae P1, P2 are also in an ascendent line; clypeus: setae Cl1, Cl2 are of the same length; labrum (Fig. 9): seta LR6 finer and 25% shorter than setae LR1, LR2, LR3. The antennae (Fig. 10) located in a pit posterior to the stemmata are three-segmented with sensilla styloconica (S1, S2), sensilla basiconica (B1, B2, B3), and sensillum chaeticum (C) (RANA & MOHANKUMAR, 2017). In *S. asellaria dentatolineata* there is a single sensilla styloconica (Fig. 10) and three sensilla basiconica; the sensillum chaeticum projects beyond the pit and tapers finely from its thick-set base. Thoracic region: L5: T1: (Fig. 11) (19-III-11, Ciempozuelos) (n=2): dark setae; black pinnacles; SD1 fine and lengthened; setae SD2, SD1 both anterior to spiracle, SD2 10% longer and relatively thick, SD1 very fine; L2, L1, L2 25% longer than SD2, L1 50% less thick than L2: "hair-like"; setae SV1, SV2, V1 in proximity to the coxa; T2: D1, D2, SD2, SD1 in descending line; L2, L1 at the same level same length, L3; SV1, SV2 (Fig. 11). Abdominal region (Figs 7, 12): A6: SV4; five setae in the anterior zone of the abdominal pro-leg; long fine, especially SV1, SV3; A7-A9: D1 long, "thick-set"; A6 crochets form a complex of eight uninterrupted uniseries (DUGDALE, 1961) with each crochet undifferentiated size-wise; A7: SD1, L1, L2 lined up around spiracle forming a "sub-triangle"; A8: SD1, L1, L2; L3 beneath L2; SV1; A9: D1, D2, SD1, L1 in descending line; A10 (Figs 7, 12): anal shield not prominent in relation to A9 which is "swollen" dorsally; setae SD1, L1, L2 in vicinity of spiracle forming a "sub-triangle"; SV4 (=L4) five setae (V1 posteriorly); crochets form a complex of eight uninterrupted uniseries; six setae (V1 posteriorly) anteriorly of anal pro-leg: L3, L1, CP1, CP2.

Parasitoids obtained: Only two species of parasitoid identified (MRS) to species level including:

BRACONIDAE

Homolobus truncator (Say, 1828) (MRS det. deposited NMS; SHAW, 2010) attacks the larva as host when *H. truncator* emerges as a larva in the host's pre-pupal phase (L5) with the braconid's cocoons in the host's cocoon itself: 465 larvae were taken 2004-2008 with a significant % parasitisation rate: February-April (141 larvae collected=33.1%) with nine cases involving *H. truncator* (6.4%); September-November (170 larvae collected =36.2%), with 14 cases involving this braconid (7.7%); on the other hand, in the summer months (June-August) of 95 larvae collected, only five cases were reported (5.2%).

Cotesia sp. (Braconidae: Microgastrinae) (MRS det. deposited NMS): larva L5: 23-VII-05 emergence: 2-VIII-05.

Glyptapanteles sp. (Braconidae: Microgastrinae) (MRS det. deposited UAM): ex larva 7-X-07 (no emergence).

Microplitis sp. (Braconidae: Microgastrinae) (MRS det. deposited NMS): Attacks L4 larva (braconid larva on emerging from host deposits subsequent cocoon between urites A6-A10); nine cases of parasitisation; summer months (May-July) seven cases (7.9%) of 88 larvae collected; October (77 larvae collected=two larvae=2.5% parasitised).

ICHNEUMONIDAE

Platylabus tricingulatus (Gravenhorst, 1820) Platylabini (Ichneumonidae: Ichneumoninae): five cases documented: 3-IV-05, 22-X-05 (two larvae), 21-I-06 (two larvae); wasp emerges ex pupa April, May (MRS det. deposited NMS).

Campoplex sp. (Ichneumonidae: Campopleginae): Larva: 13-III-05 in *Antirrhinum majus*; larva pupated 31-III-05; 3-IV-05 cocoon; emerged: 1-V-05 (MRS det. deposited with Klaus Horstmann).

Discussion and conclusions

Scopula (*Glossotrophia*) *rufomixtaria* (Graslin, 1863)

Biology: Only six larvae were taken between 2004-08 which were representatives of the first generation only although the species is bi-voltine (or trivoltine) (HAUSMANN, 2004). KING (2000), REDONDO *et al.* (2001) include data from the Mid-Ebro valley in NE Spain (Zaragoza, 200 m) of 25 larvae collected 23 (92%) were of the first generation with emergencies in captivity in April and May, nevertheless, two larvae taken in June emerged in June, July of the same year presumably representing a second generation, the first generation flies end of April-beginning of May, for this reason it must be assumed to be trivoltine at low altitudes in Spain (HAUSMANN, 2004), in fact, there is a female in the collection (Coll. GEK) of the first author from early October (Madrid, Tres Cantos, 720 m, 1 ♀, 2-X-03).

In terms of food-plants, CHRÉTIEN (1928) cites *Silene, Dianthus* (Caryophyllaceae); KING (2000); REDONDO *et al.* (2001) and KING & VIEJO-MONTESINOS (2010) describe larvae as monophagous in *Gypsophila struthium* in gypsym soils in both the Tagus and Ebro valleys in central Spain. HAUSMANN (2004) indicated the probability that it is oligophagous in the Caryophyllaceae in poor nutrient soils.

Parasitisation of the two *Scopula* taxa in the study area: Both *S. rufomixtaria* and *S. asellaria dentatolineata*, as well as another sterrhine moth: *Casilda consecraria* (Staudinger, 1871) (KING & ROMERA, 2004; KING & VIEJO-MONTESINOS, 2017) were attacked by the braconid *Homolobus truncator.* In the case of *S. rufomixtaria*, no more than six larvae were taken (see Results) with a parasitation rate of 16.6% which can be regarded as relatively important.

Other parasitoids known or documented ex larvae *S. rufomixtaria* include *H. truncator* (Shaw, 2010) and a species of *Ophion* (MRS det.) (Ichneumonidae: Ophioninae) (ex *S. rufomixtaria*: *Homolobus truncator*: 14, 21-III-99; *G. struthium*; Juslibol (Zaragoza); emergencies: 13-IV-99; *Ophion* sp. (Ichneumonidae: Ophioninae): 5-III-98; *G. struthium*; Juslibol (Zaragoza); larva pupated 29-III-98 emerged I-1999, NMS deposited). It should be pointed out, that those larvae attacked by *Ophion* were also taken in *Gypsophila struthium* and in gypsum soils (KING, 2000). *Ophion*'s strategy is different to *H. truncator* in the sense that this ichneumonid takes ten months to emerge from its own cocoon (in January) being presumably univoltine its main biological activity coinciding with the larval state of *S. rufomixtaria*, or similar species, during their own second generation. BORDERA *et al.* (1987) and BROCK (1982) document *Ophion* as recognised geometrid parasitoids (of Ennominae), making clear that their hosts overwinter as larvae, although this cannot be applied to the host in the form of *Agriopis* (BROCK, 1982; BORDERA *et al.*,1987; EBERT & STEINER, 2001b). Two larvae of *Calamodes occitanaria* (Duponchel, 1829) (Ennominae) taken in the study area (2005) suffered attack by *Ophion minutus* Kriechbaumer, 1879 (MRS det.), for this reason, these data are of interest as it would take a change of strategy on the part of the Hymenopteran if their hosts are at soil level and not in the tree layer (as is the case with *Agriopis*). On the other hand, it is noteworthy that no Scopulini larva was parasitised by *Ophion* in the Tagus valley if this was indeed the case in the ecologically similar Ebro valley.

H. truncator parasitises *S. asellaria dentatolineata*, especially in the winter months (see Results). This data is relevant because rates of parasitisation ex larvae of *C. consecraria* (KING & VIEJO-MONTESINOS, 2017) were documented before the onset of winter (July-October) with four cases of the 31 larvae then collected (=12.9%) (see Results). It would appear to be the case that *H. truncator* females attack *S. asellaria dentatolineata* larvae when the host in the shape of *C. consecraria* would not be available (these overwinter as pupa), so the braconid larvae would spend the winter within *S. asellaria dentatolineata* as koinobiont endo-parasitoids. The strategy of *H. truncator* involves its own larva taking advantage of the host constructing its cocoon within which it emerges ex host's pre-pupal phase when it then constructs its own cocoon (SHAW, 2010).

S. asellaria dentatolineata was also attacked by an additional koinobiont braconid: an unidentified specie of *Microplitis* (MRS det.) (Braconidae: Microgastrinae) with data between May and July with seven cases (7.9%) from 88 larvae collected, as well as October (77 larvae=2 larvae=2.5%). This parasitoid emerges when the host is in L4, leaving a characteristic cocoon stuck and exposed between A6 and A10; the host does not perish immediately but lives several days more (SHAW & HUDDLESTON, 1991). Although the braconid remains unverified and so the precise host-parasitoid relationship cannot be established, several geometrids have been recorded as hosts in Madrid although only one host included a sterrhine:

Ex *Idaea ochrata albida* (Zerny, 1936): *Microplitis* sp. (emerged 5-12-VI-08) ex two larvae Madrid, Tres Cantos, 720 m, 18-V-08); in the leaf litter; pupated 1-VI-08; *Microplitis* sp. (emerged 16-VI-08) ex larva: 1-VI-08; *Microplitis* sp. (emerged V-09) ex four larvae 18-IV-09; pupated 9-V-09; *Microplitis* sp. ex two larvae 9-V-09; *Microplitis* sp. (emerged 7-VI-09) ex larva 23-V-09; latter data from Madrid, El Goloso, 720 m, in the leaf litter (all material MRS det., Coll. NMS).

It can be appreciated that female host-hunting *Microplitis* orientate at soil level, additionally, two species also attacked by *Microplitis*: *Microloxia herbaria* (Hübner, [1813]) (Geometrinae) and *Perigune narbonea* (Linnaeus, 1767) (Ennominae) (MRS det., Coll. NMS) use the same food plant: *Teucrium capitatum* subsp. *capitatum* L. to orientate towards the potential host, in this case, taking advantage of air-born volatiles released by the labiate (TURLINGS *et al.*, 1995).

Two braconids belonging to the same subfamiliy: Microgastrinae: *Cotesia* sp., *Glyptapanteles* sp. were also documented ex *larvae S. asellaria dentatolineata*, a species of *Glyptapanteles*: *G. vitripennis* (Curtis, 1830) was taken ex *larva Calomodes occitanaria* (Duponchel, 1829) (Ennominae) (*Glyptapanteles vitripennis* (Curtis, 1830) ex L2; 30-XII-06; Madrid, Cerros de Vallecas, 600 m; *Thymus lacaitae* Pau; pupated 15-I-07 emerged 2-II-07, MRS det., Coll. NMS).

The only parasitoid documented which emerged from a pupa was *Platylabus tricingulatus* (Gravenhorst, 1820) (MRS det., Coll. NMS) (Platylabini: Ichneumoninae: Ichneumonidae) ex *S. asellaria dentatolineata* with larvae collected late or very early in the year which would have meant that the parasitoid overwintered in its chosen host until it contructed its own cocoon and metamorphosed with the wasp exiting from the pupa (PERKINS, 1959; SELFA *et al.*, 1988; ANENTO & SELFA, 1997). Other data from the tribe Platylabini ex geometrids indicate: *Apaeleticus bellicosus* Wesmael, 1845 ex *I. ochrata albida* (*A. bellicosus* emerged V-2009 ex pupa, host larva: 1-III-09; El Goloso beneath *Rumex acetosa* L. and *Onobrychis viciifolia* Scop. pupated 9-V-09 (MRS det., Coll. NMS).

Campoplex sp. ex *S. asellaria dentatolineata* (1 case: 2005) (Campopleginae: Ichneumonidae) a characteristic of this subfamily is that the larvae on emerging from host leave the host's exuvium crumpled up on its own cocoon (BUENO DOS REIS FERNANDES *et al.*, 2010). In any case, this single *Campoplex* species behaved differently, as this ex *S. asellaria dentatolineata* would have spent the winter inside the host which was not the case with the *Campoletis* documented ex *C. consecraria* (KING & VIEJO-MONTESINOS, 2017) which was taken in the summer months in the second generation of *C. consecraria*. These two Campopleginae species emerge as a larva exiting the host in the pre-pupal phase within the host's cocoon constructing its cocoon alongside the moribund larva (SHAW *et al.*, 2009).

Scopula (*Glossotrophia*) *asellaria dentatolineata* (Wehrli, 1926)

Confirmation of the subspecies: *S. asellaria dentatolineata* Wehrli 1926: according to HAUSMANN (1993, 2004) the lamina antevaginalis in the anterior zone of the female genitalia is elipsoid.

Biology: Larvae were taken throughout the year with two peaks: the first in March (62 specimens = 13.13%) which corresponds with those having overwintered, with adults of the first generation emerging the first half of April. Phenologically, May is the month with least larvae collected (13 = 2.6%); the other peak is to be found in October (76 = 16.2%) with the larvae resulting from the summer generation. Adults were taken from the month of April (2 ♂♂, 12-IV-08) until late October (1 (♀). 22-X-05), it can be concluded therefore that the taxon is tri-voltine in the study area, nevertheless, the first generation is more numerous, with 17 specimens taken in April and May (=73.6%).

Larval ethology: In the initial instars larvae hide in amongst the leaf litter which accumulates beneath the food-plant, moving rapidly amongst the litter which also forms in the ledges of the gypsym outcrops. In later instars (L3-L5) the larvae are to be found erect on the food-plant or in the proximities on the rock surface. On being disturbed they spring off the support on to the substrate beneath (King, personal observation).

Imagine ethology: The moths rest on the gypsym outcrops or in the fissures with the wings held flat at the rock surface (planiform) (King, personal observation).

Morphology and chaetotaxy: In this paper original data has been presented for two taxa in the genus *Scopula* of the larva and the chaetotaxy of L4 *S. rufomixtaria* and L5 *S. asellaria dentatolineata* the latter information is summarised in Table I with regard to that published in SINGH (1951). In terms of a difference in why penultimate instar larvae (L4) rather than L5 larvae of *S. rufomixtaria* were studied was due to the expediency of having this instar available in alcohol for SEM studies.

Table I.– Chaetotaxy: comparisons with larvae of *Scopula* Schrank, 1802 according to SINGH (1951) with *S. rufomixtaria* and *S. asellaria dentatolineata*.

Character	***Scopula***	***S. rufomixtaria***	***S. asellaria dentatolineata***
Cephalic capsule	Granular; vertex almost rounded; O2 in proximity to ocellus 1; O1 near ocellus 3 (seems to be between ocelli, 3, 4 (stemmata).	Granular; vertex almost rounded; O2 in proximity to ocellus 1; O1 near ocellus 3 but half ofan ocellus from ocellus 4.	Granular; vertex almost rounded; O2 in proximity to ocellus 1; O1 near ocellus 3 but 75% of an ocellus from ocellus 4.
urites	Lengthened abdomen, cuticle granular; setae "short" and not prominent at base; A1-A9; SD1 anterior to spiracle A1-A7; L1 posterior to spiracle and below it A1-A5; urites A6-A8 positioned at same level; anal shield (A10) rounded: L1 next to L2 (SD1 according to Dugdale, 1961), D1, L3 in a row.	Lengthened abdomen, cuticle granular; setae "finely tapering" and well-defined pinnacles; L1 posterior to spiracle and below it, anal shield (A10) rounded.	Lengthened abdomen, cuticle granular; setae "finely tapering" and well-defined pinnacles; SD1 anterior to spiracle A1-A7; L1 posterior to spiracle and below it A1-A8; anal shield (A10) rounded.
spiracles	Ovoid; A6 larger than that in T1; A7, A8 are of different sizes.	Ovoid; A6 same size as that in T1.	Ovoid; A6 same size as that in T1; A7, A8 same sizes also.

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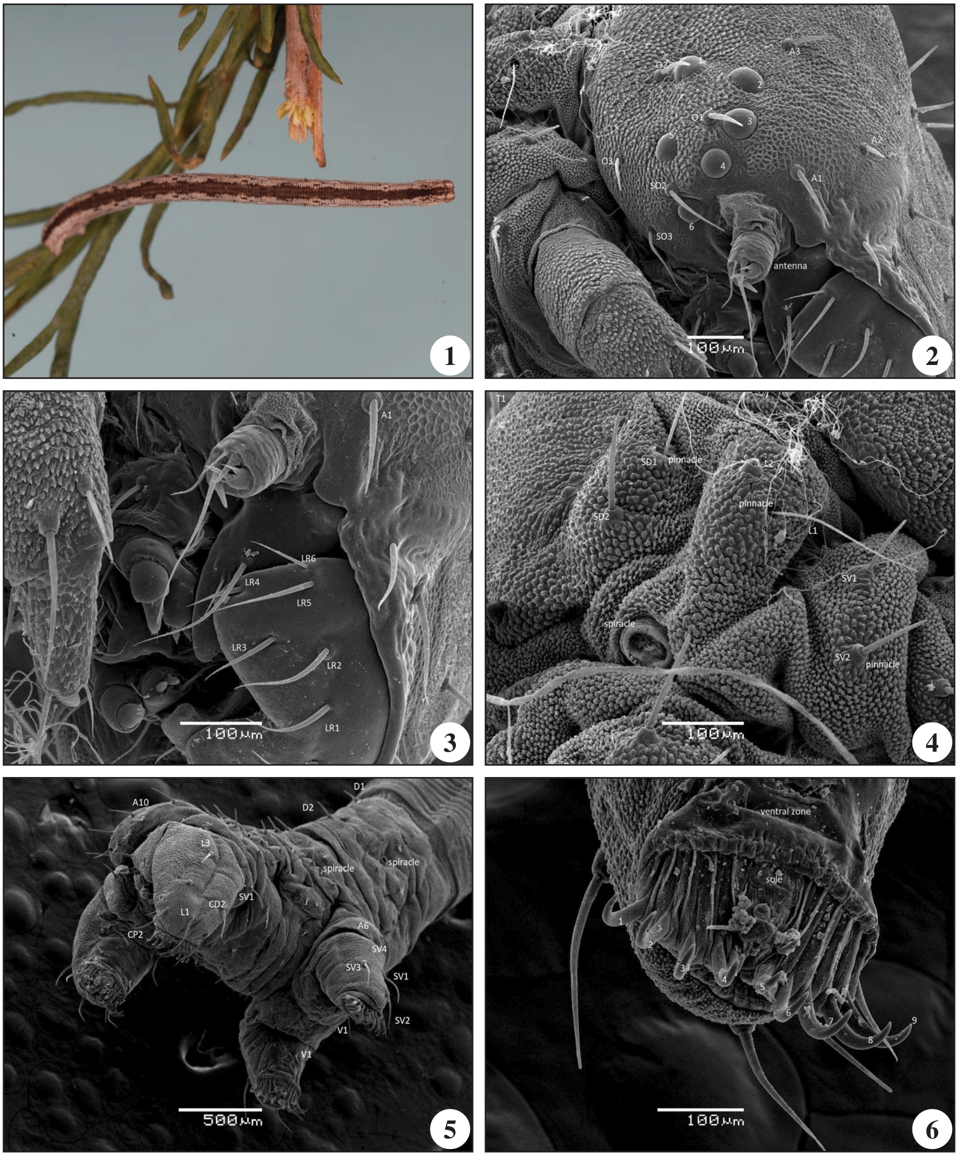
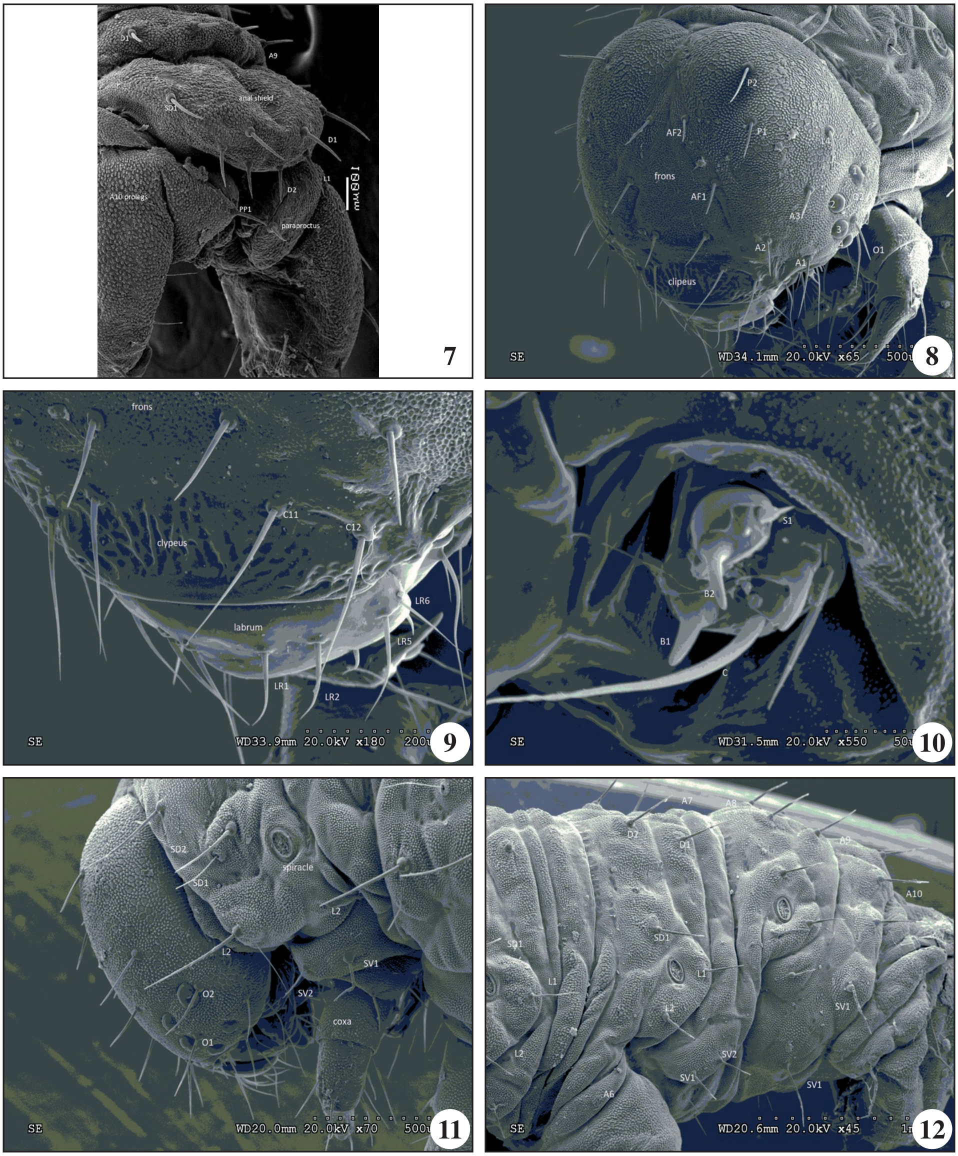


Figs 1-6.– 1. *Scopula* (*Glossotrophia*) *rufomixtaria* (Graslin, 1863): L5 larva (V-2008, Ciempozuelos in *Gypsophila struthium*) (photo: José Martín Cano). **2.** *Scopula* (*Glossotrophia*) *rufomixtaria* (Graslin, 1863): larva L4: cephalic capsule, lateral view (26-III-2006), Ciempozuelos in *G. struthium*. **3.** *Scopula* (*Glossotrophia*) *rufomixtaria* (Graslin, 1863): L4: labrum; corresponding setae; lateral view (26-III-2006, Ciempozuelos). **4.** *Scopula* (*Glossotrophia*) *rufomixtaria* (Graslin, 1863): L4: thoracic region (T1); corresponding setae. **5.** *Scopula* (*Glossotrophia*) *rufomixtaria* (Graslin, 1863): A10 anal shield; A6, A10 pro-legs, anterior; latero-ventral view; corresponding setae. **6.** *Scopula* (*Glossotrophia*) *rufomixtaria* (Graslin, 1863): A6 pro-leg, ventral view; crochets.



Figs 7-12.– 7. *Scopula* (*Glossotrophia*) *asellaria dentatolineata* Wehrli, 1926: larva: L5: abdominal region; A10; prolegs; corrresponding setae. **8.** *Scopula* (*Glossotrophia*) *asellaria dentatolineata* Wehrli, 1926: larva: L5: cephalic capsule; latero-ventral view; corresponding setae. **9.** *Scopula* (*Glossotrophia*) *asellaria dentatolineata* Wehrli, 1926: larva: L5: labrum; positioning of setae. **10.** *Scopula* (*Glossotrophia*) *asellaria dentatolineata* Wehrli, 1926: larva: L5: antenna; lateral view. **11.** *Scopula* (*Glossotrophia*) *asellaria dentatolineata* Wehrli, 1926: larva: L5: cephalic capsule; thoracic region T1; corresponding setae; lateral view. **12.** *Scopula* (*Glossotrophia*) *asellaria dentatolineata* Wehrli, 1926: larva: L5: abdominal region; A6-A10; prolegs; corrresponding setae.

REVISIÓN DE PUBLICACIONES
BOOK REVIEWS

J. Fernández Haeger, D. Jordano Barbudo, P. Fernández Rodríguez,
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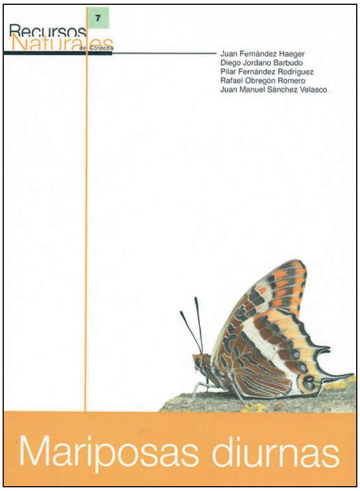

Dentro de la colección Recursos Naturales, con el número 7, aparece este libro sobre las mariposas diurnas que se encuentran en la provincia española de Córdoba, de la mano de nuestros estimados colegas cordobeses.

Siempre nos agrada la aparición de estas obras provinciales sobre las diferentes familias de Lepidoptera, que nos van completando las distribuciones reales de las diferentes especies, sobre su ecología y taxonomía. Se tratan las familia Papilionidae, Hesperiidae, Pieridae, Lycaenidae y Nymphalidae.

Comienza la obra con los agradecimientos y una introducción, seguida por la biología de las especies consideradas. Ya dentro de cada especie, nos presentan el nombre científico, un interesante diagrama fenológico donde se indican en rojo los meses donde se pueden encontrar los adultos volando y en el centro el número de generaciones; datos sobre su distribución conocida y su correspondiente mapa en cuadrículas UTM de 10X10 km y diferentes informaciones de interés general.

Continúa con un interesante capítulo sobre la conservación de las mariposas y sus hábitats, hablándonos sobre el cambio global y la crisis sobre la biodiversidad, algunas evidencias y el papel de los insectos en el funcionamiento de los ecosistemas. Sobre las principales amenazas para la conservación de los insectos. Finaliza la obra con un capítulo sobre las mariposas y jardines, así como la consideración de un recurso didáctico y de una bibliografía.

No podemos terminar estas palabras sin felicitar a los autores por este trabajo, por lo que recomendamos esta obra, para todos aquellos interesados en los Rhopalocera de esta bonita tierra española.

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The genus *Apatema* Walsingham, 1900 in the Canary Islands and Madeira, with description of 13 new species (Lepidoptera: Autostichidae, Oegoconiinae)

P. Falck, O. Karsholt & T. J. Simonsen

Abstract

The genus *Apatema* Walsingham, 1900 in the Canary Islands and Madeira is revised based on external morphology, genitalia and DNA barcodes. We recognize 18 species, 13 of which are described as new: *Apatema confluellum* Falck & Karsholt, sp. n. (Spain: Tenerife), *Apatema minimum* Falck & Karsholt, sp. n. (Spain: Lanzarote and Fuerteventura), *Apatema lapalmae* Falck & Karsholt, sp. n. (Spain: La Palma), *Apatema sallyae* Falck & Karsholt, sp. n. (Spain: Gran Canaria), *Apatema lanzarotae* Falck & Karsholt, sp. n. (Spain: Lanzarote), *Apatema mixtum* Falck & Karsholt, sp. n. (Spain: Tenerife), *Apatema pseudolucidum* Falck & Karsholt, sp. n. (Spain: Gran Canaria), *Apatema griseum* Falck & Karsholt, sp. n. (Spain: Gran Canaria), *Apatema grancanariae* Falck & Karsholt, sp. n. (Spain: Gran Canaria), *Apatema brunneum* Falck & Karsholt, sp. n. (Spain: Tenerife), *Apatema transversum* Falck & Karsholt, sp. n. (Spain: Gran Canaria), *Apatema stadeli* Falck & Karsholt, sp. n. (Spain: Tenerife) and *Apatema skulei* Falck & Karsholt, sp. n. (Spain: Gran Canaria). The monotypic *Dysallomima* Gozmány, 2008, syn. n. is treated as a new synonym of *Apatema* and its type species *Lampros coarctella* Rebel, 1896 is transferred as *Apatema coarctella* (Rebel, 1896) comb. n. *Apatema helleri* (Rebel, 1910), comb. n. is transferred from the Blastobasidae. *A. mediopallidum* Walsingham, 1900 is removed from the list of Lepidoptera of the Canary Island. Morphology of all species is described and figured in detail. All species occurs in the Canary Islands and only one, *A. fasciata* (Stainton, 1859) occurs both in these islands and in the Madeiran archipelago. Records of *A. mediopallidum* Walsingham, 1900 from the Canary Islands are based on misidentifications. Analyses of DNA barcodes support the identification distinctiveness of the species as each species appear monophyletic, well-supported and genetically isolated in the analyses. The only exception is *A. coarctella*, which could not be rendered monophyletic with respect to a single *A. mediopallidum* specimen, when sequences from non-Canarian *Apatema* were included in the analysis. We argue that this result is an artefact.
KEY WORDS: Lepidoptera, Autostichidae, *Apatema*, new species, DNA barcoding, Canary Islands, Spain, Madeira, Portugal.

El género *Apatema* Walsingham, 1900 en las Islas Canarias y Madeira, con descripción de 13 nuevas especies (Lepidoptera: Autostichidae, Oegoconiinae)

Resumen

Se revisa el género *Apatema* Walsingham, 1900 en las Islas Canarias y Madeira basado sobre la morfología externa, genitalia t ADN código de barras. Reconocemos 18 especies, 13 de las cuales se describen como nuevas: *Apatema confluellum* Falck & Karsholt, sp. n. (España: Tenerife), *Apatema minimum* Falck & Karsholt, sp. n.

(España: Lanzarote y Fuerteventura), *Apatema lapalmae* Falck & Karsholt, sp. n. (España: La Palma), *Apatema sallyae* Falck & Karsholt, sp. n. (España: Gran Canaria), *Apatema lanzarotae* Falck & Karsholt, sp. n. (España: Lanzarote), *Apatema mixtum* Falck & Karsholt, sp. n. (España: Tenerife), *Apatema pseudolucidum* Falck & Karsholt, sp. n. (España: Gran Canaria), *Apatema griseum* Falck & Karsholt, sp. n. (España: Gran Canaria), *Apatema grancanariae* Falck & Karsholt, sp. n. (España: Gran Canaria), *Apatema brunneum* Falck & Karsholt, sp. n. (España: Tenerife), *Apatema transversum* Falck & Karsholt, sp. n. (España: Gran Canaria), *Apatema stadeli* Falck & Karsholt, sp. n. (España: Tenerife) and *Apatema skulei* Falck & Karsholt, sp. n. (España: Gran Canaria). El monotípico *Dysallomima* Gozmány, 2008, syn. n. es tratado como una nueva sinonimia de *Apatema* y la especie tipo *Lampros coarctella* Rebel, 1896 es transferida como *Apatema coarctella* (Rebel, 1896) comb. n. *Apatema helleri* (Rebel, 1910), comb. n. es transferida desde los Blastobasidae. *A. mediopallidum* Walsingham, 1900 es removida de la lista de Lepidoptera de las Islas Canarias. Morfológicamente se describen y figuran en detalle, todas las especies. Todas las especies ocurren en las Islas Canarias y solo una, *A. fasciata* (Stainton, 1859) ocurre ambas en estas islas y en el Archipiélago de Madeira. Los registros de *A. mediopallidum* Walsingham, 1900 de las Islas Canarias están basados en malas identificaciones. El análisis del AND código de barras soporta la identificación, separadamente, de cada una de las especies que aparecen monofiléticamente, bien soportadas y genéticamente aisladas en el análisis. La sola excepción es *A. coarctella*, la cual no puede ser tratada como monofilética con respecto a una sola muestra de un espécimen de *A. mediopallidum*, cuando las secuencias de los *Apatema* no canarios, fueron incluidos en el análisis. Argumentamos que este resultado es un artefacto.

PALABRAS CLAVE: Lepidoptera, Autostichidae, *Apatema*, nuevas especies, ADN código de barras, Islas Canarias, España, Madeira, Portugal.

Introduction

Oegoconiinae are a small group of Gelechioidea, most of which are distributed in the Western Palearctic region. They were included by GOZMÁNY (2008) in his revision of the Palearctic Symmocidae. According to recent molecular studies, e. g. HEIKKILÄ *et al*. (2013) Oegoconiinae should be regarded as a subfamily of Autostichidae.

WALSINGHAM (1900: 220) erected the genus *Apatema* for a new species, *A. mediopallidum*, which he described from France: Corse. In a treatment of Microlepidoptera of the Canary Islands he subsequently transferred *Gelechia fasciata* Stainton, 1859 and *Lampros coarctella* Rebel, 1896 (as a synonym of *fasciata*) to *Apatema* and described a new species, *A. lucidum* (Walsinghm, 1908: 945). During most of the 20th century most specimens from outside of the Macaronesia Islands were referred to *A. mediopallidum*. *Apatema* species are rather small Gelechioidea having blackish forewings with whitish or yellowish markings, their genitalia are rather simple and similar between the species, and it has only slowly become evident that the genus is more diverse that hitherto suspected.

The Lepidoptera of the Canary Islands are considered well-known. Similar to other oceanic islands the fauna of the Canary Islands is less diverse than that of the adjacent continental countries (Morocco, Portugal), but includes a number of endemic species. Recent field work by the first author (e. g. FALCK *et al*., 2019; FALCK & KARSHOLT, 2019) has revealed a number of hitherto unrecorded or even undescribed species of Lepidoptera occurring in these islands. In the present paper we revise the genus *Apatema* in the Canary Island and the Madeiran Archipelago.

Many Canarian *Apatema* species are quite easily identified based on adult habitus (e. g. *A. sallyae* Falck & Karsholt, sp. n. and *A. lucidum* Walsingham), while others are difficult to identify without genitalia dissections (e. g. *A. mixtum* Falck & Karsholt, sp. n. and *A. fasciata* (Stainton)). When dissecting the male genitalia it is very important to separate the cornuti groups (Fig. 28) to ensure correct identification. In the female genitalia (Fig. 48) some species (e. g. *A. stadeli* Falck & Karsholt, sp. n.) have a slightly twisted ductus bursae. This gives the impression of a longitudinal fold of the anterior part of ductus bursae in the genital-slide, despite being an artefact, which we will refer to as “a longitudinal fold”.

Here we revise the Canarian *Apatema* species based on adult morphology and DNA barcodes (a 658 bp fragment of the mitochondrial COI gene). We provide detailed descriptions and diagnoses for all species and discuss their molecular diversity and potential phylogenetic relationships.

Material and methods

Most of the specimens were attracted to an 8 watt super actinic light. Some of the specimens especially from forest localities were obtained by netting in the afternoon sunshine and a few specimens were disturbed from the vegetation during daytime. Genitalia were dissected following Robinson (1976). Whole specimens were photographed with a Canon EOS 700D camera equipped with a Canon EF 100 mm objective. The genitalia slides were photographed using a Soptop CX40T Trinocular microscope in conjunction with a Toup Tek P10500A-E3 / E3ISPM05000KPA-E3 / 5.0MP USB3 camera.

The so-called DNA barcode fragment (a 658 bp fragment of the mitochondrial COI gene) was sequenced from all known *Apatema* species from the Canary Islands to detect genetically distinct clusters, and to obtain molecular data for new species. DNA samples (dried legs) were prepared according to the accepted standards and were processed at the Canadian Centre for DNA Barcoding (CCDB, Biodiversity Institute of Ontario, University of Guelph). Genetic clusters are presented with their barcode index number (BIN; cf. RATMNASINGHAM & HERBERT, 2013).

To assess overall DNA diversity and relationships within the Canary Island *Apatema* we analysed the DNA barcodes under a Bayesian framework in MrBayes 3.2. (RONQUIST *et al*., 2011). The analysis was done utilising the model-jumping option (nst=mixed) allowing MrBayes to assess the best evolutionary model for the dataset. The rates were set to GAMMA, all other priors were left as default. The analysis was run for 10 million generations with sampling every 1000 generation, and the first 25% were used as burnin. The run files were subsequently assessed in Tracer 1.7.1 (part of the BEAST package, BOUCKAERT *et al*., 2019) to confirm that the two parallel analyses had converged and reached stationarity. The majority rule consensus tree was visualised in FigTree 1.4.4. (RAMBAUT, 2014). We analysed the dataset in BEAST in conjunction with BEAUti (BOUCKAERT *et al*., 2019) under the GTR model for molecular evolution (the model found by MrBayes) with rates set to GAMMA and all other priors left as default. The analysis was run for 10 million generations with sampling every 5000 generations. The resultant trees were then imported into DensiTree (BOUCKAERT & HELED, 2014), with the first 25% used as burnin, to visualise potential conflict areas in the data. To test whether the *Apatema* species found on the Canary Island and Madeira potentially comprise a monophyletic group, we augmented our DNA barcode dataset with publicly available barcode sequences from four additional species of *Apatema* (16 sequences) and three species of the closely related genus *Oegoconia* (six sequences). The new dataset was analysed under a Bayesian framework in MrBayes 3.2. utilising the model-jumping option with rates set to GAMMA. The analysis was run for 20 million generations with sampling every 1000 generations, and the first 25% were used as burnin. The run files were subsequently assessed in Tracer 1.7.1, and the majority rule consensus tree was visualised in FigTree 1.4.4. In all Bayesian analyses a single specimen of each of the three species *Epanastatis sophroniella* (Rebel, 1894)*, E. canariensis* (Rebel, 1906) and *Ambloma klimeschi* Gozmány, 1975 were used as outgroups. All specimens used in the molecular analyses are listed in Table 1. We explored the general genetic diversity in *Apatema* from the Canary Island by calculating uncorrected p distances in Mega X (KUMAR *et al*., 2018). We calculated the average uncorrected p distance within as well as between each putative species (as listed in Table 1 and the Taxonomic section); the values are listed in Table 2. We further divided *A. coarctella* into populations from Fuerteventura, Gran Canaria, Lanzarote, La Palma and Tenerife and separately calculated the average uncorrected p distance within and between the four populations; the values are listed in Table 3. Similarly, we divided *A. fasciata* into populations from Gran Canaria, Fuerteventura and Lanzarote and separately calculated the average uncorrected p distance within and between the three populations; the values are listed in Table 4.

Table 3.– Average uncorrected p distance within and between populations of *Apatema coarctella* as described in the text.

	Tenerife	Gran Canaria + Fuerteventura	La Palma	Lanzarote
Tenerife	0			
Gran Canaria + Fuerteventura	0.0463	0.0034		
La Palma	0.0295	0.0534	0.0013	
Lanzarote	0.0447	0.0022	0.0540	0.0014

Table 4.– Average uncorrected p distance within and between populations of *Apatema fasciata* as described in the text.

	Gran Canaria	Fuerteventura	Lanzarote
Gran Canaria	0.0005		
Fuerteventura	0.0295	0.0046	
Lanzarote	0.0335	0.0290	n/c

Abbreviations used

GP Genitalia preparation
JJ Collection of Jari Junnilainen, Vantaa, Finland
PF Collection of Per Falck, Neksø, Denmark
MNCN Collection of Antonio Vives, Museo Nacional de Ciencias Naturales, Madrid, Spain
NHMUK The Natural History Museum, London, UK
TL Type locality
ZMUC Zoological Museum, Natural History Museum of Denmark, Copenhagen, Denmark

Results

Apatema Walsingham, 1900
Apatema Walsingham, 1900. *Entomologist's mom. Mag*., **36**: 219.
Type species: *Apatema mediopallidum* Walsingham, 1900. *Entomologist's mon. Mag*., **36**: 220.
= *Microgonia* Popescu-Gorj & Căpuşe, 1965. *Revue rom. Biol. Série Zool*., **10**: 400, nec *Microgonia* Herrich-Schäffer, 1855. *Samml. ausseurer. Schmett*.: 41.

Type species: *Microgonia whalleyi* Popescu-Gorj & Căpuşe, 1965. *Revue rom. Biol. Série Zool*., **10**: 401-403.

= *Dysallomima* Gozmány, 2008. *Microlepid. Palaearct*., **13**: 62, **syn. n.**

Type species *Lampros coarctella* Rebel, 1896. *Annln naturh. Mus. Wien*, **11**: 129.

Remark: WALSINGHAM (1900: 219) gave the meaning of *Apatema* as "a deceit" (meaning untrustworthy) without explaining it further. He was, however, quite foresighted as the taxonomy of *Apatema* has proved far more complicated to unravel than one would initially expect.

The monotypic genus *Dysallomima* was erected by GOZMÁNY (2008: 62) for *Lampros coarctella*, which differs from other *Apatema* species by details of the genitalia in both sexes. In our analyses of the DNA barcodes *coarctella* is nested deeply within the genus *Apatema*, and we consider it as a specialized representative of this genus.

Biology: Almost nothing is know about the biology and the early stages are unknown. The first author reared one species from a piece of dead wood overgrown with fungi.

Distribution: Western Palaearctic region.

Checklist of *Apatema*

Apatema parodia Gozmány, 1988 - TL: Morocco
Apatema apolausticum Gozmány, 1996 - TL: Romania
Apatema impunctella Amsel, 1940 - TL: Italy (Sardinia)
Apatema sutteri Gozmány, 1997 - TL: Greece
Apatema mediopallidum Walsingham, 1900 - TL: France (Corse)
= *Oegoconia quadripuncta minor* Rebel, 1916 - TL: Greece (Crete)
= *Apatema bifasciatum* Chrétien, 1922 - TL: Morocco
= *Oegoconia phanerodoxa* Meyrick, 1926 - TL: Spain
= *Oegoconia proteroclina* Meyrick, 1939 - TL: France
= *Apatema fasciata melitensis* Amsel, 1952 - TL: Malta
Apatema inexpectatum Gozmány, 1988 - TL: Morocco
Apatema apatemella (Amsel, 1958) - TL: Cyprus
Apatema acutivalva Gozmány, 2008 - TL: Cyprus
Apatema baixerasi Vives, 2001 - TL: Spain
Apatema whalleyi (Popescu-Gorj & Căpuşe, 1965) - TL: Romania
***Apatema confluellum* Falck & Karsholt, sp. n**. - TL: Spain (Tenerife)
***Apatema minimum* Falck & Karsholt, sp. n.** - TL: Spain (Lanzarote)
***Apatema lapalmae* Falck & Karsholt, sp. n.** - TL: Spain (La Palma)
Apatema helleri (Rebel, 1910) - TL; Spain (Gran Canaria)
***Apatema sallyae* Falck & Karsholt, sp. n.** - TL: Spain (Gran Canaria)
***Apatema lanzarotae* Falck & Karsholt, sp. n.** - TL: Spain (Lanzarote)
***Apatema mixtum* Falck & Karsholt, sp. n.** - TL: Spain (Tenerife)
Apatema fasciata (Stainton, 1859) - TL: Portugal (Madeira)
Apatema coarctella (Rebel, 1896) - TL: Spain (Tenerife)
Apatema junnilaineni Vives, 2001 - TL: Spain (Gran Canaria)
***Apatema pseudolucidum* Falck & Karsholt, sp. n.** - TL: Spain (Gran Canaria)
***Apatema griseum* Falck & Kasholt, sp. n.** - TL: Spain (Gran Canaria)
Apatema lucidum Walsingham, 1908 - TL: Spain (Tenerife)
***Apatema grancanariae* Falck & Karsholt, sp. n.** - TL: Spain (Gran Canaria)
***Apatema brunneum* Falck & Karsholt, sp. n.** - TL; Spain (Tenerife)
***Apatema transversum* Falck & Karsholt, sp. n**. - TL: Spain (Gran Canaria)
***Apatema stadeli* Falck & Karsholt, sp. n.** - TL: Spain (Tenerife)
***Apatema skulei* Falck & Karsholt, sp. n.** - TL: Spain (Gran Canaria)

Our work demonstrates that the genus *Apatema* is much more diverse in the Canary Islands that hitherto believed. Field work by the first author has resulted in freshly collected material of both sexes from most species. This has enabled us to identify 18 separate species, which differ in both morphology and DNA. These are described in detail below.

***Apatema confluellum* Falck & Karsholt, sp. n.** (Fig. 1)

Holotype ♀: SPAIN, Tenerife, Los Cristianos, 29-XII-2003, leg. O. Karsholt (ZMUC).

Paratypes: SPAIN, Tenerife, Los Cristianos, 1 ♂, 29-XII-2003, leg. O. Karsholt (ZMUC); Arona, 500 m, 1 ♂, 25-XI-2-XII-2012, leg. P. Falck (PF), genitalia slide 2796PF (PF); El Tanque, 500 m, 1 ♀, 2-9-III-2013, leg. P. Falck (PF); Armeñime, 100 m, 2 ♀♀, 3-9-III-2013, leg. P. Falck (PF); Los Gigantes, 150 m, 4 ♂♂, 4 ♀♀, 8-22-XI-2016, leg. P. Falck, genitalia slides 2792PF, 2794PF, DNA sample Lepid Phyl 0015PF/ CILEP015-19 (PF, MNCN); Playa Paraíso, 50 m, 2 ♀♀, 1-20-III-2017, leg. P. Falck (PF), DNA sample Lepid Phyl 0013PF/ CILEP013-19 (PF); Adeje, 300 m, 1 ♀, 1-20-III-2017, leg. P. Falck, DNA sample Lepid Phyl 0014PF/ CILEP014-19 (PF); El Médano, 10 m, 1 ♂, 1 ♀, 1-20-III-2017, leg. P. Falck (PF), same data but, 1 ♂, 21-V-3-VI-2019, leg. P. Falck (PF).

Description: Adult. Wingspan 7-11 mm. Labial palp slender, upturned, segment 2 pale-grey, laterally dark-grey at base and towards apex, medially near apex with a dark-grey spot, segment 3 black, dorsally pale-grey. Antenna black, with indistinct rings in females. Head and neck yellowish brown, thorax grey mottled with dark brown especially anteriorly; tegula pale brown. Forewing pale greyish brown mottled with brown, especially along costa and towards apex, base black; at 1/3 and 1/2 with two larges, diffuse black spots; apical spot yellowish grey, indistinct; fringe grey. Hindwing pale-grey, with pale-grey fringe.

Variation: The black spot at 1/3 of the forewing is sometimes divided in two separate spots.

Male genitalia (Figs 29, 29a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately 3.5 times longer than broad, margins almost parallel; apex rounded; sacculus 2/3 length of valva, apically hook-shaped; labis very short; juxta sub-triangular with apical protrusions; saccus sub-triangular, medium-sized; phallus straight, as long as tegumen, basal sclerite bent, length 1/3 of phallus, distally a group of thin microspines; cornuti group I a large plate with numerous broad-based triangular spines; cornuti group II with few (2-5) short thin spines; cornuti group III with 10-15 relatively short, needle-shaped spines; vesica without microspines.

