VOLUMEN / ***VOLUME*** **48 eISSN: 2340-4078 ISSN: 0300-5267**
NÚMERO / ***NUMBER*** **190 LCCN: sn 93026779 CODEN: SRLPEF**
(Fecha de publicación 30 de junio de 2020 / ***Issued 30 June 2020***

SHILAP

REVISTA DE LEPIDOPTEROLOGIA

Madrid
2020

Organismo Rector de *SHILAP* / *Officers and Board* of SHILAP

La *Sociedad Hispano-Luso-Americana de Lepidopterología (SHILAP)*, es una Sociedad científica, fundada en 1972 y formalmente registrada en 1973, de acuerdo al Régimen Jurídico de la Ley de Asociaciones de 24 de diciembre de 1964. Con el propósito de agrupar a los interesados en una Asociación con fines científicos y sin ánimo de lucro, se crea en Madrid la *Sociedad Hispano-Luso-Americana de Lepidopterología (SHILAP)*. Podrán pertenecer a ella todas las personas interesadas en el estudio de los Lepidoptera. La Sociedad es independiente de los demás Organismos, Asociaciones, Instituciones y Entidades nacionales o extranjeras que puedan tener objetivos similares, con las que mantendrá relaciones y colaborará eficazmente. Son fines de la Sociedad promover y perfeccionar el estudio de los Lepidoptera en general y en particular de los ibéricos, su ciclo biológico y conservación de su hábitat, poniendo en contacto a los entomólogos españoles y extranjeros que lo deseen, y haciendo llegar a los mismos y a los Organismos oficiales la mayor cantidad de información disponible sobre la especialidad, en pos de un intercambio mayor de experiencias científicas de índole biológico. / *The Sociedad Hispano-Luso-Americana de Lepidopterologia (SHILAP), is a scientific Society founded in 1972 and formally registered in 1973 according to the Spanish Law of Association of December 24th, 1964. The* Sociedad Hispano-Luso-Americana de Lepidopterologia (SHILAP) *was formed in Madrid to bring together in a Scientific Society all persons interested in the study of Lepidoptera. The Society is a non-profit organization. The Society shall be independent from any other national or foreign Organization, Society, Institution or group with similar aims. Nevertheless, it is open to and shall encourage effective cooperation with such Organizations. The objectives of the Society are to improve and support studies on Lepidoptera in general, paying special attention to those from the Iberian Peninsula. It shall promote the study of the biology of Lepidoptera and conservation of their habitat and encourage cooperation between its members. The Society shall facilitate the exchange of information between Spanish and foreign specialists and shall provide entomologists and Official Institutes with research results and scientific experience derived from its particular field of study.*

Sede Social
Cátedra de Entomología Agraria
E.T.S. de Ingeniería Agronómica,
Alimentación y Biosistemas
Universidad Politécnica de Madrid
Avenida Puerta de Hierro, 2
E - 28040 Madrid
ESPAÑA / *SPAIN*

Apartado de correos, 331
E - 28080 Madrid
ESPAÑA / *SPAIN*
E-mail: avives1954@outlook.es / avives1954@outlook.com
E-mail: avives1954@gmail.com
https://shilap.org

ISSN: 0300-5267 (edición impresa / *print edition*) / eISSN: 2340-4078 (edición electrónica / *online edition*)
CODEN: SRLPEF / LCCN: sn 93026779 / NLM ID: 101611953 / CDU: 595.78(05) / GND: 3004332-3
TIRADA / *EDITION*: 500 ejemplares / *500 copies*
EDITADO por / *EDITED by*: © Sociedad Hispano-Luso-Americana de Lepidopterología
IMPRESO por / *PRINTED by*: IMPROITALIA. Tomelloso, 27. E-28026 Madrid, ESPAÑA / *SPAIN*
Depósito Legal: M. 23.796-1973

VOLUMEN / ***VOLUME*** **48 eISSN: 2340-4078 ISSN: 0300-5267**
NÚMERO / ***NUMBER*** **190 LCCN: sn 93026779 CODEN: SRLPEF**

(Fecha de publicación 30 de junio de 2020 / ***Issued 30 June 2020***

SHILAP REVISTA DE LEPIDOPTEROLOGIA

SUMARIO / *CONTENTS*

NOTAS DE REDACCIÓN – ***EDITOR'S NOTES***

1. Las opiniones que los autores de las colaboraciones contenidas en esta revista exponen, representa exclusivamente su criterio personal, salvo que firmen en su carácter de Directivos de *SHILAP.*

2. Las referencias bibliográficas sobre trabajos contenidos en esta publicación deben hacerse como sigue: *SHILAP Revista de lepidopterología.*

3. Los trabajos publicados en esta revista son citados o resumidos en: *Academic Journals Database, Biological Abstracts, BIOSIS Previews*, *CABI-CAB Abstracts, Google Scholar*, *Entomology Abstracts*, *FAO-Agris*, *Fuente Académica Plus*, *Índice Español de Ciencia y Tecnología* (*ICYT*), *DIALNET*, e-revist@s - Revistas Electrónicas, *Índice Latino-americano de Revistas Científicas* (*LATINDEX*), *Matriz de Información para el Análisis de Revistas (MIAR), Información y Documentación de la Ciencia en España* (*ÍnDICEs-CSIC*), *International Bibliography of Periodical Literature* (*IBZ*), *PUBLINDEX, Qualis* (*CAPES*), *Red de Revistas Científicas de América Latina y el Caribe, España y Portugal* (*REDALYC*), *Referativnyi Zhurnal (VINITI), Repositorio Español de Ciencia y Tecnología* (*RECYT*), *Science Citation Index Expanded* (*SCIE*), *SCImago, SCOPUS, Ulrich's International Periodical Directory*, *Veterinary Science Database*, *Web of Science y Zoological Record.*

4. Todos los derechos reservados. Esta publicación no puede ser, ni total ni parcialmente, reproducida o transmitida en cualquier forma o por cualquier medio, mecánico o electrónico, fotocopia, grabación o cualquier otro sistema de almacenamiento y reproducción, sin permiso escrito del Editor.

5. Según el artículo 8 del CINZ a partir de 1999, los autores de "SHILAP Revista de lepidopterología" indican en todos los actos nomenclaturales que están pensados para su exposición permanente, pública y científica. "SHILAP Revista de lepidopterología" está producida por técnicas de impresión, las cuales garantizan una edición conteniendo simultáneamente la obtención de copias.

6. Factor de Impacto JCR (2019): 0.491 / SJR (2019): 0.401.

1. *The opinions expressed by the collaborators of this journal represent only their personal opinion, except when they sing in the capacity managers of* SHILAP.

2. *Bibliographic references about works included in this publication must be written as follows:* SHILAP Revista de lepidopterología.

3. *Papers published in this journal are cited or abstracted in:* Academic Journals Database, Biological Abstracts, BIOSIS Previews, CABI-CAB Abstracts, Google Scholar, Entomology Abstracts, FAO-Agris, Fuente Académica Plus, Índice Español de Ciencia y Tecnología (ICYT), DIALNET, e-revist@s - Revistas Electrónicas, Índice Latino-americano de Revistas Científicas (LATINDEX), Information Matrix for the Analysis of Journals (MIAR), Information and Documentation of Science in Spain (ÍnDICEs-CSIC), International Bibliography of Periodical Literature (IBZ), PUBLINDEX, Qualis (CAPES), Red de Revistas Científicas de América Latina y el Caribe, España y Portugal (REDALYC), Referativnyi Zhurnal (VINITI), Repositorio Español de Ciencia y Tecnología (RECYT), Science Citation Index Expanded (SCIE), SCImago, SCOPUS, Ulrich's International Periodical Directory, Veterinary Science Database, Web of Science *and* Zoological Record.

4. *All rights reserved. No part of this journal may be reproduced or transmitted in any form or me ans, electronic or mechanical, including photocopying, recording or by any information storage and retrieval system, without permission in writing from the Editor.*

5. *According to article 8 ICNZ, from 1999 the authors of "SHILAP Revista de lepidopterología" state that all taxonomic and nomenclatural acts are intended for permanent, public, scientific record. "SHILAP Revista de lepidopterología" is produced by printing techniques which guarantee an edition containing simultaneously obtainable copies.*

6. *JCR Impact Factor (2019): 0.491 / SJR (2019): 0.401.*

Cómo ser socio de la Sociedad Hispano-Luso-Americana de Lepidopterología
How to be membership of the Sociedad Hispano-Luso-Americana de Lepidopterologia

Esta Sociedad está abierta a todas las personas e Instituciones con interés en el estudio de los Lepidoptera en el mundo. La subscripción anual se paga al comienzo del año. Es de 75 € para los socios y 240 € para las Instituciones. Se puede pagar por Giro Postal, por Transferencia Bancaria, sin cargo para SHILAP, o con Tarjeta de Crédito. La transferencia bancaria puede hacerse a la cuenta de SHILAP en el Banco de Bilbao Vizcaya Argentaria, Madrid (IBAN: ES06 0182 1216 2802 0151 5543). Los socios recibirán *SHILAP Revista de lepidopterología* trimestralmente y otras publicaciones de la Sociedad, así como descuentos en libros y publicaciones sobre Entomología.

Las solicitudes, por carta o por correo electrónico, se enviarán a:

This Society is open to all persons and Institutions interested in the study of world-wide Lepidoptera. The annual subscription is paid at the beginning of the year. It is 75 € for members and 240 € for Institutions. Payment can be made by Postal Money Order, by Bank Transfer free of charge to SHILAP, or by Credit Card. Bank transfer should be made to SHILAP account Banco Bilbao Vizcaya Argentaria [Madrid] (IBAN: ES06 0182 1216 2802 0151 5543). Members will receive quarterly a copy of SHILAP Revista de lepidopterología *and other Society's publications as well as deductions on books and Entomological publications.*

The applications, by letter or by e-mail, should be sent to:

SHILAP
Apartado de Correos, 331
E - 28080 Madrid
ESPAÑA / ***SPAIN***
E-mail: avives1954@outlook.es / avives1954@gmail.com / avives1954@outlook.com

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 197-222 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.383

The South American Coleophoridae of the Zoological Museum of Copenhagen. Contribution to the knowledge of the Coleophoridae. CXLIII (Lepidoptera: Coleophoridae)

G. Baldizzone*

Abstract

The work presents the results of the study of the South American Coleophoridae of the Zoological Museum, University of Copenhagen. Ten species have been identified, of which *Coleophora pulchricornis* Walsingham, 1897 is new for South America, and four are new for science: *C. andina* Baldizzone, sp. n., *C. aconcaguae* Baldizzone, sp. n., *C. rasmusseni* Baldizzone, sp. n., *C. peruana* Baldizzone, sp. n. Two species, *C. breyeri* Pastrana, 1963 and *C. haywardi* Pastrana, 1963 are redescribed and information is provided on the host plant and larval case of *C. intexta* Meyrick, 1917. The new synonymy *C. breyeri* Pastrana 1963 = *C. argentinae* van der Wolf, 1999, syn. n., is established.
KEY WORDS: Lepidoptera, Coleophoridae, *Coleophora*, new species, new synonymy, South America.

Los Coleophoridae suramericamos del Museo Zoológico de Copenhague. Contribución al conocimiento de los Coleophoridae. CXLIII (Lepidoptera: Coleophoridae)

Resumen

El trabajo presenta los resultados del estudio de los Coleophoridae suramericanos del Museo Zoológico, de la Universidad de Copenhague. Diez especies han sido identificadas, de las cuales *Coleophora pulchricornis* Walsingham, 1897 es nueva para Suramérica y cuatro son nuevas para la ciencia: *C. andina* Baldizzone, sp. n., *C. aconcaguae* Baldizzone, sp. n., *C. rasmusseni* Baldizzone, sp. n., *C. peruana* Baldizzone, sp. n. Se redescriben dos especies, *C. breyeri* Pastrana, 1963 y *C. haywardi* Pastrana, 1963 y se proporciona información de la planta nutricia y del saco larvario de *C. intexta* Meyrick, 1917. Se establece la nueva sinonimia *C. breyeri* Pastrana 1963 = *C. argentinae* van der Wolf, 1999, syn. n.
PALABRAS CLAVE: Lepidoptera, Coleophoridae, *Coleophora*, nuevas especies, nueva sinonimia, Suramérica.

Introduction

The Coleophoridae family, with 1467 species (6-II-2020), widespread in most of the world, is poorly represented in South America. Currently only 17 species are known, of which two

* Honorary member of the "Fundación Otonga", Ecuador.

introduced, *Coleophora versurella* Zeller, 1849 and *C. mayrella* (Hübner, [1813]). Of these, seven were described in 1999 by van der Wolf for Argentina. The last species described was *C. cisoriella* Landry, 2005, known from Brazil and *C. darwini* Landry, 2006, known from Galápagos. From personal experience in Ecuador and Costa Rica and according to the testimonies of various colleagues, the Coleophoridae are also absent in many biotopes rich in biodiversity or always very scarce, while other well-represented families in the Palearctic Region are equally present in South America with a great number of species and specimens.

The following publication intends to provide further knowledge on the basis of the material present in the Zoological Museum, University of Copenhagen (ZMUC), largely resulting from research expeditions of some Danish lepidopterologists.

Material and methods

The Danish expedition to Argentina and Chile in 1978-79 was called "Misión Científica Danesa". A number of Danish scientists participated and among them Ebbe S. Nielsen, Ernst Traugott-Olsen and Bent. W. Rasmussen collected Lepidoptera. The expedition travelled through most of Argentine and also into parts of Chile. Two years later Ebbe S. Nielsen returned to Patagonia with Ole Karsholt and they stayed four and a half months in the Andes Mountains, mostly between Bariloche in Argentine and Valdivia in Chile, mainly searching for *Heterobathmia*, but collecting all Lepidoptera. In 1987 O. Karsholt joined an ornithological expedition that lasted three months on the High Andes of Peru; during this expedition, collections were also made at lower altitudes during transfers from one mountain to another.

The collected material had been partially studied by B. W. Rasmussen, a ZMUC technician, who also carried out research on Lepidoptera, in particular on Coleophoridae, intending to produce a publication on them. For this purpose he had also obtained important material for the identification of the species, including Pastrana paratypes and also undetermined specimens.

After Rasmussen's premature death in 1993, Ole Karsholt proposed that I study the material he sent me along with Rasmussen's genitalia preparations. This material amounted to exactly 100 specimens.

Unfortunately, Rasmussen's genitalia preparations are of poor quality because the genitalia have undergone excessive maceration, the males sometimes have been broken and dismembered into various pieces that cannot be put together, while the female ones have not been extracted from the abdomen. Rasmussen probably would have presented drawings of the genitalia instead of photographs, which would have allowed him to provide a fairly adequate representation.

However, I was able to personally carry out the genitalia preparations of many specimens that still had the abdomen, both of the species on which Rasmussen had already worked, and those that had not yet been examined. I have not tried to remount the female genitalia of unique specimens, to avoid damage, but I have tried to provide a good photographic representation through photo editing.