Female genitalia (Fig. 49): Papilla analis long, distally pointed; posterior apophysis slender, as long as papilla analis; anterior apophysis slender, as long as posterior apophysis, base bifurcate; tergum VIII sub-rectangular, posterior margin U-shaped; antrum dorsally bilobed, slightly tapered to fold on ductus bursae, posteriorly with dorso-medial indentation, edge sclerotized; ductus bursae straight, anteriorly parallel-sided with a slight longitudinal fold, evenly sclerotized; ductus seminalis with few spinulae; corpus bursae membranous rounded; signum droplet-shape, laterally folded upwards, with 1-2 small spines.

DNA barcodes (Figs 64-66, Tables 1-2): Three specimens were barcoded with some internal variation in COI (uncorrected p = 0.0061). The specimens are placed as sister to *A. minimum*. *A. confluellum* is clearly differentiated from all other species with uncorrected p distance to other species ranging from 0.0935 and 0.0986 (*A. pseudolucidum* and *A. minimum*) to 0.1207 (*A. fasciata*). Barcode Index Number: ADS6252.

Diagnosis: The greyish brown colour and the two large spots in the forewing separate *A. confluellum* from all other known *Apatema* species. In the male genitalia the nearly straight valva, the relatively long sacculus and the few cornuti in cornuti group I and II are characteristic. In the female genitalia the parallel-sided anterior part of ductus bursae and the small longitudinal fold are characteristic.

Biology: Early stages unknown. The specimens were attracted to light during March, May-June and November-December at altitudes ranging from sea level to 500 m.

Distribution: Only known from the island of Tenerife, Spain.

Etymology: The name (a noun in opposition) is derived from combining the Latin word *confluus* (= confluent) with the diminutive suffix - *ellum*.

***Apatema minimum* Falck & Karsholt, sp. n.** (Fig. 2)

Holotype ♂: SPAIN, LANZAROTE, Urb.[anización] Famara, 55 m, 2-8-XI-2018, leg. C. Hviid & B. Skule (ZMUC).

Paratypes: SPAIN, FUERTEVENTURA, Betancuria, 400 m, 1 ♂, 7-27-XI-2017, leg. P. Falck, Genitalia slide 2774PF, DNA sample Lepid Phyl 0024PF/ CILEP024-19 (PF); LANZAROTE, Urb. Famara, 55 m, 1 ♂, 2-8-XI-2018, leg. C. Hviid & B. Skule (ZMUC); El Bosquecillo, 600 m, 1 ♂, 6-XI-2018, leg. C. Hviid & B. Skule (ZMUC); Mala, 18 m, 3 ♂♂, 1 ♀, 21-X-10-XI-2019, leg. P. Falck, genitalia slide 3196PF, DNA sample Lepid Phyl 0675PF/ CILEP674-20 (PF, MNCN); Tabayesco, 280 m, 4 ♂♂, 21-X-10-XI-2019, leg. P. Falck, genitalia slides 3197PF, 3225PF, DNA samples Lepid Phyl 0313PF/ CILEP312-19, 0609PF/ CILEP608-20, 0674PF/ CILEP673-20 (PF); Caleta de Famara, 20 m, 1 ♂, 21-X-10-XI-2019, leg. P. Falck (PF).

Description: Adult. Wingspan 7-7.5 mm. Labial palp slender, upturned, segment 2 white, basally black, segment 3 white with few blackish scales ventrally. Antenna black. Head, neck and thorax creamy white; tegula creamy white, basally black. Forewing ground colour black, centrally a regular, slightly oblique creamy white fascia almost reaching dorsum; costal spot creamy white, merging with tornal spot, forming a distinct outer fascia; fringe grey. Hindwing grey with grey fringe.

Male genitalia (Figs 30, 30a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately three times longer than broad, anterior margin slightly upturned; apex rounded, posterior margin medially slightly convex; sacculus 2/3 length of valva, broadening distally, apically hook-shaped; labis short; juxta sub-triangular with apical protrusions; saccus sub-triangular, small; phallus straight, as long as tegumen, basal sclerite bent, length less than half of phallus, distally a group of thin microspines; cornuti group I a large plate with numerous short triangular spines placed on an oval, lesser sclerotized base; cornuti group II with few (3-5) short spines; cornuti group III with 8-12 relatively short needle-shaped spines; vesica with few scattered microspines.

Female genitalia (Fig. 50): Papilla analis long, distally pointed; posterior apophysis slender, as long as papilla analis; anterior apophysis slender, as long as posterior apophysis, base bifurcate; tergum VIII sub-rectangular, posterior margin weakly U-shaped; antrum dorsally bilobed, slightly tapered to fold on ductus bursae, posterior end with dorso-medial indentation, edge sclerotized; ductus bursae straight, anteriorly slightly widening and more membranous; ductus seminalis with spinulae; corpus bursae membranous, rounded; signum droplet-shape, laterally with 3-4 small spines.

DNA barcodes (Figs 64-66, Tables 1-2): Five specimens were barcoded with very high internal variation in COI (uncorrected p = 0.0317). The specimens are sister to *A. confluellum*. *A minimum* is clearly differentiated from all other species with uncorrected p distance to other species ranging from 0.0986 (*A. confluellum*) to 0.1352 (*A. grancanariae*). In fact, *A. minimum* appears to be the genetically most isolated species displaying more than 10% COI divergence (uncorrected p = 0.1) to all species except *A. confluellum*. Barcode Index Numbers: ADS4524, AEC2840.

Diagnosis: *A. minimum* superficially resembles other black and white *Apatema* species, e. g. *A. sallyae* and *A. mediopallidum*. It can be distinguished from these by the very small size, and the two regular and distinct creamy white forewing fasciae; in *A. sallyae* the inner fascia is oval, clearly not reaching dorsum and the outer fascia is indistinct; in *A. mediopallidum* the inner fascia is irregular with black dots and outer fascia is absent. In the male genitalia the short labis, the shape of the cornuti in group I and the few short cornuti in group III are characteristic. In the female genitalia the anteriorly membranous part of ductus bursae is characteristic.

Biology: Unknown. The specimens were collected at light during late October and November at altitudes ranging from sea level to 600 m.

Distribution: Known only from the islands of Fuerteventura and Lanzarote, Spain.

Etymology: The species is named after its small size, from the Latin adjective *minimus* meaning smallest.

Remarks: KLIMESCH (1985: 137) mentions two specimens of *A. mediopallidum* from Lanzarote, Haria, 2 ♂♂, 3-5-III-1967, leg. F. Kasy, with a wingspan 7 mm. These two specimens most likely belong to *A. minimum* sp. n.

***Apatema lapalmae* Falck & Karsholt, sp. n.** (Fig. 3)

Holotype ♀: SPAIN, La Palma, La Galga, 400 m, 17-23-I-2019, larva on dead wood, leg. P. Falck (ZMUC).

Paratypes: SPAIN, La Palma, La Galga, 400 m, 1 ♂, 4 ♀♀, 17-23-I-2019, larva on dead wood, leg. P. Falck, genitalia slides 3204PF, 3205PF, DNA samples Lepid Phyl 0135PF CILEP134-19, 0136PF/CILEP135-19 (PF, MNCN).

Description: Adult. Wingspan 12-13 mm. Labial palp slender, upturned, segment 2 creamy white, dark-grey laterally at base dark-grey, distally with a blackish ring, segment 3 black, distal 1/2 white. Antenna dark-grey. Head and neck creamy white, mottled with black, thorax creamy white mottled with black, towards thorax blackish brown; tegula creamy white, dark brown towards base. Forewing ground colour black with white markings; base white, at costa with a tiny white spot before an irregular oblique white fascia at 1/3, narrow at costa, widening towards dorsum; costal spot white, reaching half way towards tiny white tornal spot; diffuse white markings at dorsum between fascia and tornal spot, and one diffuse mark apically; fringe grey. Hindwing pale-grey, with grey fringe.

Variation: The colour of the head and neck may vary from almost creamy white to nearly black.

Male genitalia (Figs 31, 31a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, slender, margins almost parallel-sided, approximately 3.5 times longer than broad, anterior margin slightly upturned; apex rounded, posterior margin medially slightly convex; sacculus slightly longer than 1/2 length of valva, broader in distal third, apically hook-shaped; labis medium-sized; juxta sub-triangular with apical protrusions; saccus sub-triangular, small; phallus straight, as long as tegumen, basal sclerite straight, length less than half of phallus, distally a group of thin microspines; cornuti group I a narrow plate with numerous short spines; cornuti group II with 2-3 short spines and approximately 15 needle-shaped spines; cornuti group III with 20-25 long, needle-shaped spines; vesica with few scattered microspines.

Female genitalia (Fig. 51): Papilla analis long, distally pointed; posterior apophysis slender, as long as papilla analis; anterior apophysis slender, longer than posterior apophysis, base bifurcate; tergum VIII sub-rectangular, posterior margin U-shaped; antrum dorsally bilobed, slightly tapered to fold on ductus bursae, posterior end with dorso-medial indentation, edge heavily sclerotized; ductus bursae anterior half with longitudinal fold, left side of this fold less sclerotized, anteriorly slightly widening; ductus seminalis heavily spinulated; corpus bursae membranous, rounded; signum droplet-shape, laterally with 3-4 small spines.

DNA barcodes (Figs 64-66, Tables 1-2): Two specimens were barcoded with some internal variation in COI (uncorrected p = 0.0049). The two specimens are placed sister to *A. helleri*. *A. lapalmae* is clearly differentiated from all other species with an uncorrected p distance to other species ranging from 0.0563 (*A. helleri*) to 0.1264 (*A. minimum*). Barcode Index Number: ADY6666.

Diagnosis: *A. lapalmae* resembles *A. helleri.* It can be distinguished by the darker head and neck; the white fascia is narrow at costa, widening towards dorsum (broader at costa in *A. helleri*). In the male genitalia the relatively narrow plate with spines in cornuti group I and the on average difference in length of needle-shaped cornuti between cornuti group II and III – longest in group III are characteristic. In the female genitalia the longitudinal fold of the anterior half of ductus bursae is characteristic for *A. lapalmae* and *A. helleri*, and it is not possible to separate the two species based on the female genitalia.

Biology: The specimens were reared from a piece of dead wood overgrown with fungus, it was found in a dark part of a Laurisilva forest.

Distribution: Only known from the island of La Palma, Spain.

Etymology: The species is named after its place of occurrence, the island of La Palma. The name is an adjective.

Apatema helleri (Rebel, 1910) (Fig. 4), **comb. n**.
Blastobasis helleri Rebel, 1910. *Annln naturh. Mus. Wien*, **24**: 356
Type locality: SPAIN, GRAN CANARIA, Teror.

Material examined: SPAIN, GRAN CANARIA, Bañaderos, 200 m, 1 ♀, 25-III-1979, leg. P. Stadel Nielsen; Barranco de la Virgen, Moya, 400 m, 1 ♂, 4 ♀♀, 20-VII-1984, leg. P. Olsen, B. Skule, P. Stadel Nielsen, genitalia slides 5991LG, 6030LG, 6031LG, 6032LG; Barranco de Moya, 200 m, 1 ♂, 21-VII-1984, leg. P. Olsen, B. Skule, P. Stadel Nielsen, genitalia slide 5989LG (all ZMUC); Los Tilos de Moya, 500 m, 2 ♂♂, 3 ♀♀, 11-24-VI-2018, same data but, 2 ♂♂, 17-30-IX-2018, same data but, 1 ♀, 8-

20-VIII-2020, leg. P. Falck, genitalia slides 2779PF, 2812PF, DNA samples Lepid Phyl 0010PF/CILEP010-19, 0011PF/CILEP011-19 (PF); Barranco de Moya, 80 m, 4 ♀♀, 8-20-VIII-2020, leg. P. Falck (PF); Barranco de Azuaje, 270 m, 2 ♂♂, 3 ♀♀, 8-20-VIII-2020, leg. P. Falck (PF); Carretería, 455 m, 14 ♂♂, 9 ♀♀, 8-20-VIII-2020, leg. P. Falck (PF, MNCN); Teror, 500 m, 3 ♂♂, 5 ♀♀, 24-X-13-XI-2020, leg. P. Falck (PF).

Additional material: SPAIN, Gran Canaria, Tenoya W. of Las Palmas, 1 ♀, 11-III-1967, leg. Kasy (HNHM), genitalia slide 4987 Gozmány. The specimen is figured by GOZMÁNY (2008: 351, plate 115: 9a) under the name *Apatema fasciatum* (Stainton, 1859).

Description Adult: Wingspan 10-12.5 mm. Labial palp slender, upturned, segment 2 white, laterally black at base, segment 3 with black basal half and white apical half. Antenna black, with indistinct dark-grey rings in female; male antenna uniformly dark-grey. Head, neck and thorax white, tegula white, basally black. Forewing black with white markings; base white, at costa with a tiny white spot and an irregular oblique white fascia at 1/3 of wing; costal spot white, extending half way towards a tiny white tornal spot; diffuse white markings at dorsum between fascia and tornal spot and one diffuse mark in apical area; fringe grey. Hindwing pale-grey, with pale-grey fringe.

Male genitalia (Figs 32, 32a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, slender, margins almost parallel-sided, approximately 3.5 times longer than broad, anterior margin slightly upturned; apex rounded, posterior margin medially slightly convex; sacculus slightly longer than 1/2 length of valva, broader in distal third, apically hook-shaped; labis slender, medium-sized; juxta sub-triangular with apical protrusions; saccus sub-triangular, small; phallus straight, as long as tegumen, distal edge heavily sclerotized, basal sclerite straight, length less than half of phallus, distally a group of thin microspines; cornuti group I a suboval plate with numerous short spines; cornuti group II with few (2-3) short spines and approximately 15 needle-shaped spines; cornuti group III with 15-20 needle-shaped spines; vesica with few scattered microspines.

Female genitalia (Fig. 52): Papilla analis long, distally pointed; posterior apophysis slender, as long as papilla analis; anterior apophysis slender, slightly longer than posterior apophysis, base bifurcate; tergum VIII sub-rectangular, posterior margin U-shaped; antrum dorsally bilobed, slightly tapered to fold on ductus bursae, posterior end with dorso-medial indentation, edge heavily sclerotized; anterior half of ductus bursae with longitudinal fold, left side of this fold less sclerotized, anteriorly slightly widening; ductus seminalis heavily spinulated; corpus bursae membranous rounded; signum droplet-shape, laterally with 3-4 small spines.

DNA barcodes (Figs 64-66, Tables 1-2): Two specimens were barcoded with some internal variation in COI (uncorrected p = 0.0031). The two specimens are placed on a long branch as sister to *A. lapalmae*. *A. helleri* is clearly differentiated from all other species with uncorrected p distance to other species ranging from 0.0563 (*A. lapalmae*) to 0.1316 (*A. minimum*). Barcode Index Number: ADS6251.

Diagnosis: *A. helleri* resembles *A. lapalmae*. It can be distinguished by the pure white head and thorax; the white fascia is as wide at costa as in the middle of the wing (more narrow at costa in *A. lapalmae*). In the male genitalia cornuti group I and II with needle-shaped spines of the same length and approximately the same number of spines is characteristic. In the female genitalia the longitudinal fold of the anterior half of ductus bursae is characteristic for *A. helleri* and *A. lapalmae*, and it is not possible to separate the two species based on the female genitalia.

Biology: Early stages unknown. The specimens were attracted to light during March and June-November at altitudes ranging from sea level to 500 m.

Distribution: Only known from the northern part of the island of Gran Canaria, Spain.

Remarks: REBEL (1910) described *A. helleri* from a single specimen collected by K. M. Heller in Teror on the northern part of Gran Canaria on the 25-V-1907. We have not been able to trace the type specimen and it is apparently lost. The species was placed in *Blastobasis,* but Rebel already then had his doubt *"Mit Rücksicht darauf, daß mir nur ein einziges, einer fremden Sammlung angehöriges*

Exemplar vorliegt, dessen Geäder sich ohne Gefährdung des Stückes nicht mit voller Sicherheit erkennen läßt, und auch ein Haarkamm am Basalglied der Fühler fehlt, erscheint die generische Stellung dieser schönen Blastobasine nicht vollständig geklärt". Recently collected specimens of this characteristic species fit Rebel's description and excellent figure (REBEL, 1910: 375, fig. 5), and their genitalia and DNA barcode definitely place *helleri* in the genus *Apatema.* We therefore transfer this species from the Blastobasidae to the Autostichidae.

Apatema sallyae **Falck & Karsholt, sp. n.** (Fig. 5)

Holotype ♂: SPAIN, GRAN CANARIA, Puerto Rico, 100 m, 26-III-8-IV-1994, leg. F. Vilhelmsen, genitalia slide 2777PF (ZMUC).

Paratypes: SPAIN, GRAN CANARIA, Puerto Rico, 100 m, 2 ♂♂, 11-24-VI-2018, leg. P. Falck (PF); Maspalomas, 2 ♂♂, 19-III-1996, leg. K. Nupponen & J. Junnilainen (JJ); 6 km N Maspalomas, 400 m, 1 ♂, 28-III-2019, leg. J. Tabell (JJ); Bahia Feliz, 1 ♀, 6-7-V-2018, leg. K. Larsen (ZMUC); Pie de la Cuesta, 500 m, 5 ♂♂, 2 ♀♀, 11-24-VI-2018, leg. P. Falck, genitalia slides 2813PF, 3206PF, DNA samples Lepid Phyl 0022PF/CILEP022-19, 0023PF/CILEP023-19 (PF, MNCN); Barranquillo Andrés, 700 m, 1 ♂, 11-24-VI-2018, leg P. Falck (PF); Playa del Cura, 30 m, 6 ♂♂, 4 ♀♀, 4-23-III-2019, leg. P. Falck, genitalia slide 3321PF (PF); 1 km NW Playa del Cura, 30 m, 1 ♂, 1 ♀, 22-III-2019, leg. J. Tabell (JJ); El Sao, 110 m, 1 ♂, 4-23-III-2019, leg. P. Falck (PF).

Description Adult: Wingspan 10-14 mm. Labial palp slender, upturned, segment 2 creamy white, laterally dark-grey at base, segment 3 creamy white, dorsally greyish. Antenna dark-grey, with indistinct pale-grey rings in female. Head and neck creamy white, thorax creamy white, dark-grey towards neck; tegula creamy white, dark-grey towards base. Forewing ground colour uniform blackish grey with distinct creamy white markings; base at dorsum creamy white, at costa with a tiny spot followed by an almost oval irregular fascia at 1/3 not reaching dorsum; apical costal spot creamy white, narrowing, almost reaching dorsum; fringe grey. Hindwing pale-grey, with pale-grey fringe.

Male genitalia (Figs 33, 33a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately three times longer than broad, anterior margin slightly upturned; apex rounded, posterior margin medially slightly convex; sacculus slightly longer than 1/2 length of valva, broader in distal third, apically hook-shaped; labis slender, medium-sized; juxta sub-triangular with apical protrusions; saccus sub-triangular, small; phallus straight, as long as tegumen, basal sclerite bent, length less than half of phallus, distally a group of thin microspines; cornuti group I a large plate with numerous broad-based triangular spines; cornuti group II with 3-5short needle-shaped spines and 6-14 short spines; cornuti group III with 15-20 needle-shaped spines; vesica with few scattered microspines.

Female genitalia (Fig. 53): Papilla analis long, distally pointed; posterior apophysis slender, as long as papilla analis; anterior apophysis slender, as long as posterior apophysis, base bifurcate; tergum VIII sub-rectangular, posterior margin U-shaped; antrum dorsally bilobed, slightly tapered to fold on ductus bursae, posterior end with dorso-medial indentation, edge heavily sclerotized; ductus bursae straight, anteriorly slightly widening, evenly sclerotized; ductus seminalis with few spinulae; corpus bursae membranous round; signum droplet-shape, laterally with 3-4 small spines.

DNA barcodes. (Figs 64-66, Tables 1-2): Two specimens were barcoded with no internal variation in COI. The two specimens appear rather isolated on a long branch without clear affiliation to any other species. *A. sallyae* is clearly differentiated from all other species with uncorrected p distance to other species ranging from *ca* 0.074 (*A. helleri, A. lapalmae* and *A. skulei*) to 0.1208 (*A. minimum*). Barcode Index Number: ADS4523.

Diagnosis: *A. sallyae* resembles no other *Apatema* species known from the Canary Islands. However, it resembles *A. mediopallidum* Walsingham, 1900, with which it has been confused in the past. It can be distinguished by the creamy white head, neck and thorax and the large oval creamy white spot in the middle of the forewing. In the male genitalia the broad-based triangular spines in group I, and the short needle-shaped cornuti in group II are characteristic. In the female genitalia the anteriorly widening and evenly sclerotized ductus bursae are characteristic.

Biology: Early stages unknown. All the specimens were attracted to light during March-June at altitudes ranging from sea level to 1100 m.

Distribution: Only known from the southern part of the island of Gran Canaria.

Etymology: The species name (a noun in the genitive case) is dedicated to the first author`s oldest daughter Sally.

Remarks: *A. sallyae* is figured by KLIMESCH (1985: 147, figs. 15, 17) under the name *Apatema mediopallidum* Walsingham, 1901, with the collecting data: Gran Canaria, San Bartolomé de Tirajana, 1100 m, 1 ♂, 8-22-VI-1965, leg. J. Klimesch.

***Apatema lanzarotae* Falck & Karsholt, sp. n.** (Fig. 6)

Holotype ♂: SPAIN, LANZAROTE, Mojón Blanco, Órzola, 20 m, 21-X-10-XI-2019, leg. P. Falck, genitalia slide 3221PF, DNA sample Lepid Phyl, 0326PF/CILEP325-19 (ZMUC).

Paratypes: SPAIN, LANZAROTE, Mojón Blanco, Órzola, 20 m, 1 ♂, 21-X-10-XI-2019, leg. P. Falck, genitalia slide 3220PF, DNA sample Lepid Phyl 0315PF/CILEP314-19 (PF); El Bosquecillo, 610 m, 1 ♂, 21-X-10-XI-2019, leg. P. Falck, genitalia slide 3222PF (PF); Caleta de Famara, 20 m, 1 ♂, 21-X-10-XI-2019, leg. P. Falck, genitalia slide 3223PF (MNCN).

Description Adult: Wingspan 10 mm. Labial palp slender, upturned, segment 2 white, laterally dark-grey at base, segment 3 white, with few dark-grey scales ventrally. Antenna dark-grey, with indistinct pale-grey rings. Head, neck and thorax creamy white, mottled with brown; tegula creamy white, brownish towards base. Forewing ground colour white, mottled with dark-grey and brown, especially in basal and apical areas; centrally with a very indistinct, oblique light grey fascia, bordered by four indistinct black spots; fringe grey. Hindwing light grey with grey fringe.

Male genitalia (Figs 34, 34a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately three times longer than broad, anterior margin slightly upturned; apex rounded, posterior margin medially slightly convex; sacculus slightly longer than 1/2 length of valva, broader in distal third, apically hook-shaped; labis slender, medium-sized; juxta sub-triangular with apical protrusions; saccus sub-triangular, medium-sized; phallus straight, as long as tegumen, basal sclerite bent, length less than half of phallus, distally a group of thin microspines; cornuti group I a large plate with numerous broad-based triangular spines, distally a group of approximately 10 needle-shaped spines; cornuti group II with 5-7 short spines and 6-8 needle-shaped spines; cornuti group III with 15-20 needle-shaped spines; vesica with few scattered microspines.

Female genitalia: Unknown.

DNA barcodes (Figs 64-66, Tables 1-2): Two specimens were barcoded with some variation in COI (uncorrected p = 0.0030). The two specimens appear isolated on a long branch without clear affiliation to other species. *A. lanzarotae* is clearly differentiated from all other species with uncorrected p distance to other species ranging from 0.0801 (*A. lapalmae*) to 0.1316 (*A. minimum*). Barcode Index Number: AEC2600.

Diagnosis: *A. lanzarotae* resembles no other *Apatema* species known from the Canary Islands, although it may be difficult to distinguish from old specimens of *A. fasciata.* It can be distinguished by the indistinct black spots, in *A. fasciata* the spots are distinct. In the male genitalia the needle-shaped spines distally in cornuti group I are characteristic.

Biology: Unknown. The specimens were collected in late autumn at light.

Distribution: Known only from a few localities in the northern part of the island Lanzarote, Spain.

Etymology: The species is named after its place of occurrence, the island of Lanzarote. The name is an adjective.

Apatema mixtum Falck & Karsholt, sp. n. (Figs 7, 8)

Holotype ♂: SPAIN, TENERIFE, Arona, 500 m, 3-9-III-2013, leg. P. Falck, genitalia slide 2793PF (ZMUC).

Paratypes: SPAIN, TENERIFE. Santiago del Teide, 1000 m, 4 ♂♂, 4 ♀♀, 9-I-1981, leg. P. Stadel Nielsen, genitalia slide 5979LG; Costa del Silencio, 10 m, 1 ♂, 7-I-1981, leg. P. Stadel Nielsen (ZMUC); Callao Salvaje, 1 ♂, 1 ♀, 1-5-I-1985, leg. K. Schnack; Puerto de la Cruz, 1 ♂, 1 ♀, medio III-1987, leg. H. Enghoff (all ZMUC); Armeñime, 100 m, 1 ♂, 2 ♀♀, 26-II-4-III-2012, leg. P. Falck, DNA sample Lepid Phyl 0132PF/CILEP131-19 (PF); Arona, 500 m, 8 ♂♂, 5 ♀♀, 3-9-III-2013, leg. P. Falck, same data but, 3 ♂♂, 3 ♀♀, 8-22-XI-2016, leg. P. Falck, genitalia slides 2788PF, 2802PF, 2821PF, DNA samples Lepid Phyl 0120PF/CILEP119-19, 0121PF/CILEP120-19, 0123PF/CILEP122-19 (PF, MNCN); Taucho, 400 m, 1 ♂, 2-9-III-2013, leg. P. Falck, DNA sample Lepid Phyl 0134PF/CILEP133-19 (PF); Los Gigantes, 150 m, 3 ♂♂, 1 ♀, 8-22-XI-2016, leg. P. Falck, genitalia slide 3191PF (PF); Las Manchas, 1050 m, 4 ♀♀, 1-20-III-2017, leg. P. Falck, genitalia slide 2801PF, DNA sample Lepid Phyl 0019PF/CILEP019-19 (PF); El Médano, 30 m, 1 ♂, 18-XI-8-XII-2018, leg. P. Falck (PF); 2 km S Chio, 870 m, 1 ♂, 26-XII-2018, leg. B. Skule (ZMUC); 5 km NNW San Andrés, Anaga Mts., 780 m, 1 ♂, 29-XII-2018, leg. B. Skule (ZMUC); Puerto de la Cruz, 200 m, 3 ♂♂, 1 ♀, 13-26-VIII-2019, leg. P. Falck, genitalia slide 3192PF (PF); Aguamansa, 1050 m, 1 ♀, 13-26-VIII-2019, leg. P. Falck (PF).

Description Adult: Wingspan 9.5-13 mm. Labial palp slender, upturned, segment 2 creamy white, laterally dark-grey at base and towards apex, medially with a dark-grey spot near apex, segment 3 black, dorsally and apically creamy white. Antenna black, with indistinct dark-grey rings in female, uniformly dark-grey in male. Head, neck and thorax creamy white mottled with dark brown; tegula creamy white, dark brown towards base. Forewing blackish brown mottled with light brown, cream and white; base black; centrally with an irregular oblique whitish brown fascia bordered by four black spots; apical spot at costa white, extending half way towards a tiny white tornal spot; fringe grey. Hindwing grey with grey fringe.

Variation: The species varies in size and appearance of the four black spots which are often well separated but may be confluent in pairs. The costal and tornal spots may be connected by a thin, angulated fascia.

Male genitalia (Figs 35, 35a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately three times longer than broad, anterior margin distinctly upturned; apex rounded, posterior margin medially slightly convex; sacculus longer than 1/2 length of valva, broader in distal third, apically hook-shaped; labis slender, medium-sized; juxta sub-triangular with apical protrusions; saccus sub-triangular, medium-sized; phallus straight, as long as tegumen, basal sclerite bent, length less than half of phallus, distally a group of thin microspines; cornuti group I a plate with several broad-based triangular spines; cornuti group II with 3-6 very short spines; cornuti group III with 10-20 needle-shaped spines of medium length; vesica without microspines.

Female genitalia (Fig. 54): Papilla analis long, distally pointed; posterior apophysis slender, as long as papilla analis; anterior apophysis slender, as long as posterior apophysis, base bifurcate; tergum VIII sub-rectangular, posterior margin U-shaped; antrum dorsally bilobed, slightly tapered to fold on ductus bursae, posterior margin with dorso-medial indentation, edge sclerotized; ductus bursae parallel-sided, anteriorly rotated 90 to the right, and rotated downwards 90 just before corpus bursae, left side less sclerotized; ductus seminalis with spinulae; corpus bursae membranous rounded; signum droplet-shape, laterally with 3-4 small spines.

DNA barcodes (Figs 64-66, Tables 1-2): Six specimens were barcoded with very low variation in COI (uncorrected p = 0.0010). The specimens are placed on a long branch and are sister to *A. fasciata*. *A. mixtum* is differentiated from all other species with uncorrected p distance to other species ranging from 0.0676 (*A. lapalmae*) to 0.1247 (*A. minimum*). Barcode Index Number: ADR5557.

Diagnosis: *Apatema mixtum* closely resembles *A. fasciata* and adults cannot be distinguished with certainty. In the male genitalia the few, short, sometimes diminutive spines in cornuti group II are characteristic, in *A. fasciata* cornuti group II is missing. In the female genitalia the double rotated ductus bursae is characteristic.

Biology: Early stages unknown. The specimens were attracted to light during January-March, August and November-December at altitudes ranging from sea level to 1050 m.

Distribution: Known from several localities on the island of Tenerife, Spain.

Etymology: The name refers to the Latin adjective *mixtus* meaning mixed, in this case mixed with *A. fasciata.*

Remarks: Despite the missing details in the genitalia drawings by KLIMESCH (1985: 148, figs. 19, 20, 21) most likely he figures *A. mixtum* as *A. fasciata.*

Apatema fasciata (Stainton, 1859) (Figs 9, 10)
Gelechia fasciata Stainton, 1859. *Ann. Mag. Nat. Hist*., **3**(3): 213
Type locality: PORTUGAL, Madeira, Deserta Grande.

Material examined: PORTUGAL, MADEIRA. Funchal, Lido, 3 ♀♀, 20-30-IV-1972, 9 ♀♀, 4-17-IX-1973, 4 ♂♂, 4 ♀♀, 17-22-IV-1974, 1 ♂, 13-14-VIII-1974, 2 ♀♀, 24-26-VIII-1974, leg. N. L. Wolff, genitalia slides 3862, 4254, 4255, 4265 Wolff, 5238LG, 5239LG; 1 ♂, 2 ♀♀, same data but 12-16-VIII-1974, leg. E. Traugott-Olsen; 1 ♀, same data but 1-III-1994, leg. P. de Place Bjørn og J. Damgaard; 1 ♂, same data but 20-26-X-1997, leg. D. Nilsson; Ponta de São Lourenço, 100 m, 1 ♀, 15-IX-1977, leg. O. Lomholdt & N. L. Wolff; same data but 0-10 m, 3 ♀♀, 26-VI-1993, leg. O. Karsholt; Ponta do Sol, 1 ♂, 2 ♀♀, 12-29-VI-1993, 1 ♀, 17-IX-1997, leg. O. Karsholt; Santo da Serra, 700 m, 1 ♂, 1 ♀, 24-26-X-1994, leg. O. Karsholt, genitalia slide 5375OK. PORTO SANTO. 3 ♂♂, 10 ♀♀, 23-24-X-1994, 1 ♂♂, 4 ♀♀, 12–16-IV-1996, leg. O. Karsholt. SPAIN. FUERTEVENTURA, Betancuria, 400 m, 1 ♂, 7-27-XI-2017 leg. P. Falck, same data but, 1 ♂, 27-II-19-III-2018, leg. P. Falck, genitalia slides 2790PF, 2795PF, DNA samples Lepid Phyl 0201PF/CILEP200-19, 0202PF/CILEP201-19 (PF); Corralejo, 10 m, 4 ♀♀, 6-26-I-2020, leg. P. Falck (PF); Vega de Río Palmas, 245 m, 1 ♀, 6-21-I-2020, leg. P. Falck (PF). GRAN CANARIA. Los Tilos, Moya, 3 ♂♂, 19-VII-1984 leg. P. Olsen, B. Skule, P. Stadel Nielsen, genitalia slides 5988LG, 5992LG, 6017LG; Barranco Virgen, Moya, 400 m, 2 ♂♂, 2 ♀♀, 20-VII-1984, leg. P. Olsen, B. Skule, P. Stadel Nielsen, genitalia slides 5990LG, 6025 LG, 6027LG, 6028LG; Barranco Moya, 200 m, 1 ♀, 21-VII-1984, leg. P. Olsen, B. Skule, P. Stadel Nielsen, genitalia slide 6011LG; Barranco Mogán, 3 km NNE Mogan, 370 m, 5-XI-2014, leg. B. Skule; El Doctoral, 350 m, 9-12-V-2018, leg. K. Larsen (all ZMUC); Pie de la Cuesta, 500 m, 2 ♂♂, 3 ♀♀, 11-24-VI-2018, leg. P. Falck, same data but, 4 ♂♂, 1 ♀, 17-30-IX-2018, leg. P. Falck, same data but, 3 ♂♂, 5 ♀♀, 4-24-VI-2019, leg. P. Falck, genitalia slides 2798PF, 3193PF, 3194PF, DNA samples Lepid Phyl 0020PF/CILEP020-19, 0021PF/CILEP021-19, 0119PF/CILEP118-19, 0126PF/CILEP125-19, 0130PF/CILEP129-19 (PF); 8 km NNV Pie de la Cuesta, 895 m, 6 ♂♂, 1 ♀, 17-30-IX-2018, leg. P. Falck, genitalia slide 3195PF, DNA sample Lepid Phyl 0133PF/CILEP132-19 (PF); Ayacata, 1400 m, 1 ♀, 17-30-IX-2018, leg. P. Falck, same data but, 1 ♂, 4-23-III-2019, leg. P. Falck (PF); Los Tilos de Moya, 2 ♂♂, 17-30-IX-2018, leg. P. Falck, genitalia slide 3211PF (PF). LANZAROTE. 0.8 km S Conil, 1.4 km N Tias, 240 m, 1 ♂, 2-8-XI-2018, leg. C. Hviid & B. Skule (ZMUC); Tabayesco, 280 m, 1 ♂, 21-X-10-XI-2019, leg. P. Falck, genitalia slide 3224PF, DNA sample Lepid Phyl 0314PF/CILEP313-19 (PF); El Bosquecillo, 610 m, 1 ♂, 21-X-10-XI-2019, leg. P. Falck (PF).

Description Adult: Wingspan 10-11 mm. Labial palp slender, upturned, segment 2 on outer surface black with a creamy coloured band, on inner surface cream coloured with black apex, segment 3 black with cream coloured tip. Antenna black, with indistinct dark-grey rings. Head dark-grey, paler towards face and neck; thorax and tegula black mottled with yellowish grey. Forewing black (especially at base and in apical area) mottled with light brown, cream and white; with an irregular whitish brown fascia in middle of wing bordered by four black spots; costal spot white, extending half way towards tiny white tornal spot; fringe grey. Hindwing grey, with grey fringe.

Variation: The species varies in size and appearance of the four black spots which are often well separated but may be confluent in pairs. The costal and tornal spots may be connected by a thin, angulated fascia.

Male genitalia (Figs 36, 36a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately three times longer than broad, anterior margin clearly upturned; apex rounded, posterior margin medially slightly convex; sacculus longer than 1/2 length of valva, broader in distal third, apically hook-shaped; labis slender, medium-sized; juxta sub-triangular with apical protrusions; saccus sub-triangular, medium-sized; phallus straight, as long as tegumen, basal sclerite bent, length less than half of phallus, distally a group of thin microspines; cornuti group I a plate with several broad-based triangular spines; cornuti group II with 3-4 very short spines and 5-8 robust needle-shaped spines; cornuti group III without spines; vesica without microspines.

Female genitalia (Fig. 55): Papilla analis long, distally pointed; posterior apophysis slender, as long as papilla analis; anterior apophysis slender, as long as posterior apophysis, base bifurcate; tergum VIII sub-rectangular, posterior margin U-shaped; antrum dorsally bilobed, slightly tapered to fold on ductus bursae, posterior margin with dorso-medial indentation, edge sclerotized; ductus bursae dilated, membranous in the left side anteriorly from the fold to corpus bursae, right side weakly sclerotized, before corpus bursae rotated 90º; ductus seminalis with few spinulae; corpus bursae membranous, rounded; signum droplet-shape, laterally with 3-4 small spines.

DNA barcodes (Figs 64-66, Tables 1-2): Eight specimens were barcoded with reasonably high variation in COI (uncorrected p = 0.0165). The specimens are sister to *A. mixtum*. Despite high internal variation *A. fasciata* is differentiated from all other species with uncorrected p distance to other species ranging from *ca* 0.08 (*A. stadeli* and *A. brunneum*) to 0.1272 (*A. minimum*). Specimens from Gran Canaria (6 specimens) were clearly separate from specimens from Fuerteventura (2) and Lanzarote (1) with uncorrected p distances between them of 0.0269 and 0.0335 respectively. Similarly, the uncorrected p distance between the single specimens from Fuerteventura and Lanzarote was 0.0282. Barcode Index Numbers: ADV0186 (Gran Canaria), ADZ8617 (Fuerteventura), AEC2601 (Lanzarote).

Diagnosis: *A. fasciata* closely resembles *A. mixtum*, *A. grancanariae* and *A. transversum,* for separation see below under *A. grancanariae.* In the male genitalia the triangular cornuti in cornuti group I and the missing cornuti in group III are characteristic. In the female genitalia the weakly sclerotized and rotated ductus bursae is characteristic.

Biology: Early stages unknown. The specimens were attracted to light during January-December at altitudes ranging from sea level to 895 m.

Distribution: Known from Portugal: Madeira, Deserta Grande and Porto Santo; Spain: Fuerteventura, Gran Canaria and Lanzarote.

Remarks: *Gelechia fasciata* was described from an unstated number of specimens collected by T. V. Wollaston on the island of Deserta Grande in the Madeira archipelago. Records of *A. fasciata* from outside of Madeira and the Canary Islands (e. g. GOZMÁNY, 1955: 316) are due to misidentification. *Apatema fasciata* f. *impunctella* Amsel, 1940 represents a separate species, *A. impunctella*. It is known France and Italy (SUTTER 2006).

Apatema coarctella (Rebel, 1896) (Figs 11, 12), **comb. n.**
Lampros coarctella Rebel, 1896. *Annln naturh. Mus. Wien*, **11**: 129
Type locality: SPAIN, TENERIFE, La Orotava.

Material examined: SPAIN, FUERTEVENTURA, Puerto del Rosario, 1 ♂, 5-6-I-1990, leg. H. Enghoff (ZMUC); Caldereta, 120 m, 16 ♀♀, 7-27-XI-2017, leg, P. Falck, genitalia slides 2770PF, 2772PF, 2773PF, 3217PF, DNA samples Lepid Phyl 0198PF/CILEP197-19, 0199PF/CILEP198-19, 0200PF/CILEP199-19 (PF); Corralejo, 10 m, 1 ♂, 5 ♀♀, 7-27-XI-2017, leg. P. Falck, same data but, 1 ♂, 1 ♀, 27-II-19-III-2018, leg. P. Falck (PF); Betancuria 400 m, 1 ♀, 27-II-19-III-2018, leg. P. Falck, genitalia slide 3210PF (PF); 7 km NW Betancuria, Playa del Valle, 1 ♂, 2 ♀♀, 19-I-2002, leg. O. Karsholt (ZMUC); GRAN CANARIA, Barranco de la Virgen, Moya, 400 m, 2 ♂♂, 3 ♀♀, 20-VII-1984, leg. P. Olsen, B. Skule, P. Stadel Nielsen, genitalia slides 6033LG, 6035LG (ZMUC); Barranco Moya, 200 m, 2 ♀♀, 21-VII-1984, leg. P. Olsen, B. Skule, P. Stadel Nielsen, genitalia slides 5989LG, 6011LG (ZMUC); 1.3 km N Mogán, 430 m, 2 ♂♂, 1 ♀, 3-8-XI-2014, leg. B. Skule (ZMUC); Barranco Mogán, 3 km NNE Mogán, 370 m, 5-XI-2014, leg. B. Skule (ZMUC); Pie de la Cuesta, 500 m, 1 ♂, 1 ♀, 11-24-VI-2018, leg. P. Falck, same data but, 1 ♀, 17-30-IX-2018, leg. P. Falck, same data but, 1 ♀, 4-23-III-2019, leg. P. Falck, genitalia slides 2771PF, 2776PF, 3209PF, 3219PF, DNA samples Lepid Phyl 0156PF/CILEP155-19, 0157PF/CILEP156-19 (PF); Puerto Rico, 50 m, 1 ♀, 11-24-VII-2018, leg. P. Falck (PF); Ayacata, 1400 m, 1 ♀, 17-30-IX-2018, leg. P. Falck, genitalia slide 3218PF (PF); El Sao, 110 m, 1 ♀, 17-30-IX-2018, leg. P. Falck (PF); Lanzarote, La Degollada, 3 ♂♂, 6 ♀♀, 1-4-II-1994, leg. P. Baungaard (ZMUC); Puerto del Carmen, 5 ♂♂, 2 ♀♀, 1-5-II-1994, leg. P. Baungaard (ZMUC); Casita de Femes, 1 ♂, 2-II-1994, leg. P. Baungaard (ZMUC); Tao, 1 ♂, 3-II-1994, leg. P. Baungaard (ZMUC); Urb. Famara, 55 m, 2 ♀♀, 2-8-XI-2018, leg. C. Hviid & B. Skule (ZMUC); 0.8 km S Conil, 1.4 km N Tías, 240 m, 1 ♂, 1 ♀, 2-8-XI-2018, leg. C. Hviid & B. Skule (ZMUC); El Bosquecillo, 600 m, 1 ♂, 1 ♀, 6-XI-2018, leg. C. Hviid & B. Skule (ZMUC); Caleta de Famara, 20 m, 1 ♂, 21-X-10-XI-2019, leg. P. Falck, genitalia slide 3215PF (PF); Puerto del Carmen, 25 m, 1 ♀, 21-X-10-XI-2019, leg. P. Falck, genitalia slide 3216PF, DNA samples Lepid Phyl 0607PF/CILEP606-20, 0608PF/CILEP607-20 (PF). La Palma, Los Cancajos, 20 m, 1 ♂, 1 ♀, 17-23-I-2019, leg. P. Falck, genitalia slides 3207PF, 3208PF, DNA samples Lepid Phyl 0203PF/CILEP202-19, 0204PF/CILEP203-19. Tenerife, Teno Bajo, 100 m, 1 ♂, 4-I-1981, leg. P. Stadel Nielsen (ZMUC); Santiago del Teide, 1000 m, 1 ♂, 1 ♀, 9-I-1981, leg. P. Stadel Nielsen (ZMUC); Aguamansa, 1200 m, 1 ♀, 26-VII-1984, leg. P. Olsen, B. Skule, P. Stadel Nielsen, genitalia slide 5996LG; Calleo Salvaje, 5 ♂♂, 4 ♀♀, 1-5-I-1985, leg. K. Schnack (ZMUC); Armeñime, 100 m, 5 ♀♀, 25-XI-2-XII-2012, leg. P. Falck, same data but, 4 ♀♀, 3-9-III-2013, leg. P. Falck, genitalia slide 3212PF, DNA samples Lepid Phyl 0129PF/CILEP128-19, 0195PF/CILEP194-19, 0196PF/CILEP195-19, 0197PF/CILEP196-19 (PF); Arona, 500 m, 3 ♀♀, 3-9-III-2013, leg. P Falck, same data but, 1 ♀, 8-22-XI-2016, leg. P. Falck, same data but, 1 ♂, 1-20-III-2017, leg. P. Falck, genitalia slides 2775PF, 3214PF (PF); Los Gigantes, 150 m, 12 ♀♀, 8-22-XI-2016, leg. P. Falck (PF); Erjos, 1000 m, 1 ♂, 1-20-III-2017, leg. P. Falck, genitalia slide 2781PF, DNA sample Lepid Phyl 0212PF/CILEP211-19 (PF); El Médano, 10 m, 1 ♂, 21-V-3-VI-2019, leg. P. Falck, genitalia slide 3213PF, DNA sample Lepid Phyl 0208PF/CILEP207-19 (PF).

Description Adult: Wingspan 7.5-10.5 mm. Labial palp slender, upturned, segment 2 creamy white, laterally black at base and towards apex, medially with a dark-grey spot near apex, segment 3 black, dorsally and apically creamy white. Antenna black, with indistinct dark-grey rings in female, uniformly dark-grey in male. Head and neck light brown mottled with brown; thorax dark brown; tegula creamy white, dark brown towards base. Forewing ground colour black mottled with brown; base black with a small pale reddish-brown spot towards base; with a small pale reddish-brown spot at costa near base; centrally with an irregular, oblique reddish-brown fascia bordered by four black spots; apical spot at costa creamy white, extending half way towards the tiny reddish-brown tornal spot, occasionally forming an indistinct outer fascia; fringe grey. Hindwing grey with grey fringe.

Male genitalia (Figs 37, 37a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately three times longer than broad, anterior margin slightly upturned; apex rounded, posterior margin medially clearly convex; sacculus longer than 1/2 length of valva, forked in distal third, anterior part short, apex rounded, posterior part sigmoid, apically hook-shaped; labis slender, short; juxta sub-triangular with apical protrusions; saccus sub-triangular, small; phallus straight, as long as tegumen, basal sclerite bent, length less than half of phallus, distally a group of 8-12 shorter and 1-2 longer robust cornuti.

Female genitalia (Fig. 56): Papilla analis long, distally pointed; posterior apophysis slender, as long as papilla analis; anterior apophysis slender, as long as posterior apophysis, base bifurcate; tergum VIII sub-rectangular, posterior margin U-shaped; antrum dorsally bilobed, sclerotized, slightly tapered to the weakly developed fold on ductus bursae, posterior margin with dorso-medial indentation, edge heavily sclerotized; ductus bursae straight, dilated, membraneous with two laterally, weakly sclerotized areas; ductus seminalis with spinulae; corpus bursae membranous rounded; signum small, oval with two small spines.

DNA barcodes (Figs 64-66, Tables 1-3): Fifteen specimens were barcoded with very high variation in COI (uncorrected p = 0.0334). The specimens are sister to a clade comprising *A. junnilaineni, A. griseum, A. stadeli, A. transversum, A. skulei, A. brunneum, A. lucidum* and *A. grancanariae*. Despite high internal variation *A. coarctella* is differentiated from all other species with uncorrected p distance to other species ranging from 0.0597 (*A. lapalmae*) to 0.1255 (*A. minimum*). *A. coarctella* is divided into three well-separated sub-groups comprised by specimens from Tenerife (6 specimens), La Palma (2), Lanzarote (2), Gran Canaria and Fuerteventura (5), respectively. While within group variation is very low, the four sub-groups are very divergent with the uncorrected p distance between Gran Canaria + Fuerteventura, and La Palma being 0.0534, the distance between Gran Canaria + Fuerteventura, and Tenerife being 0.0463, the distance between Tenerife and La Palma being 0.0295, the distance between Tenerife and Lanzarote being 0.0447, and the distance between La Palma and Lanzarote being 0.054. The distance between Gran Canaria + Fuerteventura, and Lanzarote is low 0.0022, and the two groups do not appear to be isolated. Barcode Index Numbers: ADR9887 (Tenerife), AEA1295 (La Palma), ADY6487 (Fuerteventura, Gran Canaria and Lanzarote).