I was able to identify ten species, of which two were introduced to the continent (*C. versurella* and *C. mayrella*), four already described (*C. pulchricornis* Walsingham, 1897, *C. intexta* Meyrick, 1917, *C. breyeri* Pastrana, 1963, *C. haywardi* Pastrana, 1963) and four new to science (*C. andina* Baldizzone, sp. n., *C. aconcaguae* Baldizzone, sp. n., *C. rasmusseni* Baldizzone, sp. n., *C. peruana* Baldizzone, sp. n.). The adult, genitalia, and larval case of *C. pulchricornis* are illustrated for the first time. In addition, the larval case is illustrated and information is provided on the host plant of *C. intexta*. As for the two species described by Pastrana, *C. breyeri* and *C. haywardi*, a new description is provided and the genitalia are illustrated with detailed photographs. Among the material studied I identified two other undescribed species, but further studies and hopefully other specimens will be needed to describe them.

Abbreviations

BWR = Bent W. Rasmussen.
GP, PG = genitalia preparation.
MHNG = Muséum d'Histoire Naturelle, Geneva, Switzerland.
NHMUK = Natural History Museum, London, U.K. (formerly BMNH British Museum of Natural History).
NHMW = Naturhistorisches Museum, Wien, Austria.
RMNH = Naturalis Biodiversity Centre, Leiden, The Netherlands (formerly Rijksmuseum van Natuurlijke Historie).
ZMUC = Zoological Museum, Natural History Museum of Denmark, Copenhagen, Denmark.

Coleophora pulchricornis Walsingham, 1897 (Figs 1-2)

Original material examined: Holotype ♀: "TYPE" [round, printed, red edged]; "ST. THOMAS | Danish W. Indies | ex. 15.iv.1894 | Güdmann 7191"; "B.M. | Genitalia Slide ♀ 12229"; "COLEOPHORA PULCHRICORNIS | Wlsm. | TYPE ♀"; "Walsingham | Collection | 1910-427", coll. NHMUK. Paratypes: 1 ♂ "Paratype 1/2"; "West. Ind. | Hedemann '94.| WLSM 2072-1895" "PG Bldz nº 2909 ♂", coll. NHMW; 1 ♀ "St. Thomas | e. l. 15.4.94"; "PG Bldz 2910 ♀", coll. NHMW.

New material examined: 1 ♀ "PERU, Dept. Lima | 2: 8 km E Chosica | San Bartolomé | 1900 m | 20-23-I-1987 | O. Karsholt leg."; 2 ♂♂, 2 ♀♀ "PERU, Dept. Lima | 29: 10 km S Paramonga | Barranca | sea level | 22-23-II-1987, O. Karsholt leg."; 1 ♂ "PERU, Dep. Ancash | 25: 15 km N Caras | Río Salta Valley | ca. 2000 m | 19-21-II-1987 | O. Karsholt leg."; "1 ♀ "PERU, Dept. Lima | 30 m | Miraflores | 1-4-III-1987 | O. Karsholt leg.".

Diagnosis: Small-sized species of dark brown habitus. The male genitalia are somewhat similar to those of *C. willinki* van der Wolf, 1999, a species described from Argentina on the male only. The most obvious differences are: in *C. pulchricornis* the sacculus is narrower and the protuberance on the dorsal corner is longer and less pointed and regular in shape; the phallotheca is more curved and dorsally sclerotized; the cornutus is different in the shape of the dilated and asymmetrical base. The female genitalia do not resemble those of any other neotropical species.

Original description: *"Antennae white, beautifully ringed throughout with black; basal joint no tufted. Palpi dusky whitish, shaded externally with fawn-colour; second joint with a slight projecting point of scales beneath its apex. Head and thorax dull fawn-grey. Fore wings dull fawn; with a whitish ochreous costal streak throughout, widening toward the apex, and including the costal cilia; joining this from the end of the cell are three whitish-ochreous streaks following the veins; along the cell from before the middle and extending a little beyond its outer end is a longitudinal streak composed of mixed whitish-ochreous and black scales running parallel with the costa; beneath it, commencing at the base and terminating before the end of the fold, is a similar slender streak in which black predominates; some whitish ochreous scales lie around the dorsum and termen at the base of the greyish cilia. Exp. al. 10 mm. Hind wings and cilia dark brownish grey. Abdomen brownish grey. Legs whitish*".

Remarks: The species was described based on three specimens from the Danish West Indies, now Virgin Islands of the United States of America. The original description is very accurate and corresponds well to the specimens from Peru. However, there are some notable individual differences both in the coloration of the antennae and in those of the forewings: in two specimens the antennae are ringed white and dark brown as in the specimens of the original series, while in others the antennae are ringed brown and dark brown with little evident limits between the two colours. Some specimens have wings such as those described by Walsingham, while one has a wider and more nuanced whitish band in the costal area and one has a light brown forewing.

Male genitalia (Figs 16, 18-21): Gnathos knob globular. Tegumen short and stocky, restricted in middle; pedunculus dilated externally. Transtilla short and thin. Valvula small, subtriangular. Cucullus short ear-shaped. Sacculus narrow, ventrally curved, with a triangular tip sclerotized in dorsal corner.

Phallotheca short, curved, symmetrical juxta rods, more sclerotized in basal half. Cornutus sharply thorn-shaped, dilated at base asymmetrically.

Female genitalia (Figs 22, 24, 25): Papillae anales elongated oval. Apophysis posterioris twice as long as anterioris. Sterigma trapezoidal, finely corrugated anteriorly, deeply hollowed out by sinus vaginalis. Ostium bursae broad. Colliculum cup-shaped, restricted to base, with more thickly sclerotized edges. Ductus bursae short, transparent, slightly wider in distally. Corpus bursae small, oval with wedge-shaped signum.

Abdominal structures (Figs 17, 23): Without latero-posterior struts, transversal strut straight with thin proximal edge and not sclerotized medially at distal edge. Tergal disk (3rd tergite) about twice as long as wide, with about 25 conical spines.

Bionomy: According to the original description, the host plant is not known because the case was found fixed on stone fences. The larval case (Figs 13a, b) has been described by Walsingham: "Case cylindrical, mouth bent over but not projecting beyond the level of its lower side, apex triangular, its three angles somewhat flattened, the whole dull greyish ochreous; long. 13 mm". The description corresponds well to the morphology of the larval case which is with the holotype; the oral opening is inclined by about 5º.

The specimens of the original series were collected in mid-April and those from Peru in the last ten days of February and early March.

Distribution: Virgin Islands of the United States (Central America) and Peru (Department of Lima and Ancash). The species is new to South America.

Coleophora intexta Meyrick, 1917 (Figs 3-4)

Original material examined: Lectotype ♂ "Lima, 500 ft., | Peru | Parish 8-14", "B.M. ♂ | Genitalia Slide | No. 12224". Paralectotype ♀: same label, but GP B.M. 12225 ♀, coll. NHMUK.

New material examined: 2 ♂♂ "PERU: Dept. Lima | 2: 8 km E Chosica | San Bartolomé | 1900 m | 20-23-I-1987 | O. Karsholt leg."; 1 ♂, 1 ♀ "PERU: Dep. Ancash | 25: 15 km N Caras | Río Salta Valley | ca. 2000 m | 19-21-II-1987 | O. Karsholt leg."; 1 ♂ "PERU: Dept. Lima | 36: 10 km E Imperial | 150 m | 8-III-1987 | O. Karsholt leg."

Remarks: The species was described by Edward Meyrick in 1917 from specimens collected in August 1914 in Lima, Peru (MEYRICK, 1917). Landry in 2006, when describing *Coleophora darwini* from the Galápagos Islands, also studied the remaining specimens of *C. intexta* in the NHMUK. He designated a lectotype and illustrated the adult and male and female genitalia (LANDRY, 2006).

The specimens of the ZMUC show a fair variation in habitus and size, with smaller and almost uniformly brown specimens and larger specimens with evident clear stripes on the forewing.

Male genitalia (Figs 26-27): Cfr. LANDRY, 2006.

Female genitalia (Figs 28-29): Cfr. LANDRY, 2006.

Bionomy: Chris Snyers, who regularly visits Lima over the Christmas period, observed many larvae feeding on *Portulaca* sp. (Portulacaceae) leaves and managed to breed adults, allowing Hugo van der Wolf to identify the species. Data on the flight period (August for Meyrick specimens, December-January for Snyers specimens, from late January to early March for ZMUC specimens) suggest more than one generation. The larval case (Figs 14: a, b) is cylindrical, more expanded in the anterior part, 5.5 mm long, dark brown with a cottony aspect; the anal opening is triangular; the oral opening is small, circular and located on the ventral side and not at the anterior end, as in most Coleophoridae; the mouth angle is 0º-5º.

Distribution: The species is only known from Peru (Departments of Lima and Ancash).

Coleophora andina Baldizzone, sp. n. (Fig. 5)

Material examined: Holotype ♂: "PERU, Dept. Lima | 3:12 km SE Chosica | Zárate, 2200-2600 m | 23-25-i-1987 | O. Karsholt leg. | Zool. Mus. Copenhagen"; "Bldz PG nº 9793 ♂", Coll. ZMUC.

Diagnosis: Species of small size and greyish habitus. The male genitalia resemble those of *C.*

intexta Meyrick, 1917 and those of *C. darwini* Landry, 2006 with evident differences: the protuberance in the ventral corner of the sacculus is longer and thinner, that in the dorsal corner is longer, thinner and straight with the little tooth at the base much smaller and located more towards the outer edge. The phallotheca is shorter and more sclerotized and apically tapered with characteristic ridges on the juxta rods. The cornuti are much thinner, less numerous and arranged in a row, while those of the other two species are bundled in the shape of a robust thorn.

Description: Wingspan 10 mm. Head dirty white, frons light brown. Antenna dirty white, scape without erect scales. Labial palp whitish, suffused with light brown on outside; the second article is 2.5 times as long as the third. Proboscis normally developed. Thorax whitish. Forewing of uniform brownish grey colour; darker fringes. Hindwing grey with fringes of the same colour. Abdomen whitish.

Male genitalia (Figs 31, 33, 34): Gnathos knob oval. Tegumen elongated, narrow in middle, pedunculus slightly dilated outside. Transtilla ribbon-shaped, dilated at apex. Valvula small, sclerotized on outer edge. Cucullus short, ear-shaped. Sacculus curved and thickened on ventral edge with short pointed tip in ventral corner and protrusion in shape of a straight horn in dorsal corner; tip of the protuberance reaching dorsal edge of cucullus with a rounded tooth at the base. Phallotheca short, well sclerotized with juxta rods almost completely merged in the basal 2/3, with thin ventral crest in lower part of apical part. There are three elongate spine-shaped cornuti arranged in one row.

Female genitalia: Unknown.

Abdominal structures (Fig. 32): No latero-posterior struts, transversal strut thick, sclerotized on the proximal edge only in central part. Tergal disk (3rd tergite) about 8 times as long as wide, covered with about 20 spines.

Bionomy: The early stages and the foodplant are not known. The only known specimen was collected in late January.

Distribution: Peru (Andean area of the Department of Lima).

Etymology: The name derives from the Spanish word “andino-a” = adjective that indicates the origin from the Andes.

Coleophora aconcaguae **Baldizzone, sp. n.** (Fig. 6)

Material examined: Holotype ♂ “CHILE: Aconcagua | 67: Los Andes | Curimón, 700 m | 28.iii.1979 | Misión Científica Danesa”; “Genital no. 5123 | Bent W. Rasmussen”, coll. ZMUC.
Paratypes: Idem, 1 ♂ (PG Bldz 11623), 5 ♀♀ (PG BWR 5122, 5163, Bldz 12831, 12833, 12834), coll. ZMUC and coll. Bldz; 1 ♂ (PG Bldz 5392) “Argentina | Buenos Aires | V-1937 “coll. Cte Hartig”, coll. Bldz.

Diagnosis: Species of medium-small size and of light ochre habitus. The male genitalia are not similar to those of any other neotropical species due to the shape of the arched sacculus and with a long sharp protuberance in the dorsal corner and especially for the characteristic phallotheca with dorsal teeth. The female genitalia resemble those of *C. saltae* van der Wolf, 1999, an Argentinian species known only from the female. The main differences are as follows: in *C. aconcaguae* Baldizzone, sp. n. the colliculum is smaller and less sclerotized in the cup-shaped part while in the proximal part it is shorter, wider and sclerotized; the spinulate part of the ductus bursae is wider and longer and the medial line begins in a transparent stretch shortly after the central convolution while in *C. saltae* the ventral stretch is only in the spinulate part.

Description: Wingspan 10-12 mm. Head cream or light ochre. Antenna ringed white and light ochre; scape without erect scales. Labial palp white, ochre suffused on outside; second article about 1.5 times longer than third. Thorax light ochre. Forewing very clear ochre, slightly streaked with ferruginous along veins in apical area; costal fringes concolorous with a small darker apical tuft; dorsal fringes light grey. Hindwing light grey with fringes concolorous. Abdomen cream-colored.

Remark: As with other neotropical species, there is a discreet chromatic variation between specimens. Some are darker in colour with an ochre forewing and brown hindwing.

Male genitalia (Figs 35, 37-39): Gnathos knob globular. Tegumen short and stocky, narrowed in the middle, pedunculus slightly dilated outside. Transtilla straight, short and thin. Valvula small, few sclerotized. Cucullus short, and wide, narrower at the apex. Sacculus low, curved and thick ventral edge, dorsal corner with curved and pointed tip horn-shaped. Phallotheca short, well sclerotized in 2/3 of the base and with evident division of the two juxta rods in the terminal part where they are surmounted each by two or three triangular teeth. Cornuti two closely united, long, pointed in the shape of a thorn with a wider base.

Female genitalia (Figs 40-42): Papillae anales long and oval. Apophysis posterioris twice the length of the anterioris. Sterigma trapezoidal hollowed from the sinus vaginalis. Ostium bursae wide, oval. Colliculum narrow cup-shaped in the proximal part where the medial line ends. Ductus bursae long, crossed by the medial line in the posterior part wrapped in conical spines arranged in two rows; anterior part of the ductus wider and more transparent, with two sclerotized spirals in correspondence of the insertion of the ductus seminalis. Bursa copulatrix large, corpus oval sac-shaped without signum.

Abdominal structures (Fig. 36): No latero-posterior struts, transverse strut straight, with a thin proximal edge and a thicker distal edge, except in the middle. Tergal disk (3rd tergite) about 6 times as long as wide, covered by about 25 spines.

Bionomy: The early stages and the foodplant are not known. The specimens from Chile were collected in late March and those from Argentina in May.

Distribution: Chile (Chilean side of Aconcagua) and Argentina (Buenos Aires).

Etymology: The name derives from Mount Aconcagua.

Coleophora breyeri Pastrana, 1963 (Figs 7-9)

Original material examined: Paratype: 1 ♀ “TIGRE | 10.1939 | J. A. Pastrana”; *“Coleophora breyeri* sp. n. | J. A. Pastrana det.”; “PARATYPUS” [pink label]; “Genital no. 5170 | Bent W. Rasmussen”, ex coll. Pastrana, coll. ZMUC.