Diagnosis: *A. coarctella* resembles small specimens of *A. fasciata* and *A. mixtum.* It can be distinguished by an on average smaller size and the reddish-brown markings on the forewing. In the male genitalia the forked distal part of sacculus is characteristic, it separates it from all other known *Apatema* species. In the female genitalia the dilated, membraneous ductus with lateral sclerotisations is characteristic.

Biology: Unknown. Most of the specimens are collected at light during January-April, June, July and October-December at altitudes ranging from sea level to 1200 m.

Distribution: *A. coarctella* often occurs in large numbers and it is known from Fuerteventura, La Gomera (KLIMESCH, 1985: 138), Gran Canaria, Lanzarote and Tenerife.

Apatema junnilaineni Vives, 2001 (Figs 13, 14)
Apatema junnilaineni Vives, 2001. *SHILAP Revta. lepid.*, **29**(114): 168, figs 9, 9a
Locus typicus: SPAIN, GRAN CANARIA, Tejeda.

Material examined: SPAIN, GRAN CANARIA, Puerto Rico, 50 m, 1 ♂, 9-11-III-1993, leg. F. Vilhelmsen, genitalia slide 2778PF (PF); Pie de la Cuesta, 500 m, 12 ♂♂, 3 ♀♀, 4-23-III-2019, leg. P. Falck, genitalia slide 3187PF, DNA samples Lepid Phyl 0115PF/CILEP114-19, 0116PF/CILEP115-19 (PF); El Sao, 110 m, 4 ♂♂, 1 ♀, leg. P. Falck (PF); Ayacata, 1400 m, 5 ♂♂, 2 ♀♀, 4-23-III-2019, leg. P. Falck, genitalia slide 3186PF (PF); Guayadeque, 450 m, 5 ♂♂, 4-23-III-2019, leg. P. Falck (PF).

Description Adult: Wingspan 12-14.5 mm. Labial palp slender, upturned, segment 2 white, laterally blackish brown basally, segment 3 creamy white, mottled with black ventrally. Antenna blackish brown. Head and neck creamy white in male, dark brown in female; thorax dark brown, pale brown towards abdomen; tegula brownish. Forewing long and narrow; ground colour creamy white in dorsal half, mottled with brown (especially in female), blackish brown in costal half; with a black spot at dorsum near base; deep black in the middle partcell, almost forming a longitudinal line terminating in a black spot; costal spot very indistinct creamy white; fringe grey. Hindwing grey, with grey fringe.

Male genitalia (Figs 38, 38a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately 3.5 times longer than broad, anterior margin slightly upturned; apex rounded, posterior margin medially slightly convex; sacculus slightly longer than 1/2 length of valva, broader in distal third, apically pointed; labis medium-sized; juxta sub-triangular with apical protrusions; saccus sub-triangular, small; phallus straight, distal edge rounded, as long as tegumen, basal sclerite bent, length less than half of phallus, distally a group of thin microspines; cornuti group I a semi-oval large plate with numerous spines; cornuti group II a small plate with 5-8 relatively long needle-shaped spines; cornuti group III with 7-10 long, needle-shaped spines; vesica with several microspines.

Female genitalia (Fig. 57): Papilla analis long, distally pointed; posterior apophysis slender, as long as papilla analis; anterior apophysis slender, as long as posterior apophysis, base bifurcate; tergum VIII sub-rectangular, posterior margin U-shaped; antrum dorsally bilobed, slightly tapered to fold on ductus bursae, posterior margin with dorso-medial indentation, edge heavily sclerotized; ductus bursae straight, anteriorly slightly widening with a longitudinal fold, evenly sclerotized; ductus seminalis with few spinulae; corpus bursae membranous rounded; signum droplet-shape, laterally with 3-4 small spines.

DNA barcodes (Figs 64-66, Tables 1-2): Two specimens were barcoded with very low internal variation in COI (uncorrected p = 0.0019). The specimens two are placed on a long branch as sister to *A. psudolucidum* and *A. griseum*. *A. junnilaineni* is clearly differentiated from all other species with uncorrected p distance to other species ranging from 0.0671 (*A. grisea*) to 0.1290 (*A. minimum*). Barcode Index Number: ADR4784.

Diagnosis: *A. junnilaineni* is very characteristic and does not resemble other known species of *Apatema*. However, older specimens may resemble *A. grisea*. It can be distinguished by the creamy white dorsum of the forewing. In the male genitalia the small plate with 5-8 relatively long needle-shaped spines in cornuti group II is characteristic. In the female genitalia the longitudinal fold and the evenly sclerotized anterior part of ductus bursa are characteristic.

Biology: Unknown. The specimens were collected during spring at light, at altitudes ranging from sea level to 1400 m.

Distribution: Known only from the southern and central part of the island Gran Canaria.

***Apatema pseudolucidum* Falck & Karsholt, sp. n.** (Fig. 15)

Holotype ♂: SPAIN, GRAN CANARIA, Los Tilos de Moya, 500 m, 4-23-III-2019, leg. P. Falck, genitalia slide 3203PF, DNA sample Lepid Phyl 0117PF/CILEP116-19 (PF).

Description Adult: Wingspan 13 mm. Labial palp slender, upturned, segment 2 white, laterally black basally, segment 3 white. Antenna grey-brown. Head, neck and thorax creamy white; tegula creamy white, brownish towards base. Forewing ground colour white mottled with reddish brown along dorsum, mottled with black-brown in outer half along costa and in apical area; base with a black dot at costa and dorsum; six black spots, three at 1/3 in an almost oblique row, three in outer half of cell; fringe grey. Hindwing light grey with grey fringe.

Male genitalia (Figs 39, 39a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately three times longer than broad, anterior margin slightly upturned; apex rounded, posterior margin medially slightly convex; sacculus slightly longer than 1/2 length of valva, slightly broader in distal third, apically sickle-shaped; labis slender, relatively long; juxta sub-triangular with apical protrusions; saccus sub-triangular, medium-sized; phallus straight with distal edge sclerotized, as long as tegumen, basal sclerite slightly bent, length less than half of phallus, distally with relatively few microspines; cornuti group I an elongate plate with numerous robust spines; cornuti group II with 4-6 short spines and 6-8 needle-shaped spines of medium length; cornuti group III with 18-20 needle-shaped spines; vesica relatively long, with few scattered microspines.

Female genitalia: Unknown.

DNA barcodes (Figs 64-66, Tables 1-2): As only a single specimen was barcoded internal variation in COI cannot be assessed. The specimen is sister to *A. griseum*. *A. pseudolucidum* is differentiated from all other species with uncorrected p distance to other species ranging from 0.0321 (*A. griseum*) to 0.1284 (*A. minimum*). Barcode Index Number: ADY7242.

Diagnosis: *A. pseudolucidum* resembles *A. lucidum.* It can be distinguished by the white ground colour and six small distinct spots (in *A. lucidum* the ground colour is light yellowish brown with only four, often confluent, spots). In the male genitalia the few microspines in distal end of basal sclerite and the relatively long vesica are characteristic.

Biology: Unknown. The only known specimen was collected at light in a laurisilva forest during March.

Distribution: Only known from the type locality in the northern part of the island Gran Canaria, Spain.

Etymology: The species name is derived from combining of the Greek word *ψευδο* (pseudo = false) and *lucidum*, referring to its similarity to *A. lucidum*.

***Apatema griseum* Falck & Karsholt, sp. n.** (Fig. 16)

Holotype ♂: SPAIN, GRAN CANARIA, Pie de la Cuesta, 500 m, 4-23-III-2019, leg. P. Falck (ZMUC).

Paratypes: SPAIN, GRAN CANARIA, Pie de la Cuesta, 500 m, 12 ♂♂, 4-23-III-2019, leg. P. Falck, genitalia slides 3189PF, 3190PF, DNA samples Lepid Phyl 0112PF/CILEP111-19, 0113PF/CILEP112-19, 0114PF/CILEP113-19 (PF, MNCN); Ayacata, 1400 m, 2 ♂♂, 4-23-III-2019, leg. P. Falck (PF).

Description Adult: Wingspan 13-14.5 mm. Labial palp slender, upturned, segment 2 dark-grey, dorsally whitish, segment 3 black, creamy white. Antenna dark. Head dark brown, neck pale-grey brown; thorax dark brown, pale brown towards abdomen; tegula grey brown. Forewing lanceolate, ground colour uniform grey mottled with pale brown, mottled dark-grey towards apex; base black; four indistinct small black spots, almost in a row, along the cell; fringe grey. Hindwing grey with grey fringe.

Variation: The species varies in appearance of the four black spots: they are often well separated but may be confluent, almost forming a longitudinal streak.

Male genitalia (Figs 40, 40a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately three times longer than broad, anterior margin slightly upturned; apex rounded, posterior margin medially slightly convex; sacculus slightly longer than 1/2 length of valva, of equal wide, apically sickle-shaped; labis slender, relatively long; juxta sub-triangular with apical protrusions; saccus sub-triangular, medium-sized; phallus straight with distal edge sclerotized, as long as tegumen, basal sclerite slightly bent, length less than half of phallus, distally almost without microspines; cornuti group I a long elongate plate with numerous spines; cornuti group II with 4-6 short spines and 8-10 needle-shaped spines of medium lenght; cornuti group III with 15-18 robust, needle-shaped spines; vesica with few scattered microspines.

Female genitalia: Unknown.

DNA barcodes (Figs 64-66, Tables 1-2): Three specimens were barcoded with no internal variation in COI (uncorrected p = 0.0000). The specimens are sister to *A. pseudolucidum*. *A. griseum* is differentiated from all other species with uncorrected p distance to other species ranging from 0.0321 (*A. pseudolucidum*) to 0.1335 (*A. minimum*). Barcode Index Number: ADY7244.

Diagnosis: *A. griseum* resembles worn specimens of *A. junnilaineni.* It can be distinguished by the unifrom grey forewings with four small black dots, almost in a row, along the cell. In the male genitalia the equally wide sacculus with sickle-shaped apex and the cornuti group III with the very robust needle-shaped cornuti are characteristic.

Biology: Unknown. The specimens were collected during spring at light, at altitudes ranging from 500 m to 1400 m.

Distribution: Known only from a few scattered localities in the southern half of Gran Canaria.

Etymology: The species is named after the uniform grey colour of the forewing, from the Latin adjective *griseus* (= grey).

Apatema lucidum Walsingham, 1908 (Figs 17, 18)
Apatema lucidum Walsingham, 1908. *Proc. Zool. Soc. London*, **1907**: 945

Locus typicus: SPAIN, TENERIFE, “Bosque” de la Mina, Realejo, Las Mercedes, La Laguna, Tacoronte.

Material examined: SPAIN, TENERIFE, 5 km N Vilaflor, 1700 m, 1 ♂, 26-IV-1998, leg. K. Larsen, genitalia slide 5359OK (ZMUC); Taucho, 800 m, 1 ♀, 2-9-III-2013, leg. P. Falck, genitalia slide 2782PF, DNA sample Lepid Phyl 0128PF/CILEP127-19 (PF); Aguamansa, 1050 m, 27 ♂♂, 31 ♀♀, 21-V-3-VI-2019, leg. P. Falck, genitalia slides 3180PF, 3181PF, 3183PF, 3185PF, 3354PF, DNA samples

Lepid Phyl 0205PF/CILEP204-19, 0206PF/CILEP205-19, 0207PF/CILEP206-19 (PF); Arona, 400 m, 1 ♀, 21-V-3-VI-2019, leg. P. Falck (PF).

Description Adult: Wingspan 13-16 mm. Labial palp slender, upturned, segment 2 yellowish white, laterally dark brown at base and apically, segment 3 yellowish white. Antenna yellowish brown, in female with indistinct brown rings. Head, thorax and tegula pale yellowish brown, neck pale brown. Forewing ground colour pale yellowish brown mottled with brown especially distally at costa and in apically; base with a black dot at costa and dorsum; four black spots, three in a row along cell at 1/3, 1/2 and distally, the latter often comma-shaped and one spot near dorsum at 2/5; costal spot yellowish and indistinct; fringe grey. Hindwing light grey with grey fringe.

Variation: The two outer pairs of spots are sometimes confluent. Females are often heavily mottled with dark brown giving a dark brown appearance, but the black spots are still visible.

Male genitalia (Figs 41, 41a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately three times longer than broad, anterior margin slightly upturned; apex rounded, posterior margin medially slightly convex; sacculus slightly longer than 1/2 length of valva, broader in distal third, apically hook-shaped; labis slender, short; juxta sub-triangular with apical protrusions; saccus sub-triangular, medium-sized; phallus straight, as long as tegumen, basal sclerite bent, length less than half of phallus, distally a group of thin microspines; cornuti group I a large plate with numerous triangular spines; cornuti group II with 8-10 long and 5-10 shorter needle-shaped spines; cornuti group III missing; vesica without microspines.

Female genitalia (Fig. 58): Papilla analis long, distally pointed; posterior apophysis slender, as long as papilla analis; anterior apophysis slender, as long as posterior apophysis, base bifurcate; tergum VIII sub-rectangular, posterior margin U-shaped; antrum dorsally bilobed, slightly tapered to fold on ductus bursae, posterior margin with dorso-medial indentation, edge sclerotized; ductus bursae from the fold to corpus bursae dilated in the middle part, left 2/3 membranous, right side weakly sclerotized; ductus seminalis with few spinulae; corpus bursae membranous rounded, rotation angel approximately 90º; signum droplet-shape, laterally with 3-4 small spines.

DNA barcodes (Figs 64-66, Tables 1-2): Four specimens were barcoded with some internal variation in COI (uncorrected p = 0.0031). The specimens are sister to *A. grancanariae*. *A. lucidum* is clearly differentiated from all other species with uncorrected p distance to other species ranging from 0.0504 (*A. grancanariae*) to 0.1309 (*A. minimum*). Barcode Index Number: ADY7243.

Diagnosis: *A. lucidum* resembles *A. pseudolucidum.* It can be distinguished by the pale yellowish brown colour of the forewing and by having only four black and less distinct spots (six small black, very distinct spots in *A. pseudolucidum*). In the male genitalia the lack of cornuti group II and rather few long needle-shaped cornuti in cornuti group III are characteristic. In the female genitalia the dilated membranous ductus bursae and the rotation angel are characteristic.

Biology: Early stages unknown. The adults were flying actively in the evening sunshine in mixed forest and attracted to light during April-June at altitudes ranging from 400 m to 1700 m.

Distribution: Only known from the island of Tenerife, Spain.

Remarks: The adults figured by GOZMÁNY (2008: 483, plate 115, figs. 10, 10a) do not correspond to *A. lucidum*, fig. 10 is most likely *A. fasciata* and fig. 10a *A. mixta*. The male and female genitalia are figured by GOZMÁNY (2008: 370, plate 4, fig.10; 438, plate 72, fig. 10), the male paralectotype, “Tacaronte, Tenerife 31-V-1907 W[a]ls[ingha]m. 98251” *“Apatema lucidum* W[a]ls[ingh]m P.[roceedings of the] Z.[oological] S.[ociety] [London] 1907-947-8. [sic!] Paratype 9/11” (NMW), and the female paralectotype “Type” “La Laguna, Tenerife 23-V-1907 W[a]ls[ingha]m. 98241” “Walsingham Collection 1910-427” *“Apatema lucidum* W[a]ls[ingha]m. Type ♀ (BMNH).

***Apatema grancanariae* Falck & Karsholt, sp. n.** (Fig. 19)

Holotype ♂: SPAIN, Gran Canaria, Pie de la Cuesta, 500 m, 4-23-III-2019, leg. P. Falck, DNA sample Lepid Phyl 0124PF/CILEP123-19 (ZMUC).

Paratypes: SPAIN, GRAN CANARIA, Ayacata, 1400 m, 2 ♂♂, 3 ♀♀, 4-23-III-2019, leg. P. Falck, genitalia slides 3198PF, 3199PF, 3200PF, DNA samples Lepid Phyl 0122PF/CILEP121-19, 0125PF/CILEP124-19, 0127PF/CILEP126-19 (PF, MNCN); Pie de la Cuesta, 500 m, 1 ♂, 4-23-III-2019, leg. P. Falck, genitalia slide 3201PF, DNA sample Lepid Phyl 0192PF/CILEP191-19 (PF); Guayadeque, 460 m, 1 ♂, 4-23-III-2019, leg. P. Falck, genitalia slide 3202PF, DNA sample Lepid Phyl 0193PF/CILEP192-19 (PF).

Description Adult: Wingspan 13.5-15 mm. Labial palp slender, upturned, segment 2 white, laterally black at base and apically, segment 3 black with white tip. Antenna black, in female with indistinct grey rings. Head and neck pale brown mottled with dark brown; thorax dark brown, paler brown towards abdomen; tegula brown, darker brown basally. Forewing ground colour dark-grey mottled with black; base black with a creamy white spot medially; centrally with an irregular oblique creamy white fascia mottled with grey and brown, the fascia is bordered by four black spots; apical spot at costa creamy white, extending half way towards tiny white tornal spot, sometimes forming an indistinct outer fascia; fringe grey. Hindwing grey with grey fringe.

Male genitalia (Figs 42, 42a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately three times longer than broad, anterior margin slightly upturned; apex rounded, posterior margin medially slightly convex; sacculus slightly longer than 1/2 length of valva, broader in distal third, apically hook-shaped; labis slender, medium-sized; juxta sub-triangular with apical protrusions; saccus sub-triangular, medium-sized; phallus straight, as long as tegumen, basal sclerite bent, length approximately 1/3 of phallus, distally a group of thin microspines; cornuti group I a large plate with numerous relatively long spines; cornuti group II with 3-5 short spines and 8-12 needle-shapeds; cornuti group III missing, vesica without microspines.

Female genitalia (Fig. 59): Papilla analis long, distally pointed; posterior apophysis slender, approximately 1/5 longer than papilla analis; anterior apophysis slender, as long as posterior apophysis, base bifurcate; tergum VIII sub-rectangular, posterior margin with U-shaped indentation; antrum dorsally bilobed, slightly tapered to fold on ductus bursae, posterior margin with dorso-medial indentation, edge sclerotized; ductus bursae sclerotized only anteriorly to the fold and around ductus seminalis, otherwise becoming dilated and membranous, rotated 90º just before corpus bursae; ductus seminalis with spinulae; corpus bursae membranous rounded; signum droplet-shape, laterally with 3-4 small spines.

DNA barcodes (Figs 64-66, Tables 1-2): Six specimens were barcoded with very high variation in COI (uncorrected p = 0.0233). The specimens are sister to *A. lucidum*. Despite high internal variation *A. grancanariae* is differentiated from all other species with uncorrected p distance to other species ranging from 0.0504 (*A. lucidum*) to 0.1352 (*A. minimum*). Barcode Index Numbers: AEA2797, AEA0771 and ADY6665.

Diagnosis: *A. grancanariae* resembles other *Apatema* species with similar wing pattern, especially *A. fasciata*, *A. mixtum* and *A. transversum.* It can be distinguished from *A. fasciata* and *A. mixtum* by an on average larger size, but it is not always possible to separate adults confidently. It can be distinguished from *A. transversum* by the paler and more oblique fascia in the middle of the forewing. In the male genitalia the short sclerite, the relatively long spines in cornuti group I, the missing cornuti group III and the lack of microspines in the vesica are characteristic (in *A. fasciata* the cornuti in group I are triangular, in *A. mixtum* cornuti group II and III are present with few minute cornuti in group II, in *A. transversum* cornuti group II and III are present with a number of shorter spines in group II). In the female genitalia the dilated, membranous ductus bursae with a 90 rotation just before corpus bursae is characteristic.

Biology: Unknown. The specimens were attracted to light in March at altitudes ranging from 460 m to 1400 m.

Distribution: Known only from a few scattered localities in the southern part of the island of Gran Canaria, Spain.

Etymology: The species is named after its place of occurrence, the island of Gran Canaria. The name is an adjective.

***Apatema brunneum* Falck & Karsholt, sp. n.** (Fig. 20)

Holotype ♀: SPAIN, Tenerife, Aguamansa, 1050 m, 13-26-VIII-2019, leg. P. Falck (ZMUC).

Paratypes: SPAIN, Tenerife. Aguamansa, 1050 m, 1 ♂, 5 ♀♀, 26-VII-1984, leg. P. Olsen, B. Skule, P. Stadel Nielsen, genitalia slides 6006LG, 6013LG, 6014LG, 6019LG (ZMUC); same data but 1 ♀, 1-VIII-1979, leg P. Stadel Nielsen (ZMUC), same data but, 2 ♂♂, 36 ♀♀, 13-26-VIII-2019, leg. P. Falck, genitalia slides 3176PF, 3177PF, 3178PF, 3184PF, 3355PF, DNA samples Lepid Phyl 0316PF/CILEP315-19, 0317PF/CILEP316-19, 0318PF/CILEP317-19 (PF, MNCN); Las Mercedes, 750 m, 2 ♂♂, 13 ♀♀, 13-26-VIII-2019, leg. P. Falck, genitalia slides 3179PF, 3182PF, DNA sample Lepid Phyl 0319PF/CILEP318-19 (PF).

Description: Adult. Wingspan 10.5-13 mm. Labial palp slender, upturned, segment 2 creamy white, laterally and basally dark-grey, with dark-grey rings distally, segment 3 black, dorsally and apically creamy white. Antenna black, with indistinct dark-grey rings in female. Head, neck and thorax yellowish brown, head in particular mottled with dark brown; tegula yellowish brown, dark brown towards base. Forewing dark brown mottled with yellowish brown, apically black with a golden shine; base black, center of wing an irregular oblique yellowish brown fascia bordered by four black spots; costal spot yellowish, mottled with brown, extending to tornal spot, forming an angulated fascia; fringe grey. Hindwing grey with grey fringe.

Variation: The species is rather uniform in appearance, but the four black spots display some variation; they are often well separated, but the outer pair may be confluent.

Male genitalia (Figs 43, 43a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately three times longer than broad, slightly tapered towards apex, anterior margin slightly upturned; apex rounded, posterior margin medially slightly convex; sacculus slightly longer than 1/2 length of valva, broader in distal third, apically hook-shaped; labis medium-sized; juxta sub-triangular with apical protrusions; saccus sub-triangular, large; phallus straight, as long as tegumen, basal sclerite bent, length less than half of phallus, distally a group of thin microspines; cornuti group I a large plate, slightly turned about the longitudinal axis, with numerous triangular spines; cornuti group II with few (3-5) short spines and 12-15 needle-shaped spines; cornuti group III with 11-12 needle-shaped spines; vesica with few scattered microspines.

Female genitalia (Fig. 60): Papilla analis long, distally pointed; posterior apophysis slender, as long as papilla analis; anterior apophysis slender, as long as posterior apophysis, base bifurcate; tergum VIII sub-rectangular, posterior margin V-shaped; antrum dorsally bilobed, slightly tapered to fold on ductus bursae, posterior margin with dorso-medial V-shaped indentation, edge sclerotized; ductus bursae from the fold to corpus bursae dilated in the middle part, with longitudinal fold, left half membranous, right side sclerotized; ductus seminalis heavily twisted with numerous spinulae; corpus bursae membranous rounded, rotation angel approximately 90; signum droplet-shape, laterally with 3-4 small spines.

DNA barcodes (Figs 64-66, Tables 1-2): Four specimens were barcoded with very low internal variation in COI (uncorrected p = 0.0015). The specimens are placed as sister to group comprising *A. transversum, A. stadeli* and *A. skulei*. *A. brunneum* is clearly differentiated from all other species with uncorrected p distance to other species ranging from *ca* 0.06 (*A. lucidum* and *A. stadeli*) to 0.1106 (*A. confluellum*). Barcode Index Number: AEC2839.

Diagnosis: *A. brunneum* resembles several other *Apatema* species, especially *A. mixtum* and *A. fasciata*. It can be distinguished by the yellowish brown fascia and the overall golden shine. In the male genitalia the relatively large saccus and the large cornuti group I, turned about the longitudinal axis, giving an impression of the spines being pointing in different directions, are characteristic. In the female genitalia the dilated and membranous part of ductus bursae, the twisted ductus seminalis and the rotated corpus bursae are characteristic.

Biology: Early stages unknown. The adults were flying actively in the evening sunshine, and later attracted to artificial light, in mixed forest at altitudes from 750 m to 1050 m.

Distribution: Only known from a few forest-localities in the island of Tenerife, Spain.

Etymology: The species is named after the brown colour of the forewing, from the Latin adjective *brunneus* (= brown).

Remarks: The female genitalia is figured by GOZMÀNY (2008: 341 and 438 plate 72 fig. 10a).

Apatema transversum Falck & Karsholt, sp. n. (Figs 21, 22)

Holotype ♀: SPAIN, GRAN CANARIA, Pie de la Cuesta, 500 m, 11-24-VI-2018, leg. P. Falck (ZMUC).

Paratypes: SPAIN, GRAN CANARIA, Pie de la Cuesta, 500 m, 6 ♂♂, 3 ♀♀, 11-24-VI-2018, leg. P. Falck, genitalia slides 2789PF, 2797PF, DNA sample Lepid Phyl 0017PF/CILEP017-19 (PF), same data but, 1 ♂, 17-30-IX-2018, leg. P. Falck (PF); Barranquillo Andrés, 700 m, 1 ♂, 5 ♀♀, 11-24-VI-2018, leg. P. Falck, genitalia slides 2783PF, 2800PF, DNA samples Lepid Phyl 0016PF/CILEP016-19, 0018PF/CILEP018-19 (PF, MNCN); Puerto Rico, 50 m, 2 ♂♂, 1 ♀, 11-24-VI-2018, leg. P. Falck, genitalia slides 2791PF, 2799F, 2803PF (PF); Playa del Cura, 30 m, 1 ♂, 4-23-III-2019, leg. P. Falck, DNA sample Lepid Phyl 0118PF/CILEP117-19 (PF).

Description adult: Wingspan 10-12.5 mm. Labial palp slender, upturned, segment 2 creamy white, base laterally and towards apex dark-grey, segment 3 black, dorsally and apically creamy white. Antenna black, with indistinct dark-grey rings in female, uniformly dark-grey in male. Head creamy white, neck and thorax creamy white mottled with dark brown; tegula creamy white, dark brown towards base. Forewing grey-brown mottled with yellowish brown, dark-grey and black, especially towards apex; base black; centrally an irregular, slightly oblique yellowish brown fascia bordered by four black spots, the colour of the wing laterally of the fascia only slightly darker; costal spot yellowish white, extending to tiny white tornal spot, forming a diffuse fascia; fringe grey. Hindwing grey with grey fringe.

Variation: The species varies in appearance of the four black spots, they are often well separated but may be confluent in pairs.

Male genitalia (Figs 44, 44a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately three times longer than broad, anterior margin slightly upturned; apex rounded, posterior margin medially slightly convex; sacculus 2/3 length of valva, distinctively broader in distal third, apically hook-shaped; labis medium-sized; juxta sub-triangular with apical protrusions; saccus sub-triangular, medium-sized; phallus straight, as long as tegumen, distal edge sclerotized, basal sclerite bent, length less than half of phallus, distally a group of thin microspines; cornuti group I a large plate with numerous spines; cornuti group II with numerous short spines and 5-10 short needle-shaped spines; cornuti group III with 15-20 needle-shaped spines of medium length; vesica with several triangular scattered microspines.

Female genitalia (Fig. 61): Papilla analis long, distally pointed; posterior apophysis slender, as long as papilla analis; anterior apophysis slender, as long as posterior apophysis, base bifurcate; tergum VIII sub-rectangular, posterior margin with weak indentation; antrum dorsally bilobed, slightly tapered to fold on ductus bursae, posterior margin with dorso-medial indentation, edge heavily sclerotized; ductus bursae straight, anteriorly slightly widening, evenly sclerotized; ductus seminalis with few spinulae; corpus bursae membranous, rounded; signum droplet-shape, laterally with 3-4 small spines.

DNA barcodes (Figs 64-66, Tables 1-2): Four specimens were barcoded with some internal variation in COI (uncorrected $p = 0.0055$). The specimens are placed in an unresolved trichotomy with *A. skulei* and *A. stadeli*. *A. transversum* is differentiated from all other species with uncorrected p distance to other species ranging from *ca* 0.046 (*A. stadeli* and *A. skulei*) to 0.1307 (*A. minimum*). Barcode Index Number: ADT8536.

Diagnosis: *A. transversum* resembles *A. mixtum*, *A. fasciata*, *A. brunneum* and *A. grancanariae*. It can be distinguished by the almost transverse fascia and the colour of the fascia, which is almost the same as the rest of wing. In the male genitalia the numerous short spines in cornuti group II and the presence of several triangular microspines in the vesica are characteristic. In the female genitalia the evenly sclerotized ductus bursae and the short longitudinal fold anteriorly are characteristic.

Biology: Unknown. The specimens were attracted to artificial light.

Distribution: Known only from the southern part of the island of Gran Canaria, Spain.

Etymology: The species is named after the almost transverse fascia of the forewing, from the Latin adjective *transversus* (= transverse, from side to side).

Apatema stadeli **Falck & Karsholt, sp. n.** (Figs 23, 24)

Holotype ♂: SPAIN, TENERIFE, Aguamansa, 1050 m, 1-VIII-1979, leg. P. Stadel Nielsen (ZMUC).

Paratypes: SPAIN, TENERIFE, Aguamansa, 1050 m, 7 ♂♂, 13 ♀♀, 29-VII-1-VIII-1979, leg. P. Stadel Nielsen, genitalia slides ZMUC1PF, ZMUC2PF, 3356aPF (ZMUC); same data but, 1 ♀, 26-VII-1984, leg. P. Olsen, B. Skule, P. Stadel Nielsen, genitalia slide 5995LG (ZMUC), same data but, 2 ♂♂, 7 ♀♀, 13-26-VIII-2019, leg. P. Falck (PF); Arona, 670 m, 9 ♂♂, 14 ♀♀, 21-V-3-VI-2019, leg. P. Falck, genitalia slide 2780PF, DNA samples 0012PF/CILEP012-19, 0209PF/CILEP208-19, 0210PF/CILEP209-19, 0211PF/CILEP210-19 (PF, MNCN); Las Manchas, 1050 m, 6 ♂♂, 9 ♀♀, 21-V-3-VI-2019, leg. P. Falck, genitalia slide 3356PF,(PF, MNCN); Las Mercedes, 750 m, 1 ♂, 1 ♀, 13-26-VIII-2019, leg. P. Falck (PF); Puerto de la Cruz, 200 m, 1 ♀, 13-26-VIII-2019, leg. P. Falck (PF).

Description Adult: Wingspan 10.5-13 mm. Labial palp slender, upturned, segment 2 white, laterally at base and towards apex black, segment 3 white mottled with black towards base. Antenna black. Head varies from creamy white to blackish brown, neck blackish brown; thorax blackish, towards abdomen creamy white; tegula creamy white, blackish brown towards base. Forewing ground colour black; base white, with a small white spot at costa near base; wing centrally with an irregular, slightly oblique white fascia almost extending to dorsum; costal spot white, occationally extending to white tornal spot, forming a fascia; fringe grey. Hindwing grey with grey fringe.

Variation: The species varies in the colour of the head, see above; in some specimens the four black spots bordering the white fascia centrally on the wing are visible.

Male genitalia (Figs 45, 45a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately 3.5 times longer than broad, anterior margin slightly upturned; apex rounded, posterior margin medially slightly convex; sacculus slightly longer than 1/2 length of valva, broader in distal third, apically hook-shaped; labis slender, long; juxta sub-triangular with apical protrusions; saccus sub-triangular, medium-sized; phallus straight, as long as tegumen, basal sclerite bent, length less than half of phallus, distally a group of thin microspines; cornuti group I a large plate with numerous spines; cornuti group II with 15-20 short spines and 6-10 needle-shaped spines of medium length; cornuti group III with numerous very thin spines of different length, distally 3-5 needle-shaped spines; vesica with scattered microspines.

Female genitalia (Fig. 62): Papilla analis long, pointed distally; posterior apophysis slender, as long as papilla analis; anterior apophysis slender, as long as posterior apophysis, base bifurcate; tergum VIII sub-rectangular, posterior margin U-shaped; antrum dorsally bilobed, slightly tapered to fold on ductus bursae, posterior margin with dorso-medial indentation, edge heavily sclerotized; ductus bursae straight, anteriorly parallel-sided with small longitudinal fold, evenly sclerotized; ductus seminalis with spinulae; corpus bursae membranous rounded; signum droplet-shape, laterally with 3-4 small spines.

DNA barcodes (Figs 64-66, Tables 1-2): Four specimens were barcoded with very low internal variation in COI (uncorrected p = 0.0015). The specimens are placed in an unresolved trichotomy with *A. skulei* and *A. transversum*. *A. stadeli* is differentiated from all other species with uncorrected p distance to other species ranging from *ca* 0.046 (*A. transversum* and *A. skulei*) to 0.1294 (*A. minimum*). Barcode Index Number: ADZ8618.

Diagnosis: *A. stadeli* resembles *A. skulei* and *A. mediopallidum*. It can be distinguished by the black forewings with pure white markings; in *A. skulei* the forewing is more or less mottled with blackish brown in the markings; in *A. mediopallidum* the markings are creamy white and the black spots, bordering the fascia in the middle of the forewing, are clearly visible. In the male genitalia the relatively long labis and cornuti group III with the combination of thin, gracile spines and a few needle-shaped spines are characteristic, in *A. mediopallidum* only two cornuti groups are present. In the female genitalia the small longitudinal fold and the anteriorly parallel-sided ductus bursae are characteristic.

Biology: Unknown. The specimens were attracted to light during May-August at altitudes ranging from 670 m to 1050 m.

Distribution: Known only from the island of Tenerife, Spain.

Etymology: The species name (a noun in the genitive case) is dedicated to the Danish lepidopterist Per Stadel Nielsen who collected some of the first specimens and many other *Apatema* specimens used for our study.

***Apatema skulei* Falck & Karsholt, sp. n.** (Figs 25, 26)

Holotype ♀: SPAIN, Gran Canaria, Barranco Moya, 400 m, 20-VII-1984, leg. P. Olsen, B. Skule, P. Stadel, genitalia slide 5999LG (ZMUC).

Paratypes: SPAIN, Gran Canaria, Los Tilos de Moya, 1 ♀, 19-VII-1984 leg. P. Olsen, B. Skule, P. Stadel Nielsen, genitalia slides 6007LG (ZMUC); Barranco Moya, 400 m, 2 ♂♂, 4 ♀♀, 20-VII-1984, leg. P. Olsen, B. Skule, P. Stadel Nielsen, genitalia slides 5980LG, 5987LG, 5998LG, 6049LG, 3203aPF (ZMUC), same data but, 1 ♂, 8-20-VIII-2020, leg. P. Falck (PF); Carreteria, 455 m, 14 ♂♂, 36 ♀♀, 8-20-VIII-2020, leg. P. Falck, genitalia slides 3380PF, 3387PF, 3388PF, 3389PF, DNA samples Lepid Phyl 0667PF/CILEP666-20, 0668PF/CILEP667-20, 0669PF/CILEP668-20, 0670PF/CILEP669-20, 0671PF/CILEP670-20, 0672PF/CILEP671-20, 0673PF/CILEP672-20 (PF, MNCN); Barranco de Azuaje, 270 m, 2 ♂♂, 9 ♀♀, 8-20-VIII-2020, leg. P. Falck (PF); Teror, 500 m, 2 ♂♂, 2 ♀♀, 26-X-13-XI-2020, leg. P. Falck (PF).

Description Adult: Wingspan 9.5-12 mm. Labial palp slender, upturned, segment 2 black, dorsally creamy white, segment 3 black, dorsally and tip creamy white. Antenna black, in female with indistinct dark-grey rings. Head dark-brown, towards neck pale-brown, neck blackish brown; thorax blackish, mottled with cream and pale-brown, towards abdomen creamy white; tegula creamy white, blackish brown towards base. Forewing ground colour black, mottled with pale-brown to reddish brown in markings; base white, with a small white spot at costa near base; centrally with an irregular, slightly oblique creamy white fascia extending towards dorsum, bordered by four black spots; costal and tornal spot creamy white, sometimes forming a fascia; fringe grey. Hindwing grey with grey fringe.

Variation: *A. skulei* varies in the amount of black in the white markings; especially males can be very dark in general appearance.

Male genitalia (Figs 46, 46a): Uncus long, slender rectangular, apex spatulate; gnathos almost as long as uncus, straight, apically hook-shaped, apex pointed; tegumen sub-triangular, anterior margin flatly U-shaped; valva simple, approximately 3.5 times longer than broad, anterior margin slightly upturned; apex rounded, posterior margin medially slightly convex; sacculus longer than 1/2 length of valva, slightly broader in distal third, apically hook-shaped; labis slender, long; juxta sub-triangular with apical protrusions; saccus sub-triangular, medium-sized; phallus straight, as long as tegumen, basal sclerite bent, length less than half of phallus, distally a group of thin microspines; cornuti group I a large plate with numerous spines; cornuti group II with 15-20 short spines and 8-10 needle-shaped spines of medium length; cornuti group III with 15-20 needle-shaped spines; vesica with numerous microspines.

Female genitalia (Fig. 63): Papilla analis long, distally pointed; posterior apophysis slender, as long as papilla analis; anterior apophysis slender, as long as posterior apophysis, base bifurcate; tergum VIII sub-rectangular, posterior margin U-shaped; antrum dorsally bilobed, slightly tapered to fold on ductus bursae, posterior margin with dorso-medial indentation, edge heavily sclerotized; ductus bursae straight, anteriorly parallel-sided with small longitudinal fold, evenly sclerotized; ductus seminalis with spinulae; corpus bursae membranous, rounded; signum droplet-shape, laterally with 3-4 small spines.

DNA barcodes (Figs 64-66, Tables 1-2): Seven specimens were barcoded with some internal variation (uncorrected p = 0.0042). The specimens are placed in an unresolved trichotomy with *A. stadeli* and *A. transversum*. *A. skulei* is differentiated from all other species with uncorrected p distance to other species ranging from *ca* 0.046 (*A. transversum* and *A. stadeli*) to 0.1324 (*A. minimum*). Barcode Index Number: AEG1008.

Diagnosis: *A. skulei* resembles *A. stadeli* and *A. mediopallidum*. It can be distinguished by the black forewing with markings more or less mottled with black, brown and reddish; in *A. stadeli* the markings are pure white and the black spots are often not visible; in *A. mediopallidum* the markings are creamy white and the black spots, bordering the fascia centrally in the forewing, are clearly visible. In the male genitalia the relatively long labis and cornuti group III with the combination of thin, gracile spines and a few needle-shaped spines, and the numerous microspines in vesica are characteristic. It is very similar to *A. stadeli*, but the number of microspines in vesica is higher; in *A. mediopallidum* only two cornuti groups are present. In the female genitalia the small longitudinal fold and the anteriorly parallel-sided ductus bursae are characteristic.

Biology: Unknown. Most of the specimens were collected at light and a few ones disturbed from a rock wall in the afternoon July-November at altitudes ranging from 270 m to 500 m.

Distribution: Known only from a few localities in the northern part on the island of Gran Canaria, Spain.

Etymology: The species name (a noun in the genitive case) is dedicated to the Danish lepidopterist Bjarne Skule, who collected some of the first specimens and many other *Apatema* specimens used in our study.

Phylogenetic analyses

The phylogenetic analyses yielded overall congruent results. All species treated herein are monophyletic and well-supported in all analyses, but the backbone phylogeny is poorly supported as evident by low support values and unresolved branches in the two MrBayes analyses (Figs 64-65), and "fuzzy"/unresolved relationships in the DensiTree rendering of the BEAST analysis (Fig. 66). Many species pairs or species groups are, however, well supported in all analyses, as evident either by strong support values in the MrBayes analyses, or by a dense and compact (= stable, BOUCKEART & HELED (2014)) appearance in the DensiTree rendering. The main difference between the analyses of the Canarian specimens only (both MrBayes and BEAST) and the analysis of all *Apatema* sequences is that the latter analysis indicated that the Canarian species may not comprise a monophyletic group as the clade comprising *A. confluellum* and *A. minimum* is sister to a clade comprising the non-Canarian species *A. whalleyi* and *A. baixerasi*, and two of the four specimens identified as *A. mediopallidum*. The remaining Canarian species from a monophyletic clade together with the remaining two species identified as *A. mediopallidum*.

Discussion

The molecular analyses (Figs. 64-66, Table 2) strongly support the taxonomic arrangement discussed above. All identified species are clearly genetically distinct from other species (Table 2) with uncorrected p distance values between species ranging from 0.0321 (between *A. griseum* and *A. pseudolucidum*) to 0.1352 (between *A. minimum* and *A. grancanariae*). All between-species values are thus well above the 2% threshold suggested as putative guideline for species delimitation by HEBERT et al. (2003). The threshold is not entirely unproblematic, however, as some species (*A. minimum*, *A. coarctella* and *A. grancanariae*) have within species distance values that are above 0.02. For *A. minimum* and *A. coarctella* the average within-species diversity is approximately as high as the average distance between *A. griseum* and *A. pseudolucidum*. This clearly indicate that the species requires further investigation. Both MrBayes analyses further support the taxonomic arrangement as all recognised species are monophyletic in the analysis with high support values between 0.98 and 1. The DensiTree rendering of the BEAST analysis (Fig. 66) further illustrates this as all species are rendered as dense and compact, while many deeper relationships between species or species groups are less well defined. The analyses also confirm that *A. fasciata* and *A. coarctella* show considerable intraspecific geographical diversity. *A. coarctella* (Table 3) is divided into three populations comprising specimens from Tenerife, La Palma, and Gran Canaria/Fuerteventura/Lanzarote, respectively. The three populations all display average inter-population uncorrected p distance > 0.02. Similarly, *A. fasciata* (Table 4) is divided into three populations comprising specimens from Gran Canaria, Fuerteventura, and Lanzarote, respectively (although we were able to include only one specimen from the latter locality). Again the three populations all display average inter-population uncorrected p distance > 0.02. The analysis of all available *Apatema* sequences (Fig. 65) indicates that the species found on the Canary Island and Madeira do not comprise a monophyletic group as *A. confluellum* and *A. minimum* are placed in a well-supported (pp > 0.9) clade with the species *A. baixerasi*, *A. mediopallidum*, and *A. whalleyi* from continental Europe. One *A. mediopallidum* (PHLSA273-11) from Valencia in mainland Spain groups with *A. coarctella* and actually renders the latter species non-monophyletic in the majority rule tree, while another *A. mediopallidum* (LEFIJ5483-16) from Cyprus is also placed deeply within the Canarian *Apatema*, albeit not clearly associated with any species (Fig. 66). We have not examined either of the *A. mediopallidum* specimens, but we consider it likely that their placement in the analysis is due to some mitochondrial DNA artefact caused by external factors such as *Wolbachia* based on similar observations in previous studies (e. g. KONDANDARAMAIAH *et al*., 2013, SIMONSEN *et al*., 2019).

The results presented here show that the genus *Apatama* is very diverse in the Canary Islands. 18 of the currently known 28 *Apatama* species occur in these islands, with the other ten species being found in continental Europe, the Mediterranean islands or North Africa. There is, however, hidden diversity among *Apatama* species occurring outside of the Macaronesian islands as well as evident from unpublished morphological and genetic studies of the genus (P. Huemer and J. ˇumpich in litt.). We have not found any overlap between species occurring in the Canary Islands and elsewhere. Only one species from continental Europe, *A. mediopallidum* has been recorded from the Canary Islands (KLIMESCH, 1985: 137), but the records are due to misidentification. *A. mediopallidum* should be deleted from the list of Canary Island Lepidoptera (VIVES MORENO, 2014: 107).

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Table 1.– Species affiliation, voucher and BOLD ID, and collection localities for all species included in the molecular analyses as described in the text.

Genus	**Species**	**BOLD ID#**	**Voucher ID**	**Country**	**Region**	**Island**	**Locality**
Ambloma	*klimeschi*	CILEP050-19	0050PF	Spain	Canary Islands	Tenerife	Playa Paraíso
Epanastasis	*sophroniella*	CILEP030-19	0030PF	Spain	Canary Islands	Tenerife	Arona
Epanastasis	*canariensis*	CILEP043-19	0043PF	Spain	Canary Islands	Gran Canaria	Ayacata
Oegoconia	*quadripuncta*	CGUKC819-09		United Kingdom	Surry		South Croydon
Oegoconia	*deauratella*	XAG374-05		Canada	Ontario		Puslinch Township, Wellington Co.
Oegoconia	*deauratella*	LEFIF982-10		Finalnd	Regio aboensis		Dragsfjaerd
Oegoconia	*novimundi*	LEEUA169-11		Denmark	NEZ		Copenhagen
Oegoconia	*novimundi*	BBLOE684-11		USA	California		Point Mugu SP, Los Angeles Co.
Oegoconia	*quadripuncta*	LNAUT3224-15		USA	California		San Diego, San Diego Co.
Apatema	*apolausticum*	LASTS834-15		Italy	South Tyrol		Fuchsberg
Apatema	*apolausticum*	PHLAE116-11		Italy	Piedmont		Massiccio Argentera, Cuneo
Apatema	*apolausticum*	PHLAC259-10		Italy	South Tyrol		Montiggl
Apatema	*apolausticum*	LASTS481-14		Italy	South Tyrol		Margreid
Apatema	*apolausticum*	PHLAC260-10		Italy	South Tyrol		Montiggl
Apatema	*baixerasi*	PHLSA165-11		Spain	Valencia		El Saler
Apatema	*mediopallidum*	LON6917-18		Croatia	Zadar		Meka Draga
Apatema	*mediopallidum*	LON6918-18		Croatis	Zadar		Pag
Apatema	*mediopallidum*	PHLSA273-11		Spain	Valencia		Sierra de Crevillente
Apatema	*mediopallidum*	LEFIJ5483-16		Cyprus	Pafos		Oreites Forest
Apatema	*whalleyi*	LEATJ364-15		Italy	South Tyrol		Sonnenberg
Apatema	*whalleyi*	LEATE498-13		Italy	South Tyrol		Schleiser Leiten
Apatema	*whalleyi*	LEATC349-13		Italy	South Tyrol		Schleiser Leiten
Apatema	whalleyi	PHLAE115-11		Italy	Piedmont		Massiccio Argentera, Cuneo
Apatema	*whalleyi*	LEATC345-13		Italy	South Tyrol		Schleiser Leiten
Apatema	*whalleyi*	PHLAH060-12		Austria	Carinthia		Reinegg, Magerrasen
Apatema	*confluellum*	CILEP013-19	0013PF	Spain	Canary Islands	Tenerife	Playa Paraíso
Apatema	*confluellum*	CILEP014-19	0014PF	Spain	Canary Islands	Tenerife	Adeje, Tenerife
Apatema	*confluellum*	CILEP015-19	0015PF	Spain	Canary Islands	Tenerife	Los Gigantes
Apatema	*minimum*	CILEP024-19	0024PF	Spain	Canary Islands	Fuerteventura	Betancuria
Apatema	*minimum*	CILEP312-19	0313PF	Spain	Canary Islands	Lanzarote	Tabayesco
Apatema	*minimum*	CILEP608-20	0609PF	Spain	Canary Islands	Lanzarote	Tabayesco
Apatema	*minimum*	CILEP673-20	0674PF	Spain	Canary Islands	Lanzarote	Tabayesco

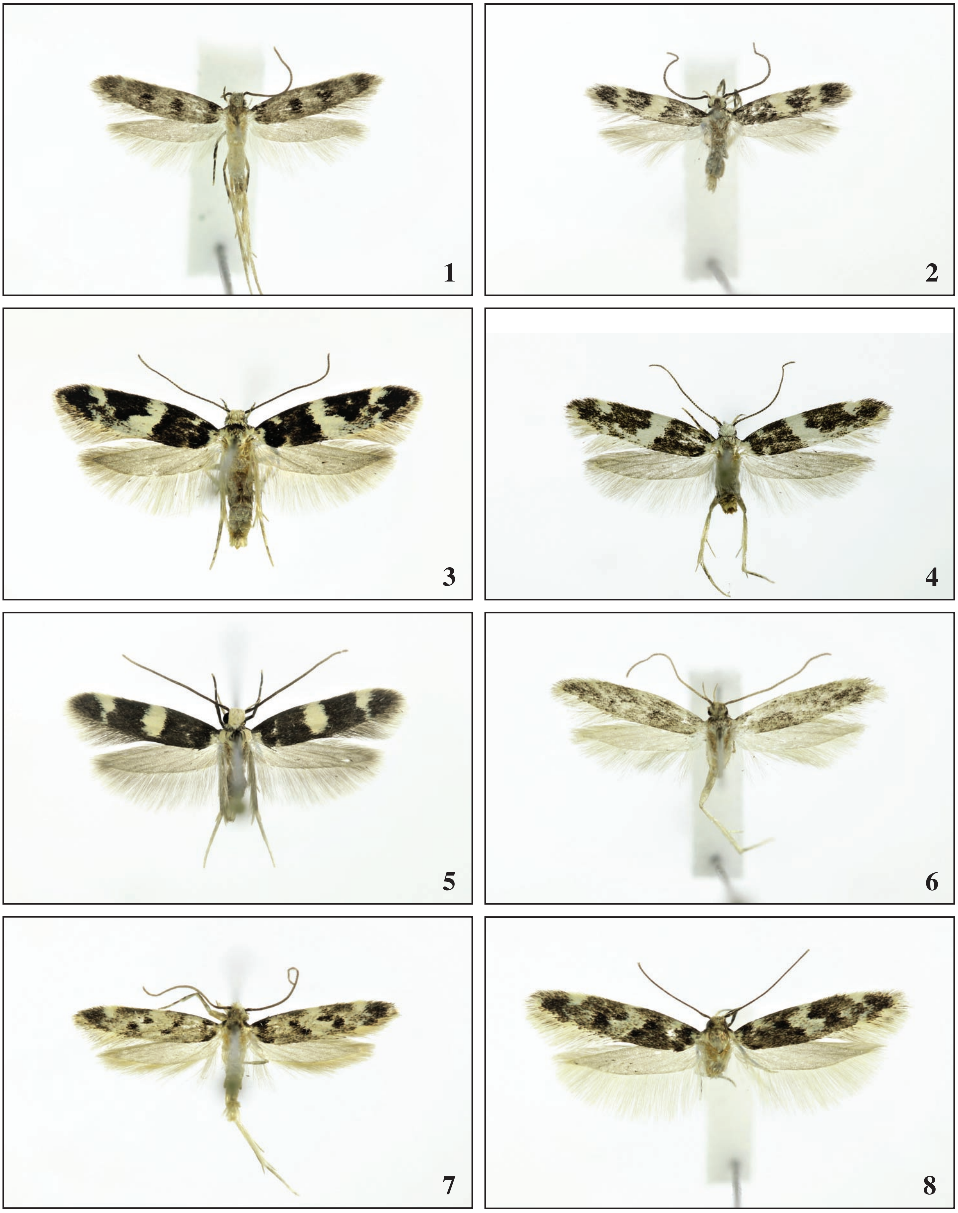
Apatema	*minimum*	CILEP674-20	0675PF	Spain	Canary Islands	Lanzarote	El Bosquecillo
Apatema	*lapalmae*	CILEP134-19	0135PF	Spain	Canary Islands	La Palma	La Galga
Apatema	*lapalmae*	CILEP135-19	0136PF	Spain	Canary Islands	La Palma	La Galga
Apatema	*helleri*	CILEP010-19	0010PF	Spain	Canary Islands	Gran Canaria	Los Tilos de Moya
Apatema	*helleri*	CILEP011-19	0011PF	Spain	Canary Islands	Gran Canaria	Los Tilos de Moya
Apatema	*sallyae*	CILEP022-19	0022PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*sallyae*	CILEP023-19	0023PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*lanzarotae*	CILEP314-19	0315PF	Spain	Canary Islands	Lanzarote	Mojón Blanco
Apatema	*lanzarotae*	CILEP325-19	0326PF	Spain	Canary Islands	Lanzarote	Mojón Blanco
Apatema	*mixtum*	CILEP019-19	0019PF	Spain	Canary Islands	Tenerife	Las Manchas
Apatema	*mixtum*	CILEP119-19	0120PF	Spain	Canary Islands	Tenerife	Arona
Apatema	*mixtum*	CILEP120-19	0121PF	Spain	Canary Islands	Tenerife	Arona
Apatema	*mixtum*	CILEP122-19	0123PF	Spain	Canary Islands	Tenerife	Arona
Apatema	*mixtum*	CILEP131-19	0132PF	Spain	Canary Islands	Tenerife	Armeñime
Apatema	*mixtum*	CILEP133-19	0134PF	Spain	Canary Islands	Tenerife	Arona
Apatema	*fasciata*	CILEP020-19	0020PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*fasciata*	CILEP021-19	0021PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*fasciata*	CILEP118-19	0119PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*fasciata*	CILEP125-19	0126PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*fasciata*	CILEP129-19	0130PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*fasciata*	CILEP132-19	0133PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*fasciata*	CILEP200-19	0201PF	Spain	Canary Islands	Fuerteventura	Betancuria
Apatema	*fasciata*	CILEP201-19	0202PF	Spain	Canary Islands	Fuerteventura	Betancuria
Apatema	*fasciata*	CILEP313-19	0314PF	Spain	Canary Islands	Lanzarote	Tabayesco
Apatema	*coarctella*	CILEP128-19	0129PF	Spain	Canary Islands	Tenerife	Armeñime
Apatema	*coarctella*	CILEP155-19	0156PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*coarctella*	CILEP156-19	0157PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*coarctella*	CILEP194-19	0195PF	Spain	Canary Islands	Tenerife	Armeñime
Apatema	*coarctella*	CILEP195-19	0196PF	Spain	Canary Islands	Tenerife	Armeñime
Apatema	*coarctella*	CILEP196-19	0197PF	Spain	Canary Islands	Tenerife	Armeñime
Apatema	*coarctella*	CILEP197-19	0198PF	Spain	Canary Islands	Fuerteventura	Caldereta
Apatema	*coarctella*	CILEP198-19	0199PF	Spain	Canary Islands	Fuerteventura	Caldereta
Apatema	*coarctella*	CILEP199-19	0200PF	Spain	Canary Islands	Fuerteventura	Caldereta
Apatema	*coarctella*	CILEP202-19	0203PF	Spain	Canary Islands	La Palma	Los Cancajos

Apatema	*coarctella*	CILEP203-19	0204PF	Spain	Canary Islands	La Palma	Los Cancajos
Apatema	*coarctella*	CILEP207-19	0208PF	Spain	Canary Islands	Tenerife	El Médano
Apatema	*coarctella*	CILEP211-19	0212PF	Spain	Canary Islands	Tenerife	Erjos
Apatema	*coarctella*	CILEP606-20	0607PF	Spain	Canary Islands	Lanzarote	Puerto del Carmen
Apatema	*coarctella*	CILEP607-20	0608PF	Spain	Canary Islands	Lanzarote	Puerto del Carmen
Apatema	*junnilaineni*	CILEP114-19	0115PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*junnilaineni*	CILEP115-19	0116PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*pseudolucidum*	CILEP116-19	0117PF	Spain	Canary Islands	Gran Canaria	Los Tilos de Moya
Apatema	*griseum*	CILEP111-19	0112PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*griseum*	CILEP112-19	0113PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*griseum*	CILEP113-19	0114PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*lucidum*	CILEP127-19	0128PF	Spain	Canary Islands	Tenerife	Taucho
Apatema	*lucidum*	CILEP204-19	0205PF	Spain	Canary Islands	Tenerife	Aguamansa
Apatema	*lucidum*	CILEP205-19	0206PF	Spain	Canary Islands	Tenerife	Aguamansa
Apatema	*lucidum*	CILEP206-19	0207PF	Spain	Canary Islands	Tenerife	Aguamansa
Apatema	*grancanariae*	CILEP121-19	0122PF	Spain	Canary Islands	Gran Canaria	Ayacata
Apatema	*grancanariae*	CILEP123-19	0124PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*grancanariae*	CILEP124-19	0125PF	Spain	Canary Islands	Gran Canaria	Ayacata
Apatema	*grancanariae*	CILEP126-19	0127PF	Spain	Canary Islands	Gran Canaria	Ayacata
Apatema	*grancanariae*	CILEP191-19	0192PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*grancanariae*	CILEP192-19	0193PF	Spain	Canary Islands	Gran Canaria	Guayadeque
Apatema	*brunneum*	CILEP315-19	0316PF	Spain	Canary Islands	Tenerife	Aguamansa
Apatema	*brunneum*	CILEP316-19	0317PF	Spain	Canary Islands	Tenerife	Aguamansa
Apatema	*brunneum*	CILEP317-19	0318PF	Spain	Canary Islands	Tenerife	Aguamansa
Apatema	*brunneum*	CILEP318-19	0319PF	Spain	Canary Islands	Tenerife	Las Mercedes
Apatema	*transversum*	CILEP016-19	0016PF	Spain	Canary Islands	Gran Canaria	Barranquillo Andrés
Apatema	*transversum*	CILEP017-19	0017PF	Spain	Canary Islands	Gran Canaria	Pie de la Cuesta
Apatema	*transversum*	CILEP018-19	0018PF	Spain	Canary Islands	Gran Canaria	Barranquillo Andrés
Apatema	*transversum*	CILEP117-19	0118PF	Spain	Canary Islands	Tenerife	Arona
Apatema	*stadeli*	CILEP012-19	0012PF	Spain	Canary Islands	Tenerife	Arona
Apatema	*stadeli*	CILEP208-19	0209PF	Spain	Canary Islands	Tenerife	Arona
Apatema	*stadeli*	CILEP209-19	0210PF	Spain	Canary Islands	Tenerife	Arona
Apatema	*stadeli*	CILEP210-19	0211PF	Spain	Canary Islands	Tenerife	Arona
Apatema	*skulei*	CILEP666-20	0667PF	Spain	Canary Islands	Gran Canaria	Carretería

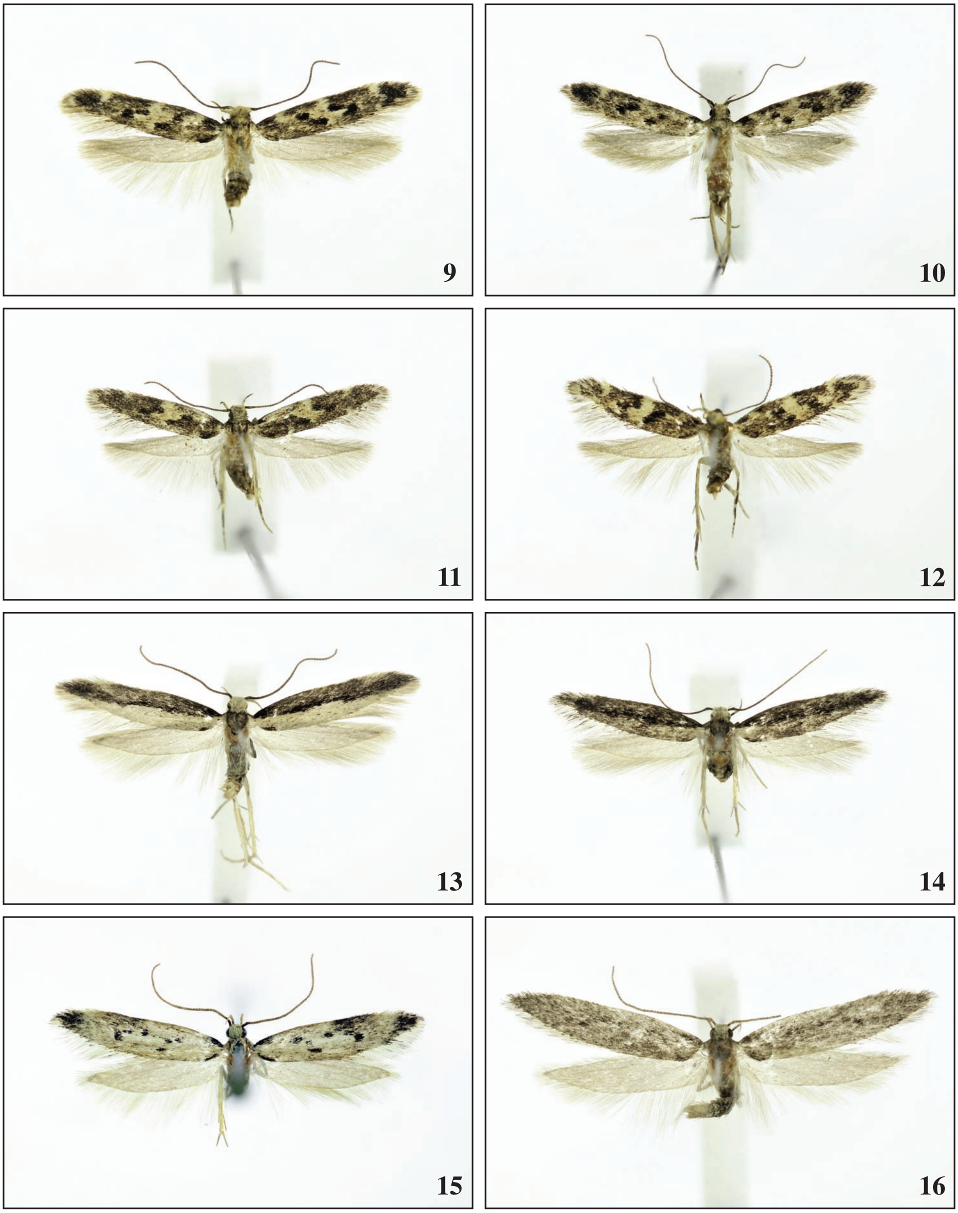
Apatema	*skulei*	CILEP667-20	0668PF	Spain	Canary Islands	Gran Canaria	Carretería
Apatema	*skulei*	CILEP668-20	0669PF	Spain	Canary Islands	Gran Canaria	Carretería
Apatema	*skulei*	CILEP669-20	0670PF	Spain	Canary Islands	Gran Canaria	Carretería
Apatema	*skulei*	CILEP670-20	0671PF	Spain	Canary Islands	Gran Canaria	Carretería
Apatema	*skulei*	CILEP671-20	0672PF	Spain	Canary Islands	Gran Canaria	Carretería
Apatema	*skulei*	CILEP672-20	0673PF	Spain	Canary Islands	Gran Canaria	Carretería

Table 2.– Average uncorrected p distance within and between all species of *Apatema* in the Canary Islands as described in the text.

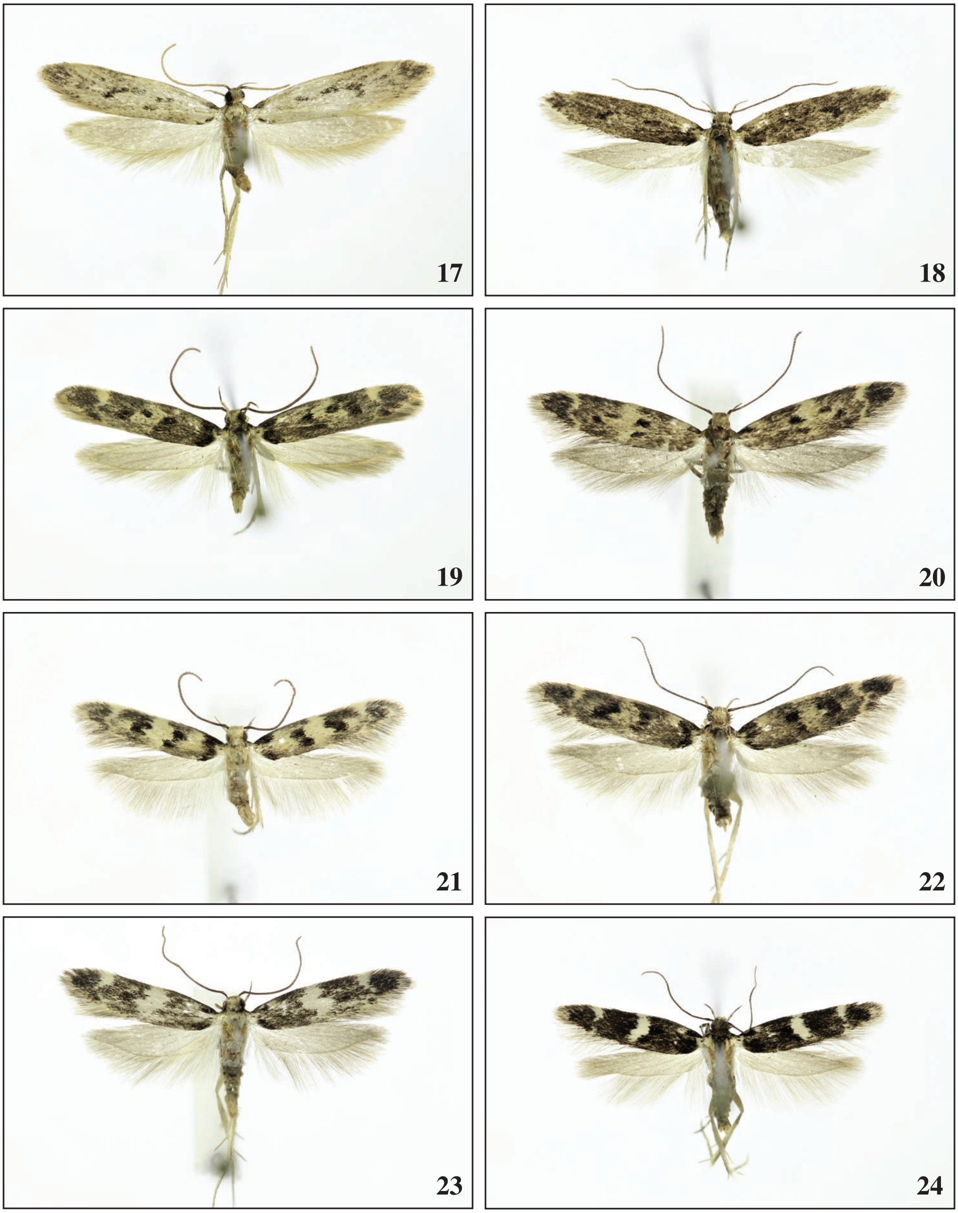
	fasciata	*sallyae*	*mixtum*	*lucidum*	*lapalmae*	*helleri*	*conflue.*	*junni.*	*brunn.*	*tranver.*	*stadeli*	*griseum*	*pseudo.*	*minimum*	*granca.*	*lanzar.*	*coarc.*	*skulei*
fasciata	0.0165																	
sallyae	0.0960	0.0000																
mixtum	0.0909	0.0838	0.0010															
lucidum	0.0919	0.0774	0.0985	0.0031														
lapalmae	0.0954	0.0741	0.0676	0.0722	0.0049													
helleri	0.0993	0.0744	0.0894	0.0927	0.0563	0.0031												
confluellum	0.1207	0.0928	0.1119	0.1061	0.0971	0.0984	0.0061											
junnilaineni	0.0897	0.0852	0.0802	0.0738	0.0802	0.0902	0.1035	0.0019										
brunneum	0.0798	0.0798	0.0937	0.0600	0.0720	0.0883	0.1106	0.0784	0.0015									
tranversum	0.0894	0.0777	0.0714	0.0615	0.0679	0.0746	0.1138	0.0704	0.0686	0.0055								
stadeli	0.0804	0.0830	0.0950	0.0677	0.0708	0.0816	0.1161	0.0738	0.0608	0.0456	0.0015							
griseum	0.0967	0.0895	0.0928	0.0612	0.0770	0.0902	0.1057	0.0671	0.0712	0.0768	0.0805	0.0000						
pseudolucidum	0.1108	0.0967	0.0922	0.0714	0.0793	0.0815	0.0935	0.0729	0.0846	0.0744	0.0798	0.0321	n/a					
minimum	0.1270	0.1208	0.1247	0.1309	0.1264	0.1316	0.0986	0.1290	0.1080	0.1307	0.1294	0.1335	0.1284	0.0317				
grancanariae	0.0875	0.0753	0.0992	0.0504	0.0767	0.0913	0.1078	0.0827	0.0677	0.0766	0.0695	0.0737	0.0754	0.1352	0.0233			
lanzarotae	0.1196	0.0867	0.1022	0.0850	0.0801	0.0982	0.1145	0.1056	0.0948	0.0946	0.0942	0.1062	0.1079	0.1316	0.0981	0.0030		
coarctella	0.0845	0.0762	0.0777	0.0662	0.0597	0.0728	0.1058	0.0749	0.0698	0.0653	0.0641	0.0816	0.0806	0.1255	0.0710	0.0834	0.0334	
skulei	0.0934	0.0741	0.0907	0.0664	0.0640	0.0801	0.0998	0.0812	0.0694	0.0456	0.0463	0.0698	0.0683	0.1324	0.0742	0.0830	0.0713	0.0042



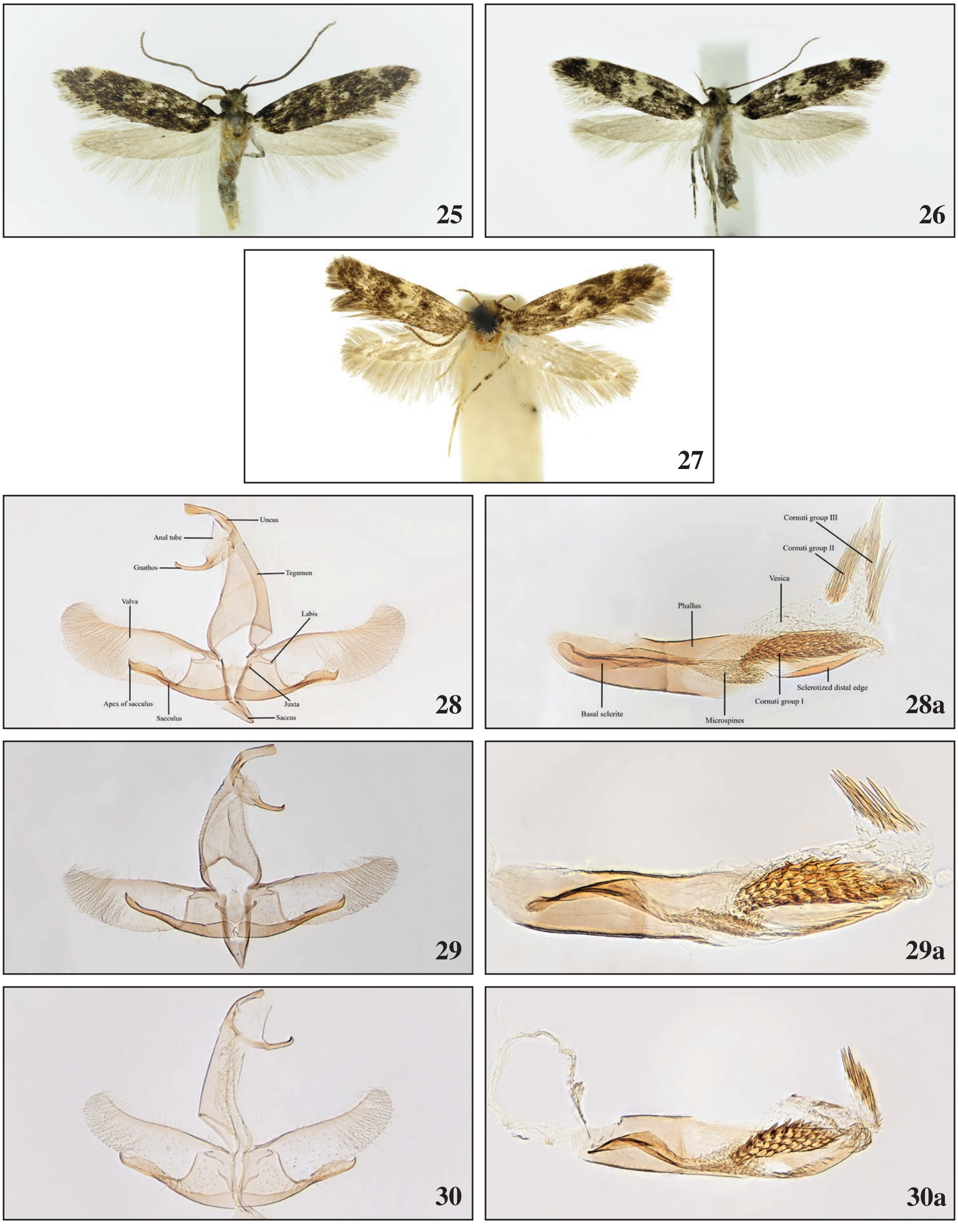
Figs 1-8.– 1. *Apatema confluellum* Falck & Karsholt, sp. n., ♂, Tenerife, 9 mm. **2.** *Apatema minimum* Falck & Karsholt, sp. n., ♂, Lanzarote, 7 mm. **3.** *Apatema lapalmae* Falck & Karsholt, sp. n., ♀, La Palma, 14 mm. **4.** *Apatema helleri* (Rebel, 1910), ♂, Gran Canaria, 14 mm. **5.** *Apatema sallyae* Falck & Karsholt, sp. n., ♂, Gran Canaria, 12 mm. **6.** *Apatema lanzarotae* Falck & Karsholt, sp. n., ♂, Lanzarote, 11 mm. **7.** *Apatema mixtum* Falck & Karsholt, sp. n., ♂, Tenerife, 12 mm. **8.** *Apatema mixtum* Falck & Karsholt, sp. n., ♀, Tenerife, 15.5 mm.



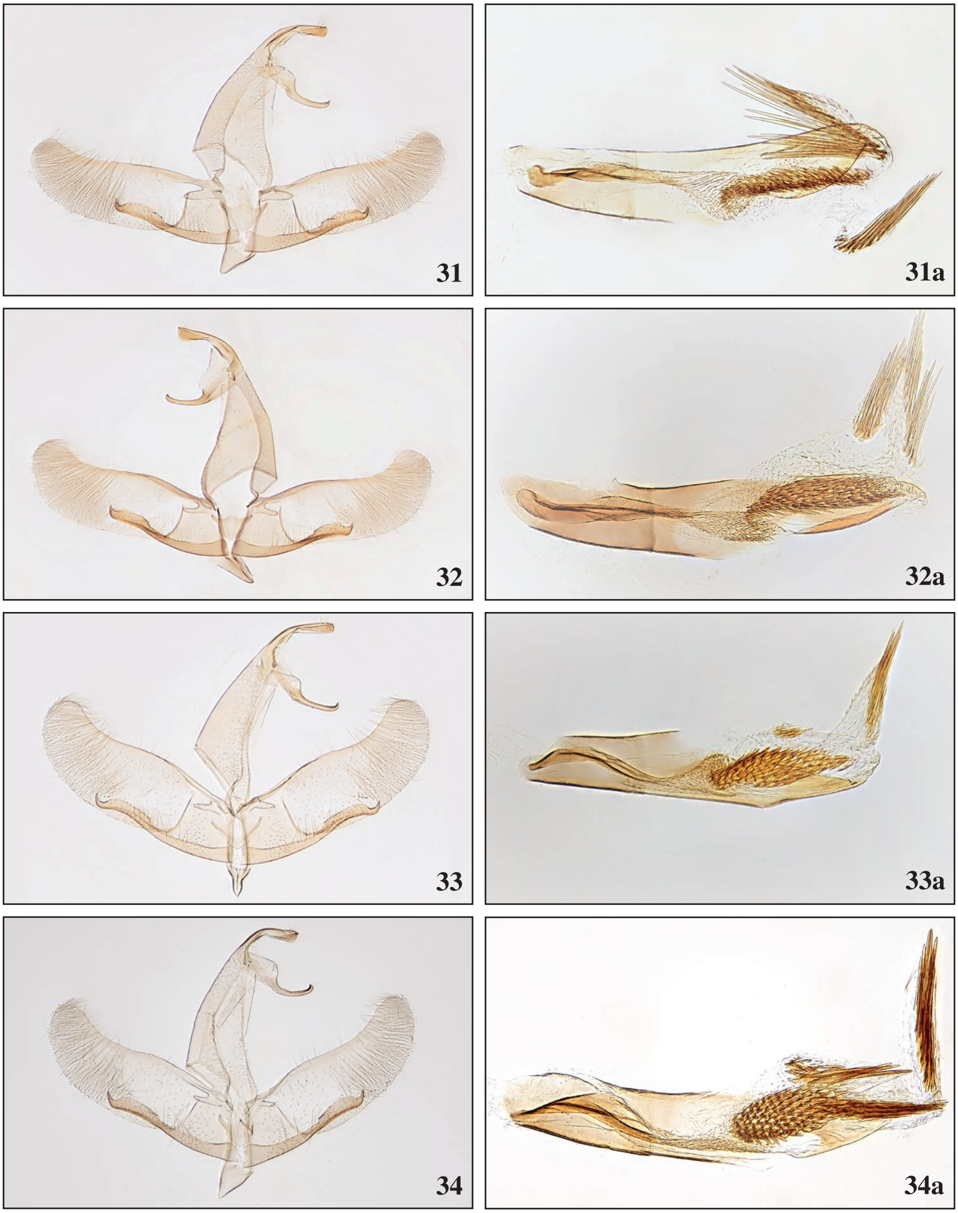
Figs 9-16.– 9. *Apatema fasciata* (Stainton, 1859), ♀, Gran Canaria, 11.5 mm. **10.** *Apatema fasciata* (Stainton, 1859), ♀, Fuerteventura, 11 mm. **11.** *Apatema coarctella* (Rebel, 1896), ♀, Tenerife, 9 mm. **12.** *Apatema coarctella* (Rebel, 1896), ♀, Fuerteventura, 8 mm. **13.** *Apatema junnilaineni* Vives, 2001, ♂, Gran Canaria, 14,5 mm. **14.** *Apatema junnilaineni* Vives, 2001, ♀, Gran Canaria, 11 mm. **15.** *Apatema pseudolucidum* Falck & Karsholt, sp. n., ♂, Gran Canaria, 13.5 mm. **16.** *Apatema griseum* Falck & Karsholt, sp. n., ♂, Gran Canaria, 14.5 mm.



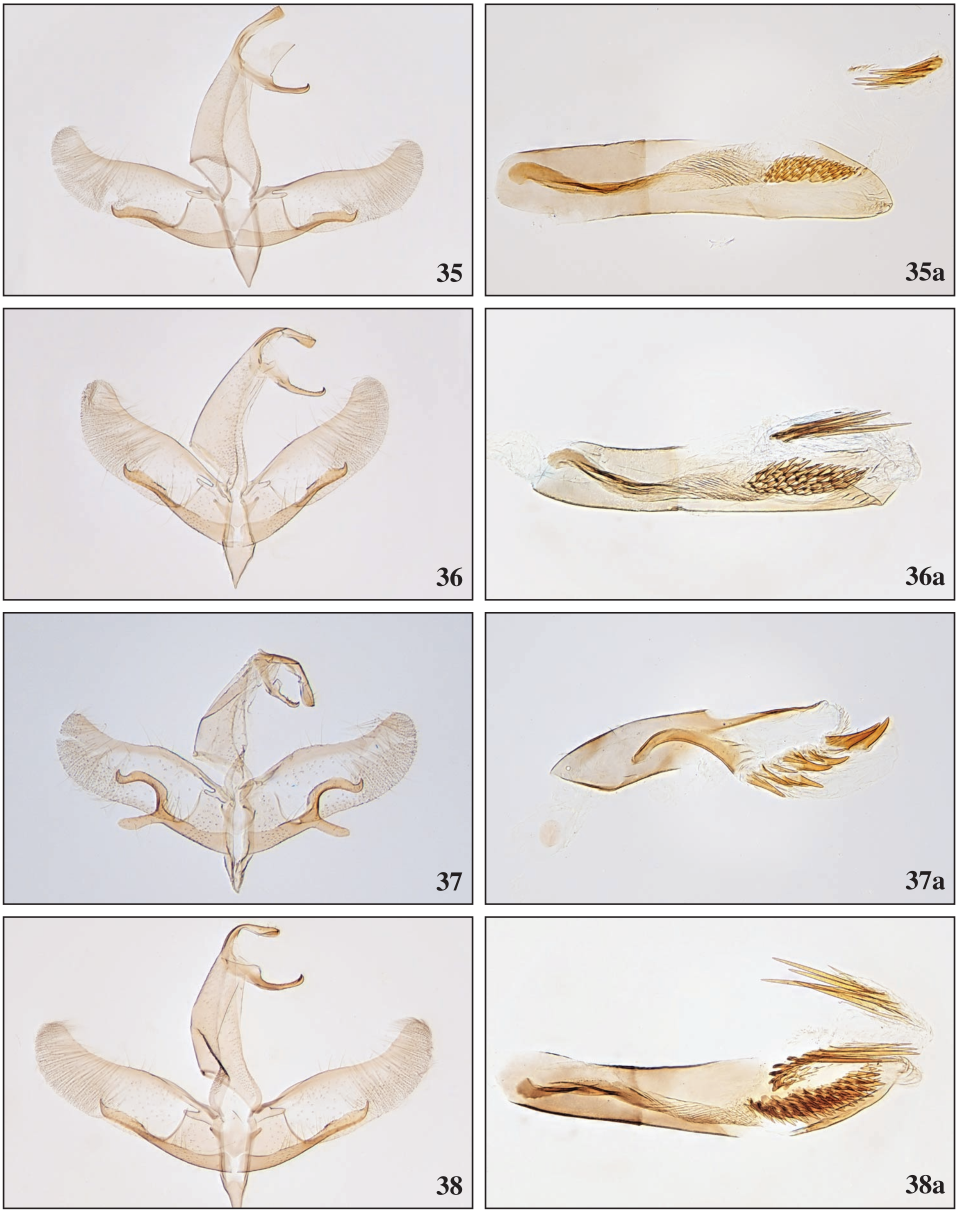
Figs 17-24.– 17. *Apatema lucidum* Walsingham, 1908, ♂, Tenerife, 17 mm. **18.** *Apatema lucidum* Walsingham, 1908, ♀, Tenerife, 14 mm. **19.** *Apatema grancanariae* Falck & Karsholt sp. n., ♂, Gran Canaria, 15 mm. **20.** *Apatema brunneum* Falck & Karsholt, sp. n., ♀, Tenerife, 11.5 mm. **21.** *Apatema transversum* Falck & Karsholt, sp. n., ♂, Gran Canaria, 10 mm. **22.** *Apatema transversum* Falck & Karsholt, sp. n., ♀, Gran Canaria, 12 mm. **23.** *Apatema stadeli* Falck & Karsholt, sp. n., ♂, Tenerife, 12.5 mm. **24.** *Apatema stadeli* Falck & Karsholt, sp. n., ♀, Tenerife, 12 mm.



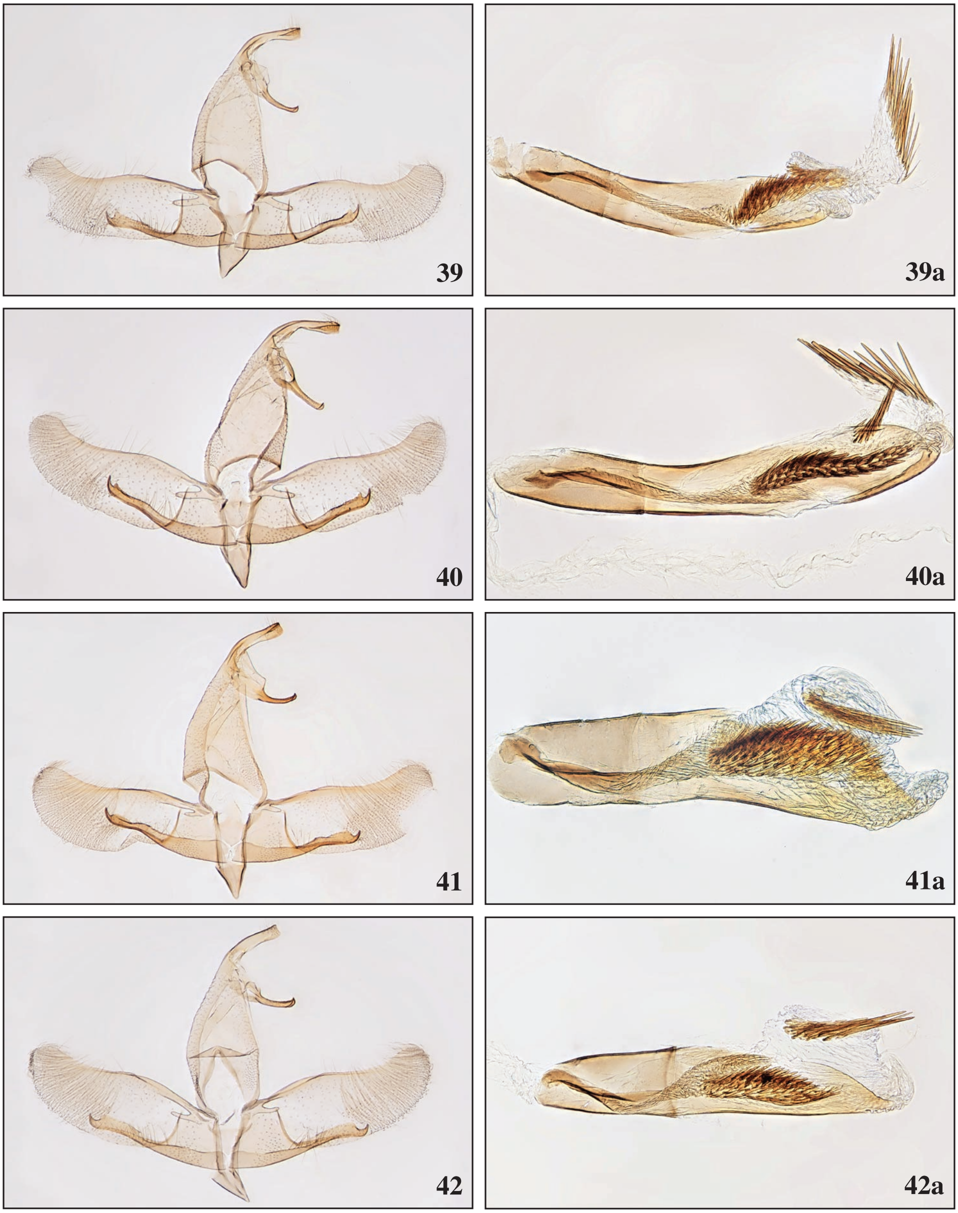
Figs 25-30.– 25. *Apatema skulei* Falck & Karsholt, sp. n., ♂, Gran Canaria, 10.5 mm. **26.** *Apatema skulei* Falck & Karsholt, sp. n., ♀, Gran Canaria, 12 mm. **27.** *Apatema mediopallidum* Walsingham, 1900, ♂, Holotype, Corsica, France, 12 mm. Copyright Trustes of the NHMUK. **28.** Schematic illustration of male genitalia. **28a.** Phallus. **29.** *Apatema confluellum* Falck & Karsholt, sp. n., ♂, Tenerife, GP2792PF. **29a.** Phallus, Tenerife, GP2796PF. **30.** *Apatema minimum* Falck & Karsholt, sp. n., ♂, Lanzarote, GP3197PF. **30a.** Phallus, Lanzarote, GP3197PF.



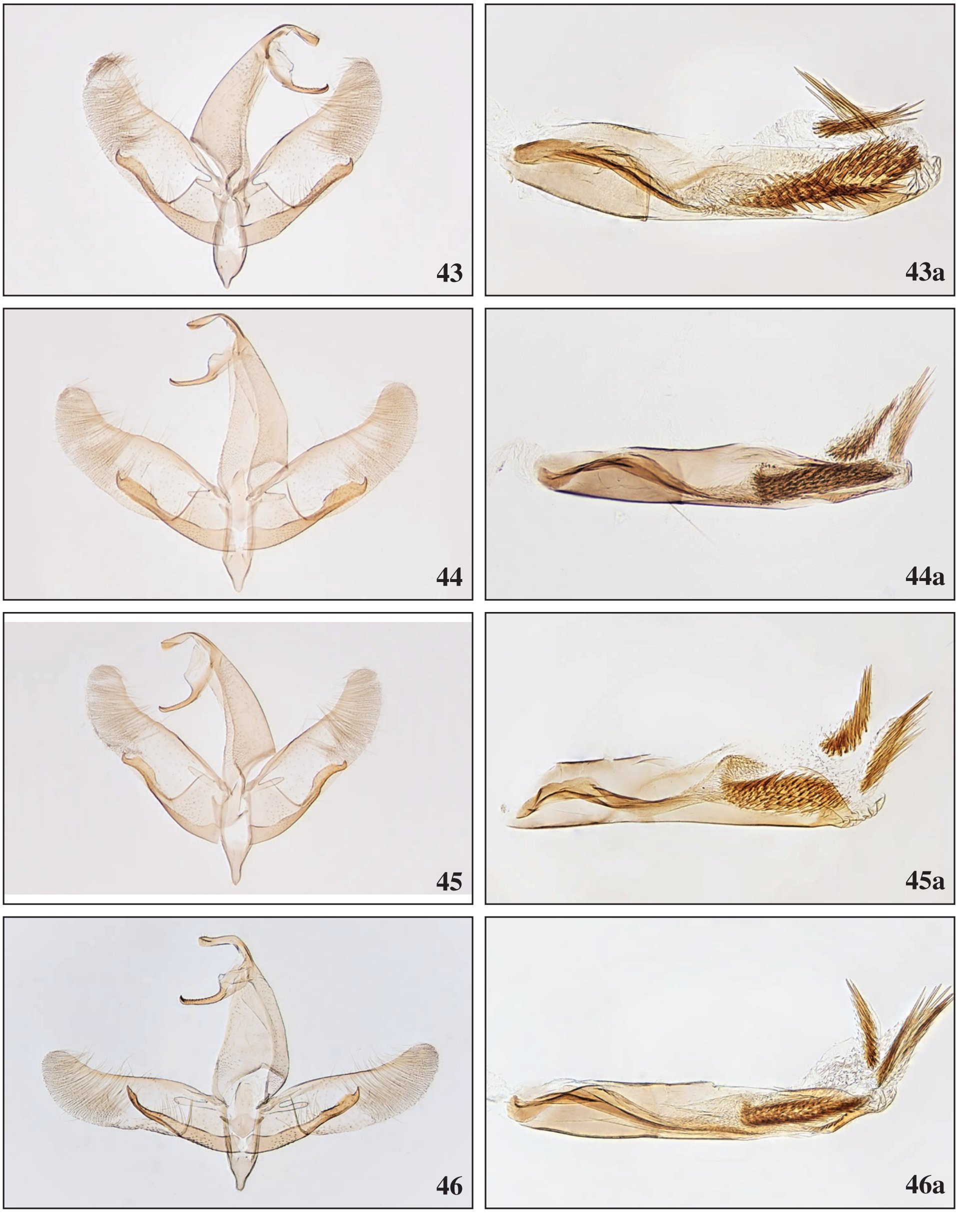
Figs 31-34.– 31. *Apatema lapalmae* Falck & Karsholt, sp. n., ♂, La Palma, GP3205PF. **31a.** Phallus, La Palma, GP3205PF. **32.** *Apatema helleri* (Rebel, 1910), ♂, Gran Canaria, GP2779PF. **32a.** Phallus, Gran Canaria, GP2779PF. **33.** *Apatema sallyae* Falck & Karsholt, sp. n., ♂, Gran Canaria, GP3206PF. **33a.** Phallus, Gran Canaria, GP2777PF. **34.** *Apatema lanzarotae* Falck & Karsholt, sp. n., ♂, Lanzarote, GP3220PF. **34a.** Phallus, Lanzarote, GP3221PF.



Figs 35-38.– 35. *Apatema mixtum* Falck & Karsholt, sp. n., ♂, Tenerife, GP2793PF. **35a.** Phallus, Tenerife, GP2793PF. **36.** *Apatema fasciata* (Stainton, 1859), ♂, Gran Canaria, GP3195PF. **36a.** Phallus, Gran Canaria, GP3211PF. **37.** *Apatema coarctella* (Rebel, 1896), ♂, Tenerife, GP3213PF. **37a.** Phallus, Tenerife, GP2775PF. **38.** *Apatema junnilaineni* Vives, 2001, ♂, Gran Canaria, GP2778PF. **38a.** Phallus, Gran Canaria, GP2778PF.



Figs 39-42.– 39. *Apatema pseudolucidum* Falck & Karsholt, sp. n., ♂, Gran Canaria, GP3203PF. **39a.** Phallus, Gran Canaria, GP3203PF. **40.** *Apatema griseum* Falck & Karsholt, sp. n., ♂, Gran Canaria, GP3189PF. **40a.** Phallus, Gran Canaria, GP3189PF. **41.** *Apatema lucidum* Walsingham, 1908, ♂, Tenerife, GP3185PF. **41a.** Phallus, Tenerife, GP3354PF. **42.** *Apatema grancanariae* Falck & Karsholt, sp. n., ♂, Gran Canaria, GP3201PF. **42a.** Phallus, Gran Canaria, GP3201PF.



Figs 43-46.– 43. *Apatema brunneum* Falck & Karsholt, sp. n., ♂, Tenerife, GP3178PF. **43a.** Phallus, Tenerife, GP3179PF. **44.** *Apatema transversum* Falck & Karsholt, sp. n., ♂, Gran Canaria, GP2789PF. **44a.** Phallus, Gran Canaria, GP2783PF. **45.** *Apatema stadeli* Falck & Karsholt, sp. n., ♂, Tenerife, GP2780aPF. **45a.** Phallus, Tenerife, GP2780PF. **46.** *Apatema skulei* Falck & Karsholt, sp. n., ♂, Gran Canaria, GP3389PF. **46a.** Phallus, Gran Canaria, GP3388PF.