New material examined: 1 ♂, 1 ♀ “ARGENTINA, Neuquén | 12: Río Limay | Arroyo | 22-XII-1978 | Misión Científica Danesa”; 3 ♂♂ “ARGENTINA: Río Negro | 7: S. C de Bariloche | Colonia Suiza | 610 m | 7-XI-1978 | Misión Científica Danesa”; 3 ♂♂, 1 ♀, ibidem, 6-XII-1978; 1 ♂, 1 ♀ ibidem, 10-XII-1978; ♀, 3 ♂♂, 2 ♀, ibidem, 12-XII-1978; 2 ♂♂ , ibidem, 24-XII-1978; 2 ♂♂, 2 ♀♀, ibidem, 31-XII-1978; 1 ♂, 1 ♀ ibidem, 2-I-1979; 1 ♂, ibidem, 3-I-1979; 2 ♂♂, ibidem, 5-7-I-1982, Nielsen & Karsholt; 1 ♀ “ARGENTINA, Chubut | 13: El Bolsón | Lago Pueblo, 220 m | 21-XI-1978 | Misión Científica Danesa; 1 ♂ “CHILE, Prov. Cauquenes | 10 km NW Cauquenes | Rio Tutuven, 300 m | 3-4-X-1983 | E. S. Niesen”; 1 ♂ “CHILE, Valdivia | 15: 20 km S Valdivia | Rincón de la Piedra | 180 m | 15-XI-1981 | Nielsen & Karsholt”, coll. ZMUC e coll. Bldz

Additional material: 1 ♀ “BR[AZIL], Bahia, transition forest next to marsh, ± 9 km E Boa Nova, GPS: 750 m elev. | S 14.413240º, W 040.13502º | 6 and 8-XII-2013 uvl | B. Landry & V. Becker”, coll. MHNG.

Diagnosis: Species of rather variable appearance both for the habitus and for the size. The genitalia resemble those of the Nearctic species *C. cratipennella* Clemens, 1864 and the related Palearctic species *C. tamesis* Waters, 1929 (BALDIZZONE & LANDRY, 1993) with evident differences in the shape of the sacculus, phallotheca and cornuti in the male, and of sterigma, colliculum and ductus bursae in the female.

Remarks: The species was described from specimens collected in Argentina: Tigre (Prov. Buenos Aires) (PASTRANA, 1963). The original description is not easily accessible. Moreover, the illustration of the female genitalia does not reflect a *Coleophora* species, but a *Caloptilia* species (J.-F. Landry, pers. comm.). Therefore, it seems opportune to redescribe *C. breyeri*. Its identity is based on the figure of the male genitalia in the original description, and from my study of a paratype.

In 1999 van der Wolf described *C. argentinae*, illustrating the male genitalia which, according to the photo published, is identical to those of *C. breyeri*, while those of the female are very different. The adult description corresponds to the habitus of some specimens of *C. breyeri* found in the ZMUC

material. I think that *C. argentinae* was described on the basis of males and females of two different species and it is a junior synonym of *C. breyeri* Pastrana, 1963, **syn. n**.

Description: Pastrana's specimens and the one from Brazil have a wingspan of 10-12 mm. Head white suffused with light brown dorsally. Antenna ringed in white and light ochre, scape white without erect scales. Labial palp white, tinged with ochre outside; the second article is about 1.5 times longer than the third. Proboscis normally developed. Thorax whitish. Forewing light ochre, white streaked along the costa and veins; fringes light grey. Hindwing and fringes light grey. Abdomen whitish.

Specimens from ZMUC: Wingspan 12-15 mm. Head whitish to light brown. Antenna ringed white and brown, scape whitish or light ochre without erect scales. Labial palp white on the internal side, ochre outside; second article about twice as long as third. Proboscis normally developed. Forewing from light ochre to brown, whitened in more or less extended way from anal fold to costa; fringes light ochre grey. Hindwing brown; fringes like those of forewing. Abdomen whitish to brown.

Male genitalia (Figs 43, 45-47): Gnathos knob globular. Tegumen very narrow in the middle, pedunculus slightly dilated outside. Transtilla thin and long, ribbon-like. Valvula small, curved on the ventral edge. Cucullus short and stocky, curved and sclerotized on the dorsal side. Sacculus small, ventral edge slightly curved, ventral corner with triangular protuberance, lateral edge linear or slightly concave. Phallotheca with two symmetrical juxta rods terminated at the apex slightly sclerotized with an oval tip; in the distal half they are dorsally sclerotized and on each there are two triangular teeth. Cornuti divided into two groups: proximally with one pine needle-shaped cornutus, distally with four curved needle-shaped cornuti of progressive lengths, joined at base in a claw-like formation.

Female genitalia (Figs 48-50): Papillae anales narrow and long. Apophysis posterioris twice as long as anterioris. Sterigma narrow and elongated, curved on the distal edge, slightly hollowed by sinus vaginalis. Ostium bursae large, oval. Colliculum large, sclerotized, cup-shaped. Ductus bursae thin posteriorly, crossed by medial line, covered with small spines in section between insertion of ductus seminalis and distal half; anterior part of ductus wider, convoluted, almost completely covered with small plates. Corpus bursae oval, with leaf-shaped signum.

Abdominal structures (Fig. 44): No latero-posterior struts, the transverse strut with thicker proximal edge and thinner distal edge in the middle. Tergal disk (3rd tergite) 6 times as long as wide, with about 30 conical spines.

Bionomy: The early stages and the foodplant are not known. The two related species *C. cratipennella* and *C. tamesis* develop on *Juncus* spp. (Juncaceae). At the collecting site Colonia Suiza is a small bog with *Juncus* sp. (Karsholt, pers. comm.) and the specimen of *C. breyeri* from Brazil was collected on the edge of a swampy area, where they are probably also some Juncaceae (B. Landry, pers. comm.). Pastrana's specimens were collected in October and those in the ZMUC in the months between October and January.

Distribution: Argentina, Brazil, Chile.

Coleophora haywardi Pastrana, 1963 (Fig. 10)

Original material examined: Paratypes: 1 ♂ "R. A.[rgentina], Prov. Salta | Cafayate | 1650 m| K. J. Hayward 1953"; "ex: *Gomphrena maritiana* Gill"; *"Coleophora haywardi* sp. n. | 1963 | J. A. Pastrana det."; 1 ♂ "PARATYPUS" [pink label]; "Genital no. 5132 | Bent W. Rasmussen". 1 ♂, same labels (PG Bldz nº 11620 ♂", coll. ZMUC.

New material examined: 8 ♂♂, 19 ♀♀ "R. ARGENTINA | Salta - Dep. Anta | Salta - Forestal | 50 km E | J. V. González | 15-22-I-1980 | Col: R. Golbach".

Remarks: The species was described by Pastrana on 28 specimens bred by K. J. Hayward. The genitalia were illustrated with a drawing in the original publication and with photographs by VAN DER WOLF (1999). I believe it necessary to provide a redescription of the species.

Diagnosis: Medium-sized species with clear ochre habitus. The genitalia have some similarities with those of *C. kosteri* van der Wolf, 1999, a species known only from Argentina. In the male genitalia the most evident difference is the shape of the sacculus, which in *C. haywardi* is narrower and longer

with two characteristic teeth towards the apex; in the female genitalia the spinulate part of the ductus bursae is wider and much longer.

Description: Wingspan 13-15 mm. Head white. Antenna white or light ochre, scape white without erect scales. Labial palp white, tinged with light ochre outside; second segment about 1.5 times as long as third. Proboscis normally developed. Thorax white. Forewing white, sometimes streaked with very light ochre along veins; fringes white or light ochre; dorsal fringes light grey. Hindwing and fringes light grey. Abdomen white or cream.

Male genitalia (Figs 51, 53-55): Gnathos knob oval. Tegumen short, very narrow in the middle, pedunculus slightly dilated outside. Transtilla thin and elongated, united medially. Valvula small, subtriangular with rounded ventral part. Cucullus short and wide, ear-shaped. Sacculus with curved ventral edge, with two teeth of different sizes in distal half and a pointed triangular tip at dorsal corner. Phallotheca long, curved with symmetrical juxta rods thinned distally, sclerotized only dorsally. Cornuti consisting of numerous thorns of different lengths gathered at base in long braid.