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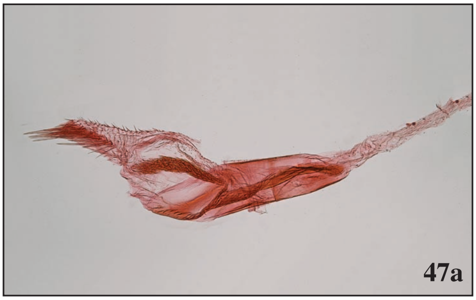
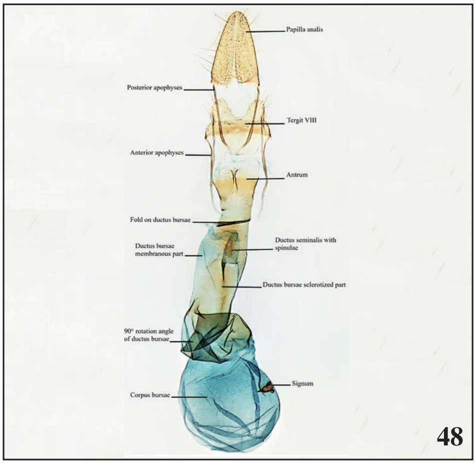


47a



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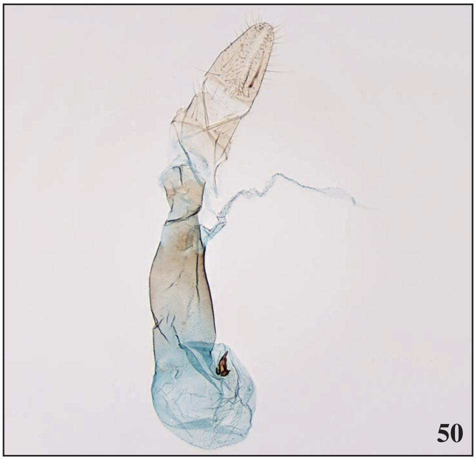

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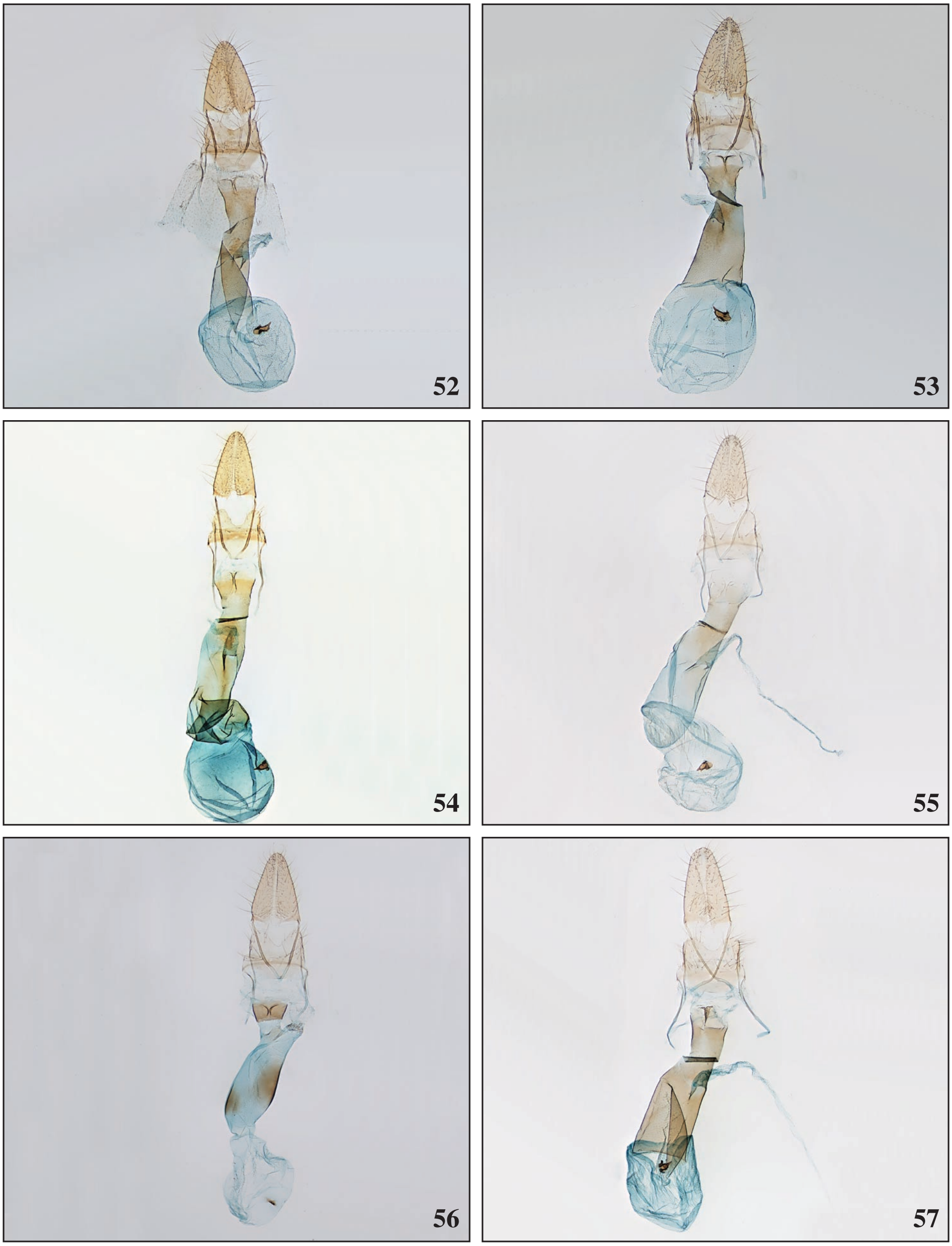
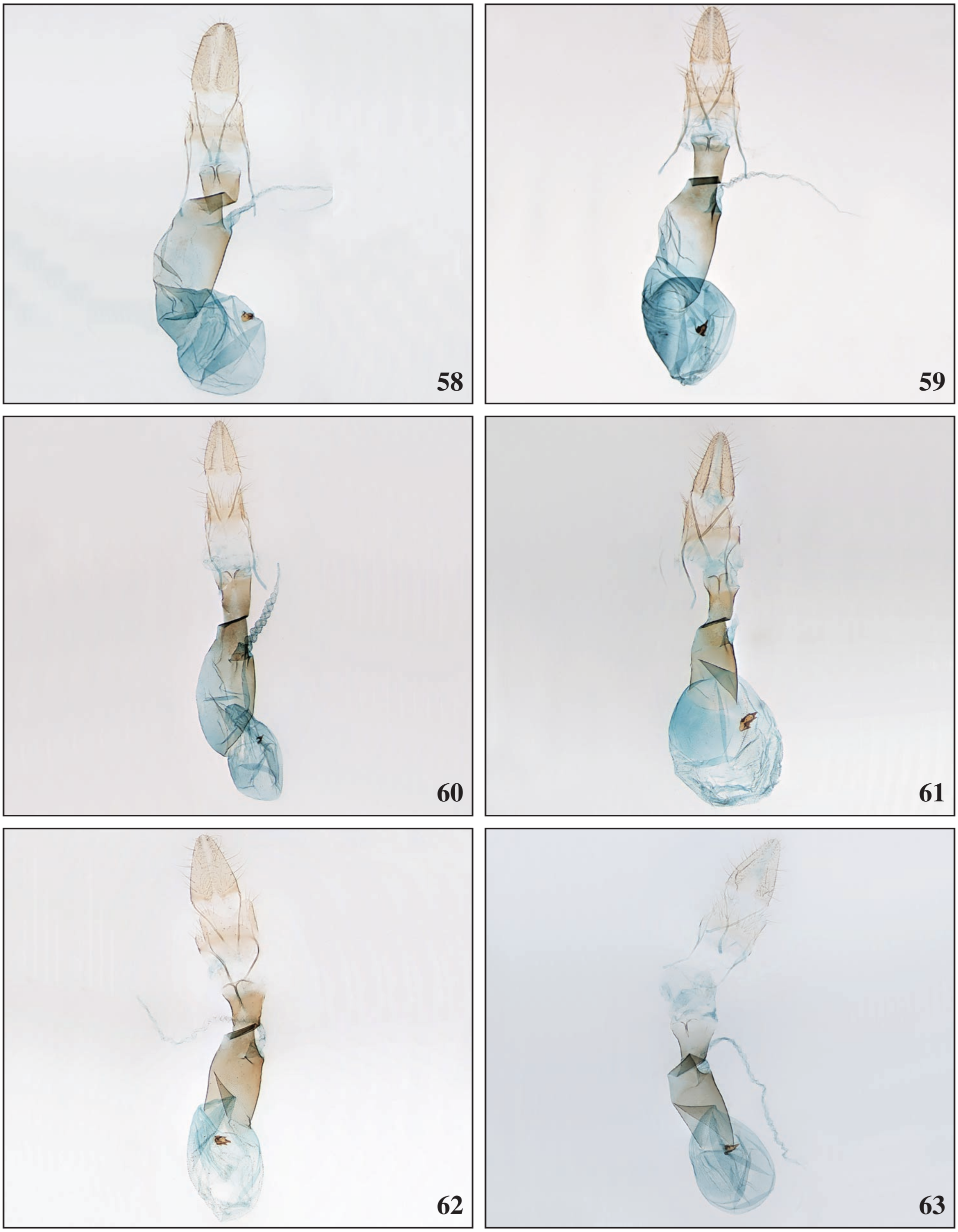
Figs 47-51.– 47. *Apatema mediopallidum* Walsingham, 1900, ♂, Holotype, Corsica, France, no. 13944. Copyright Trustes of the NHMUK. **47a.** Phallus, Corsica, France, no. 13944. **48.** Schematic illustration of female *Apatema* genitalia. **49.** *Apatema confluellum* Falck & Karsholt, sp. n., ♀, Tenerife, GP2794PF. **50.** *Apatema minimum* Falck & Karsholt, sp. n., ♀, Lanzarote, GP3196PF. **51.** *Apatema lapalmae* Falck & Karsholt, sp. n., ♀, La Palma, GP3204PF.



Figs 52-57.– 52. *Apatema helleri* (Rebel, 1910), ♀, Gran Canaria, GP2812PF. **53.** *Apatema sallyae* Falck & Karsholt, sp. n., ♀, Gran Canaria, GP2813PF. **54.** *Apatema mixtum* Falck & Karsholt, sp. n., ♀, Tenerife, GP2801PF. **55.** *Apatema fasciata* (Stainton, 1859), ♀, Gran Canaria, GP3194PF. **56.** *Apatema coarctella* (Rebel, 1896), ♀, Tenerife, GP3212PF. **57.** *Apatema junnilaineni* Vives, 2001, ♀, Gran Canaria, GP3186PF.



Figs 58-63.– 58. *Apatema lucidum* Walsingham, 1908, ♀, Tenerife, GP3181PF. **59.** *Apatema grancanariae* Falck & Karsholt, sp. n., ♀, Gran Canaria, GP3198PF. **60.** *Apatema brunneum* Falck & Karsholt, sp. n., ♀, Tenerife, GP3177PF. **61.** *Apatema transversum* Falck & Karsholt, sp. n., ♀, Gran Canaria, GP2800PF. **62.** *Apatema stadeli* Falck & Karsholt, sp. n., ♀, Tenerife, GP3356aPF. **63.** *Apatema skulei* Falck & Karsholt, sp. n.,♀, Gran Canaria, GP3205aPF.

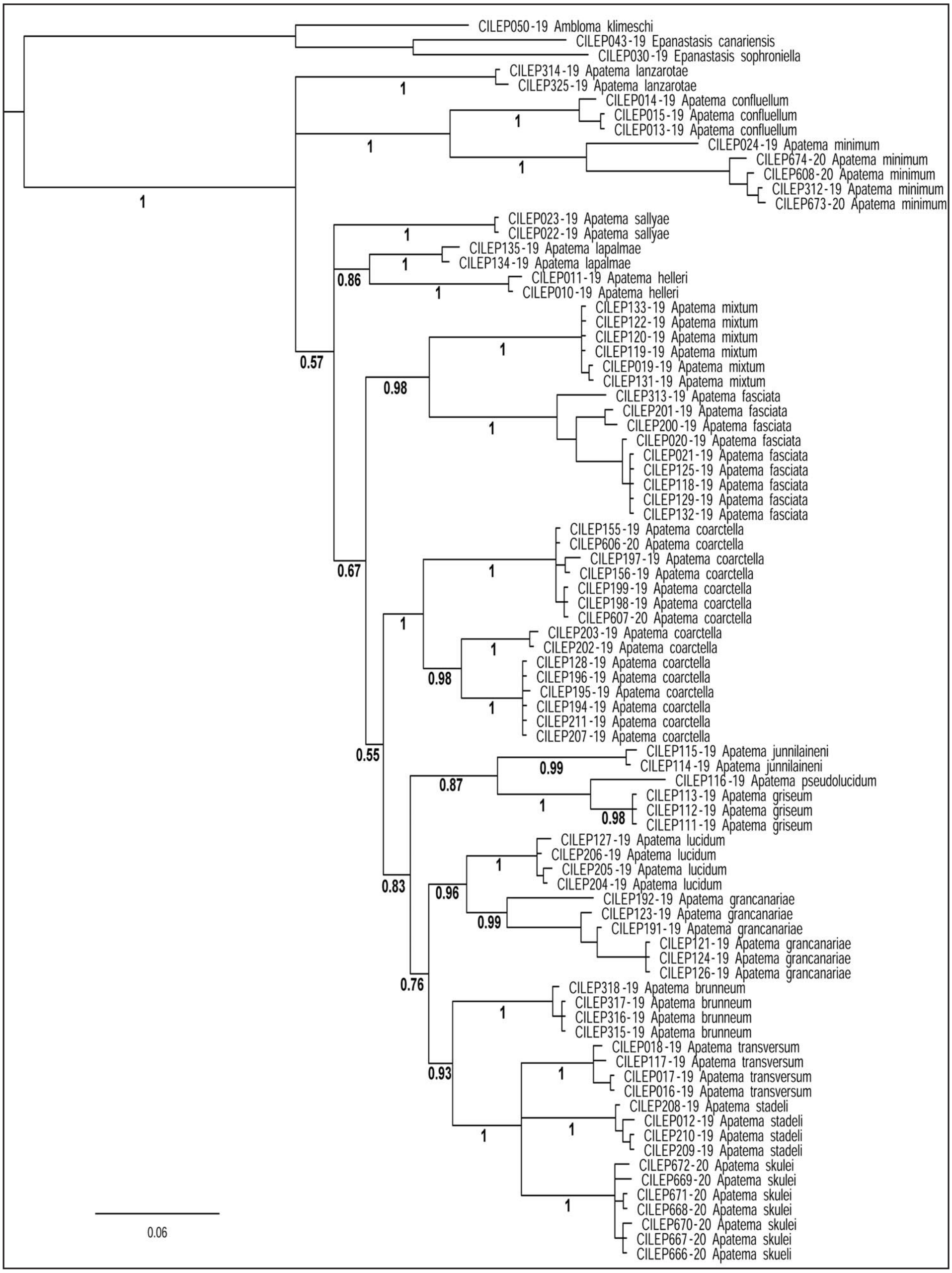


Fig. 64.– Consensus tree from the 10 million generation analysis in MrBayes with 25% burnin of the DNA-barcodes of the *Apatema* species occurring in the Canary Island. Numbers below the branches are posterior probability values.

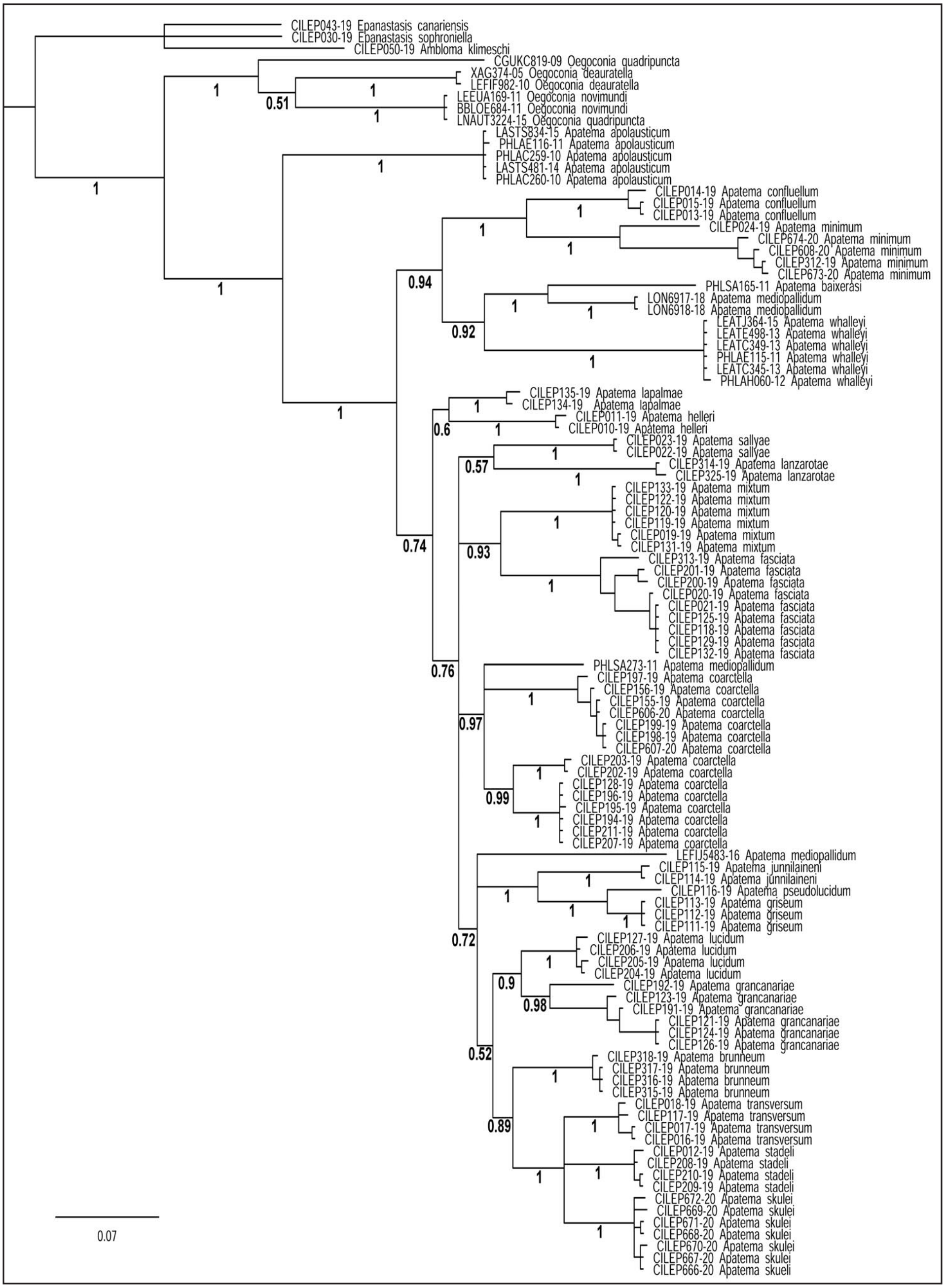


Fig. 65.– Consensus tree from the 20 million generation analysis in MrBayes with 25% burnin of all available DNA-barcodes of *Apatema* species. Numbers below the branches are posterior probability values.

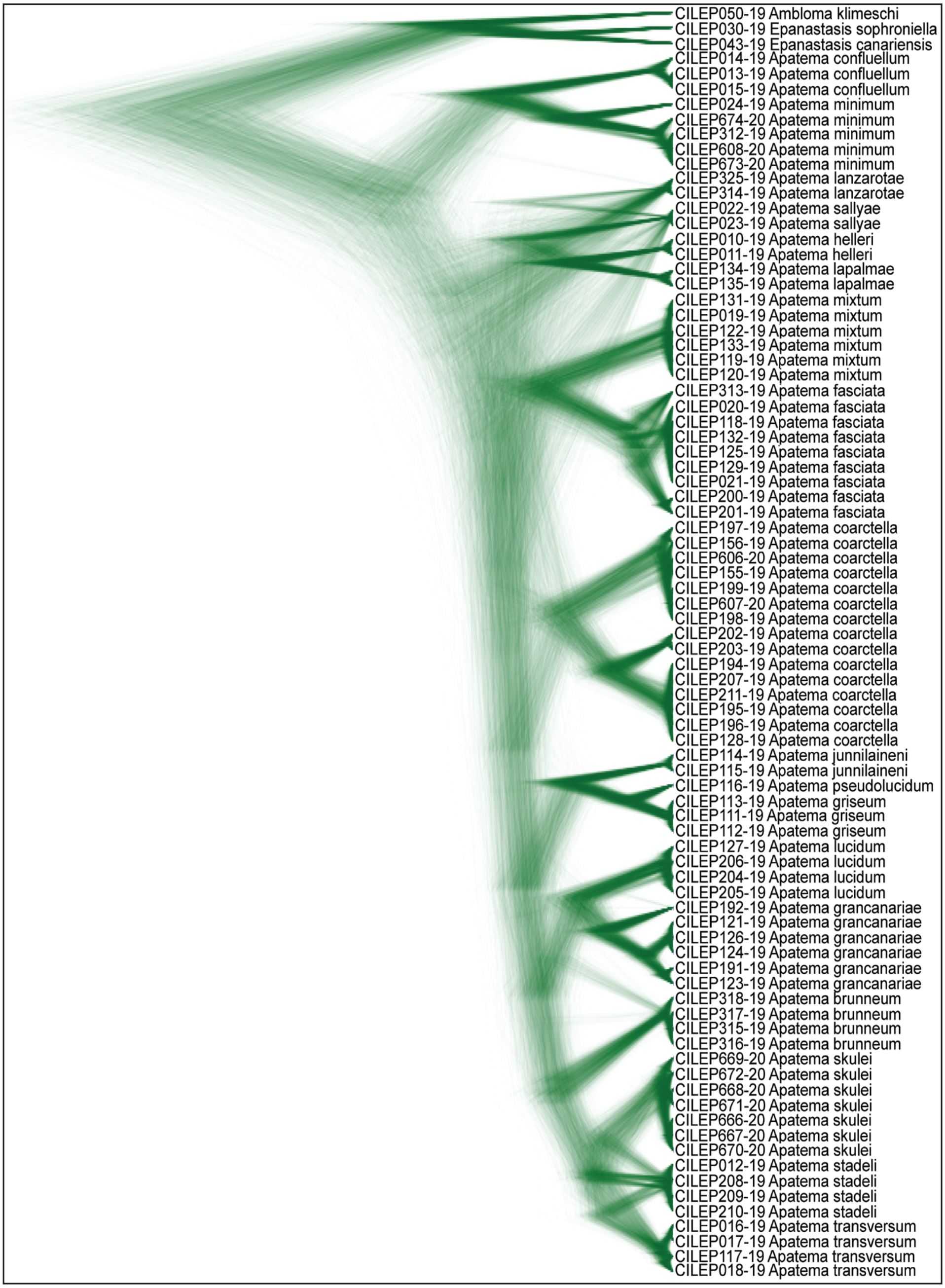


Fig. 66.– DensiTree rendering of the 10 million generation analysis in BEAST with 25% burnin of the DNA-barcodes of the *Apatema* species occurring in the Canary Island.

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Application of time-lapse camera situated near a light source, for registration insects' rhythm of attraction to light (Lepidoptera: Noctuidae)

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G. Furman, A. Poltavsky (†), M. Traore, G. Petrány,
R. V. Yakovlev & G. Müller

Abstract

Camera traps are an efficient means of biodiversity assessments, however, the employment of camera traps for the study of insects is still in its beginning. Accurate counting and recognition of flying insects are also of great importance in pest control. In this paper, we present a new method combining a time-lapse camera, and a light source, designed to estimate macro-Lepidoptera species composition, occurrence and also daily rhythms of their attraction to light. The advantage of the system is that it enables to monitor the species assemblages distantly. The rhythms to light attraction discussed for six Noctuidae species.
KEY WORDS: Lepidoptera, Noctuidae, camera trap, Israel.

Aplicación de las cámaras trampa de tiempo situadas cerca de un recurso luminoso, para el registro del ritmo de atracción a la luz de los insectos (Lepidoptera: Noctuidae)

Resumen

Las cámaras trampa son un medio eficiente para la valoración de la biodiversidad, sin embargo, el empleo de las cámaras trampa, para el estudio de los insectos, todavía está en su comienzo. Contar los insectos voladores y su reconocimiento exacto, son también de gran importancia para el control de plagas. En este trabajo, presentamos un nuevo método que combina el tiempo obtenido con la cámara y una luz, diseñado para calcular la composición de especies macro-Lepidoptera, la presencia y también los ritmos diarios de su atracción a la luz. La ventaja del sistema es que permite el monitoreo del agrupamiento de especies a distancia. Se discuten los ritmos de la atracción a la luz para seis especies de Noctuidae.
PALABRAS CLAVE: Lepidoptera, Noctuidae, camera trampa, Israel.

Introduction

There is evidence that insect populations worlds-wide are suffering declines (SANCHEZ-BAYO & WYCKHUYSBCD, 2019). The reasons are still poorly understood but climate change and human activity had been implicated as drivers. Due to this, there is increasing need for monitoring the dynamics of insect populations and its interactions with environmental factors. Manual data collection is limited because it requires costly expert manual labor and it is limited in space and time.

Modern photographic equipment allows researchers access into wildlife habitats using cameras. Camera traps are an efficient means of conducting species inventories, biodiversity assessments, estimating site occupancy, and observing behavior (O'BRIEN, 2011). Recent attempts to use remote photography for the detecting the presence of rare species or ones that are presumed extinct are particularly valuable (KUCERA *et al.,* 2011).

Scientific use of camera traps had increased notably over the past several years (NICHOLS *et al.*, 2011) including studies on carnivores, birds, reptiles, and amphibians (MEEK *et al.,* 2014). However, employment of camera traps for the study of insects is still in its naissance and attempts were made with various setups. One example comes from a study aimed to monitor the biodiversity of various insect groups in the Netherlands and used a camera directed to a vertical white screen (HOGEWEG *et al*., 2019a; HOGEWEG *et al*., 2019b). COLLETT & FISHER (2017) offered to replace pitfall trapping for monitoring small leaf litter arthropods with a short focal distance vertically placed time-lapse camera. In addition, time interval photography of yellow sticky screens (known as "yellow traps") had also been suggested for insect monitoring and biodiversity estimation (ZHONG *et al*., 2018). MARTIN *at al.* (2008) offered to photograph the surface of yellow traps to assisting the early detection of pests the greenhouses. A few commercial applications for monitoring pests in agriculture have also been developed. The commercial "Trapview" system is based on photographing insect trapped on sticky pheromone traps, which allows monitoring of specific pests in the field in real.

Accurate counting and recognition of flying insects are also of great importance in pest control. Recently, attempts were made to use cameras to track insect pest populations in agriculture (ZHONG *et al*., 2018; MANOUKIS *et al*., 2019). Many insects, including important pests, are night active and show light attraction behavior. Therefore, light traps have been used extensively to obtain information about their occurrence, seasonal dynamics and species assemblages (SZENTKIRÁLYI, 2002; EPSKY *et al*., 2008; JONASON *at al*., 2014). In this paper, we present a new method combining a time-lapse camera, and a light trap, designed to estimate macro-Lepidoptera species composition, occurrence, and daily rhythms in light attraction.

Methods

ELECTRIC DEVICES AND LIGHT TRAP DESIGN

In order to attract insects we used weak light sources, which are considered to have remarkably local moth attraction ranges, resulting in samples that are highly representative of the local habitat (MERCKX & SLADE, 2014). The light source consisted of a 12v 8w fluorescent light tube (30 cm of length) attached vertically to horizontal white plastic screen of 100 x 100sm. (Fig. 1). A Canon EOS 700D camera was situated 50sm above the white screen surface. This camera is equipped with a high-resolution sensor, and a zoom lens, which allows choosing the optimal view area on the screen. During the daytime, the camera was automatically turned off by a light sensor.

STUDY SITES

We recorded light trapped moth abundance in two different localities representing Mediterranean (Tel-Aviv University Botanical and Zoological gardens, Tel Aviv, Israel) and extreme desert (Qetura, the southern Arava desert, Israel) habitats. Recordings were performed during night time on April 5-6, 2019 and November 5-6, 2019, respectively. On both recordings, we selected dates corresponding to new moon, given that under these conditions the moth attraction to the light is largest (NEMFC, 1971). During the recordings at the Mediterranean locality, the times of sunset and sunrise were at 18:20 (April 5, 2019) and 5:00 (April 6, 2019), respectively. Air temperatures at sunset and sunrise measured at 27ºC and 22ºC, respectively. On the desert locality recordings, sunset and sunrise times were 16:30 (November 5, 2019) and 6:00 (November 6, 2019), respectively, with air temperatures measuring at 32ºC and 26ºC at sunset and sunrise, respectively.

MONITORING MACRO-LEPIDOPTERA LIGHT ATTRACTION

In order to obtain temporal data on the moths' attraction to light, we set the light source to turn on and off every 30 minutes. This resulted in insects accumulating on the horizontal screen during the "on" phase and being released during the subsequent "off" phase, enabling to monitor the change in insect light attraction throughout the night.

The camera photographed one frame every 7.5 minutes, during both the on and off phases of the light. To synchronize the operation of the camera and the lamp, a control unit had been developed consisted of a Lm555 timer (Fig. 1), a CD4020B*2 frequency divider, a key to turn on the camera shutter and a lamp control relay.

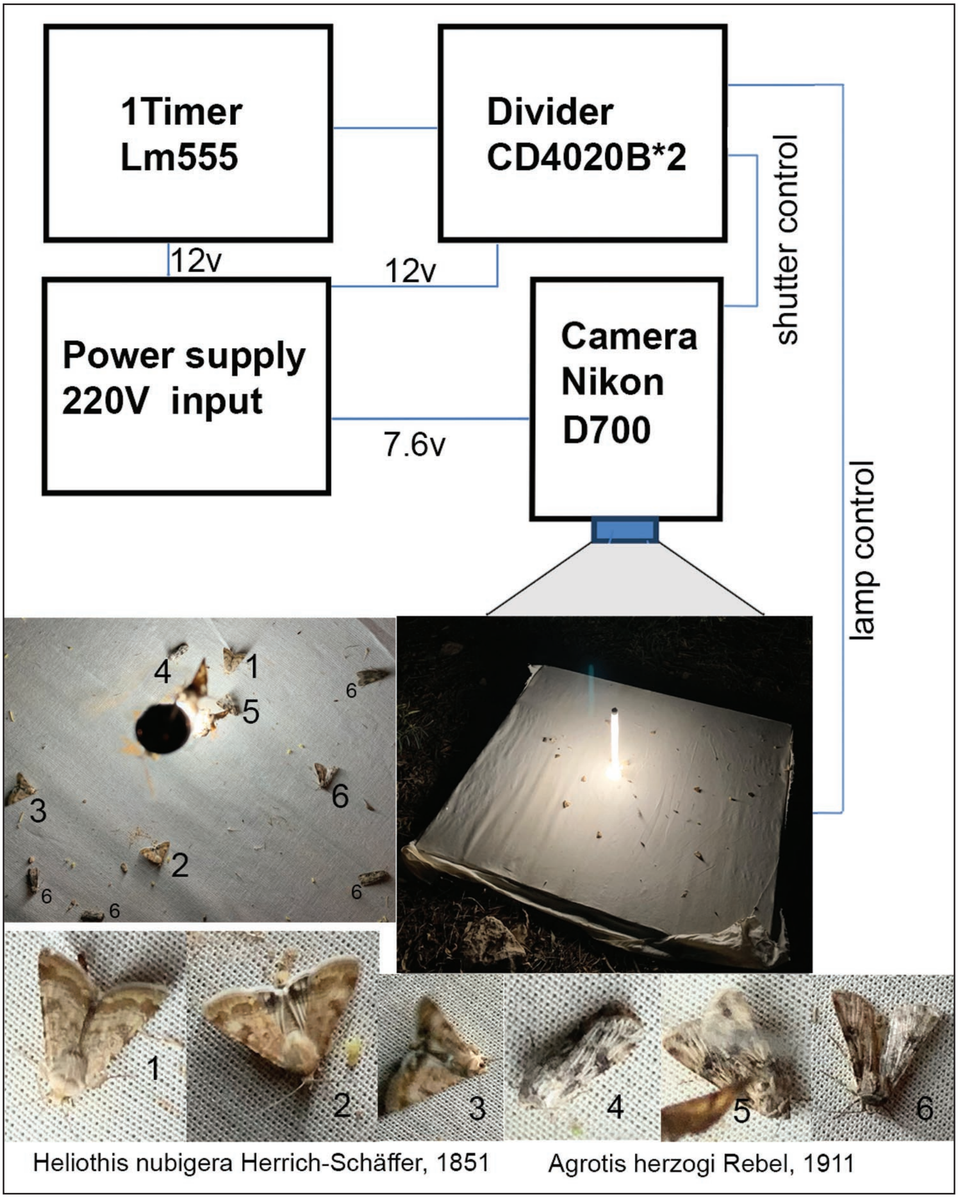

Fig. 1.– Electric devices and light trap design.

Results

To validate our system, we focused on the family Noctuidae (Lepidoptera) as the Israeli fauna of this family was taxonomically described in detail (KRAVCHENKO *et al*., 2007a; KRAVCHENKO *et al*., 2007b) and its members are easy to identify and relatively abundant (see Fig. 1 for examples of Noctuid moth samples caught on camera during the monitoring session). For example, on pictures taken in the Arava desert (kibbutz Qetura) at nights of 7 November 2019 (Fig. 1) two noctuid species represented on the pictures: *Heliothis nubigera* Herrich-Schäffer, 1851 (numbers 1, 2, 3) and *Agrotis herzogi* Rebel, 1911 (numbers 4, 5, 6).

Using our monitoring system, we were able to sample and identify individuals from several common species and observe temporal changes in the numbers of trapped individuals during the night (Figs 2, 3). Graphs show the number of specimens identified in frames taken over one hour interval.

In the Quetura locality, we recorded 32 samples of *Heliothis nubigera* Herrich-Schäffer, 1851, which is species common all over Israel. In the desert, this species occurs only on oases and settlements. The distribution of *H. nubigera* specimens over the night showed a bimodal pattern, with the first peak taking place ~3 hours after sunset (around 20:00) and the second one around midnight (Fig. 2).

Specimens of *Heliothis peltigera* ([Denis & Schiffermüller], 1775) showed one peak, occurring at the same time as the first peak in *H. nubigera* abbudance (Fig. 2). The species is common, locally even abundant all over Israel. In the desert, it occurs only on oases and settlements and it is bivoltine. We also recorded 59 specimens of *Agrotis herzogi* Rebel, 1911, which is univoltine and autumnal and it is common all over the Israeli arid region. All specimens were recorded after midnight, and the number of recorded specimens peaked between 1;00-2:00 (Fig. 2).

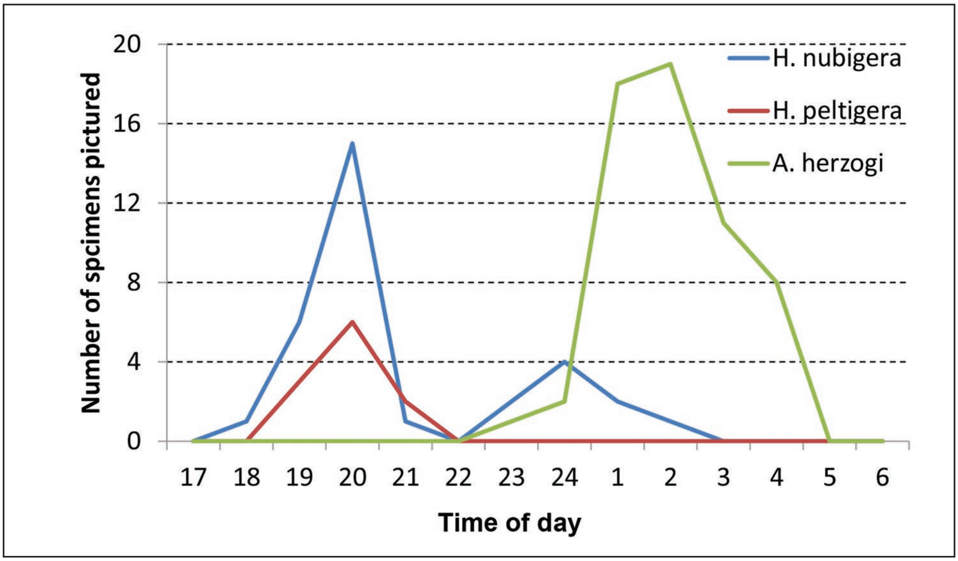

Fig. 2.– The rhythm of the moth's attraction on light source in Qetura locality.

At the Botanical Garden in Tel-Aviv University, we found that; most of the sampled specimens (71%) belonged to 3 species. We recorded 20 specimens of *Autographa gamma* (Linnaeus, 1758). This species is common all over Israel, concentrates in oases in the arid regions and is multivoltine. The occurrence of this species, as recorded in our light trap, peaked between 21:00-22:00 (Fig. 3).

Eighteen specimens of *Spodoptera exigua* (Hübner, [1808]) were recorded. This is a multivoltine species, which is abundant all over Israel. The peak of trapped specimens occurred soon after sunset between 20:00 and 22:00 (Fig. 3). Lastly, we recorded 36 specimens of the *Agrotis ipsilon* (Hufnagel, 1766). This species is multivoltine and abundant throughout Israel as well, except for the desert area where it concentrates mainly in oases. Most of these species specimens were recorded between 22:00 and 2:00 (Fig. 3).

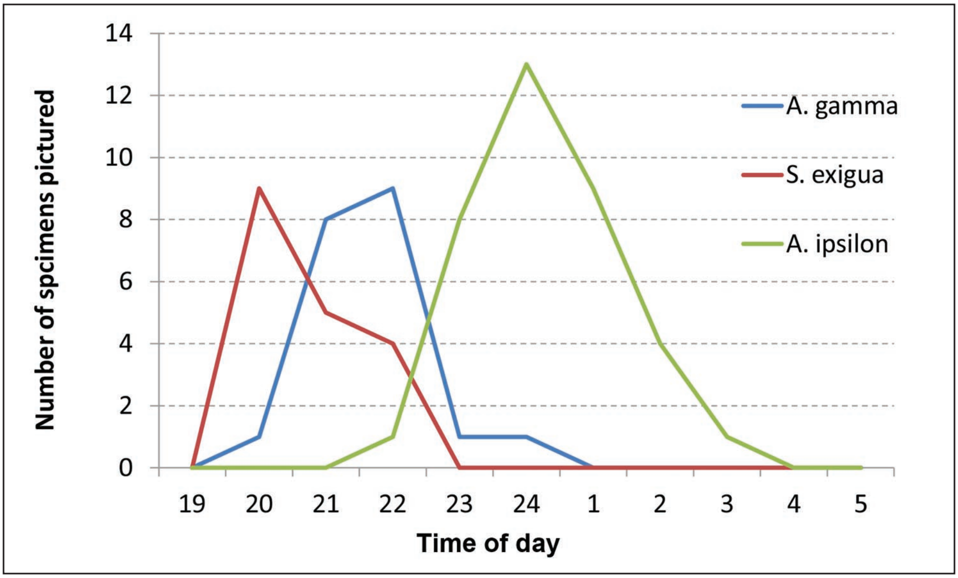

Fig. 3.– The rhythm of the moth's attraction on light source in Botanical garden in Tel Aviv.

Discussion

Here we show that using a camera established near a light source, it is possible to monitor not only species assemblages of the macro-moths but also the rhythm of their attraction to light. The advantage of the system is that it enables to monitor the species assemblages distantly.

The peak attraction time of insects to light is not directly correlated to their peak mobility time (KRAVCHENKO, 1981, 1984, 1986). Mobility is linked with some vitally important aims in insects like mating, egg-laying, feeding and so on, which are more motivating than light attraction. Therefore, light attraction is considered to be the final stage of any mobility period (CHERNYSHEV, 1984).

Among the species studied in our work, both representatives of genus *Agrotis* tended to attract to light around midnight, or alightly later. This timing is common for many cutworms of the subfamily Noctuinae and is inline with their high attraction to pheromone traps before midnight (KRAVCHENKO, 1987).

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Butterflies diversity from a remnant of semiurban Caatinga, Septentrional Sertaneja Depression Ecoregion, Patos, Paraíba, Brazil (Lepidoptera: Papilionoidea)

A. Ferreira-Júnior

Abstract

In order to perform a concise characterization and evaluation of the butterflies taxocenosis structure of the Rural Health and Technology Center (CSTR) of the Federal University of Campina Grande (UFCG), a semiurban area of the Caatinga biome, Semiarid region, in the Septentrional Sertaneja Depression Ecoregion, a species inventory with entomological net was conducted. There were recorded 81 species of butterflies, distributed in a general abundance of 2531 individuals; among them, 808 specimens were captured and collected, and none of the individuals marked with nontoxic pen and released were recaptured. The list of species was complemented by adding nine more butterflies species, mostly Hesperiidae, from collection before and after the sampling period, constituting a total of 90 species. Many of the butterflies species found in the CSTR are new records for Paraíba state and only four species are considered for the Northeast geographic region, based on other checklists for areas of Atlantic Forest, Caatinga, Cerrado and Amazon biomes in this region: *Junonia genoveva infuscata* Felder & Felder, 1867, *Staphylus melangon epicaste* Mabille, 1903, *Clito sompa* Evans, 1953 and *Lerema ancillaris* (Butler, 1877).

KEY WORDS: Lepidoptera, Papilionoidea, species list, urban ecology, semiarid, seasonally dry tropical forest, Brazil.

Diversidad de mariposas de un remanente de Caatinga semiurbana, Ecorregión de la Depresión Sertaneja Septentrional, Patos, Paraíba, Brasil (Lepidoptera: Papilionoidea)

Resumen

Para caracterizar y evaluar rápidamente la estructura de taxocenosis de mariposas del Centro de Salud y Tecnología Rural (CSTR) de la Universidad Federal de Campina Grande (UFCG), un área semiurbana del bioma Caatinga, región Semiárida, Ecorregión de Depresión Sertaneja Norteña, fue realizado un inventario de especies con red entomológica. Fueron registradas 81 especies de mariposas, distribuidas en una abundancia general de 2.531 individuos; de estos, 808 especímenes fueron capturados y colectados, ninguno de los individuos marcados con pluma no tóxica y liberados fueron recapturados. La lista de especies se complementó agregando nueve especies de mariposas más, principalmente Hesperiidae, de las recopilaciones antes y después del período de muestreo, lo que ha constituido un total de 90 especies. Muchas de las especies de mariposas encontradas en el CSTR son nuevos registros para el estado de Paraíba y solo cuatro especies se mencionan como nuevos registros para la región geográfica Noreste, basado en otros inventarios para las áreas de los biomas Bosque Atlántico, Caatinga, Cerrado y Amazonas de esta región: *Junonia genoveva infuscata* Felder & Felder, 1867, *Staphylus melangon epicaste* Mabille, 1903, *Clito sompa* Evans, 1953 y *Lerema ancillaris* (Butler, 1877).

PALABRAS CLAVE: Lepidoptera, Papilionoidea, lista de especies, ecología urbana, semiárido, bosque tropical estacionalmente seco, Brasil.

Introduction

Brazil is cited as one of the main megadiverse countries, housing a significant number of terrestrial invertebrates (LEWINSOHN & PRADO, 2005). However, knowledge of the diversity of this group, especially butterflies, is still incipient and unequally distributed among the political (geoeconomic) and biogeographic divisions, with evident negligence for the Northeastern Semiarid region (LEWINSOHN *et al.*, 2005; CARNEIRO *et al.*, 2008; FREITAS & MARINI-FILHO, 2011; SANTOS *et al.*, 2011). Thus, it is required to acquire knowledge of biodiversity for its contribution and development of multiple conservation approaches, mitigation strategies and compensation of the various environmental impacts, given the growing pace of imbalance of natural ecosystems, habitat loss, extinction of species and the devastating effects of the global warming (WILSON, 1997; CHAPIN *et al.*, 2000; BONEBRAKE *et al.*, 2010; WARREN *et al.*, 2013; GARCÍA-ROBLEDO *et al.*, 2016; MELLO *et al.*, 2016).

The term diversity, commonly used in works focusing on Community Ecology and Conservation Biology, represents the variety of living beings and may include information on richness and equitativity, this last expressing the relative importance of each species through abundance in sampling (MELO, 2008). Information about the diversity of butterflies in a given habitat, even those considered urban or with varied anthropogenic disturbance, can contribute to their conservation and understanding landscape connectivity, quali-quantitative monitoring and as a starting point for detecting spatial or temporal environmental changes, in addition to supporting biogeographic studies and specific patterns (HARDING *et al.*, 1995; BROWN-JUNIOR & FREITAS, 1999; SOGA & KOIKE, 2012).

Specifically, the species richness (A, B, C, D, E or 1, 2, 3, 4, 5) does not express the number of individuals, a function of the abundance (A, A, A, A, A or 1, 1, 1, 1, 1, or yet A1, A2, A3, A4, A5, ... AN, or eventually for the composition A1, B1, B2, B3, B4, C1, C2, C3, D1, D2, E1, structure of distinct qualities with equal or different quantities of individuals), and consist of key metrics in the various fields of research in Ecology that generally underestimate the counts in samples of different characteristics (homogeneous and heterogeneous), with two large structural groups of statistical tests, parametric and non-parametric models, and two approaches to infer species richness based on data measures (computational simulations), incidence (absence 0 or ≥ 1 presence), numbers of uniques (1 sample) and duplicates (2 samples), and abundance (0 or ≥ 1), numbers of singletons (1 individual) and doubletons (2 individuals), - as expressed by KHALIGHIFAR *et al.* (2020), with more details, depending of the disposition and conformation, the data of binary incidence, 0 or 1, cannot be permuted into abundance finite data, however, the contrary transformation is possible - asymptotic and non-asymptotic approaches, that can be compared to the multiple assemblies (convergents/divergents, similars/dissimilars) and arrive at a theoretical (speculative) and experimental relationship of the appropriate real number of the richness (statistical approximation theory) in certain environments with possible undetected species, hypotheses that can be proven indispensably through the standardized application of collection protocols (sample integrity) and the sampling effort, once again highlighting the support to the understanding of the arbitrators to the causes of biodiversity phenomena and the consequences of unsustainable human exploration for making decisions based on a well-founded environmental policy (CHAO & CHIU, 2016a; 2016b; CHAO & COLWELL, 2017).

Considering the ontological and ontogenetic mutability of the linguistic sign “species”, this word can express multiplicity of significant (among the various idioms and languages of the human species) and significances (concept) according to the dialectical contextual insertion in the systems (analogy, minor valence relationship, and homology, major valence relationship, of

Aristotelian origin applied over time), introduced and felt between enunciator (emitter) and enunciatory (receptor) through of the channels of enunciation of the enunciated (D'SAUSSURE, 2012). Species can be defined in the stricto sensu as a biological taxonomic category that includes its taxa by the unified concept of species, - genophenotypic (intrinsically) and/or phenogenotypic (extrinsically) living beings/organisms - segments of metapopulational lineages evolving separately, possible common denominator, through secondary and primary contingent properties used as operational criteria of the point of cut and circumscription of the lines of speciative evidence, with the metamorphosis occurring at the level of anagenesis and the speciation in the dimension of cladogenesis, analyzed by the robustness of integrated methods (emphasize for the phylogenetic-cladistic with your inferences) by genetic scrutineers (coalescence theory), phylogeographic, morphological, physiological and behavioral, among other aspects of the evolutionary biological taxonomic systematic (organization of knowledge), conducted and legislated by associations and commissions with yours consolidated international nomenclature codes, botanical (IAPT, 1950; TURLAND *et al*., 2018) and zoological (ICZN, 1895; ICZN, 1999), in addition to international committees and codes for the nomination of prokaryotes (ICSP, 2020; PARKER *et al*., 2019) and viruses (ICTV, 2018; ICTV, 2019); aditional groups with their supra and infracategorical epithets, inter and intraspecific interactions, evolutionarily involved throughout natural history through the various types of speciation with potential gene introgressions, parallel speciation and hybridizations in the flow of genetic pools (*e.g.*, ecotypes zones with semipermeable reproductive barriers and occurrence of at least two sympatric subspecies of the same species of butterfly that do not evolve completely apart), followed by heuristic, syntactic-semantic, nomenclatural-terminological conflicts (controversies), subject to the reviews and adequations submitted to the scientific community consensus or dissent (see MAYDEN, 1997; D'QUEIROZ, 2007; ALEIXO, 2007; HAUSDORF, 2011; NAOMI, 2011; BRABY *et al*., 2012 for more details of the heated debate about delimitation and conceptualization parameters of species and subspecies).

While the identity of the "species" can be applied to objects and subjects, living and non-living beings, memes, money banknotes, agents, patients, epidemiological cases (medical science), bugs in software programs (computer science and information technologies), characters that make up the atomicity of numbers and letters in different languages in the websites, books and physical-digital-virtual articles (Literature), genes or alleles of the genetic code and other discrete, elementary and substantial entities, contents within of categorical continents of the monistic hierarchical organization, not only of biological sciences, trans-interdisciplinary topics in the spectrum of conceptual applications and discussions of information theory (CHAO & CHIU, 2016a; 2016b); including not only the pertinent contemporary philosophical-anthropological-sociological reflections (considering other perspectives, see DANOWSKI & D'CASTRO, 2014), that together with Biology representatives (Zoology, Ecology, etc.) try to restructure and balance the coexistence of desires among beings for a more reasonable, tolerable, peaceful and just world during the probable most prominent viral pandemic of the 21st century, probably caused by the random events, misfortunes of the consequence by the human hyper-impaction on wild biodiversity, through the unpredictable strains of high mutagenic power transversely the species of the new coronavirus (SIDDELL *et al*., 2020) of Chiroptera origin (ZHOU *et al*., 2020), etiological agent Sars-Cov-2 (CSG/ICTV, 2020) that infects millions of individuals of the human species expressing ample deadly power pathogenic by the Covid-19 disease (ICTV, 2019).