Female genitalia (Figs 56-58): Papillae anales narrow and oval. Apophysis posterioris twice as long as anterioris. Sterigma ogival. Ostium bursae small, V-shaped. Colliculum very sclerotized, shaped like narrow calyx; medial line ending in proximal narrower part. Ductus bursae wider and longer distally, crossed by medial line and completely covered with small spines; proximal part transparent, except in convolution at insertion of ductus seminalis. Corpus bursae elongated, piriform-shaped, with leaf-shaped signum.

Abdominal structures (Fig. 52): Latero-anterior struts about twice as long as the latero-posterior. Transverse strut straight, with distal edge thicker than the proximal edge sclerotized only in the middle. Tergal disk (3rd tergite) about 4.5 times as long as wide, covered by over 50 conical spines.

Bionomy: The host plant is *Gomphrena martiana* Gillies ex Moq. (Amaranthaceae). In the original description by Pastrana and on the labels of Hayward's specimens is written "maritiana". The larval case (Figs 15a, b), built with silk, is cylindrical, 14-16 mm long, ochre and parchment-like appearance with evident growth lines. The oral opening with wide edge, angled by about 10º-15º; the anal opening is triangular. In the ZMUC material there are numerous cases in various stages of development; the juvenile ones are whitish, covered with food frustules dorsally and in the mouth area and the anal opening they do not yet have a triangular shape. The construction of the case is probably the same as those of many Palearctic species such as *C. follicularis* (Vallot, 1802).

Distribution: The species is known only from Argentina (Department of Salta).

Coleophora rasmusseni **Baldizzone, sp. n.** (Fig. 11)

Material examined: Holotype ♂: "ARGENTINA, Neuquén | 12: Río Limay | Arroyito | 16.xi.1978| Misión Cient[ífica] Danesa"; "Genital no. 5129 | Bent W. Rasmussen", coll. ZMUC.
Paratype ♀: Idem, (GP BWR 5128), coll, ZMUC.

Diagnosis: Medium-sized species characterized by a light brown forewing with white stripes along the veins. The genitalia are different from those of all other known neotropical species in the male by the unmistakable strongly curved shape of the sacculus with a long pointed extension at the dorsal corner; in the female genitalia the sterigma is characteristicly wider than high, more strongly sclerotized in proximal 2/3.

Description: Wingspan 13 mm. Head white dorsally and light brown on the frons. Antenna: scape white without erect scales; flagellum light brown, except in basal 1/6 ringed white and light brown. Labial palp white, suffused with light brown outside; second article about twice as long as third. Proboscis very short. Thorax white. Tegula white suffused light brown outside. Forewing light brown, sharply striated white along costa and veins in costal half, almost completely brown between anal fold and dorsum ; fringes light grey. Hindwing and fringes light grey. Abdomen not observed because dissected before my study.

Male genitalia (Figs 59, 61-62): Gnathos knob oval. Tegumen slightly constricted medially, pedunculus short, enlarged outside. Transtilla thin, sharp at the apex. Valvula small, with subtriangular

ventral section. Cucullus large, wide, ear-shaped. Sacculus strongly curved, thicker on ventral edge, ending at dorsal corner with long, thin and sharp projection. Phallotheca with two juxta rods symmetrical, long, curved, tapered progressively in distal direction, with thin and sharp apex. Cornuti consisting of numerous spines of different lengths joined to form a long braid.

Female genitalia (Figs 63-65): Papillae anales small, oval. Apophysis posterioris twice as long as anterioris, more robust and strongly sclerotized. Sterigma trapezoidal, wider than long, distal edge curved, bristling with setae, much hollowed medially by sinus vaginalis, clearly more thickly sclerotized in proximal 2/3 and corrugated on each side of ostium bursae. Ostium bursae oval. Colliculum cup-shaped with proximal part narrower, tubular, transparent, sclerotized on outer edges. Ductus bursae without medial line, covered with small spines in distal half while proximal part almost transparent, lightly sclerotized. Corpus bursae oval; signum leaf-shaped.

Abdominal structures (Figs 60, 63): Without lateral-posterior struts; transverse strut slightly curved, with proximal edge very thin compared to distal one. Tergal disk (3rd tergite) about 7 times longer than wide, covered with about 25 spines in male; in female about 9 times longer than wide and covered with more than 50 spines.

Bionomy: The early stages and the foodplant are not known. The specimens were collected in November.

Distribution: Argentina (Province of Neuquén, near Arroyito, Río Limay).

Etymology: The species is dedicated to Bent Waldemar Rasmussen in recognition of his work on the South American Coleophoridae of ZMUC.

Coleophora peruana **Baldizzone, sp. n.** (Fig. 12)

Material examined: Holotypus ♂: "PERU, Dep. Ancash | 25: 15 km N Caras | Río Salta Valley | 19.-21-ii-1987, ca. 2000 m | O. Karsholt leg. | Zool. Mus. Copenhagen"; "Bldz PG nº 9793 ♂", coll. ZMUC.

Diagnosis: Small species of light grey habitus. In male genitalia it resembles *C. lepyropis* Meyrick, 1921, a light ochre species known only from Brazil with faint streaks along the veins. Compared to the male genitalia of *C. peruana* Baldizzone, sp. n., the cucullus of. *C. lepyropis* is larger, the transtilla smaller and thinner, the lateral edge of the sacculus is less jagged and the phallotheca is shorter.

Description: Wingspan 11 mm. Head white with cream tinge on the frons. Antenna of uniform light ochre colour; scape without erect scales. Labial palp white, suffused with light brown outside; the second article is about 1.5 times longer than the third. Proboscis normally developed. Thorax shiny white. Forewing light grey, slightly shaded creamy at the apex; costal fringes creamy, dorsal fringes grey. Hindwing grey with concolorous fringes. Abdomen whitish.

Male genitalia (Figs 66, 68-69): Gnathos knob globular. Tegumen narrowed in the middle, pedunculus dilated outside. Transtilla short, curved, pointed at the apex. Valvula small, narrow and elongated. Cucullus small and short, wider in the central part. Sacculus, slightly curved on the ventral edge, very thick lateral outer edge, inclined, irregularly jagged, dorsal corner of irregularly triangular shape. Phallotheca with two long juxta rods, sclerotized in the dorsal part, with a small tooth in the last 1/3 distal and a curved apical tooth. The cornuti are numerous spines united in a robust elongated formation.

Abdominal structures (Fig. 67): No latero-posterior struts; transverse strut straight with proximal edge thicker medially and distal edge thinner medially. Tergal disk (3rd tergite) about 6 times as long as wide, covered with about conical 25 spines.

Bionomy: The early stages and the foodplant are not known. The specimen was collected in February.

Distribution: Peru (Department of Ancash, Río Salta Valley).

Etymology: From the Spanish word "peruano-a" = adjective that indicates the origin from Peru.

Coleophora versurella Zeller, 1849
= *C. chiarelliae* Pastrana, 1963

Material examined: 1 ♂, 5 ♀♀ "CHILE: Aconcagua | 67: Los Andes | Curimón, 700 m | 28-III-1979 | Misión Científica Danesa", coll. ZMUC.

Remark: Species introduced in South America. Pastrana in 1963 described it also under the name *C. chiarelliae*, a junior synonym, from specimens bred in Argentina. The species was subsequently collected also in Chile (FRÍAS *et al*., 1996).

Distribution. Palearctic: Widely distributed. Oriental: India. Nearctic (adventive): Canada, U.S.A. Neotropical (adventive): Argentina, Chile (BALDIZZONE *et al*., 2006).

Coleophora mayrella (Hübner, [1813])

Material examined: Many specimens from Argentina and Chile, studied by J.-F. Landry, who published a list of the material examined (LANDRY, 1994).

Distribution. Palearctic: Europe, North Africa, Turkey, Armenia, Central Asia, Russian Far East. Nearctic (adventive): Canada, U.S.A. Neotropical (adventive): Argentina, Chile. Australian (adventive): Australia, New Zealand (BALDIZZONE *et al*., 2006).

Acknowledgements

I warmly thank my friend Ole Karsholt, former curator at the ZMUC Lepidoptera collection, for entrusting me with the interesting material treated here, for all the information and the help he provided me, as well as for commenting the manuscript. Special thanks go to my friend Hugo van der Wolf, (Nuenen, The Netherlands) for important information, including unpublished notes on the biology of *C. intexta*, for suggestions, and encouragement. Thanks to Bernard Landry of MHNG (Geneva, Switzerland) who sent me his Coleophoridae collected in Brazil, corrected the English text and suggested some improvements. I thank Rob de Vos, curator of the Lepidoptera of the Naturalis Museum of Leiden (The Netherlands) for the photograph of the larval case of *C. intexta*, and I thank Alessandro Giusti, curator of the Lepidoptera of the NHMUK (London, UK) for the information and photo of adult and larval case of the *C. pulchricornis* holotype. Thanks to Jean-François Landry (Ottawa, Canada) for the information about the female of *C. breyeri* Pastrana. I thank also my friend Pier Giuseppe Varalda (Morano sul Po, Italy) for the photographs of the adults and larval cases of *C. haywardi*. Finally, I thank Antonio Vives (Madrid, Spain) for the Spanish translation of the abstract.

BIBLIOGRAPHY

BALDIZZONE, G. & LANDRY, J.-F., 1993.– *Coleophora cratipennella* Clemens, 1864 and *C. tamesis* Waters, 1929, two distinct species (Lepidoptera, Coleophoridae).– *Nota lepidopterologica,* **16**: 2-12.

BALDIZZONE, G., WOLF, H. W. van der & LANDRY, J., 2006.– Coleophoridae, Coleophorinae (Lepidoptera).– In *World Catalogue of Insects*, **8**: 1-215. Apollo Books, Stenstrup.

FRÍAS, D. H., HENRY, A., ALVIÑA, A. & LANDRY, J.-F., 1996.– Aspectos de la biología, taxonomía y control de las especies del género *Coleophora* (Lepidoptera: Coleophoridae) de distribución chilena.– *Acta Entomológica Chilena,* **20**: 115-122 + 1 pl.

LANDRY, J.-F., 1994.– Two new species of metallic-green *Coleophora* Hübner (Lepidoptera: Coleophoridae) from the Nearctic region, and first records of *C. mayrella* (Hübner) from South America.– *The Canadian Entomologist,* **126**: 1185-1191.

LANDRY, J.-F. 2005.– Two new species of *Coleophora* from the New World. With record of a new hostplant family for Coleophorines. (Lepidoptera: Coleophoridae: Coleophorinae*).– Holarctic Lepidoptera*, **10**(2003): 9-15.

LANDRY, J.-F., 2006.– A new species of *Coleophora* (Lepidoptera: Coleophoridae: Coleophorinae) from the Galápagos Islands, Ecuador.– *Zootaxa*, **1161**: 51-64.

MEYRICK, E., 1917.– *Exotic Microlepidoptera,* **2**(2-3): 33-96.

MEYRICK, E., 1921.– *Exotic Microlepidoptera,* **2**(13-15): 385-480.

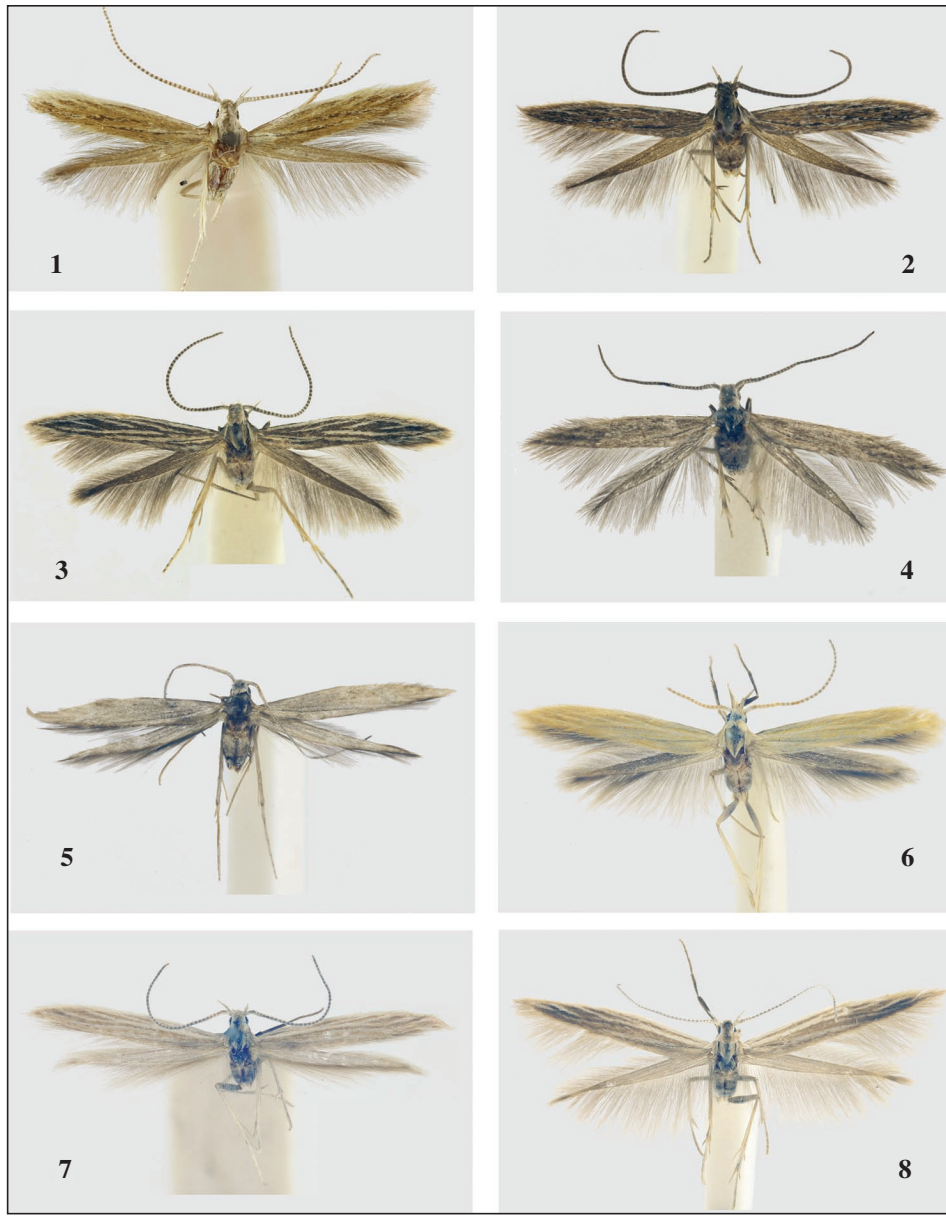
PASTRANA, J. A,. 1963.– La familia Coleophoridae (Lep.) en la América Latina.– *Revista de la Sociedad Entomológica Argentina,* **26**: 89-101. [1962].

WALSINGHAM, L., 1897.– Revision of the West-Indian Micro-Lepidoptera, with descriptions of new species.– *Proceedings of the Zoological Society of London,* **1897**: 54-183.