Various environmental factors, biotic and abiotic, can influence relatively on the distribution and structure of neotropical butterfly communities, such as different latitude and altitude gradients, topographic, floristic and microhabitat heterogeneity, seasonality, microclimatic conditions and varying degrees of fragmentation and vegetative disturbance, thus the assemblies may have different composition, richness and abundance (BROWN-JUNIOR, 1991; BROWN-JUNIOR & FREITAS, 2000a, b; BROWN-JUNIOR & FREITAS, 2002).

Specifically, the effects of urbanization gradient and other anthropogenic disturbances in natural ecosystems, associated on butterfly assemblages, can lead to forest fragmentation, modification of habitats and species composition, through the emergence of exotic or cultivated species and the loss of native species, with consequent decrease in diversity (BROWN, 1989; RUSZCZYK & SILVA, 1997; HARDY & DENNIS, 1999; NEW & SANDS, 2002; FAHRIG, 2003; MCKINNEY, 2008). So, the presence or absence and population density of a particular species may serve as bioindicators of the conservation level and quality of the environmental landscapes, as they are insects characteristic of this assessment and susceptible to such impacts (FREITAS *et al*., 2003; FREITAS *et al*., 2006; OLIVEIRA *et al.,* 2018).

In contrast, urban environments, with green areas that maintain considerable vegetation and favorable weather conditions, even provide shelter and resources for the establishment and survival of adults and butterfly larvae, also becoming refuge for birds, reptiles and other insects, highlighting the importance of these remnants for the study and conservation of the biodiversity (RUSZCZYK, 1986a, 1986b, 1986c, 1986d; MURPHY, 1997; BROWN-JUNIOR & FREITAS, 2002; KOH & SODHI, 2004; COLLIER *et al*., 2006; CLARK *et al*., 2007). From this perspective, there is a tendency in the reduction of butterfly dispersion and diversity in relation to the increased degree of urbanization and alteration, where less impacted semiurban and peripheral areas present greater richness compared to more altered central urban green areas, with few exceptions (RUSZCZYK & ARAÚJO, 1992; FORTUNATO & RUSZCZYK, 1997; RUSZCZYK, 1998; HARDY & DENNIS, 1999; NEW & SANDS, 2002; HOGSDEN & HUTCHINSON, 2004; OLIVEIRA *et al.,* 2018; TZORTZAKAKIA *et al*., 2019).

Most of the Brazilian works developed with butterflies in fragments of urban and semiurban vegetation are described for areas of plazas, cemeteries, university campuses, municipal parks and other conservation units for the Atlantic Forest (sensu lato), involving the listing of species through active and/or passive collection, and various ecological analysis, with greater representativeness for the Southern (RUSZCZYK, 1986a, b, c, d, e; RUSZCZYK, 1987; RUSZCZYK & ARAUJO, 1992; LEMES *et al*., 2008; SACKIS & MORAIS, 2008; BONFANTTI *et al*., 2009; BONFANTTI *et al*., 2011; LEMES *et al*., 2015; FAVRETTO *et al*., 2015; PEREIRA *et al*., 2015) and Southeast regions (RODRIGUES *et al*., 1993; FORTUNATO & RUSZCZYK, 1997; RUSZCZYK & SILVA, 1997; VANINI *et al*., 1999; BROWN-JUNIOR & FREITAS, 2002; SILVA *et al*., 2007; PEREIRA *et al*., 2011; SILVA *et al*., 2012; SOARES *et al*., 2012). Few inventories can be cited for Midwest region (PINHEIRO *et al*., 2008; BOGIANI *et al.,* 2012), Northern region (GARCIA *et al*., 1990; GARCIA & BERGMANN, 1994) and Northeast region, described for Cerrado and Amazon (MARTINS *et al*., 2017; PEREIRA *et al*., 2018), Atlantic Forest (KESSELRING & EBERT, 1982; VASCONCELOS *et al*., 2009; OLIVEIRA *et al.,* 2018; MELO *et al*., 2019) and Caatinga urban areas (COSTA *et al*., 2013; ROQUE *et al*., 2014), where very few butterfly studies are known for the urban locations of the Semiarid region, demonstrating the importance of this survey work.

The present study was developed to contribute to the knowledge and conservation of the butterflies fauna of the Semiarid region of Northeastern Brazil through the elaboration of a species list and characterization of alpha diversity in an area of semiurban xerophytic caatinga located in the town of Patos, state of Paraíba. It is noteworthy that the area covered by the municipality is considered of extreme biological importance for the invertebrate group and priority for knowledge and conservation of the Caatinga biome biodiversity (MMA/SBF, 2002; SILVA *et al*., 2003).

Material and methods

STUDY AREA

The Health and Rural Technology Center (CSTR) of the Federal University of Campina Grande (UFCG) is located on the outskirts of the urban area of Patos town, Paraíba state (07º03’32” S e 37º16’29” W), it has an average altitude of 250 meters, rocky outcrops and an approximate area of 220 m^2, inserted in the Caatinga biome, Semiarid region, Septentrional Sertaneja Depression Ecoregion (VELLOSO *et al.*, 2002). The regional climate is semiarid, BSh, according to the classification of Köppen, marked by a dry and a rainy season (ÁLVARES *et al.*, 2014). The annual average temperature is around 25ºC, while the relative humidity 65,9% and the rainfall has an annual average of inferior 1000 mm (SOUSA *et al.*, 2019), being irregularly distributed between the months of the year. It is in a high degree of anthropization, with much of the total area occupied by constructions. However, it has an area that concentrates a relatively considerable vegetation, where is inserted a forest vivarium with seedlings, next to one of the largest and oldest water reservoir of the municipality, Jatobá weir; besides extensions with ruderal vegetation spots, especially during the rainy season, and shrub-tree caatinga, which undergo periodic weeding and pruning. Both places provide food and oviposition substrates to butterflies, where native angiosperm species of different habits are present, mostly represented by families Fabaceae, Anacardiaceae, Bignoniaceae, Euphorbiaceae and Myrtaceae (SOUSA *et al.*, 2019), Convolvulaceae, Malvaceae, Rubiaceae, Apocynaceae, Asteraceae, in addition to exotic and native ornamental species of others families located in regularly irrigated flower beds.

SAMPLING

The butterflies were captured with the aid of an entomological net, identified in the field when possible, marked with a nontoxic pen and released or collected. Visual counts were also performed of individuals of species with population explosions, once per transect and without net capture, mostly some species of Pieridae and Nymphalidae. At the time of the catch the transect was recorded. Registries were made in ruderal open areas, shrub and tree vegetation spots, within three transects proportional to the campus length and explored from February 2011 to December 2011 (10 months), except October, one day per month, from 08 am to 04 pm, alternately, 2:40 hours per transect, totaling a sampling effort of 80 hours/net/collector with one more auxiliary for spreadsheet annotations and marking of the entomological envelopes. Also, butterfly species that were not captured during the sampling period, but they have records for the study area, were added to complement the richness of the CSTR.

Specimens (vouchers) were deposited in the butterfly Collection of the Caatinga Insect Ecology and Interactions Laboratory (CLEIIC) of the Federal University of Campina Grande (UFCG), Patos, Paraíba, Brazil.

The systematic follows the one proposed by LAMAS (2004, 2008) and ESPELAND (2018). For the suprageneric categories of Nymphalidae, WAHLBERG *et al.* (2009), Riodinidae, SERAPHIM *et al.* (2018) and Hesperiidae, WARREN *et al.* and LI *et al.* (2019). Many identifications were obtained through physical (BROWN-JUNIOR, 1992; CANALS, 2003) and digital guides (WARREN *et al.*, 2013), consulting specialists when needed.

DATA ANALYSIS

Are described richness data, absolute and relative frequencies by abundance of species, subfamilies and families, as well as the presence and absence of species in the rainy and dry seasons of the year. In sequence, to evaluate the collection effort, richness extrapolations (previsions) were performed through the nonparametric estimators that quantify rarities, Bootstrap, Jackknife 1, 2 and Chao 1, 2 (DIAS, 2004), using the software PAST 3.24 (HAMMER *et al.*, 2019), comprising only the information for the 10 months of sampling.

The constancy of the butterfly species was obtained through the relation between the proportion of the samples in which a given species was registered and the total number of samples, through the formula C = p.100/N, being p the number of sampling occasions recorded for each species and *N* the total of sampling occasions, categorizing the species as constant, present in more than 50% of the collections (6-10 months), accessory, between 25 and 50% (3-5 months), and accidental, in less than 25% of the collections (1-2 months) (BODENHEIMER, 1955; SILVEIRA-NETO *et al.*, 1976); while the dominance was calculated from the relative abundance of each species using the formula D = (i/t).100, being *i* the total of individuals of a species and *t* the total of sampled individuals, characterized as eudominant > 10%, dominant > 5-10%, subdominant > 2-5%, recessive = 1-2% and rare < 1% (FRIEBE, 1983).

Simple comparisons of richness and composition were also made with the intention to achieve some similarity with other available inventories for urban green areas in the Pampa, Cerrado and Atlantic Forest biomes (SILVA *et al.*, 2007; SACKIS & MORAIS, 2008; PINHEIRO *et al.,* 2008; BONFANTTI *et al.,* 2009; VASCONCELOS *et al.*, 2009; BONFANTTI *et al.*, 2011; SOARES *et al.*, 2012; BOGIANI *et al.*, 2012; PEREIRA *et al.*, 2015; LEMES *et al.*, 2015; MELO *et al.*, 2019), and with the other inventories developed in the northeastern Semiarid region (NOBRE *et al.*, 2008; PALUCH *et al.*, 2011; ZACCA & BRAVO, 2012; LIMA & ZACCA, 2014; KERPEL *et al.*, 2014; RAFAEL *et al.*, 2017). New records for the Northeast region were obtained from the inventories available in scientific literature (CARDOSO, 1949; KESSELRING & EBERT, 1982; NOBRE *et al.*, 2008; ZACCA *et al.*, 2011; PALUCH *et al.*, 2011; ZACCA & BRAVO, 2012; LIMA & ZACCA, 2014; KERPEL *et al.*, 2014; PALUCH *et al.*, 2016; RAFAEL *et al.*, 2017; MARTINS *et al.*, 2017; PEREIRA *et al.*, 2018; MELO *et al.*, 2019).

Results and Discussion

Eighty-one (81) butterfly species were recorded distributed in 30 species of Hesperiidae (37%), 26 of Nymphalidae (32%), 13 of Pieridae (16%), eight of Lycaenidae (10%), three of Papilionidae (4%) and one species of Riodinidae (1%) (Table I). The list of species was complemented by adding nine more species, mostly Hesperiidae, from anterior and posterior collections to the sampling period, constituting a total of 90 species: *Historis acheronta* (Fabricius, 1775) (Nymphalidae); *Anteos clorinde* (Godart, [1824]) (Pieridae); *Electrostrymon endymion* (Fabricius, 1775), *Strymon crambusa* (Hewitson, 1874), *Pseudolycaena marsyas* (Linnaeus, 1758) (Lycaenidae); *Aguna megaeles* (Mabille, 1888), *Staphylus* sp., *Staphylus melangon epicaste* Mabille, 1903, *Heliopetes arsalte* (Linnaeus, 1758) (Hesperiidae) (Table I).

For the general abundance a total of 2531 individuals were registered, represented by 987 of Nymphalidae (39%), 945 of Pieridae (37.3%), 331 of Hesperiidae (13%), 239 of Lycaenidae (9.4%), 22 of Riodinidae (1%) and seven of Papilionidae (0.3%) (Table II). Among these records, 808 specimens were captured and collected, none of the marked and released individuals were recaptured.

Among the most representative families in number of species are Hesperiidae, Nymphalidae, Pieridae and Lycaenidae, respectively. Such representativeness was not maintained in relation to the proportion of the number of individuals, there was an inversion between the first three families, showing Nymphalidae as the most abundant, followed by Pieridae, Hesperiidae and Lycaenidae, while Papilionidae was the least abundant family and Riodinidae obtained the lowest proportion of richness, a single species, *Aricoris campestris* (H. Bates, 1868) - common in open vegetation and with characteristic distribution to the northeastern Semiarid region (NOBRE *et al.*, 2008; PALUCH *et al.*, 2011; ZACCA & BRAVO, 2012; KERPEL *et al.*, 2014; RAFAEL *et al*, 2017) and in an area of Cerrado and Amazon of the Maranhão state (MARTINS *et al.*, 2017) - being slightly higher to the total proportion of the number of individuals of the three species recorded for Papilionidae.

The most significant subfamilies in richness are Hesperiinae (13 species, 16%), Coliadinae (10 species, 12%), Pyrginae (9 species, 11%), Eudaminae (8 species, 10%), Nymphalinae and Theclinae (6 species, 7% each), respectively; when it comes to abundance, Coliadinae (845 specimens, 33.39%), Heliconiinae (329 specimens, 13%), Nymphalinae (272 specimens, 10.75%), Biblidinae (245 specimens, 9.68%) and Polyommatinae (206 specimens, 8.14%) are the prominent ones (Table II).

Table II.– Absolute and relative frequencies of the richness and abundance by butterfly families and subfamilies, and for the different seasons of the sampling period at the Health and Rural Technology Center (CSTR), Patos, Paraíba, Brazil, between February 2011 and December 2011, except October. Legend: S = richness, N = abundance; RAI = rain period (Feb-Jun), DRY = dry period (Jul-Dec).

Families/ subfamilies	S	%	N	%	Season (N)			
					RAI	**%**	**DRY**	**%**
Papilionidae	3	4	7	0.3	4	0.3	3	0.2
Papilioninae	3	4	7	0.28	4	0.3	3	0.2
Pieridae	13	16	945	37.3	430	36.3	515	38.3
Coliadinae	10	12	845	33.39	376	31.7	469	34.8
Pierinae	3	4	100	3.95	54	4.6	46	3.4
Lycaenidae	8	10	239	9.4	148	12.5	91	6.8
Theclinae	6	7	33	1.3	29	2.4	4	0.3
Polyommatinae	2	3	206	8.14	119	10	87	6.5
Riodinidae	1	1	22	1	5	0.4	17	1.3
Riodininae	1	1	22	0.87	5	0.4	17	1.3
Nymphalidae	26	32	987	39	384	32.4	603	44.8
Libytheinae	1	1	1	0.04	1	0.1	0	0
Danainae	5	6	75	2.96	25	2.1	50	3.7
Heliconiinae	4	5	329	13	169	14.3	160	11.9
Biblidinae	5	6	245	9.68	34	2.9	211	15.7
Cyrestinae	1	1	44	1.74	29	2.4	15	1.1
Nymphalinae	6	7	272	10.75	109	9.2	163	12.1
Charaxinae	2	3	12	0.47	10	0.8	2	0.1
Satyrinae	2	3	9	0.36	7	0.6	2	0.1
Hesperiidae	30	37	331	13	214	18.1	117	8.7
Eudaminae	8	10	120	4.74	50	4.2	70	5.2
Pyrginae	9	11	144	5.69	125	10.5	19	1.4
Hesperiinae	13	16	67	2.65	39	3.3	28	2.1
Total	**81**	**100**	**2531**	**100**	**1185**	**100**	**1346**	**100**

Of the 81 sampled species, 67 are recorded for the rainy season, 20 exclusive species, and 61 for the dry period, 14 exclusive species, with slightly more than half shared between both seasons, 47 species or 58% (Table I), with the highest peak of richness and abundance for the month of June (42 species, 406 individuals), followed by the richness of September (41 species, 267 individuals), April (40 species, 193 individuals), March (39 species, 179 individuals), February (38 species, 190 individuals), July and August (37 species each, 277 and 294 individuals), May (36 species, 217 individuals), November (31 species, 293 individuals) and December (29 species, 215 individuals); different from the total registered individuals, divided into 53% for the dry season, 1346 individuals, and 47% for the rainy season, 1185 individuals (Table II). Such findings between the different periods and among the months of sampling can express a seasonal fluctuation in the frequency of individuals and transience of species in the studied community, showing active individuals of different species in both seasons.

Potentially, the irregularity of the smallest number of individuals for the rainy season in the CSTR (Table II) results of the discontinuity of collections during the sampling year, possible differences in the collection effort during the samples (CALDAS & ROBBINS, 2003), inconstant and extemporaneous rains, in addition to other local characteristics.

Comparatively, for a more conserved area in the Caatinga, VASCONCELLOS *et al*. (2010) quantified and qualified Lepidoptera as the seventh order of the most abundant and representative insects for the rainy season, collected mainly with the malaise trap (independent of the collector's effort) at Fazenda Almas, Paraíba, where they registered the significance of the precipitation and relative humidity as fundamental predictors of the patterns of abundance and activity in most insect orders in this conservation unit. There are experiments to the identification of the specific patterns of the seasonal and spatial distribution of insects, however, they continue with incipient definitions for the butterflies and moths of the Semiarid, needing stimuli and more traction to acquire knowledge and resolutions of the contingents. The greater abundance recorded in the CSTR for the most adverse dry period (Table II) can be considered an anomaly to the logic of the greater availability of resources by the favorable climatic conditions through the months of greater precipitation and consequent vegetal mass increase, also followed by the increase of the insect populations of many species, among the evident population explosions of Pieridae, with relatively robust wings and involved in characteristic migrations in the Semiarid of the Northeast region, not exclusive to Brazil (SEMIÁRIDOS, 2013), during the rainy season, being influenced by an exo-endogenous geomagnetic compass (biological clock), assessed through of the degrees of angles between the solar zenith (positive phototropism) and the directional azimuth of the individuals (OLIVEIRA *et al*., 1998), masses and air currents, large scale climatic phenomena such as El Niño-Southern Oscillation (ENSO) (its oscillation is the main factor of temperature and continental precipitation) and La Niña, which occurred at the moderate level for the sampling year of 2011 (CPTEC/INPE, 2016), and by the climatic seasons that drive higher primary productivity and stimulates the phenology of host plants, mainly Fabaceae for pierids (BECCALONI *et al*., 2008), with annual migrations of butterflies from wet tropical forests for the drys (SRYGLEY *et al*., 2006; SRYGLEY *et al*., 2010), and presumably, during the interval of greatest precipitations in the Caatinga ecoregions, at least in the Septentrional Sertaneja Depression, areas located between Ecuador and the parallel of the Tropic of Capricorn.

For the year of 2020, in the urban zone of the city of Brejo do Cruz, Paraíba, distant about of 100 km from Patos, many Pieridae were seen following a constant flow at different hours of the day, with flight direction from west to east, with a considerable reduction in the number of individuals in April, coinciding with the rainfall reduction. SRYGLEY *et al.* (2014), expresses that the influence of the environment, oriented by the frequency and amplitude of the ENSO cycle, acts in the phenology of larvae and adult butterflies, in the frequencies and amplitudes of insects population outbreaks and physiological-behavioral changes related to migration, with a consequent increase or decrease in the herbivory rate, making it possible to predict through modeling how the plants and insects of wet and dry neotropical forests may respond to climate change. It should be noted that for the Semiarid region of the Caatinga biome the rainy period match around the seasons of the summer (beginning on December 22 - solstice, highest pluviosity) and autumn (beginning on March 21 - equinox), while the dry period corresponds around of the seasons of winter (beginning on June 21 - solstice) and spring (beginning on September 23 - equinox); see BEDAQUE & BRETONES (2020) for more elucidations.

The richness estimators Jackknife 1 and 2 returned a result of 98 and 104 species, Bootstrap predicted 89 species, while the Chao 1 and 2 revealed an extrapolation of 105 and 92 species, indicating that more species can be recorded if a greater collection effort is employed. This observation can be supported by the register of nine additional species outside the sampling, as well as a new species of Riodinidae described for Caatinga, *Pheles caatingensis* Callaghan & Nobre, 2014 (CALLAGHAN & NOBRE, 2014), later transferred to another genus, *Melanis caatingensis* (Callaghan & Nobre, 2014) (DIAS *et al*., 2015), with the record of one individual killed, in a spider web in the middle of a house bell on João Soares Street, on the way to the work in Diocesan Social Action of Patos (Ação Social Diocesana de Patos - ASDP), in the Brasília neighborhood, near the degraded riparian forest of the polluted extension of the Espinharas River, that runs through the town, about five kilometers from the CSTR.

The non-parametric estimator that responded best to the results found was the Chao 2, 92 species, - richness prediction based on incidence, presence or absence of species that define rarity, number of uniques (species found only in one sample) and duplicates (species found in only two samples) - considering only the data of the heterogeneous distribution of the 81 species in the sampling period between February and December 2011 (except October), and the addition of 9 registered species, part before and after of the sample period in the CSTR, totaling 90 species. These 90 species are added with *Melanis caatingensis* (Callaghan & Nobre, 2014) and more the visual record of a single individual of a non-resident clearwing butterfly, observed passing through the city center, plaza of the Bandstand I (Coreto I), hypothetically flying in direction to the Pico do Jabre State Park, where it is relatively common (FERREIRA-JÚNIOR *et al*., in prep.), both species registered outside the CSTR, but obviously within the city of Patos, resulting in the totality of 92 species that match the 92 species predicted by the estimator Chao 2 (asymptote).

CHAO & JOST (2012) express that a sample of a certain size may be sufficient to fully characterize a low diversity assembly and insufficient to represent a rich assembly (see Table III) because if there are many undetectable species (“invisibles”) in an assemblage with high diversity it will be statistically impossible to obtain a good estimate of species richness; therefore, a precise lower limit is usually more practical than an inaccurate point estimate, with the need of uniques/duplicates (incidence) and singletons/doubletons (abundance), basic concept of intuitive design in the non-parametric estimation of the species richness that will be detected in samples showing that abundant species contain almost no information about the richness of undetected species, while rare species, which are unlikely to be recorded or rarely seen, contain almost all information about the richness of undetected species; consequently, most non-parametric estimators of the number of undetected species are based on the lower-order frequency counts (CHAO & CHIU, 2016b).

However, considering the relationship of the richness and the proximity between the caatinga environments of the CSTR and Tamanduá Farm (approximately 20 km distance), with 24 species that were not registered for the CSTR, and knowing that in the adult phase many species of Lepidoptera are migratory and remain in metapopulations during the seasons (seasonality) through the high dispersion capacity by the flight and other survival strategies, such as diapause, it becomes probable in time that part of this difference in the species composition can move from one environment to another and be recorded, according to the specificity of habitat inherent to each species, expressing possible faunistic transient interchangeability in space and time (turnover). In the future, perhaps the cumulative number of the butterflies richness of the CSTR or town of Patos undergo changes, being able to increase and achieve momentary equality and temporarily with the previsions of the other estimators, with least chance of overmatch the Chao 1 because of the tendency of landscape modification by the anthropic actions, while possible resamples by monitoring can express different results for a comparative diagnosis, in addition to possible changes by the taxonomic revisions. In the worst case, a considerable decrease in the number of species if effective conservation programs are not properly implemented in the conservation units and ecological buffer zones surrounding the CSTR, ideally reinforcing them or creating new units for the maintenance of wild flora and fauna.

Species constancy revealed a value of 31 accidental species, 27 constants and 23 accessory (Table I). There are twelve species, mainly Pieridae, among the most common constant that were present throughout the sampling period: *Anteos menippe* (Hübner, [1818]), *Phoebis philea* (Linnaeus, 1763), *Phoebis sennae marcellina* (Cramer, 1777), *Eurema elathea flavescens* (Chavannes, 1850), *Pyrisitia leuce* (Boisduval, 1836), *Pyrisitia nise tenella* (Boisduval, 1836) and *Ascia monuste orseis* (Godart, 1819) (Pieridae), *Euptoieta hegesia meridiania* Stichel, 1938, *Anartia jatrophae* (Linnaeus, 1763), *Hamadryas februa* (Hübner, [1823]) and *Marpesia petreus* (Cramer, 1776) (Nymphalidae), *Hemiargus hanno* (Stoll, 1790) (Lycaenidae).

Regarding dominance, 72% of the species were categorized as rare (58 species), most of them represented by Hesperiidae (26 species), Nymphalidae (16 species), Lycaenidae (7 species), Pieridae (5 species), Papilionidae (3 species) and Riodinidae (1 species), respectively, reaching only 13% of the total abundance sampled, 338 individuals (Table I). Only one species of Pieridae was considered eudominant, *E. elathea flavescens*, with 12% of the sampled (310 individuals); particularly, due to population explosions, visual counts were made of many individuals of this species, not all of them captured and marked, which may have resulted in a lack of recaptures. While five species were characterized as dominant, totaling 39% and the majority of the sample, 974 individuals: two of Nymphalidae, *A. jatrophae* (248 individuals) and *E. hegesia meridiania* (205 individuals), one of Lycaenidae, *H. hanno* (198 individuals), and two of Pieridae, *A. menippe* (178 individuals) and *P. sennae marcellina* (145 individuals).

It is noted that the CSTR environment is home to a butterfly fauna characteristic of the northeastern Semiarid region (81 shared species), representing approximately 20% of the registered species by the largest butterfly survey of this region (KERPEL *et al*., 2014), and more distinct from green areas of the Atlantic Forest (65 shared species), Cerrado (60 shared species) and Amazon (26 shared species), in the Northeast region of Brazil (Table I and IV).

The richness obtained in the present study is nearly (SILVA *et al*., 2007; SACKIS & MORAIS, 2008; PEREIRA *et al*., 2015) or it is bigger (VASCONCELOS *et al*., 2009; SOARES *et al*., 2012; BOGIANI *et al*., 2012) than many of the major urban butterfly inventories in Brazil, conducted with sampling effort and relatively distinct methodologies in the Pampa, Cerrado and Atlantic Forest biomes, and it is much lower in five of the eleven works used for comparison (PINHEIRO *et al*., 2008; BONFANTTI *et al*., 2009, 2011; LEMES *et al*., 2015; MELO *et al*., 2019); it is observed that less than half of the CSTR species have distribution records for these urban areas, except one, described in Table III. In compensation, most of the recorded species are shared with the available inventories for the Caatinga biome, Semiarid region, carried out in different phytophysiognomies of the ecoregions of Meridional Sertaneja Depression, Borborema Plateau, Chapada Diamantina Complex, Ibiapaba-Araripe Complex and Campo Maior Complex; although they have a considerably larger number of species, because they are more conserved environments and, also, they are outside the urban matrix (Table IV). Moreover, there is a good similarity between the richness and species composition of the CSTR with a more conserved caatinga area, Tamanduá Farm, and very close to the campus, approximately 20 km distance, where the applied collection effort was practically doubled, being that share 76% of all recorded species in both localities, 68 species, with 22 exclusive species to the CSTR and 24 exclusive species to the Tamanduá Farm (FERREIRA-JÚNIOR *et al*., in prep.).

Table III.– Simple comparison of the richness and composition butterflies at the Health and Rural Technology Center (CSTR) with the main urban butterfly inventories developed with sampling effort and relatively different methodologies and available for Brazil. Legend: FAT = Atlantic Forest, CER = Cerrado, CAA = Caatinga, PAM = Pampa; N = entomological net, T = bait traps.

Work	**State**	**City**	**Biome**	**Method**	**Effort**	**Richness**	**Shared species**
Present study CSTR	PB	Patos	CAA	N	80 h/net	81 (90)	-
SILVA *et al*. (2007)	MG	Belo Horizonte	FAT CER	N (T)	72 h/net	83 (91)	33
SACKIS & MORAIS (2008)	RS	Santa Maria	PAM	N	113 h/net	89	26
PINHEIRO *et al*. (2008)	DF	Brasília	CER	N (T)	-	128 (-)	35
BONFANTTI *et al*. (2009)	RS	Frederico Westphalen	FAT	N	80 h/net	161	24
VASCONCELOS *et al*. (2009)	BA	Salvador	FAT	N (T)	144 h/net	55 (70)	26
BONFANTTI *et al*. (2011)	PR	Curitiba	FAT	N (T)	240 h/net	166 (-)	17
SOARES *et al*. (2012)	MG	Belo Horizonte	FAT	N (T)	104 h/net	64 (78)	25
BOGIANI *et al*. (2012)	MS	Campo Grande	CER	N (T)	100 h/net	62 (-)	25
PEREIRA *et al*. (2015)	PR	Curitiba	FAT	N	120 h/net	85	15
LEMES *et al*. (2015)	RS	Santa Maria	FAT	N	360 h/net	130	27
MELO *et al*. (2019)	PE	Recife	FAT	N	464 h/net	273 (288)	58

Many of the butterfly species found in the CSTR are new records for the state of Paraíba and practically all of them can be considered for this locality in the Semiarid portion of the state. Only four species are appointed as new records for the Northeast region, *S. melangon epicaste* Mabille, 1903, *Clito sompa* Evans, 1953, *Lerema ancillaris* (A. Butler, 1877) (Hesperiidae) and *Junonia genoveva infuscata* C. Felder & R. Felder, 1867 (Nymphalidae), based on the other inventories available for Atlantic Forest, Caatinga, Cerrado and Amazon biomes of this geographic region; although types of *C. sompa* and *J. genoveva infuscata* are described for states of this region (LAMAS 2004; WARREN *et al.,* 2013). It is also noteworthy the registration of *Fountainea halice moretta* (H. Druce, 1877), considered an endemic species of the Semiarid region and commonly mentioned for other areas of Caatinga and high altitude wetlands in Northeast (ZACCA & BRAVO, 2012; NOBRE *et al*., 2008; LIMA & ZACCA, 2014; KERPEL *et al*., 2014).

Just a single individual of *Mechanitis lysimnia nesaea* Hübner, [1820] (Ithomiini) and *Lycorea halia discreta* Haensch, 1909 (Danaini) was registered, and only two frugivorous species of Satyrinae, *Pharneuptychia phares* (Godart, [1824]) (Satyrini) and *Opsiphanes invirae* (Hübner, [1808]) (Brassolini). The low representativeness of Ithomiini and Satyrini can presumably demonstrate that the richness of these tribes is considered low for the Septentrional Sertaneja Depression and to other specific areas of the Semiarid, due to the high anthropogenic disturbance of the CSTR, as well as adverse microclimatic and vegetative conditions, absence of food resources for adults and immatures, essential to the survival of other representatives of these groups (NOBRE *et al*., 2008, 2012). There is a strong specificity of occurrence of these groups with the food resources for the Satyrini adults, butterflies restricted to the frugivorous diet, and Solanaceae host plants, almost exclusive for the oviposition of the immatures (coevolution) of Ithomiini (BECCALONI *et al.*, 2008). These taxa or clades between parentheses, specifically Satyrini and Ithomiini, together with other species of Riodinidae, are more common and well distributed in areas of high altitude wetland, Atlantic Forest, Cerrado and Amazon of the Northeast (PALUCH *et al*., 2011; ZACCA *et al*., 2011; ZACCA & BRAVO, 2012; LIMA & ZACCA, 2014; KERPEL *et al*., 2014; PALUCH *et al*., 2016; RAFAEL *et al*., 2017; MARTINS *et al*., 2017).

Table IV.– Simple comparison of the richness and composition butterflies at the Health and Rural Technology Center (CSTR) with available butterfly works developed in the Semiarid region of the Brazilian Northeast. Legend: DSS = Septentrional Sertaneja Depression, DSM = Meridional Sertaneja Depression, PBO = Borborema Plateau, CHD = Chapada Diamantina Complex, CIA = Ibiapaba-Araripe Complex, CCM = Campo Maior Complex; N = entomological net, T = bait traps.

Work	State	Altitude	Caatinga Ecoregion	Effort	Richness	Shared species
Present study CSTR	PB	250 m	DSS	80 h/one collector/N	81 (90)	-
NOBRE *et al*. (2008)	PE	600-1000 m	PBO e DSM	360 h/one collector/N (T)	121 (15)	63
PALUCH *et al*. (2011)	PE	840 m	PBO	216 h/two collectors/N (T)	197	55
ZACCA & BRAVO (2012)	BA	480-1290 m	CHD	392 h/one collector/N (T)	169	52
LIMA & ZACCA (2014)	BA	400-1020 m	CHD	97 h/one collector/N (T)	121 (24)	44
KERPEL *et al*. (2014)	PI, CE, PB, PE e BA	Varied	DSM, PBO, CHD, CIA	N (T)	389	79
RAFAEL *et al*. (2017)	CE	450-854 m	CIA e CCM	49 h/N (T)	107	42

Only one individual of *Vanessa myrinna* (E. Doubleday, 1849) was registered and apparently not a Nymphalinae resident butterfly, since its occurrence is usually cited in the Atlantic Forest and high altitude wetland from Northeast (ZACCA *et al*., 2011; PALUCH *et al*., 2011; KERPEL *et al*., 2014; MELO *et al*., 2019), and so far there are no records of their Asteraceae host plants, *Achyrocline* sp. and *Gamochaeta* sp. (BECCALONI *et al*., 2008), for the study area and surroundings. Also, a single frugivorous individual of Nymphalinae, *H. acheronta*, was captured at

CSTR in the rainy season after the sampling year. According to NOBRE *et al*. (2012), it is a non-resident species, as its larvae feed on *Cecropia* sp. (BECCALONI *et al.*, 2008), characteristic plant of Atlantic Forest and without natural records for the Meridional and Septentrional Sertaneja Depression Ecoregions. Nevertheless, a higher incidence of individuals of this species had been recorded with bait traps for frugivorous butterflies in the Pico do Jabre State Park (S. M. Kerpel, unpublished data), high altitude wetland in the Borborema Plateau Ecoregion and approximately distant 47 km from the CSTR, where there is no record of this host plant genus as well (AGRA *et al*., 2004). A single individual of *A. megaeles* was also recorded after the sampling period in the rainy season and its host plant species, *Bauhinia forficata* Link (BECCALONI *et al.*, 2008), is registered in the campus (SOUSA *et al*., 2019).

Although the CSTR is a very altered environment, as its vegetation is composed of abundant invasive ruderal plants, with less diverse fauna compared to more conserved areas, and more species characteristic of open and flexible environments, disturbance tolerants and more generalists (44 species), with lower habitat specificity; their irrigated flower beds provides floral resources in both seasons, maintainers of many characteristic species from the Brazilian northeastern semiarid. Thereby, necessary actions are proposed to stimulate the cultivation of native plants, with potential supply of food resources (fruits and nectar), oviposition (plant tissues) and shelter (shaded places) for the turnover, establishment and maintenance of the lepidopteran guilds and other floral visitors/residentes from this area, as an efficacious management strategy to increment and expand the value of urban and periurban green areas of zones predominantly urban, intermediate and predominantly rural (IBGE, 2017) for conservation of biodiversity, and as a maintenance source of colonizers and pollinators, better ecosystem functionality and faunal connectivity of the Caatinga landscapes, reducing dispersion barriers.

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Table I.– List of butterfly species sampled at the Health and Rural Technology Center (CSTR), Patos, Paraíba, Brazil, between February 2011 and December 2011, except October, and total frequencies. Legend: S = richness, N = abundance, AF = absolute frequency, RF = relative frequency; D = dominance of species, EU = eudominant, DO = dominant, SU = subdominant, RE = recessive, RA = rare; C = species constancy, CON = constant, ACE = accessory, ACI = accidental; RAI = rainy season (Feb-Jun), DRY = dry season (Jul-Dec); species that have been also recorded for at least one of the works described for the biomes and the apostrophe (’) means records of different subspecies or just the same species for the 1 = Caatinga (NOBRE *et al*., 2008; PALUCH *et al*., 2011; ZACCA & BRAVO, 2012; LIMA & ZACCA, 2014; KERPEL *et al*., 2014; RAFAEL *et al*., 2017), 2 = Atlantic Forest (CARDOSO, 1949; KESSELRING & EBERT, 1982; ZACCA *et al*., 2011; PALUCH *et al*., 2016; MELO *et al*., 2019), 3 = Cerrado (EMERY *et al*., 2006; PINHEIRO & EMERY, 2006; MARTINS *et al*., 2017), 4 = Amazon (MIELKE *et al*., 2010; MARTINS *et al*., 2017; PEREIRA *et al*., 2018); * = butterfly species out of sampling and with records for the CSTR; ** = new records for the Northeast region of Brazil.

Taxa (S)	**AF (N)**	**RF (%)**	**D**	**C**	**Season**		**Biomes**
					RAI	**DRY**	
PAPILIONOIDEA (90)							
PAPILIONIDAE (3)							
Papilioninae							
Troidini							
Battus polydamas (Linnaeus, 1758)	1	0.03	RA	ACI		X	1/2/3/4
Papilionini							
Heraclides anchisiades capys (Hübner, [1809])	4	0.1	RA	ACE	X	X	1/2/3/4’
Heraclides thoas brasiliensis (Rothschild & Jordan, 1906)	2	0.1	RA	ACI	X	X	1/2/3/4’
PIERIDAE (14)							
Coliadinae							
Anteos clorinde (Godart, [1824])*							1/2/3
Anteos menippe (Hübner, [1818])	178	7	DO	CON	X	X	1/2/3/4
Eurema albula (Cramer, 1775)	32	1	RE	CON	X	X	1/2/3/4
Eurema arbela gracilis (Avinoff, 1926)	1	0.03	RA	ACI	X		1/3’/4’
Eurema deva (E. Doubleday, 1847)**	2	0.1	RA	ACI		X	2’/3’/4
Eurema elathea flavescens (Chavannes, 1850)	310	12	EU	CON	X	X	1/2/3’/4’
Phoebis argante (Fabricius, 1775)	1	0.03	RA	ACI	X		1/2/3/4
Phoebis philea (Linnaeus, 1763)	39	1	RE	CON	X	X	1/2/3/4
Phoebis sennae marcellina (Cramer, 1777)	145	6	DO	CON	X	X	1/2/3/4
Pyrisitia leuce (Boisduval, 1836)	32	1	RE	CON	X	X	1/2/3/4
Pyrisitia nise tenella (Boisduval, 1836)	105	4	SU	CON	X	X	1/2/3
Pierinae							
Pierini							
Ascia monuste orseis (Godart, 1819)	92	4	SU	CON	X	X	1/2/3
Ganyra phaloe endeis (Godart, 1819)	5	0.2	RA	ACI		X	1
Glutophrissa drusilla (Cramer, 1777)	3	0.1	RA	ACI		X	1/2/4
LYCAENIDAE (11)							
Theclinae							
Eumaeini							
Allosmaitia strophius (Godart, [1824])	1	0.03	RA	ACI	X		1/2/3
Chlorostrymon simaethis (Drury, 1773)	4	0.1	RA	ACE	X		1
Electrostrymon endymion (Fabricius, 1775)*							1/2/3
Kisutam syllis (Godman & Salvin, 1887)	2	0.1	RA	ACI	X		1/2/3
Pseudolycaena marsyas (Linnaeus, 1758)*							1/2/3/4
Strymon astiocha (Prittwitz, 1865)	10	0.4	RA	ACE	X	X	1/2/3

Strymon bubastus (Stoll, 1780)	6	0.2	RA	ACE	X	X	1/2/3
Strymon crambusa (Hewitson, 1874)*							1/3
Strymon rufofusca (Hewitson, 1877)	10	0.4	RA	ACE	X		1/2/3
Polyommatinae							
Hemiargus hanno (Stoll, 1790)	198	8	DO	CON	X	X	1/2/3’/4’
Leptotes cassius (Cramer, 1775)	8	0.3	RA	ACE	X	X	1/2/3
RIODINIDAE (1)							
Riodininae							
Nymphidiini							
Aricoris campestris (H. Bates, 1868)	22	1	RA	CON	X	X	1/3/4
NYMPHALIDAE (27)							
Libytheinae							
Libytheana carinenta (Cramer, 1777)	1	0.03	RA	ACI	X		1/2/3’/4
Danainae							
Danaini							
Danaus eresimus plexaure (Godart, 1819)	4	0.1	RA	ACE	X	X	1/2/3/4’
Danaus erippus (Cramer, 1775)	35	1	RE	CON	X	X	1/2/3
Danaus gilippus (Cramer, 1775)	34	1	RE	CON	X	X	1/2/3/4’
Lycorea halia discreta Haensch, 1909	1	0.03	RA	ACI		X	1/2/3/4’
Ithomiini							
Mechanitis lysimnia nesaea Hübner, [1820]	1	0.03	RA	ACI		X	1/2/3’/4’
Heliconiinae							
Argynnini							
Euptoieta hegesia meridiania Stichel, 1938	205	8	DO	CON	X	X	1/2/3/4’
Heliconiini							
Agraulis vanillae maculosa (Stichel, [1908])	26	1	RE	CON	X	X	1/2/3/4’
Eueides isabella dianasa (Hübner, [1806])	7	0.3	RA	ACE	X	X	1/2/3/4’
Heliconius erato phyllis (Fabricius, 1775)	91	4	SU	CON	X	X	1/2/3/4
Biblidinae							
Biblidini							
Biblis hyperia nectanabis (Fruhstorfer, 1909)	21	1	RA	CON	X	X	1/2/3/4’
Catonephelini							
Eunica tatila bellaria Fruhstorfer, 1908	5	0.2	RA	ACI	X	X	1/3/4
Ageroniini							
Hamadryas februa (Hübner, [1823])	113	4	SU	CON	X	X	1/2/3’/4’
Hamadryas feronia (Linnaeus, 1758)	74	3	SU	CON	X	X	1/2/3/4’
Callicorini							
Callicore sorana (Godart, [1824])	32	1	RE	ACE		X	1/2/3
Cyrestinae							
Cyrestini							
Marpesia petreus (Cramer, 1776)	44	2	RE	CON	X	X	1/2’/3’/4’
Nymphalinae							
Coeini							
Historis acheronta (Fabricius, 1775)*							1/2/3/4
Nymphalini							
Vanessa myrinna (Doubleday, 1849)	1	0.03	RA	ACI		X	1/2/3
Victorinini							
Anartia jatrophae (Linnaeus, 1763)	248	10	DO	CON	X	X	1/2/3/4

Junoniini							
Junonia genoveva infuscata C. Felder & R. Felder, 1867**	15	1	RA	ACI	X		
Melitaeini							
Anthanassa hermas (Hewitson, 1864)	4	0.1	RA	ACI	X		2/3
Ortilia ithra (Kirby, 1900)	3	0.1	RA	ACI	X		1/2/3
Phystis simois (Hewitson, 1864)	1	0.03	RA	ACI	X		1/3
Charaxinae							
Anaeini							
Fountainea halice moretta (H. Druce, 1877)	10	0.4	RA	ACE	X	X	1/4’
Hypna clytemnestra forbesi Godman & Salvin, 1884	2	0.1	RA	ACI	X		1/2/3’/4’
Satyrinae							
Brassolini							
Opsiphanes invirae (Hübner, [1808])	3	0.1	RA	ACI	X	X	1’/2’/3’/4
Satyrini							
Pharneuptychia phares (Godart, [1824])	6	0.2	RA	ACE	X		1/3/4
HESPERIIDAE (34)							
Eudaminae							
Aguna megaeles (Mabille, 1888)*							1/2
Astraptes anaphus (Cramer, 1777)	17	1	RA	ACE	X	X	1/2
Chioides catillus (Cramer, 1779)	13	1	RA	CON	X	X	1/2/3/4
Cogia calchas (Herrich-Schäffer, 1869)	18	1	RA	CON	X	X	1/2/3
Epargyreus exadeus (Cramer, 1779)	4	0.1	RA	ACI		X	1/2/3
Typhedanus undulatus (Hewitson, 1867)	3	0.1	RA	ACI	X	X	1/2/3
Urbanus dorantes (Stoll, 1790)	26	1	RE	CON	X	X	1/2/3/4
Urbanus procne (Plötz, 1881)	30	1	RE	CON	X	X	1/2/3/4
Urbanus proteus (Linnaeus, 1758)	9	0.3	RA	ACE	X	X	1/2/3/4’
Pyrginae							
Carcharodini							
Staphylus sp.*							1
Staphylus melangon epicaste Mabille, 1903***							3/4’
Nisoniades macarius (Herrich-Schäffer, 1870)	7	0.3	RA	ACE	X	X	1/2/3/4
Erynnini							
Gesta gesta (Herrich-Schäffer, 1863)	7	0.3	RA	ACE	X		1/2/3
Mylon cristata Austin, 2000	1	0.03	RA	ACI	X		2
Pyrgini							
Clito sompa Evans, 1953**	1	0.03	RA	ACI	X		3
Heliopetes macaira orbigera (Mabille, 1888)	9	0.3	RA	ACE	X	X	1/3
Heliopetes arsalte (Linnaeus, 1758)*							1/2/3/4
Heliopyrgus domicella willi (Plötz, 1884)	44	2	RE	CON	X	X	1
Pyrgus orcus (Stoll, 1780)	60	2	SU	CON	X	X	1/2/3/4
Pyrgus veturius Plötz, 1884	4	0.1	RA	ACE	X		1/2/4
Zopyrion evenor thania Evans, 1953	11	0.4	RA	ACE	X		1/2/3’
Hesperiinae							
Incertae-sedis							
Perichares adela (Hewitson, 1867)	1	0.03	RA	ACI		X	1’/2’/3’
Thymelicini							
Copaeodes jean favor Evans, 1955	4	0.1	RA	ACE		X	1
Calpodini							
Panoquina lucas (Fabricius, 1793)	8	0.3	RA	ACI	X	X	1/2/3’
Synale hylaspes (Stoll, 1781)	1	0.04	RA	ACI		X	1/2/3

Anthoptini							
Synapte malitiosa equa Evans, 1955	4	0.1	RA	ACE	X	X	1/2
Moncini							
Callimormus saturnus (Herrich-Schäffer, 1869)	6	0.2	RA	ACE	X	X	1/3
Cymaenes tripunctus theogenis (Capronnier, 1874)	20	1	RA	ACE	X	X	1/2/3/4
Lerema ancillaris (A. Butler, 1877)**	1	0.03	RA	ACI	X		
Lerodea erythrostictus (Prittwitz, 1868)	4	0.1	RA	ACE	X	X	1/3
Methionopsis ina (Plötz, 1882)	1	0.04	RA	ACI		X	1/3
Hesperiini							
Hylephila phyleus (Drury, 1773)	12	1	RA	CON	X	X	1/2
Quinta cannae (Herrich-Schäffer, 1869)	4	0.1	RA	ACI	X		1/2
Wallengrenia otho clavus (Erichson, [1849])	1	0.03	RA	ACI		X	1/2’/3’
Total	**2531**	**100**	**81**	**81**	**67**	**61**	**83/70/74/46**

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The Brazilian species of the Neotropical genus *Ophitis* Felder & Felder, 1874 with description of one new species (Lepidoptera: Notodontidae, Heterocampinae)

V. O. Becker

Abstract

Seven species of *Ophitis* Felder & Felder, 1874 are recorded for Brazil: *O. adusta* (Rothschild, 1917), *O. biplaga* (Rothschild, 1917), *O. lemoulti* (Schaus, 1905), *O. magnaria* Felder & Felder, 1874, *O. mielkei* Becker, sp. n., *O. mistura* (Schaus, 1905), and *O. rothschildi* (Draudt, 1932). Except for *O. mistura* (Schaus, 1905) and *O. rothschildi* (Draudt, 1932), the other five are new records for the country.

KEY WORDS: Lepidoptera, Notodontidae, Hetrocampinae, *Ophitis*, synonyms, new species, Neotropical, Brazil, genitalia, illustrations.

Las especies brasileñas del género neotropical *Ophitis* Felder & Felder, 1874 con descripción de una especie nueva (Lepidoptera: Notodontidae, Heterocampinae)

Resumen

Siete especies de *Ophitis* Felder & Felder, 1874 son registradas para Brasil: *O. adusta* (Rothschild, 1917), *O. biplaga* (Rothschild, 1917), *O. lemoulti* (Schaus, 1905), *O. magnaria* Felder & Felder, 1874, *O. mielkei* Becker, sp. n., *O. mistura* (Schaus, 1905), and O. *rothschildi* (Draudt). Con excepción de *O. mistura* (Schaus, 1905)y *O. rothschildi* (Draudt, 1932), las otras cinco son registros nuevos para el país.

PALABRAS CLAVE: Lepidoptera, *Ophitis*, especie nueva, Neotropical, Brasil, genitales, ilustraciones.

Introduction

The genus *Ophitis* Felder & Felder, 1874 includes 13 species of which only two (*O. cossoides* (Rothschild, 1917), and *O. griffini* (Schaus, 1939) (both synonyms; see below), were originally described from Brazil (BECKER, 2014: 18). It was treated by the earlier authors (SCHAUS, 1901: 313; DRAUDT, 1932: 995) as a monotypic genus. All the other species currently associated with it were originally described in the genus *Rifargia* Walker, 1862. Except for *O. culpata* (Schaus, 1912) and *O. adusta* (Rothschild, 1917), that reach Costa Rica, it is a South American genus, mostly in the Amazonian lowlands. The material in the collections show that at least seven species are present in Brazil, one of them undescribed. In order to identify the Brazilian species, all the type material belonging to the described species had to be examined.

Ophitis contain medium to large-size (50-80 mm wingspan) moths, with long, narrow FW, long, robust abdomen, resembling Sphingidae; antennae are short ciliated, looking nearly filiform. Male genitalia with uncus long, valvae broad, weakly sclerotized, sacculus pleated.

Material and methods

This work is based on 87 specimens (13 genitalia preparations), 81 in VOB, six in AMC, and on the type-material in the USNM and the NHMUK. Synoptic collections, representing all these species were taken to these institutions and compared with the types deposited there. The holotype of the new species is provisionally deposited in VOB, and will be transferred, together with the collection, to a Brazilian institution in the future. Genitalia were prepared following the methods described by ROBINSON (1976). Terms for morphological characters follow HODGES (1971).

Abbreviations

AMC	Alfred Moser collection, São Leopoldo, Rio Grande do Sul, Brazil
FW	Forewing
g. s.	genitalia slide
HW	Hind wing
NHMUK	The Natural History Museum, United Kingdom
PTC	Paul Thiaucourt collection, Paris
UFPR	Universidade Federal do Paraná, Curitiba, Brazil
USNM	United States National Museum, Washington
VOB	Vitor O. Becker collection, Serra Bonita Reserve, Camacan, Bahia, Brazil

Results and discussion

Among the material of *Ophitis,* collected in Brazil, specimens belonging to seven species were found. Five of them not previously recorded, including an undescribed one. In order to allow the identification of the Brazilian species, illustrations of adults and genitalia, diagnosis, and distribution of the species are here presented.

Ophitis magnaria Felder & Felder, 1874 (Figs. 1-3, 21-23)
Ophitis magnaria Felder & Felder, 1874. *Reise Novara Lep. Het*., (9)**2**(2): pl. 97, fig. 10
Holotype ♀, French Guiana: ‘Guyana gall.’ [no further data] (NHMUK) [examined].
= *Rifargia imitata* Druce, 1911. *Ann. Mag. Nat. Hist*., (8) **8**: 148
Holotype ♂, Trinidad: Caparo (NHMUK), synonymized by BECKER, 2014: 18 [examined].

Diagnosis: Male 27-30 mm (60-65 mm wingspan) (Figs. 1, 3), female (Fig. 2), slightly larger and with broader wings. Whitish gray; FW black area, based of antemedial band, inserted with an irregular, whitish area towards costa. Male genitalia (Fig. 21) with uncus tapering distad; a minute indentation at apex; socii small, thin, curved ventrad; valva with costa bearing a strong, sharp pointed, curved process at middle.

Material examined: Types; 5 ♂♂ (2 g. s.: 4099, 5559).

Distribution: Trinidad to Brazil (Pará, Rondônia, Goiás).

Remarks: Both types represent the sexes of the same species. Similar to the dark form of *mistura*, but in the last the area based of antemedial band is wholly black.

Ophitis mistura (Schaus, 1905) (Figs. 4, 5, 24-26)
Rifargia mistura Schaus, 1905. *Proc. U. S. Nat. Mus*., **29**: 269
Lectotype ♂, French Guiana: St. Jean, Maroni River (USNM 8729), designated by SCHINTLMEISTER, 2014: 306.
= *Rifargia cossoides* Rothschild*,* 1917. *Novit, Zool*., **26**: 254
Holotype ♂, Brazil: Amazonas, Fonte Boa, ‘Upper Amazons’ (Klages) (NHMUK), synonymized by SCHAUS, 1928: 72 [examined].

Diagnosis: Male 30-34 mm (66-72 mm wingspan) (Figs. 4, 5). FW whitish gray, area based of antemedial band ochreous-brown to blackish; a white patch below apex, distad of postmedial band, between R4 and M1; diffuse, pale band across middle, from costa to tornus; small ocellus on tornus. HW fuscous brown. Male genitalia (Fig. 24): uncus long, thin; socii small, bent distad; valva broad, costa with a long, sharp pointed thorn at base; abruptly constricted at distal third.

Material examined: Types; 13 ♂♂ (2 g. s.: 4098, 5560), 1 ♀.

Distribution: Guianas, Perú, and Brazil, south to Espírito Santo.

Remarks: *Rifargia mistura* Schaus, 1905 was described from an unspecified number of specimens with no reference to sex. Two male syntypes were traced, the male designated as lectotype, and the second male as paralectotype. The type of *R. mistura* Schaus, 1905 resembles the dark form of *R. lemoulti* Schaus, 1905. Specimens from Perú are more brownish, resembling *R. culpata* Schaus, 1912 (Fig. 6), from Costa Rica, including their genitalia (Fig. 27); the only noticeable difference is in the shape of costa of valvae, even in *R. culpata*, whereas abruptly constricted at distal third in *R. mistura.* Also similar to the sympatric *O. magnaria,* distinguished by the contrasting white patch below apex, distad of postmedial band. SCHINTLMEISTER (2016: 330), stated that *R. mistura* is a junior synonym of *O. cymantis* (Schaus, 1905), attributing this combination to BECKER (2014: 15), what obviously is a mistake, as *Pronerice cymantis* Schaus, 1905 is correctly listed under *Kurtia* Schaus, 1901 (BECKER, 2014: 13).

Ophitis lemoulti (Schaus, 1905) (Figs. 7-10, 30-32)

Rifargia lemoulti Schaus, 1905. *Proc. U. S. Nat. Mus*., **29**: 268

Lectotype ♂, FRENCH GUIANA: St. Jean, Maroni River (USNM 8728), designated by SCHINTLMEISTER, 2016: 330 [examined].

Diagnosis: Males 27-33 mm (60-70 mm wingspan) (Figs. 7, 8,10), females 30-33 mm (66-72 mm wingspan (Fig. 9). FW with area based of antemedial band ochreous, dusted brown, especially next to the band, or wholly brown, or dark-brown; area distad of antemedial band mouse-gray, with faint pattern. Male genitalia (Fig. 30) with long, thin uncus; socii arms very long, thin, helicoidal; valva with short, flat protrusion on costa before apex.

Material examined: Types; 32 ♂♂ (4 g. s.: 4101, 5556-5558), 2 ♀♀.

Distribution: Guianas to Brazil, as far South as Santa Catarina, in the lowlands.

Remarks: Described from an unspecified number of males and females. Three syntypes were traced, the male lectotype, and one male and one female designated as paralectotypes. The area based of antemedial band variable: most specimens ochreous, as in the type-series (Figs. 7, 9), brown to dark-brown, to near blackish in others (Figs. 8, 10). Specimens showing all the different forms can be sympatric, being collected at the same light in the same night. Male genitalia of all forms identical.

Ophitis biplaga (Rothschild, 1917) (Figs. 11, 12, 33-35)

Rifargia biplaga Rothschild, 1917. *Novit. Zool*., **26**: 254, pl. 4, fig. 8

Holotype ♂, PERÚ: [Puno], Carabaya, Tinguri, 3,400 ft, VIII-1904 (Ockenden) (NHMUK) [examined].

Diagnosis: Male 26-32 mm (60-72 mm wingspan) (Figs. 11, 12). FW mottled fuscous; pair of irregular, bluish-white patches on dorsum. HW fuscous; orbicular on tornus, preceded by an elongate white mark, bearing a small black dot. Male genitalia (Fig. 33) with uncus thick, socii small; valva broad; sacculus with a short, broad tooth at middle; aedeagus short, thick; a small, sharp pointed spine near apex; vesica with multiple loose spines.

Material examined: Type; 2 ♂♂ (g. s. 5597).

Distribution: Eastern Peru, Western Brazil, in the Amazon region.

Remarks: A conspicuous species, with dark area, based of antemedial band, diffuse, almost indistinct. The two white patches next to dorsum of FW are unique in the genus. Male genitalia resemble those of *adusta.*

Ophitis rothschildi (Draudt, 1932) (Figs. 17, 18, 36-38)
Rifargia rothschildi Draudt, 1932. *in* SEITZ. *Gross-Schmett. d. Erde,* **6**: 1006, name of substitution
= *Rifargia muscosa* Rothschild, 1917. *Novit. Zool*., **26**: 255, pl. 7, fig. 5, *nec* Dognin, 1905

Holotype ♂, SURINAM: Aroewarwa Creek, Moroewym Valley, IV-1905 (Klages) (MNHUK). Preocc., DOGNIN, 1905: 149.

= *Malocampa griffini* Schaus, 1939. *Proc. U. S. Nat. Mus*., **86**: 549

Holotype ♂, BRAZIL: 'Espirito Santo' [no further data] ([Hoffmann]) (USNM 34706), synonymized by BECKER, 2014: 18.

Diagnosis: Male 22-26 mm (48-56 mm wingspan) (Figs. 17, 18). FW mottled gray, antemedial band straight, double; area based of it slightly darker. HW pale, yellow along internal margin. Distal margin of 8th sternite (Fig. 38) with a large, protruding, apically round plate at the middle, with two lateral small, triangular, sharp-pointed expansions. Male genitalia (Fig. 36) with uncus tapering distad; socii arms large, flat, falcate; apex sharp.

Material examined: Types; 2 ♂♂ (g. s. 4938)

Distribution: Surinam to Brazil, as far South as Espírito Santo.

Remarks: A very distinct species in the genus; easily distinguished by the pale HW, with yellow scales along internal margin.

***Ophitis mielkei* Becker, sp. n.** (Figs. 19, 20, 39-41)

Material examined: Holotype ♂, BRAZIL: Rondônia, Vilhena, 600 m, 2-4-XII-1994, g. s. 5598 (Becker 94243) (VOB). Paratypes: 1 ♂, g. s. 4733, same data as holotype; ♀, Pará, Cachimbo, 11-18-IV-1956 (Travassos & Medeiros) (UFPR).

Diagnosis: Whitish gray; FW with ante- and postmedial bands, and median line, double; dusted fuscous on dorsum, before medial band, and on tornus, distad of postmedial band; HW fuscous, darker distad of median line.

Description: Male 25 mm (54 mm wingspan) (Fig. 19); female 30 mm (65 mm wingspan (Fig. 20). Labial palpi whitish ventrally, dark gray dorsally; frons whitish, mixed with gray scales; vertex darker; antenna white; thorax fuscous dorsally, whitish ventrally; tarsi ringed gray. FW with antemedial band, median line, and post median band double; subterminal line black; two diffuse, fuscous patches: first on dorsum, before antemedial band; second on tornus, distad of postmedial band; underside whitish, dusted fuscous; median line and postmedial band fuscous; subterminal line white. HW fuscous; darker distad of median line to termen. Abdomen fuscous dorsally; white ventrally.

Male genitalia (Fig. 39): Uncus short, broad, apex round; pair of hairy warts ventrally, near apex; socii long, arms broadly curved, tapering distad to a sharp tip; costa of valva with blunt, conical expansion at distal third; juxta square; vinculum round, slightly concave at middle. Aedeagus short, thickened distad, a sharp tooth and several minute thorns near apex, laterally.

Distribution: Central Brazil, in the Cerrado biome.

Remarks: This small whitish gray species, the smallest of the Brazilian species, cannot be confused with no other in the genus. The short, broad uncus is also unique.

Ophitis adusta (Rothschild, 1917) (Figs. 13-16, 42-44)
Naprepa adusta Rothschild, 1917. *Novit. Zool*., **26**: 231, pl. 5, fig. 8
Holotype ♀, PERÚ: [Puno], Carabaya, Tinguri, 3,400 ft, VIII-1904 (Ockenden) (NHMUK) [examined].
= *Rifargia christinae* Thiaucourt, 1987. *Lambillionea,* **87**: 56, figs. 10-12

Holotype ♂, ECUADOR: Route Baeza-Lumbaqui, Puente Azuela, 1600 m, 19-II-1979) (Porion) (PTC), synonymized by BECKER, 2014: 18 [not examined].

= *Riforgia kawensis* Thiaucourt, 1987. *Lambillionea,* **87**: 54, figs. 8-9

Holotype ♂, FRENCH GUIANA: Cayenne, piste de Kaw, p. k. 31, 11-XII-1986 (Toulgoët*)* (PTC), synonymized by BECKER, 2014: 18 [not examined].

Diagnosis: Males 30-35 mm (65-76 mm wingspan) (Fig. 13, 14); females 35-40 mm (75-86 mm wingspan) (Figs. 15, 16). Dark fuscous-brown. FW with long, irregular dark gray dashes along middle from base to near termen. HW with basal half dark gray. Male genitalia (Fig. 42) with long, thin uncus; socii short, bent distad, slightly wide and flat distad; valva with smooth costa.

Material examined: Type of *adusta;* 27 ♂♂ (3 g. s.: 4100, 5554, 5555), 2 ♀♀.

Distribution: Costa Rica to Brazil, as far south as São Paulo.

Remarks: The large series examined includes specimens that match the type-specimens of all species names, some of them even sympatric. Their genitalia are identical. Specimens from the dry Cerrado areas of Central Brazil and western São Paulo, are smaller and paler, resembling the large species of *Xylodonta* Becker.

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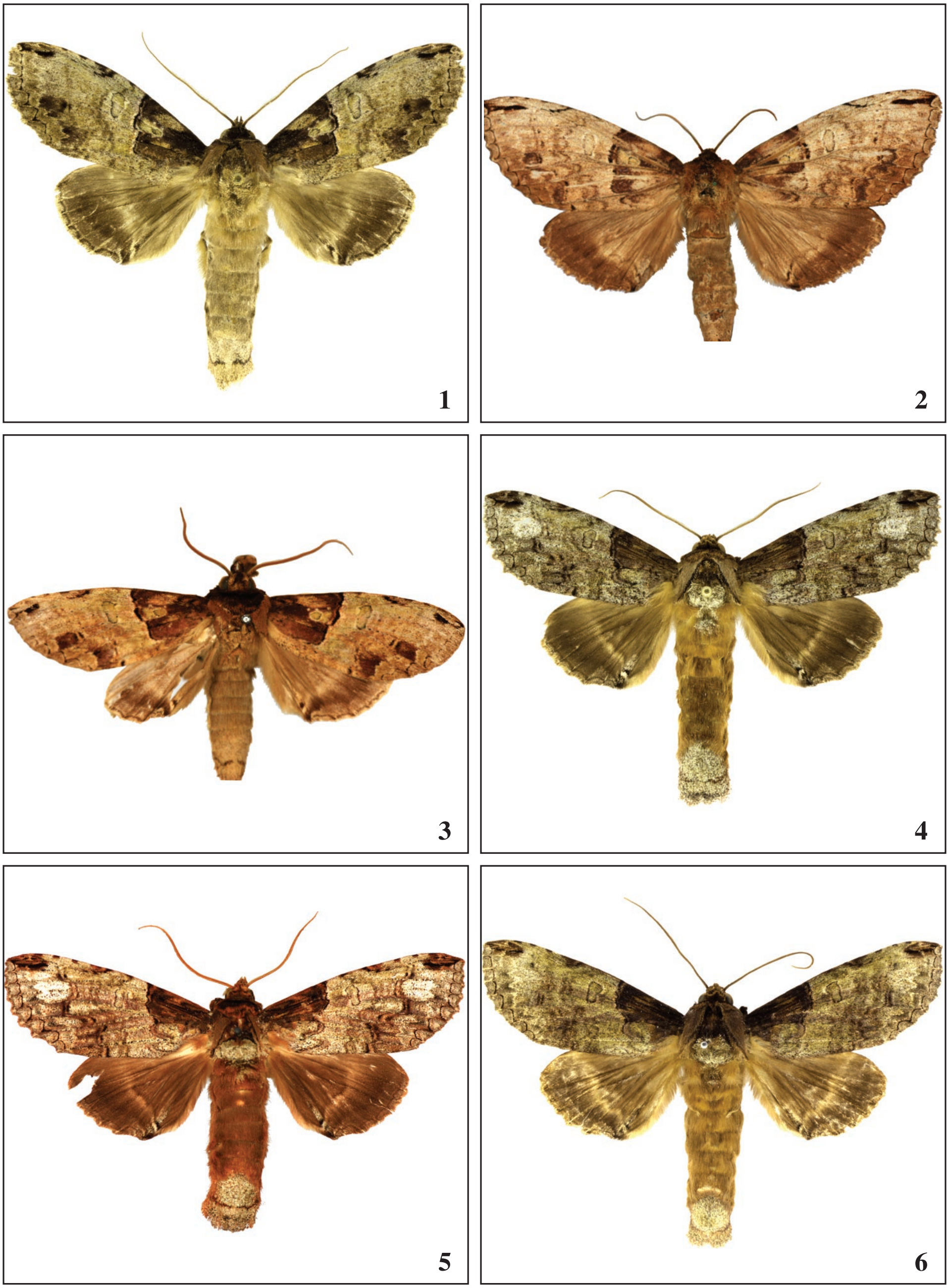
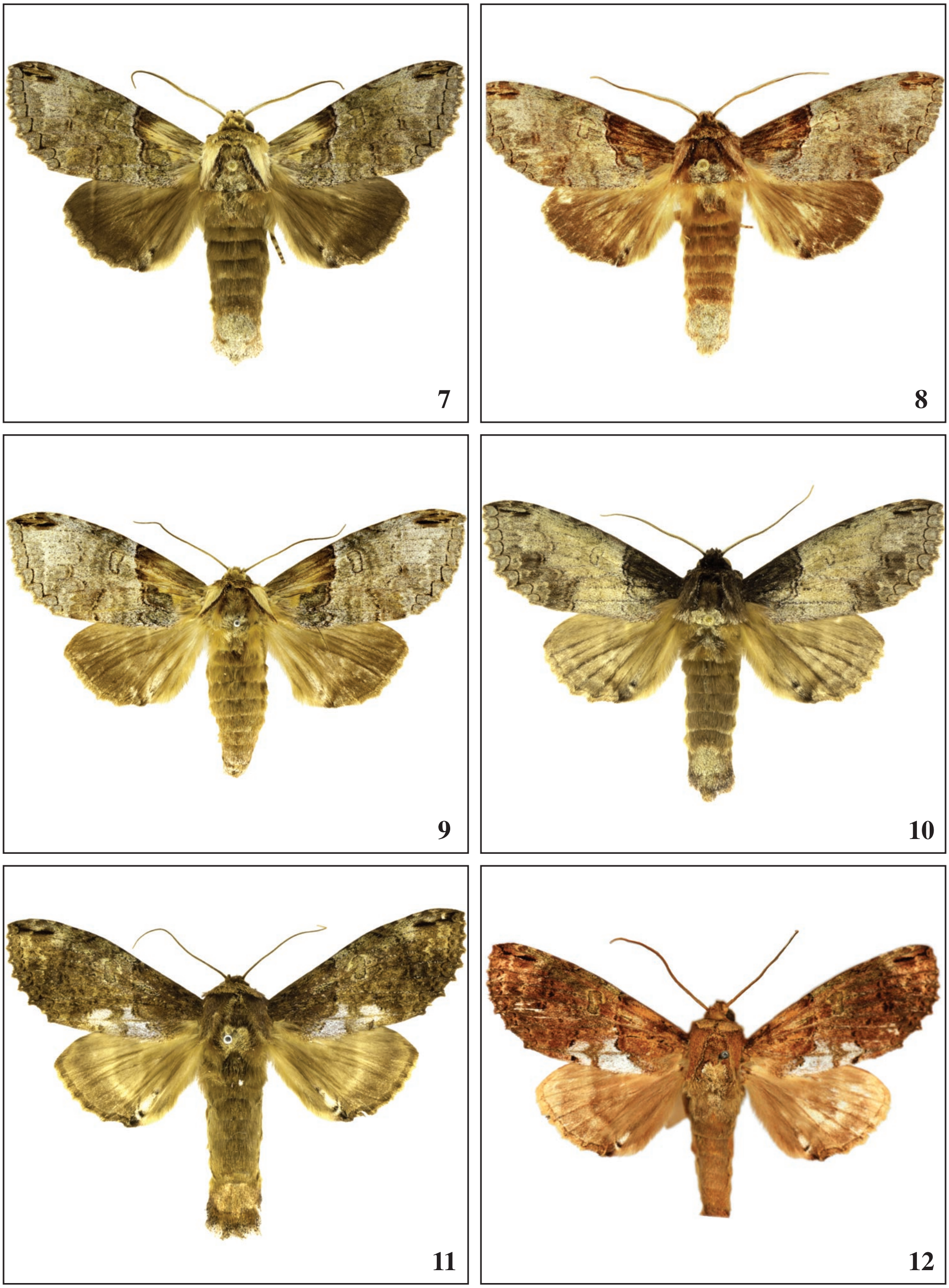
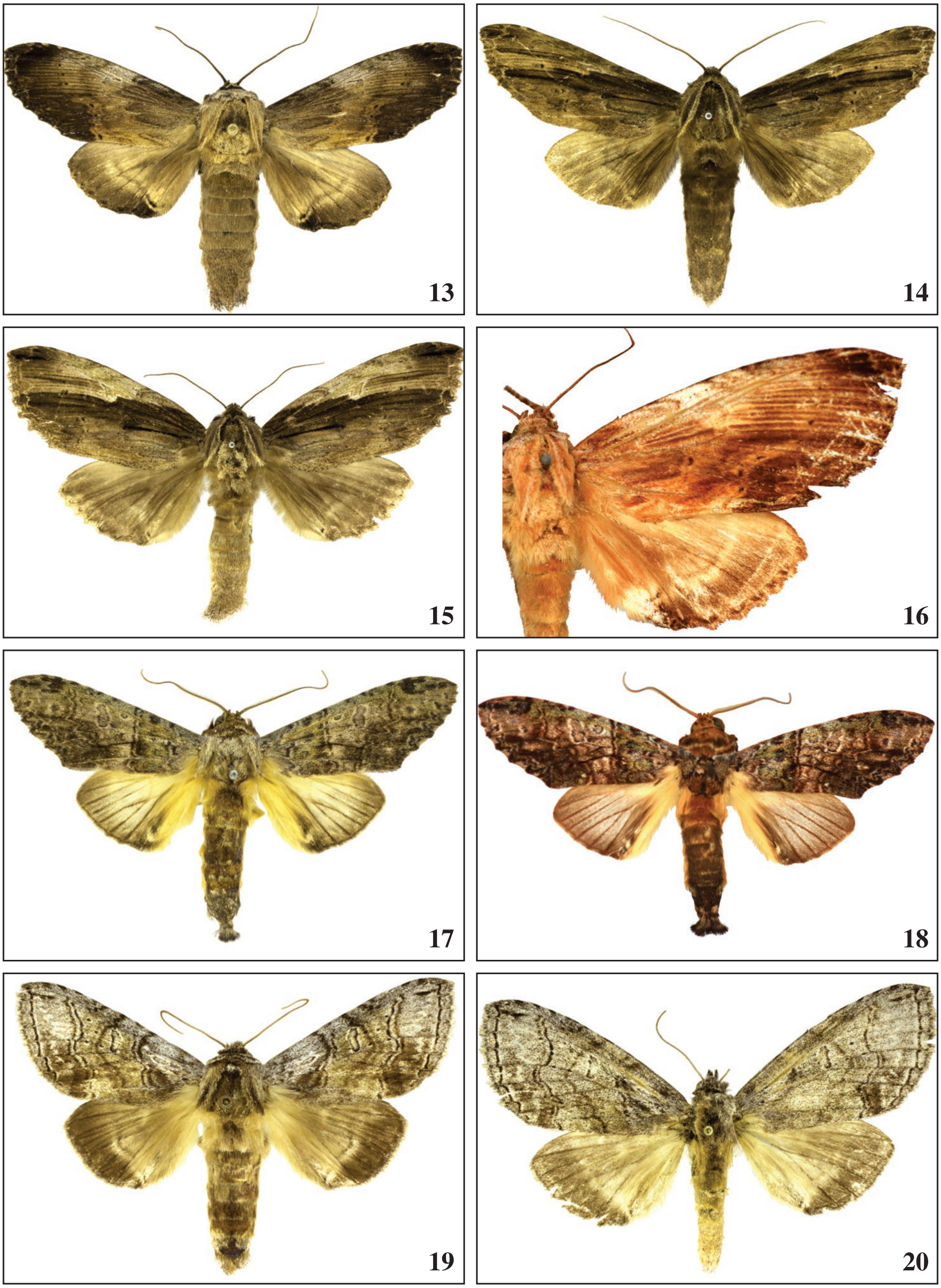


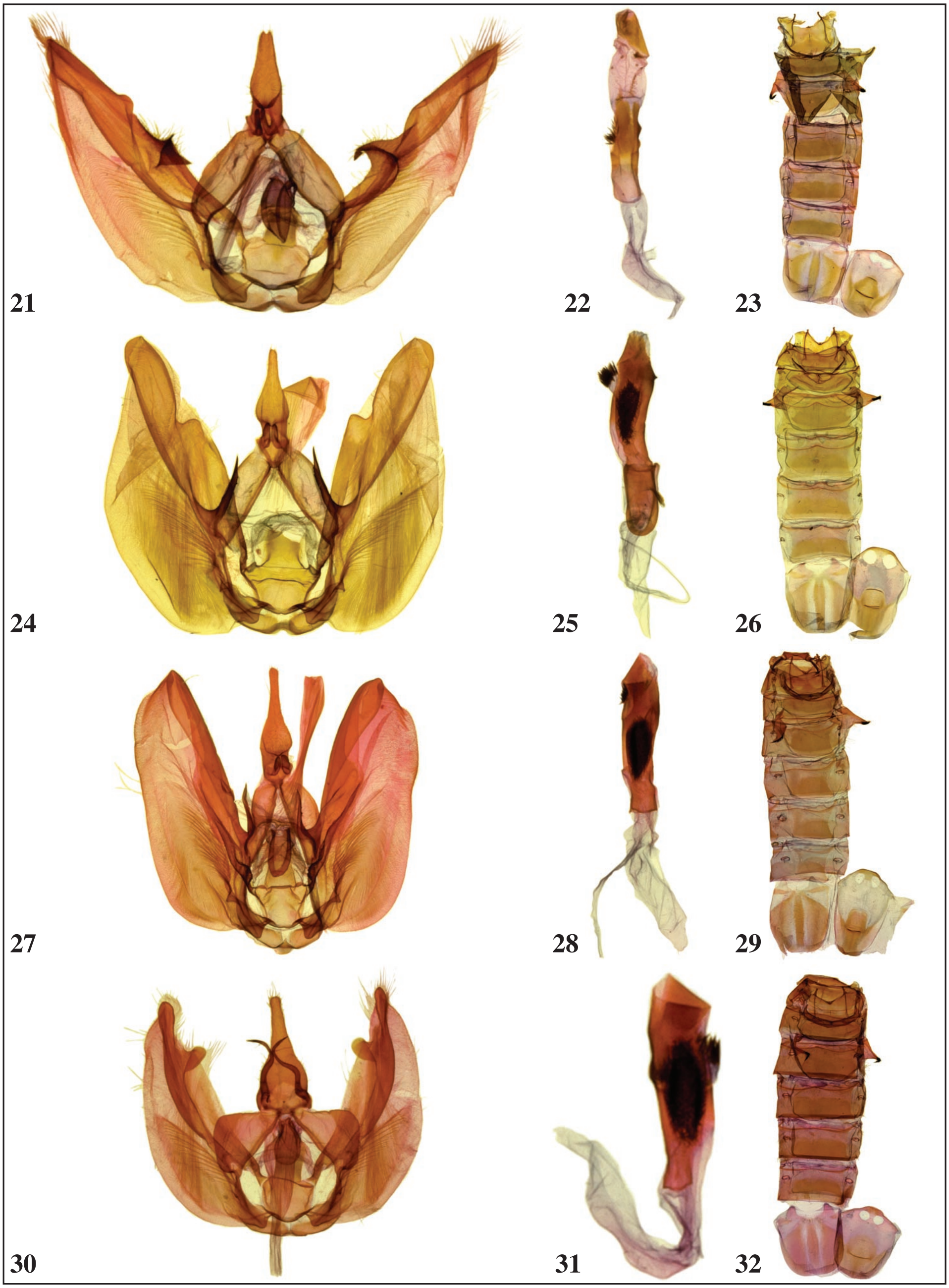
Figs. 1-6.– Adult *Ophitis* species, dorsal view. **1-3.** *O. magnaria.* **1.** ♂ Brazil. **2.** holotype ♀. **3.** holotype ♂ (= *imitata*). **4-5.** *O. mistura.* **4.** ♂ Brazil. **5.** ♂ holotype (= *cossoides*). **6.** *O. culpata* ♂ Costa Rica.



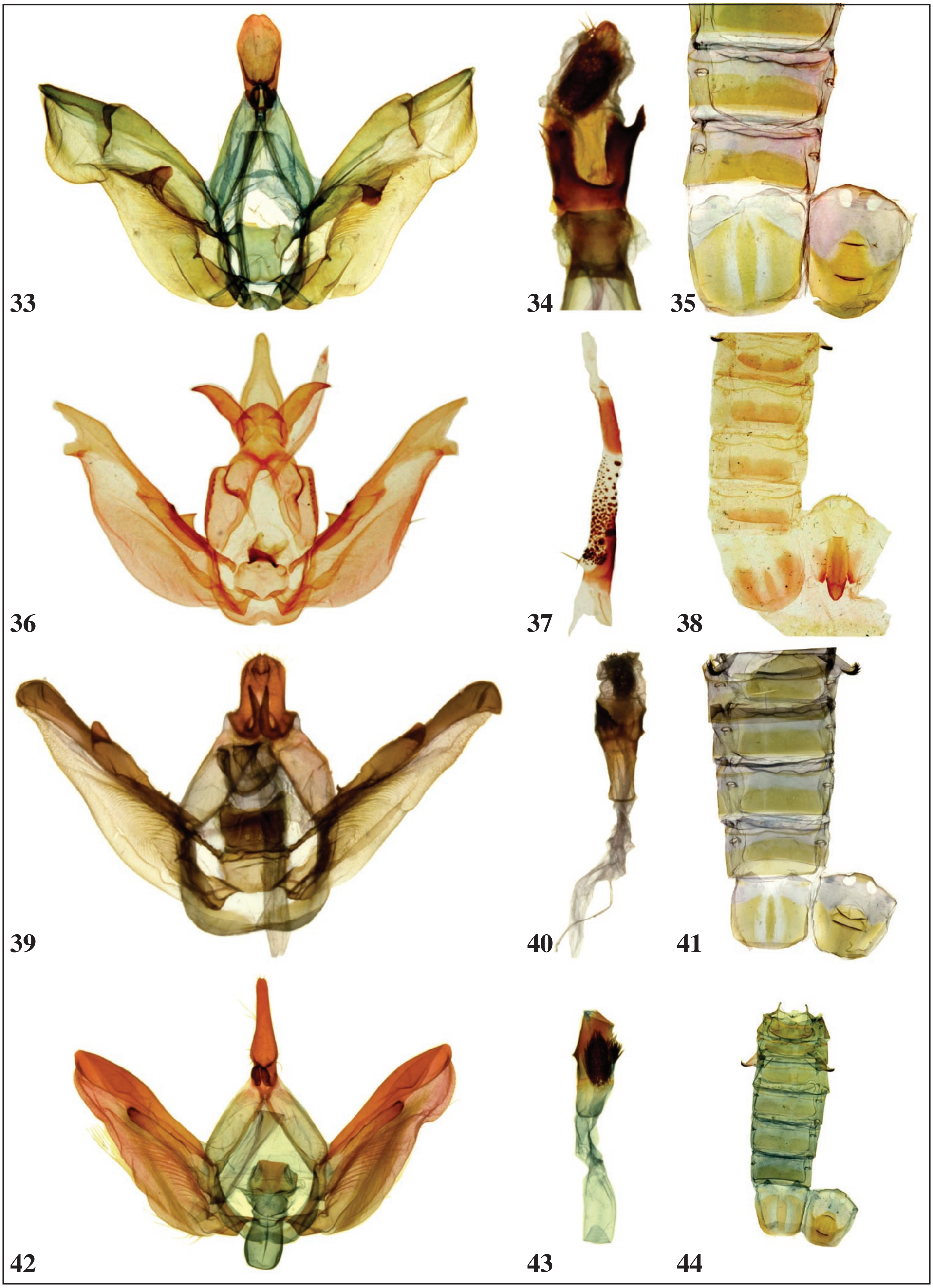
Figs. 7-12.– 7-10. *O. lemoulti,* Brazil. **7, 8, 10.** ♂♂. **9.** ♀. **11-12.** *O. biplaga.* **11.** ♂ Brazil. **12.** holotype ♂.



Figs. 13-20.– 13-16. *O. adusta.* **13-14.** ♂♂, Brazil. **15.** ♀, Costa Rica. **16.** holotype ♀. **17-18.** *O. rothschildi.* **17.** ♂ Brazil. **18.** holotype ♂ (= *muscosa*). **19-20.** *O. mielkei.* **19.** holotype ♂. **20.** paratype ♀.



Figs 21-32.– 21-44. Male genitalia, aedeagus, and 8th abdominal segment (tergite left; sternite right) of *Ophitis* species (ventral view). **21-23.** *O. magnaria.* **24-26.** *O. mistura.* **27-29.** *O. culpata*. **30-32.** *O. lemoulti.*



Figs. 36-44.– 33-35. *O. biplaga.* **36-38.** *O. rothchildi.* **39-41.** *O. mielkei* (holotype). **42-44.** *O. adusta.*

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A new Hyblaeidae species from Solomon Islands. Studies of Hyblaeidae 4 (Insecta: Lepidoptera)

U. Buchsbaum & M.-Y. Chen

Summary

The species *Hyblaea solomonensis* Buchsbaum & Chen, sp. n. is described from the Solomon Islands. The species is to be placed in the *Hyblaea constellata* Guenée, 1852 - species group due to its similarity in the external morphological features, as well as in the genital structures. The new species differs from all other species in this group.

KEY WORDS: Insecta, Lepidoptera, Hyblaeidae, *Hyblaea solomonensis*, distribution, taxonomy, Solomon Islands.

Eine neue Hyblaeidae - Art von den Solomon Inseln. Studien zu Hyblaeidae 4 (Insecta: Lepidoptera)

Zusammenfassung

Die Art *Hyblaea solomonensis* Buchsbaum & Chen, sp. n. wird von den Salomon-Inseln beschrieben. Die Art ist wegen ihrer Ähnlichkeit sowohl in den äußeren morphologischen Merkmalen als auch in den Genitalstrukturen in die *Hyblaea constellata* Guenée, 1852 - Artengruppe zu stellen. Die neue Art unterscheidet sich äußerlich und in den Genitalien von allen anderen Arten dieser Artengruppe.

SCHLÜSSELWORTE: Insecta, Lepidoptera, Hyblaeidae, *Hyblaea solomonensis*, Verbreitung, Taxonomie, Solomon Inseln.

Una nueva especie de las Islas Salomón. Estudios de Hyblaeidae 4 (Insecta: Lepidoptera)

Resumen

Se describe de las Islas Salomón la especie *Hyblaea solomonensis* Buchsbaum & Chen, sp. n. La especie debe de situarse en *Hyblaea constellata* Guenée, 1852 grupo de las especies se agrupan debido a su semejanza tanto en las características morfológicas, como en la estructura de la genitalia. La nueva especie difiere de las otras especies en este grupo.

PALABRAS CLAVE: Insecta, Lepidoptera, Hyblaeidae, *Hyblaea solomonensis*, distribución, taxonomía, Islas Salomón.

Introduction

The Solomon Islands are situated south-east from New Guinea in the Pacific Ocean. The new species was collected in the Guadalcanal Island which is the island where the Capital of the Solomon

Islands is situated. Information about the biogeography is given by CARVAJAL & ADLER (2005), KEPPEL *et al*. (2010) and LUCKY & SARNAT (2010).

Not much is known about the Pacific Islands Insect fauna (e. g. YANO, 1963; ROBINSON, 1975; FILARDI *et al*., 1999; TENNET, 1999). A new Arctiinae species of the genus *Eugoa* Walker, 1858 (Erebidae: Arctiinae) was recently described by BUCSEK & RINDOS (2018).

HYBLAEIDAE

The genus *Hyblaea* Fabricius, 1793 is known with about 20 species (DE FREINA & BUCHSBAUM, 2012; BUCHSBAUM *et al*., 2012, 2019) and some more undescribed species. Some species were synonymised by BERIO (1967) without giving any reason and with no exact explanation.

A further species, *Hyblaea constellata* Guenée, 1852 is recorded from Guadalcanal Island and wrong spelled as *Hyblaea onstellata* (*sic*) Guenée, 1852 (KODA & KUSIGEMATI 1985). The figures show that this is a species of the *H. constellata* species group. Several species of the *H. constellata* species group are known from the neighboring islands like New Guinea. BUCHSBAUM *et al*. (2019) described *H. behouneki* Buchsbaum, Speidel & Chen 2019 which belongs to the *H. puera* (Cramer, 1777) species group. DE FREINA & BUCHSBAUM (2012) described another species of the *H. puera* species group from the Island Mauritius in the Indian Ocean: *H. mauricea* de Freina & Buchsbaum, 2012.

Hyblaea solomonensis **Buchsbaum & Chen, sp. n.** (Figs 1-3)

Holotype: 1 ♀, S. Pacific. SOLOMON ISL.; Guadalcanal I. 50-80 m; Lunga riv. Env., 2-10 km S; of Barana, Honiara reg.; 23-IX-18-XII-2016; Sr. Jákl et Vlad. Gurko. Holotype in Collection Ulf Buchsbaum, Kranichfeld (CUBK), later to be deposited in Coll. Zoologische Staatssammlung München (ZSM). No Paratypes.

Description and differential diagnose

Wingspan: 38 mm, Forewing length: 17 mm. Ground colour of body and wings brown. Abdomen ends with dark orange tip. Forewings brown with white antemedian and subterminal fasciae from dorsum antemedian to inner margin. Postdiscal region paler brown. Hindwings dark brown with 4 orange spots at dorsum in the median region and at basal angle.

Underside of forewings brown. At dorsum pale yellow. From costa two wide orange stripes. Base orange. Hindwings orange with dark brown discal spot underlined with a brown stripe and brown marked terminal shade. From tornus to apex on the hindwing [underside] a brown waved line along termen. No other species and no specimens in the *H. constellata* group and also in all other *Hyblaea* species have such markings, this waved line and the large "underlined" discal spot.

Female genitalia: Papillae anales sclerotized and hairy, narrow, long. Anterior apophyses short. Ductus bursae long, wide, weakly sclerotized with same length as corpus bursae. Corpus bursae oval with a single pointed arrow-like signum. Other species similar to *H. constellata* with two signa and ductus bursae longer and thinner.

Distribution: Only known from the type locality on the Solomon Islands, Guadalcanal.

Biology: unknown.

Etymology: The species is called *H. solomonensis* after the locality where this species was collected, the Solomon Islands.

Discussion

The similarity in the external morphological and the genitalia characteristics place this species in the *H. constellata* species group. The species groups were suggested by CHANDRASEKHAR *et al*.

(2008) based on their DNA analyses of Hyblaeidae species from all over the world. The sister species group *H. puera* has constantly two signa in the female genitalia. No other species in the *H. constellata* species group has a discal spot as described above. *H. constellata* Guenée, 1852 is described from Bengal (India) without indication of the exact locality and figured in BOISDUVAL & GUENÉE (1852) on plate 13, figure 6 which shows that this species is totally different from the here described new species.

The *H. puera* species group is based on the type species and type locality in Surinam (South America) with several more species in South and North America. The *H. constellata* species group is only known from Asia, with the type locality and type species from Bengal without indication of exact locality but the members of the group are widespread in whole Asia until New Guinea and Australia. It contains many species.

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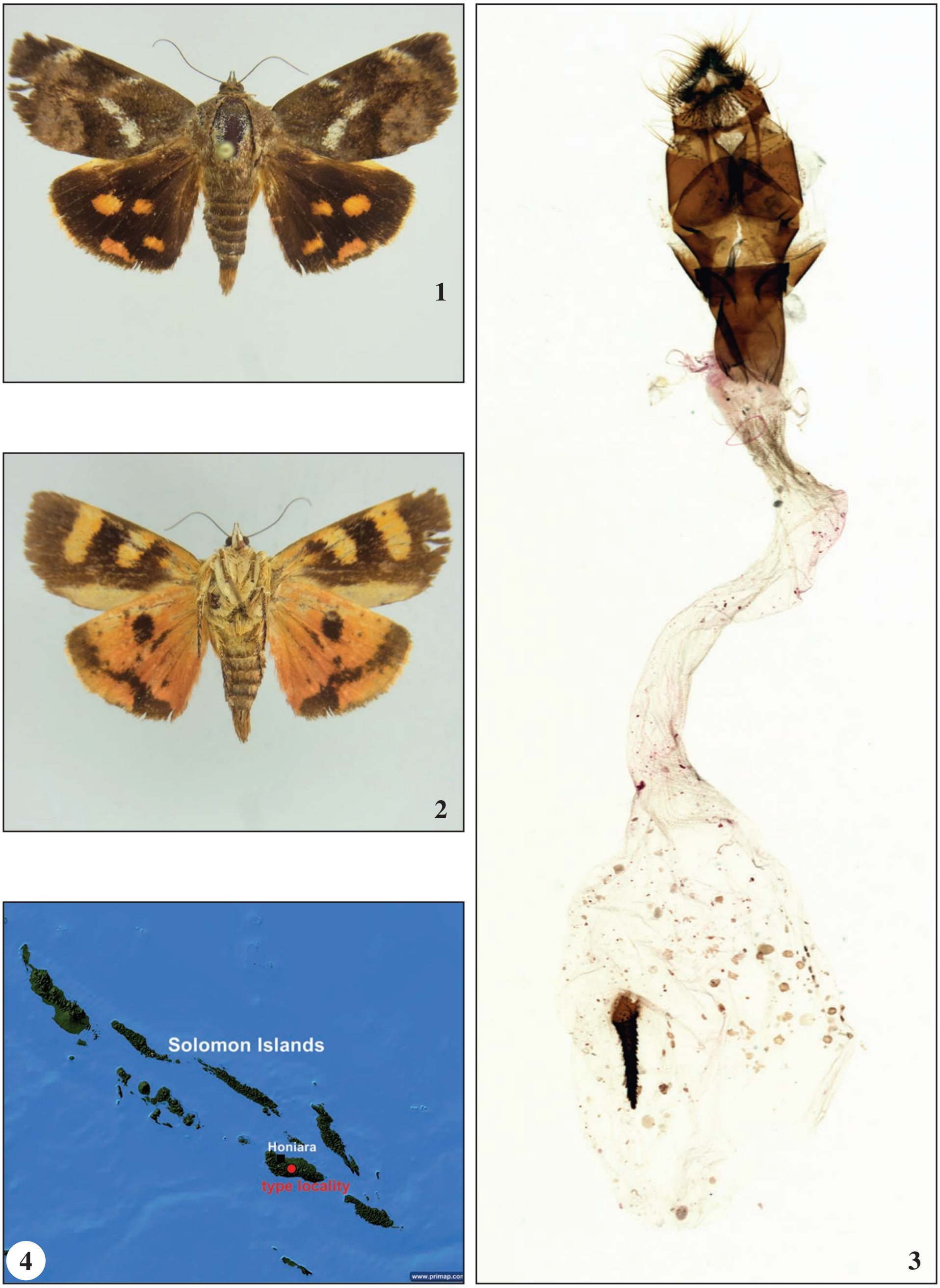

Figures 1-4.– 1. *Hyblaea solomonensis* Buchsbaum & Chen, sp. n., holotype. **2.** Underside. **3.** Female genitalia. **4.** Map with type locality.

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New records of Scythrididae from Namibia, with descriptions of five new species (Lepidoptera: Scythrididae)

K. Nupponen, R. Haverinen & A. Pototski

Abstract

A list of 24 species embracing 1505 specimens of the family Scythrididae from Namibia is presented. The material was collected during November–December 2019 in the course of a Finnish–Estonian expedition to the Northern and Central Namibia. Five new species are described: *Haploscythris fannyae* Nupponen, sp. n., *Scythris eburnipalpella* Nupponen sp. n., *S. eneae* Nupponen, sp. n., *S. fimbriatella* Nupponen, sp. n., and *S. pretarsella* Nupponen, sp. n. *Scythris curvipilella* Bengtsson, 2002, *S. mesoplecta* Meyrick, 1921 and *S. sericiella* Bengtsson, 2014 are reported as new to Namibia. The known distribution range of each species is given.
KEY WORDS: Lepidoptera, Scythrididae, new species, new records, Afrotropical region, Namibia.

Nuevos registros de Scythrididae de Namibia, con descripción de cinco nuevas especies (Lepidoptera: Scythrididae)

Resumen

Se presenta una lista de 24 especies recogidas sobre 1.505 especímenes de la familia Scythrididae de Namibia. El material fue colectado durante noviembre-diciembre de 2019, en el curso de la expedición Finés-Estoniana al norte y centro de Namibia. Se describen cinco nuevas especies: *Haploscythris fannyae* Nupponen, sp. n., *Scythris eburnipalpella* Nupponen sp. n., *S. eneae* Nupponen, sp. n., *S. fimbriatella* Nupponen, sp. n. y *S. pretarsella* Nupponen, sp. n. Se citan por primera vez como nuevas para Namibia a *Scythris curvipilella* Bengtsson, 2002, *S. mesoplecta* Meyrick, 1921 y *S. sericiella* Bengtsson, 2014. Se da el rango de distribución de cada especie.
PALABRAS CLAVE: Lepidoptera, Scythrididae, nuevas especies, nuevos registros, región Afrotropical, Namibia.

Introduction

The Scythrididae fauna of the Afrotropical region was recently reviewed (BENGTSSON, 2014), on the basis of thorough examination of available materials preserved in various museum and private collections. The majority of existing materials, comprising almost 4000 specimens, originate from just a few countries, namely South Africa, Namibia, Kenya, Yemen, and Oman. Additional records of Scythrididae material from South Africa and Namibia were recently published (NUPPONEN, 2018). Altogether 81 species of Scythrididae are so far reported from Namibia.

The present article is based on new materials of Scythrididae collected during November–December 2019 in the course of a Finnish-Estonian expedition to Namibia. The aim of the trip was to investigate nocturnal Scythrididae by various types of light traps, which have turned out effective, but hitherto used only few times in the southern hemisphere.

Material and methods

The Finnish-Estonian expedition to Namibia was made during 22-XI-02-XII-2019. The investigated area covered the Northern and Central Namibia at ten collecting sites at altitudes of 760 m to 1645 m above sea level. The habitats of collecting sites were various bushy savannas (Figs. 1-2). Altogether 24 species embracing 1505 specimens of Scythrididae were recorded during the trip. The material was collected by light trapping at night. Three to five light traps were used every night, with various UV-tube and led-lamps, as well as 160 W incandescent lamps. Larger insects were removed from trapped material. The remaining portion, mainly microlepidoptera, was transported to Finland. Timo Nupponen sorted the material and transferred the Scythrididae to the corresponding author for determination. The material is deposited in the research collection of T. & K. Nupponen (Espoo, Finland). The types are available for loan via Finnish Museum of Natural History, University of Helsinki, Finland (FMNH), or directly from the corresponding author. The coordinates are presented in decimal degrees.

Abbreviations

NUPP	research collection of Kari and Timo Nupponen, Espoo, Finland.
FMNH	Finnish Museum of Natural History, University of Helsinki, Finland.

Descriptions of new species

Haploscythris fannyae Nupponen, sp. n.

Type material. Holotype ♂: Namibia, 24.61490º S 017.95583º E, 1106 m, Marienthal near Fish River, 1-XII-2019, R. Haverinen & A. Pototski leg. Genitalia slide: K. Nupponen prep. no. 2/25-VII-2020. In coll. NUPP (FMNH). Paratypes: Idem, 2 ♀♀. Genitalia slides: K. Nupponen prep. no. 1/25-VII-2020, 4/30-VII-2020. In coll. NUPP.

Diagnosis: *H. fannyae* Nupponen, sp. n. is a pale mottled species, resembling especially *H. albifuscella* Bengtsson, 2014 and to some extent also *H. canispersa* (Meyrick, 1913), which, however is large. The male genitalia of *H. fannyae* are similar to those of *H. vredendalensis* Bengtsson, 2014 and *H. swartbergensis* Nupponen, 2018, but differ readily from those in many details, such as a characteristic bifurcate phallus, very long, slender and curved valva appendixes, and shapes and locations of extensions in the valvae. In the female genitalia, a minutely spined mushroom-shaped sterigma is diagnostic.

Description (Fig. 3): Wingspan 13.5-14 mm. Head, collar, neck tuft, haustellum, scape, and thorax pale ivory mixed with fuscous. Flagellum dark fuscous, 0.75 × length of forewing; in male ciliate, sensillae a little shorter than diameter of flagellum. Labial palp white, except ventral surface of segments II and III medially dark brown. Legs: dorsal surface beige, darker in fore legs; ventral surface white; tarsus subdistally at each leg with a more or less distinct blackish brown patch. Abdomen dorsally ivory (in male) or beige (in female) mixed with whitish grey, ventrally white. Forewing white, with scattered black and dark brown scales over the wing; dark scales form a distinct patch in fold at mid wing, small spot at cell end, and indistinct longitudinal stripes at costal and apical areas. Hindwing pale fuscous. Fringes pale ochreous in hindwing and dark fuscous in forewing.

Male genitalia (Fig. 4): Uncus large medioposteriorly incised plate, laterally subtriangular setose hoods, basally two backwards directed robust flaps with about ten stout thorns at tip. Gnathos basally hood-shaped, posteriorly edged by incomplete basal loop; gnathos arm at basal half straight and evenly thick, apical half tapered and bent, tip pointed. Phallus 0.6 × length of valva, basally slightly widened; basal half straight, at middle bent at right angle; distal half bifurcate, one prong straight with pointed tip and a thorn subapically, the other prong bent with minute apical tooth dorsally. Juxta 0.25 × length of valva. Valvae asymmetrical, rather complex with extensions: both valvae subbasally a robust and medially bent dorsal extension; both valvae have subapical extensions dorsally and ventrally: dorsal extensions triangular, that of right valva smaller and closer to apex; ventral extension of left valva simple and rather small, that of right valva two times longer and bifurcate; on dorsal side of each valva long, setose and rather thin U-shaped appendix with short but stout extension at middle. Vinculum short and broad, arched. Sternum VIII trapezoid, medioposteriorly incurved, anteriorly shallowly concave; posterolaterally small flaps at each side. Tergum VIII large U-shaped plate, tips of shanks blunt; at base between shanks a membranous and posteriorly labiate flap, posterior half furnished with minute granules.

Female genitalia (Fig. 5): Sterigma mushroom-shaped, densely minutely spined, ostium located at its base. Antrum funnel shaped. Sternum VII trapezoid, cleft medially. Apophyses anteriores 0.6 × length of apophyses posteriores.

Habitat: Bushy savanna (Fig. 2). The moth is nocturnal.

Distribution: Namibia (Central).

Etymology: The species is dedicated to the author’s dog Fanny, a Jack Russel Terrier sharing the coloration with the moth.

Remarks: *H. fannyae* Nupponen, sp. n. is placed to the genus *Haploscythris* Viette, 1956 on the basis of its male genitalia, having conspicuous appendix on dorsal side of each valvae. Altogether 28 species are comprised in the genus (BENGTSSON, 2014; NUPPONEN, 2018).

Scythris eburnipalpella Nupponen, sp. n.

Type material. Holotype ♀: NAMIBIA, 19.46888º S 017.74885º E, 1544 m, Ghaub private N-reserve, 26-XI-2019, R. Haverinen & A. Pototski leg. Genitalia slide: K. Nupponen prep. no. 1/20-VI-2020.

Diagnosis: Externally *S. eburnipalpella* Nupponen, sp. n. is distinguished from other ochreous Scythrididae, like some forms of *S. pelinaula* Meyrick, 1916, by its characteristic ivory labial palps being remarkably contrasting with ochreous head. In the female genitalia of *S. eburnipalpella*, a posteriorly asymmetric sternum VII and a sclerotized formation in sternum VI are unique.

Description (Fig. 6): Wingspan 15 mm. Head, collar, neck tuft, tegula and thorax ochreous, collar a little paler than head. Haustellum and labial palp ivory. Scape ochreous, pecten ivory and as long as diameter of scape. Flagellum 0.7 × length of forewing, dark brown. Foreleg femur ochreous, tibia and tarsus fuscous. Midleg ochreous, tarsus slightly paler. Hindleg ochreous, ventrally mixed with ivory, tibia dorsally at middle with a dark fuscous patch. Abdomen beige, ventrally paler than dorsally and mixed with white. Forewing ochreous, pattern absent. Hindwing fuscous.

Male genitalia: Unknown.

Female genitalia (Fig. 7): Sterigma cylindrical, stout and heavily sclerotized; anteriorly attached to asymmetrical structure (homology unclear). Ductus bursae a membranous tube. A pair of semi-circular setose lobes laterad sterigma (lamella postvaginalis?). Sternum VII trapezoid posteriorly attached with roundish but strongly asymmetrical sclerotization. Sternum VI rectangular, with large and laterally elongated subtrapezoidal plate with heavily sclerotized edge. Apophyses anteriores half as long as apophyses posteriores, bent basally inwards and distally outwards.

Habitat: Bushy savanna (Fig. 1). The moth is nocturnal.

Distribution: Namibia (North).

Etymology: Latin *eburneos* = ivory. The species name alludes to ivory labial palps of the adult.

Remark: *S. eburnipalpella* Nupponen, sp. n. cannot be assigned to any present species group, until further material including males is available.

Scythris eneae Nupponen, sp. n.

Type material. Holotype ♂: NAMIBIA, 19.46888º S 017.74885º E, 1544 m, Ghaub private N-reserve, 26-XI-2019, R. Haverinen & A. Pototski leg. Genitalia slide: K. Nupponen prep. no. 1/18-VI-2020. In coll. NUPP (FMNH). Paratypes: Idem, 3 ♂♂, 3 ♀♀. Genitalia slide: K. Nupponen prep. no. 2/2-VII-2020 ♀; one male genitalia preparation preserved in glycerol. In coll. NUPP.

Diagnosis: Externally *S. eneae* Nupponen, sp. n. can be confused with several pale unicolorous Scythrididae, e.g. *S. ochrantha* Meyrick, 1909, *S. eburnella* Bengtsson, 2014 and *S. wankiensis* Bengtsson, 2014. Combination of ochreous forewings and dark fuscous hindwings may help to identify the moth, but examination of the genitalia is required for confident determination. The male genitalia of *S. eneae* resemble those of the *ochrantha* and *passerini* species groups, but readily separated from those by combination of characters. A bifurcate phallus separates *S. eneae* from all its other relatives except *S. fissurella* Bengtsson, 1997, *S. niemineni* Nupponen, 2014 and *S. passerini* Bengtsson, 1997. *S. eneae* differs from those in many details, such as a narrow bifurcate uncus, a shorter posterior projection of sternum VIII, a sclerotized structure at base of the uncus, and shape of the valvae. The female genitalia are similar to those of *S. distactica* Meyrick, 1921, but differ by a longer and thoroughly sclerotized sterigma.

Description (Fig. 8): Wingspan 13.5-14 mm. Head, haustellum, neck tuft, collar, tegula, scape and thorax pale ochreous. Labial palp pale ochreous, inner surface a little paler. Flagellum 0.7 × length of forewing, dark brown; in male ciliate, length of sensillae about 0.9 × diameter of flagellum. Legs: foreleg fuscous; midleg and hindleg pale ochreous, ventrally paler. Abdomen pale ochreous, ventrally paler than dorsally. Forewing pale ochreous, unicoloured. Hindwing dark fuscous; fringes ochreous mixed with various tones of fuscous.

Male genitalia (Fig. 9): Uncus extended, bifurcate at distal third, basally a sclerotized and laterally setose labiate structure. Basal loop of gnathos laterally extended and anteriorly heavily sclerotized; distal arm thorn-shaped, half-length of uncus. Tegumen wide, hood-shaped; subposteriorly a pair of stout processes (socii?). Phallus 0.65 × length of valva, bifurcate from middle, branches 0.3 and 0.45 × length of phallus, longer one sigmoid, shorter one distally spatulate. Valvae slightly asymmetrical and bent; basal 0.8 evenly broad, apically extended, more so in left valva, tapered and spinose; ventrally semi-circular subapical flaps, that of right valva a little larger. Vinculum labiate, short. Sternum VIII a subtriangular plate, posteriorly somewhat extended, tip blunt, anterior margin concave; in middle a transverse reinforcement. Tergum VIII square, anteriorly with V-shaped indentation.

Female genitalia (Fig. 10): Sterigma long, straight and stout, rather heavily sclerotized; posteriorly tapered, basally a little broadened. Segment IX densely with minute needle-formed sclerites. Sternum VII trapezoid, 1.2 times as broad as high, medioposteriorly a membranous labiate extension. Apophyses anteriores 0.85 × length of apophyses posteriores.

Habitat: Bushy savanna (Fig. 1). The moth is nocturnal.

Distribution: Namibia (North).

Etymology: The species is named in the honour of recently deceased Estonian entomologist Ene Jürivete, a charter member and secretary of the Estonian Lepidopterological Society.

Remarks. *S. eneae* sp. n. belongs to the *ochrantha* species group (see BENGTSSON, 2014), based on structure of the male and female genitalia. The group is rather heterogeneous, and on the other hand shares some characters with the *passerini* species group (BENGTSSON, 1997; NUPPONEN, 2014; NUPPONEN & SALDAITIS, 2013). The two groups include nine described species.

Scythris fimbriatella Nupponen, sp. n.

Type material. Holotype ♂: NAMIBIA, 19.46888º S 017.74885º E, 1544 m, Ghaub private N-reserve, 26-XI-2019, R. Haverinen & A. Pototski leg. Genitalia slide: K. Nupponen prep. no. 1/16-VI-2020. In coll. NUPP (FMNH). Paratypes: Idem, 2 ♂♂, 1 ♀; NAMIBIA, 18.91591º S 017.36731º E, 1152 m, Oshivelo 40 km S, Rd. B1, private farm land, 1 ♀, 23-XI-2019, R. Haverinen & A. Pototski leg.; NAMIBIA, 20.50723º S 017.24747º E, 1516 m, Waterberg Plateau NWR, 1 ♂ 28-XI-2019, R. Haverinen & A. Pototski leg. Genitalia slide: K. Nupponen prep. no. 2/16-VI-2020, ♀. In coll. NUPP.

Diagnosis: Externally *S. fimbriatella* Nupponen, sp. n. may be separable from other Scythrididae by narrow ivory forewings with characteristically darker fringes, and a black dash in dorsal margin. The male genitalia of *S. fimbriatella* are readily separated from the other described Scythrididae by peculiar valvae and the uncus, as well as by shape of tergum VIII. In the female genitalia, a two-part sterigma is characteristic.

Description (Fig. 11): Wingspan 14-14.5 mm. Head, haustellum, collar, neck tuft, tegula, scape and thorax ivory mixed with white. Flagellum 0.75 × length of forewing, fuscous; in male ciliate, sensillae 0.8 × diameter of flagellum. Labial palps cream white, outer surface of segments I and II mixed with ivory. Legs ivory mixed with white, except tibia and tarsus of forelegs dorsally fuscous. Abdomen dorsally fuscous, ventrally white mixed with ivory. Forewing narrow, ivory with black dash in dorsal margin at 0.35 and small black spot at cell end, costal area mixed with fuscous, more so at basal 0.2, fringes fuscous, darker than forewing. Hindwing pale fuscous; fringes ivory mixed with fuscous, darker than hindwing.

Male genitalia (Fig. 12): Uncus a large longish plate, posteriorly bifurcate, in situ caudad. Gnathos stout and bent ventrad, shorter than uncus. Tegumen wide, posterolaterally extended on each side. Phallus longer than valva, thin, bent dorsal, base widen. Valvae rather short, twisted and basally fused, basal half chute-shaped; distal half subquadrangular with three horn-like extensions, largest directed caudad and two other ones dorsal. Sternum VIII subrectangular, laterally swollen; anterolaterally at each side short but stout extension; subbasally a transverse sclerotized belt; posterolateral corners setose; medioposteriorly triangular extension with blunt tip. Tergum VIII subpentagonal, about twice wider than high, posteriorly slightly extended, mediolaterally on each side hood-like flaps.

Female genitalia (Fig. 13): Sterigma consists two parts: basally conical, distally attached to widely U-shaped sclerotization. Sternum VII trapezoid, twice as broad as high, posterior margin medially slightly concave. Apophyses anteriores 0.6 × length of apophyses posteriores.

Habitat: Bushy savanna. The moth is nocturnal.

Distribution: Namibia (North).

Etymology: Latin *fimbriatus* = fringed. The species name alludes to dark fuscous cilia on the forewing, which contrast strongly with the ivory wing.

Remarks: The characters in the male genitalia of *S. fimbriatella* Nupponen, sp. n., especially combination of the valvae and the uncus do not fit in with those of any present species group. The DNA barcodes may help to solve exact systematic position of *S. fimbriatella*, but so far it is considered as an isolated species.

Scythris pretarsella Nupponen, sp. n.

Type material. Holotype ♂: NAMIBIA, 23.34687º S 017.07828º E, 1409 m, Rehoboth, 2-XII-2019, R. Haverinen & A. Pototski leg. Genitalia slide: K. Nupponen prep. no. 2/29-VII-2020. In coll. NUPP (FMNH). Paratypes: NAMIBIA, 21.53251º S 015.76281º E, 1351 m, Erongo Mts., Erongo Plateau Camp, 2 ♀♀, 22-XI-2019, R. Haverinen & A. Pototski leg. Genitalia slides: K. Nupponen prep. no. 2/13-VII-2020, 1/30-VII-2020. In coll. NUPP.

Diagnosis: Externally *S. pretarsella* Nupponen, sp. n. is similar to many unicoloured pale species, e.g. *S. stagnosa* Meyrick, 1913, but may be separated from those by contrasted pretarsi of the legs. Dissection of genitalia is required for confident determination. The male genitalia fit in with those in the *abyanensis* species group but are readily separated from other known species of the group by a short and very thick phallus and shape of segment VIII. In the female genitalia, the arched structure in sternum VIII is diagnostic.

Description (Fig. 14): Wingspan 13-13.5 mm. Tegula, scape and thorax ivory mixed with white. Head, collar, neck tuft, labial palps, and haustellum creamy white, a little paler than thorax. Flagellum 0.75 × length of forewing, ivory; in male ciliate, sensillae 0.8 × diameter of flagellum. Legs ivory mixed with white, except tibia and tarsus of forelegs dorsally pale fuscous; pretarsus of all legs black, conspicuously darker than tarsomeres. Abdomen dorsally fuscous, ventrally ivory mixed with white. Forewing ivory, narrow without distinct pattern, in midwing indistinct pale ochreous patches. Hindwing pale fuscous.

Male genitalia (Fig. 15): Uncus stout, short and posteriorly bristled plate, medioposteriorly somewhat incised. Gnathos base narrow belt, distal arm thin and ventrad bent, longer than uncus, tip pointed. Tegumen wide, open hood. Phallus short and very thick, distally extended, tip slightly bent and pointed. Valvae reduced, parallel sclerotized and sparsely setosed flaps. Sternum VIII pentagonal, anterolaterally at each side short but stout extension; subbasally an arched transverse sclerotized belt; posterolaterally on each side a digitate extension. Tergum VIII triangular, anterolaterally on each side horn-like extension, anterior margin concave; tip drawn far out, subapically a more or less transparent flap.

Female genitalia (Fig. 16): Sterigma subrectangular plate, posteriorly minutely spined, anterior margin sclerotized and medially slightly concave. Antrum funnel shaped. Posterior margin of sternum VIII concave and sclerotized. Sternum VIII with large arched structure, shanks reaching anterior margin of sternum VII. Sternum VII rectangular. Apophyses anteriores 0.6 × length of apophyses posteriores.

Habitat: Bushy savanna. The moth is nocturnal.

Distribution: Namibia (Central).

Etymology: The species name alludes to conspicuously contrasted black pretarsi of the legs.

Remarks: *S. pretarsella* sp. n. is tentatively placed in the *abyanensis* species-group, established by BENGTSSON (2014). The group includes fourteen species (BENGTSSON, 2014; NUPPONEN, 2018).

Annotated Scythrididae records from Namibia

The species are listed alphabetically in generic and specific order. The known distribution of each species is given.

Apostibes deckerti Bengtsson, 2014
Apostibes deckerti Bengtsson, 2014. *Esperiana Mem*., **7**: 34, figs 1i, 1m-a, b, c, 1f

Namibia, 19.468880 S 017.74885º E, 1544 m, Ghaub private N-reserve, 1 ♀, 26-XI-2019, R. Haverinen & A. Pototski leg.; Genitalia slide: 1/21-IX-2020 KN.

Distribution: Kenya, Namibia, Yemen.

Haploscythris chloraema (Meyrick, 1887)
Butalis chloraema Meyrick, 1887. *Trans. Ent. Soc. Lond*., **1887**: 279

Namibia, 24.61490º S 017.95583º E, 1106 m, Mariental near Fish river, 1 ♀, 1-XII-2019, R. Haverinen & A. Pototski leg. Genitalia slide: 1/13-VII-2020 KN.

Distribution: Botswana, Namibia South Africa.

Haploscythris eberti Bengtsson, 2014
Haploscythris eberti Bengtsson, 2014. *Esperiana Mem*., **7**: 63, figs. 43i, 43m-a, b, 43f

Namibia, 24.61490º S 017.95583º E, 1106 m, Mariental near Fish river, 3 ♂♂, 6 ♀♀, 1-XII-2019, R. Haverinen & A. Pototski leg.

Distribution: Namibia, South Africa (Northern & Western Cape).

Haploscythris valvaecrinitus Bengtsson, 2014
Haploscythris valvaecrinitus Bengtsson, 2014. *Esperiana Mem*., **7**: 72, figs. 55i, 55m-a, b, 55f

Namibia, 24.61490º S 017.95583º E, 1106 m, Mariental near Fish river, 13 ♂♂, 10 ♀♀, 1-XII-2019, R. Haverinen & A. Pototski leg.; Namibia, 23.34687º S 017.07828º E, 1409 m, Rehoboth, 1 ♂, 2-XII-2019, R. Haverinen & A. Pototski leg.

Distribution: Namibia, South Africa, Zimbabwe.

Haploscythris vulturoides Bengtsson, 2014
Haploscythris vulturoides Bengtsson, 2014. *Esperiana Mem*., **7**: 75, figs. 58i, 58m-a, b, 58f

Namibia, 24.61490º S 017.95583º E, 1106 m, Mariental near Fish river, 14 ♂♂, 9 ♀♀, 1-XII-2019, R. Haverinen & A. Pototski leg. Genitalia slide: 2/30-VII-2020 KN ♀.

Distribution: Namibia, South Africa.

Scythris anaecapitella Bengtsson, 2014
Scythris anaecapitella Bengtsson, 2014. *Esperiana Mem.*, **7**: 123, figs. 126i, 126m-a, b, 126f

Namibia, 24.61490º S 017.95583º E, 1106 m, Mariental near Fish river, 1 ♂, 1-XII-2019, R. Haverinen & A. Pototski leg.; Namibia, 23.34687º S 017.07828º E, 1409 m, Rehoboth, 1 ♂, 2-XII-2019, R. Haverinen & A. Pototski leg. Genitalia slide: 1/29-VII-2020 KN.

Distribution: Namibia, South Africa.

Scythris bernardi Bengtsson, 2014
Scythris bernardi Bengtsson, 2014. *Esperiana Mem.*, **7**: 133, figs. 139i, 139m-a, b, 139f

Namibia, 23.32260º S 017.01457º E, 1460 m, Lake Oanob resort, 1 ♀, 30-XI-2019, R. Haverinen & A. Pototski leg. Genitalia slide: 3/30-VII-2020 KN; Namibia, 24.61490º S 017.95583º E, 1106 m, Mariental near Fish river, 2 ♀♀, 1-XII-2019, R. Haverinen & A. Pototski leg.

Distribution: Namibia.

Scythris calciflua Meyrick, 1921
Scythris calciflua Meyrick, 1921. *Ann. Transv. Mus.*, **8**: 115

Namibia, 18.91591º S 017.36731º E, 1152 m, Oshivelo 40 km S, Rd. B1, private farm land, 1 ♂,1 ♀, 23-XI-2019, R. Haverinen & A. Pototski leg.; Namibia, 17.35460º S 013.88166º E, 760 m, Kunene River 12 ♂♂, 24-XI-2019, R. Haverinen & A. Pototski leg.; Namibia, 19.46888º S 017.74885º E, 1544 m, Ghaub private N-reserve, 1327 exx., 26-XI-2019, R. Haverinen & A. Pototski leg.; Namibia, 20.50723º S 017.24.747º E, 1516 m, Waterberg Plateau NWR, 5 ♂♂, 1 ♀, 28-XII-2019, R. Haverinen & A. Pototski leg.; Namibia, 23.32260º S 017.01457º E, 1460 m, Lake Oanob resort, 1 ♀, 30-XI-2019, R. Haverinen & A. Pototski leg.

Distribution: Mozambique, Namibia, South Africa, Zimbabwe.

Remark: The species was unusually abundant in a bushy dry savanna (Fig. 1), and over 1300 exx. came to light during a single night.

Scythris camelella Walsingham, 1907
Scythris camelella Walsingham, 1907. *Entomologist's mon. Mag.*, **43**: 9

Namibia, 23.32260º S 017.01457º E, 1460 m, Lake Oanob resort, 1 ♂, 1 ♀, 30-XI-2019, R. Haverinen & A. Pototski leg.

Distribution: Palaearctic Region: Afghanistan, Algeria, Egypt, Iran, Jordan, Pakistan, Spain, Syria, Tunisia; Afrotropical Region: Kenya, Namibia, South Africa, Sudan, Yemen.

Scythris clemens Meyrick, 1921
Scythris clemens Meyrick, 1921. *Ann. Transv. Mus.*, **8**: 114

Namibia, 23.32260º S 017.01457º E, 1460 m, Lake Oanob resort, 1 ♀, 30-XI-2019, R. Haverinen & A. Pototski leg.; Namibia, 23.34687º S 017.07828º E, 1409 m, Rehoboth, 1 ♂, 2-XII-2019, R. Haverinen & A. Pototski leg.

Distribution: Mozambique, Namibia.

Scythris curvipilella Bengtsson, 2002
Scythris curvipilella Bengtsson, 2002. *Esperiana*, **9**: 75, figs 49-50, 91, 147

Namibia, 19.46888º S 017.74885º E, 1544 m, Ghaub private N-reserve, 2 ♂♂, 26-XI-2019, R. Haverinen & A. Pototski leg. Genitalia slide: 1/2-VII-2020 KN; Namibia, 23.34687º S 017.07828º E, 1409 m, Rehoboth, 1 ♀, 2-XII-2019, R. Haverinen & A. Pototski leg.

Distribution: Kenya, Namibia (North and Central), Yemen.

Remark: **New to Namibia**.

Scythris eburnella Bengtsson, 2014

Scythris eburnella Bengtsson, 2014. *Esperiana Mem.*, **7**: 163, figs 187i, 187m-a, b, 187f

Namibia, 19.46888º S 017.74885º E, 1544 m, Ghaub private N-reserve, 2 ♂♂, 2 ♀♀, 26-XI-2019, R. Haverinen & A. Pototski leg.; Namibia, 23.32260º S 017.01457º E, 1460 m, Lake Oanob resort, 1 ♂, 30-XI-2019, R. Haverinen & A. Pototski leg.

Distribution: Namibia, South Africa (Northern Cape).

Scythris etoshensis Bengtsson, 2014

Scythris etoshensis Bengtsson, 2014. *Esperiana Mem.*, **7**: 96, figs 88i, 88m-a, b, 88f

Namibia, 18.91591º S 017.36731º E, 1152 m, Oshivelo 40 km S, Rd. B1, private farmland, 1 ♀, 23-XI-2019, R. Haverinen & A. Pototski leg. Genitalia slide: 1/05-VII-2020 KN.

Distribution: Namibia.

Scythris geminella Bengtsson, 2014

Scythris geminella Bengtsson, 2014. *Esperiana Mem.*, **7**: 170, fis 199i, 199m-a, b, 199f

Namibia, 21.53251º S 015.76281º E, 1351 m, Erongo Mts., Erongo Plateau Camp, 5 ♀♀, 22-XI-2019, R. Haverinen & A. Pototski leg.; Namibia, 19.46888º S 017.74885º E, 1544 m, Ghaub private N-reserve, 2 ♀♀, 26-XI-2019, R. Haverinen & A. Pototski leg.

Distribution: Namibia, South Africa.

Scythris mesoplecta Meyrick, 1921

Scythris mesoplecta Meyrick, 1921. *Ann. Transv. Mus.*, **8**: 116

Namibia, 19.46888º S 017.74885º E, 1544 m, Ghaub private N-reserve, 1 ♀, 26-XI-2019, R. Haverinen & A. Pototski leg.; Genitalia slide: 2/21-IX-2020 KN.

Distribution: Namibia, South Africa.

Remark: **New to Namibia**.

Scythris meyi Bengtsson, 2014

Scythris meyi Bengtsson, 2014. *Esperiana Mem.*, **7**: 99, figs 93i, 93m-a, b

Namibia, 18.91591º S 017.36731º E, 1152 m, Oshivelo 40 km S, Rd. B1, private farm land, 2 ♂♂, 4 ♀♀, 23-XI-2019, R. Haverinen & A. Pototski leg.; Namibia, 19.46888º S 017.74885º E, 1544 m, Ghaub private N-reserve, 2 ♂♂, 1 ♀, 26-XI-2019, R. Haverinen & A. Pototski leg.; Namibia, 20.50723º S 017.24747º E, 1516 m, Waterberg Plateau NWR, 1 ♂, 28-XI-2019, R. Haverinen & A. Pototski leg.; Namibia, 20.69897º S 016.84158º E, 1655 m, Wawer’s Rock, 30 km S from Otjiwarongo 1 ♂, 2 ♀♀, 29-XI-2019, R. Haverinen & A. Pototski leg.; Namibia, 23.32260º S 017.01457º E, 1460 m, Lake Oanob resort, 2 ♂♂, 1 ♀, 30-XI-2019, R. Haverinen & A. Pototski leg.; Namibia, 24.61490º S 017.95583º E, 1106 m, Mariental near Fish river, 1 ♂, 2 ♀♀, 1-XI-2019, R. Haverinen & A. Pototski leg.; Namibia, 23.34687º S 017.07828º E, 1409 m, Rehoboth, 7 ♂♂, 14 ♀♀, 2-XII-2019, R. Haverinen & A. Pototski leg.

Distribution: Namibia, South Africa.

Scythris otaviensis Bengtsson, 2014

Scythris otaviensis Bengtsson, 2014. *Esperiana Mem.*, **7**: 218, figs 279i, 279m-a, b

Namibia, 19.46888º S 017.74885º E, 1544 m, Ghaub private N-reserve, 1 ♂, 26-XI-2019, R. Haverinen & A. Pototski leg. Genitalia slide: 2/20-IX-2020 KN.

Distribution: Namibia.

Scythris pelinaula Meyrick, 1916

Scythris pelinaula Meyrick, 1916. *Exot. Microl.*, **2**: 14

Namibia, 19.46888º S 017.74885º E, 1544 m, Ghaub private N-reserve, 1 ♀, 26-XI-2019, R. Haverinen & A. Pototski leg. Genitalia slide: 1/19-VI-2020 KN.

Distribution: Afrotropical Region: Botswana, Ethiopia, Gambia, Kenya, Malawi, Mali, Namibia, South Africa, Sudan, Tanzania, UAE, Yemen; Oriental Region: Oman, India, Iran.

Scythris sericiella Bengtsson, 2014
Scythris sericiella Bengtsson, 2014. *Esperiana Mem.*, **7**: 159, figs. 181i, 181m-a, b

Namibia, 24.61490º S 017.95583º E, 1106 m, Mariental near Fish river, 1 ♂, 1-XII-2019, R. Haverinen & A. Pototski leg. Genitalia slide: 1/15-IX-2020 KN.

Distribution: Namibia (Central), South Africa.

Remark: **New to Namibia**.

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Figs. 1-2.– 1. Habitat of *Scythris eburnipalpella* Nupponen, sp. n., *S. eneae* Nupponen, sp. n., *S. fimbriatella* Nupponen, sp. n. and nine other Scythrididae reported in the present article: bushy savanna in North Namibia. (Photo: R. Haverinen, 26-XI-2019). **2.** Habitat of *Haploscythris fannyae* Nupponen, sp. n. and eight other Scythrididae reported in the present article: bushy savanna in Central Namibia. (Photo: R. Haverinen, 1-XII-2019).

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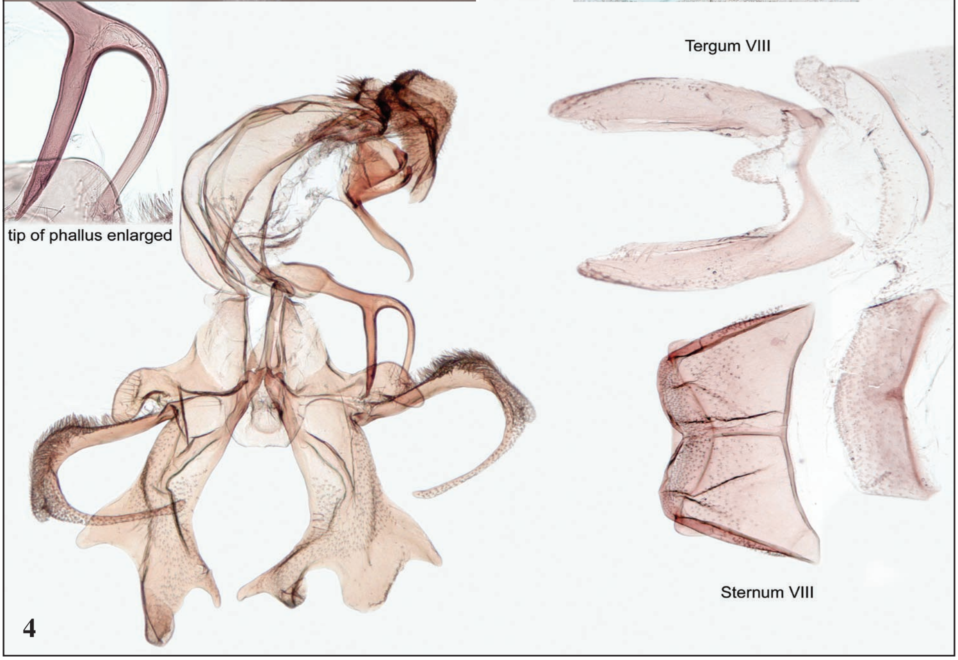

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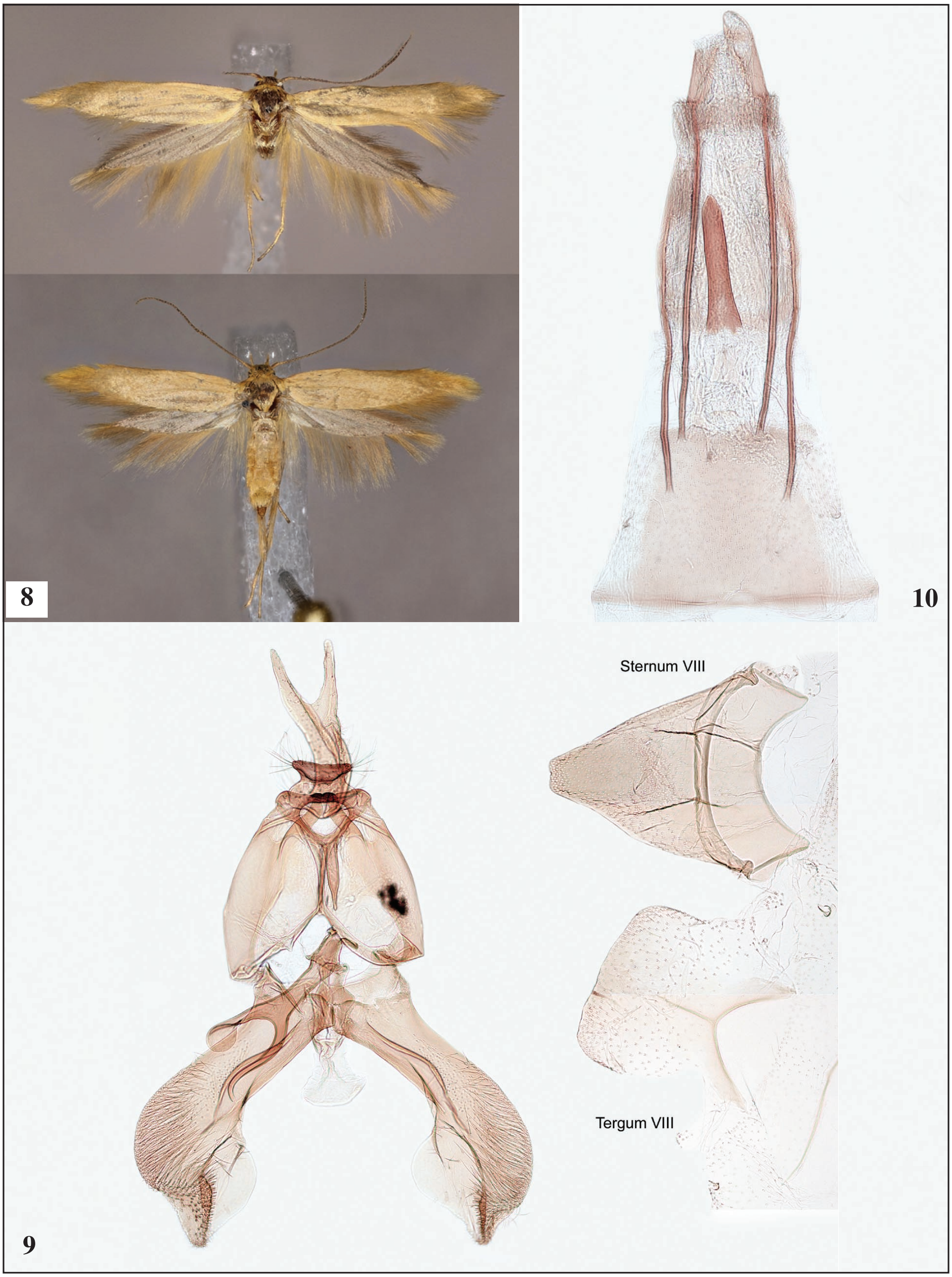
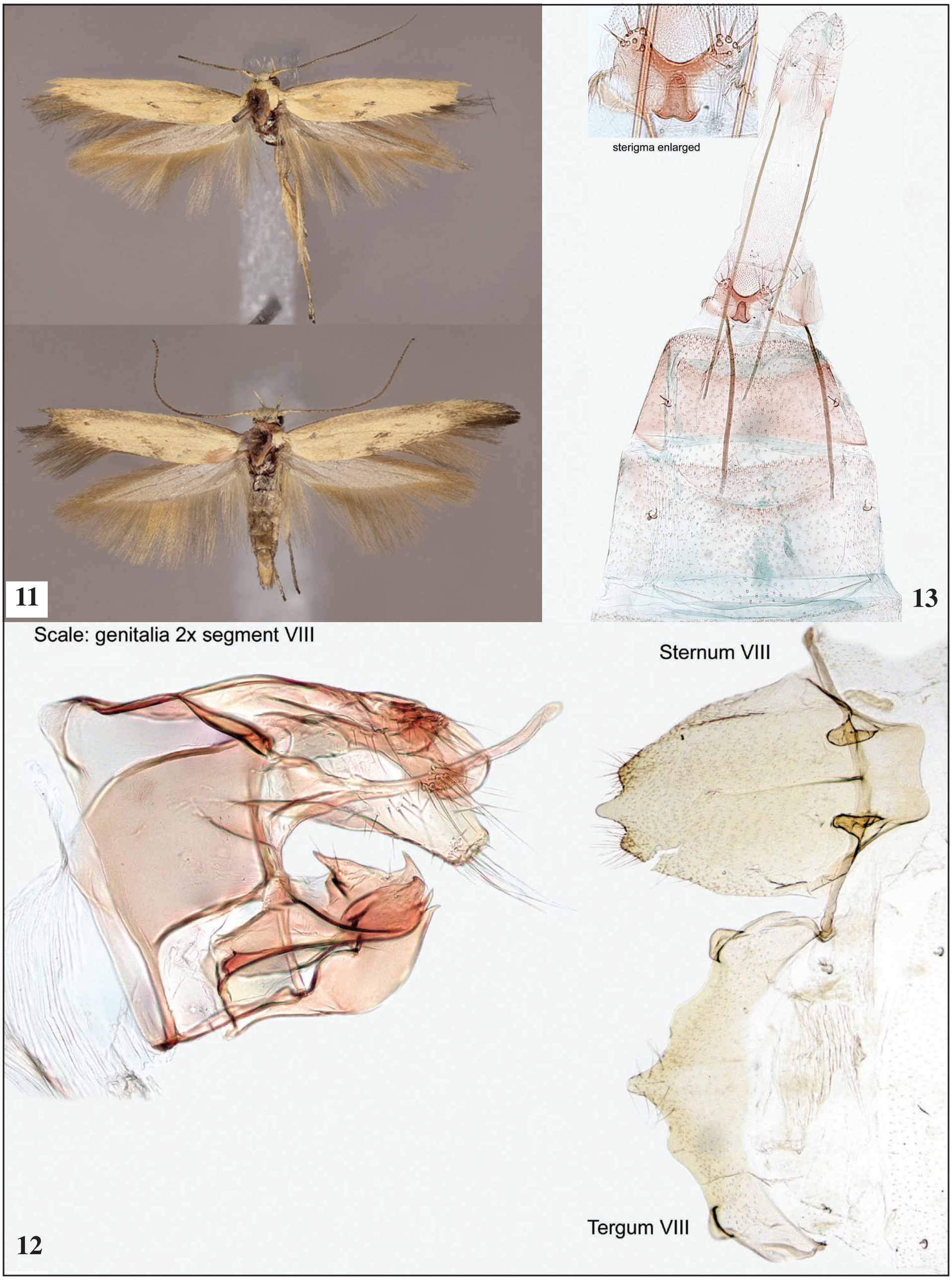
Figs. 3-5.– 3. Adults of *Haploscythris fannyae* Nupponen, sp. n. (up: male, holotype; below: female, paratype). **4.** Male genitalia of *Haploscythris fannyae* Nupponen, sp. n. (holotype; GP 2/25-VII-2020 KN). **5.** Female genitalia of *Haploscythris fannyae* Nupponen, sp. n. (paratype: GP 4/30-VII-2020 KN).

Figs. 6-7.– 6. Adult of *Scythris eburnipalpella* Nupponen, sp. n. (female, holotype). **7.** Female genitalia of *Scythris eburnipalpella* Nupponen, sp. n. (holotype: GP 1/20-VI-2020 KN).



Figs. 8-10.– 8. Adults of *Scythris eneae* Nupponen, sp. n. (up: male, holotype; below: female, paratype). **9.** Male genitalia of *Scythris eneae* Nupponen, sp. n. (holotype; GP 1/18-VI-2020 KN). **10.** Female genitalia of *Scythris eneae* Nupponen, sp. n. (paratype: GP 2/2-VII-2020 KN).



Figures 11-13.– 11. Adults of *Scythris fimbriatella* Nupponen, sp. n. (up: male, holotype; below: male, paratype). **12.** Male genitalia of *Scythris fimbriatella* Nupponen, sp. n. (holotype; GP 1/16-VI-2020 KN). **13.** Female genitalia of *Scythris fimbriatella* Nupponen, sp. n. (paratype: GP 2/16-VI-2020 KN).

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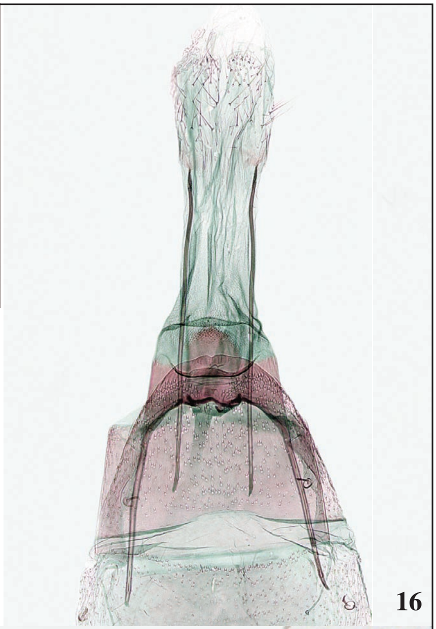

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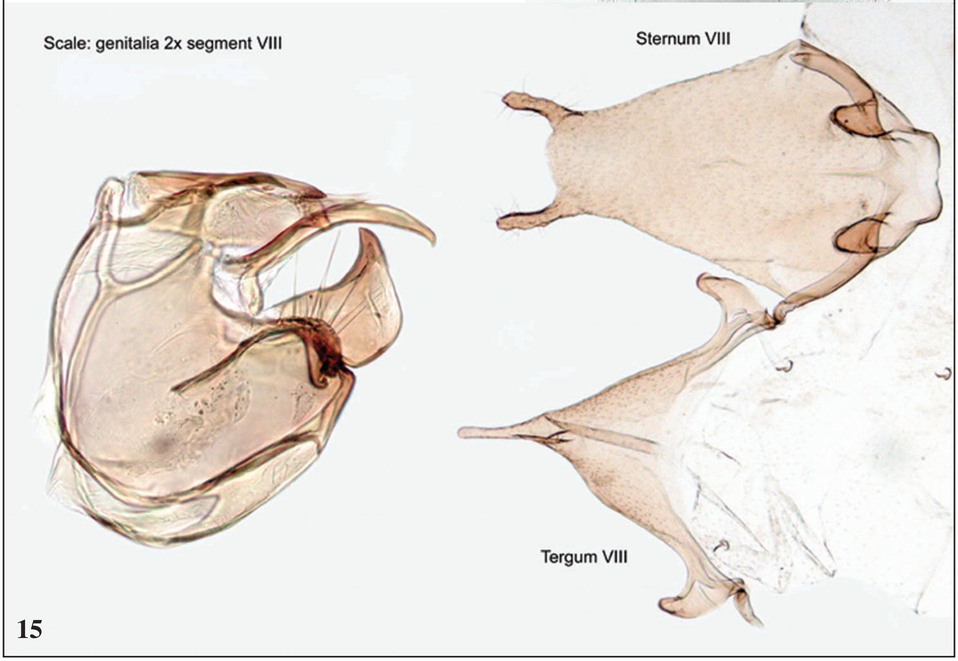

Figs. 14-16.– 14. Adult of *Scythris pretarsella* Nupponen, sp. n. (male, holotype). **15.** Male genitalia of *Scythris pretarsella* Nupponen, sp. n. (holotype; GP 2/29-VII-2020 KN). **16.** Female genitalia of *Scythris pretarsella* Nupponen, sp. n. (paratype: GP 1/30-VII-2020 KN).

NOTICIAS GENERALES / *GENERAL NEWS*

CORRECCIÓN / *CORRECTION*.– En 2020 se publicó en *SHILAP Revta. lepid.*, **48**(192): 693- 697, "I. G. López-Muraira, H. R. Iruegas-Buentello, H. Flores-Martínez & F. Gómez-Leyva.– *Antispastis xylophragma* Meyrick, 1926 primera cita sobre *Solanum umbellatum* Mill. y nuevo para México (Lepidoptera: Glyphipterigidae, Acrolepiinae)", pero siguiendo a GAEDIKE (1984.– Revision der nearktischen und neotropischen Acrolepiidae (Lepidoptera).– *Entomologische Abhandlungen*, **47**: 179-194) pasa asinonimia del género *Antispastis* Meyrick, 1926 de *Acrolepia* Curtis, 1838, por lo que el título del trabajo debería de haber sido: "*Acrolepia xylophragma* (Meyrick, 1926) primera cita sobre *Solanum umbellatum* Mill. y nuevo registro para México (Lepidoptera: Glyphiterigidae, Acrolepiinae).– **DETALLES / *DETAILS*:** I. G. López-Muraira; Instituto Tecnológico de Tlajomulco Km 10 Carretera Tlajomulco-San Miguel Cuyutlán Jalisco, 45640; MÉXICO / MEXICO (E-mail: lopezmuraira@gmail.com).

ALFILERES ENTOMOLÓGICOS PRECIO ESPECIAL PARA LOS SOCIOS DE SHILAP.– En estos momentos SHILAP pone a disposición de sus socios alfileres entomológicos pavonados en negro y fabricados en Austria EMIL ARLT - ELEFANT / IMPERIAL, sin duda los mejores, y en la República Checa con una excelente calidad y de dos marcas diferentes a elegir AUSTERLITZ y MORPHO / SPHINX (la marca MORPHO ha cambiado de nombre y se denomina SPHINX), los precios y los números disponibles en estos momentos son:

ELEFANT - IMPERIAL EMIL ARLT

Números: 000, 00, 0, 1, 3, 4, 5, 6 y 7 (hasta final de existencias)	9 euros / 100 alfileres
Minucias: 0,10, y 0,20 (hasta final de existencias)	15 euros / 500 alfileres
Minucias (KARLSBADER): 0'15 (hasta final de existencias)	15 euros / 500 alfileres

AUSTERLITZ

Números: 000, 00, 0, 1, 2, 3, 4, 5, 6 y 7	5,5 euros / 100 alfileres

MORPHO / SPHINX

Números: 000, 00, 0, 1, 2, 3, 4, 5, 6 y 7	5 euros / 100 alfileres
Minucias: 0,10, 0,15 y 0,20	12 euros / 500 alfileres

A estos precios hay que incluir los gastos de envío.– **DETALLES / *DETAILS*:** SHILAP; Apartado de correos, 331; E-28080 Madrid, ESPAÑA / *SPAIN* (E-mail: avives1954@outlook.es).

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