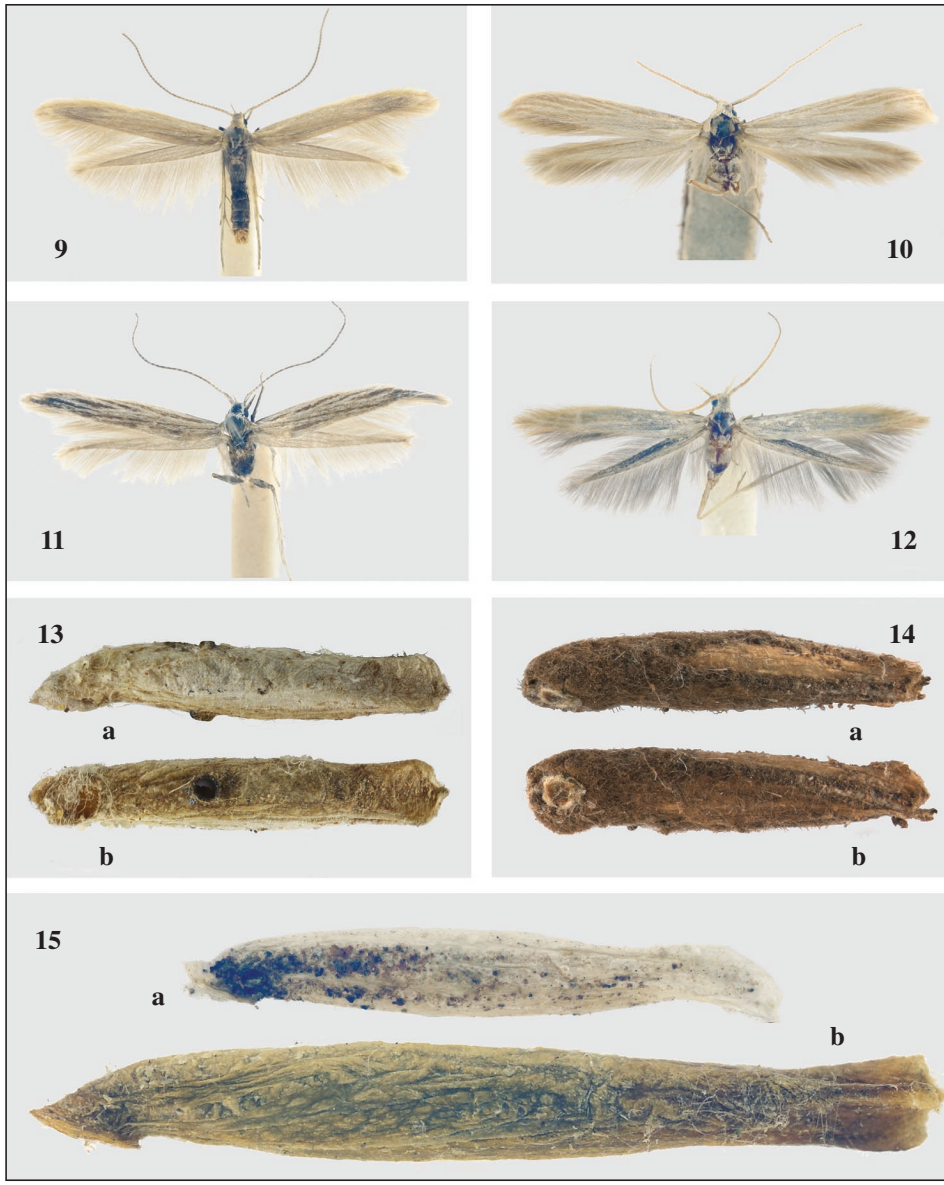
WOLF, H. W. van der 1999.– New species of Coleophoridae from Argentina (Lepidoptera: Coleophoridae).– *SHILAP Revista de lepidopterología,* **27**(107): 361-373.

G. B.
Via Manzoni, 24
I-14100 Asti (AT)
ITALIA / *ITALY*
E-mail: baldizzonegiorgio@gmail.com
https://orcid.org/0000-0001-8127-0843

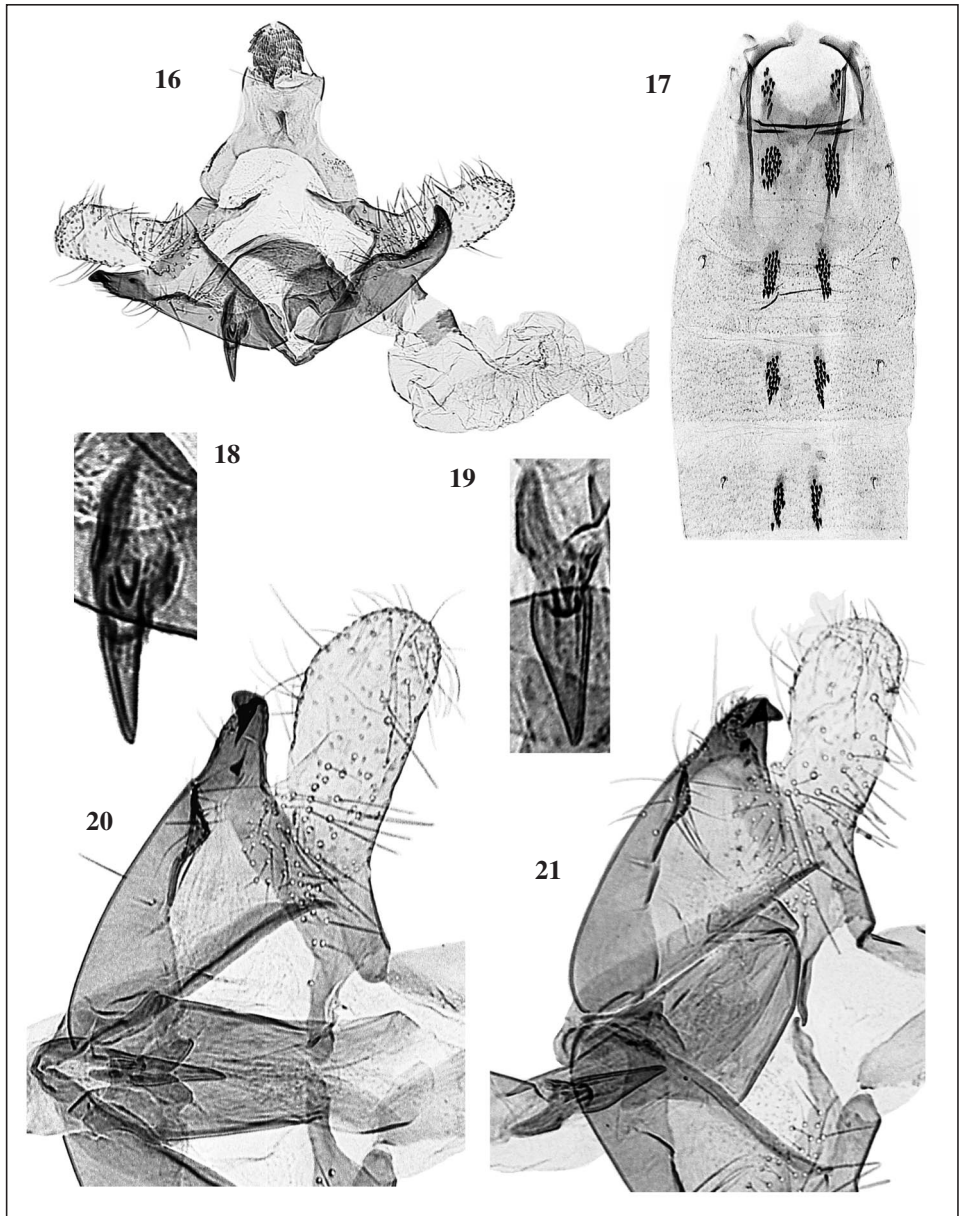
(Recibido para publicación / *Received for publication* 23-I-2020)
(Revisado y aceptado / *Revised and accepted* 28-II-2020)
(Publicado / *Published* 30-VI-2020)



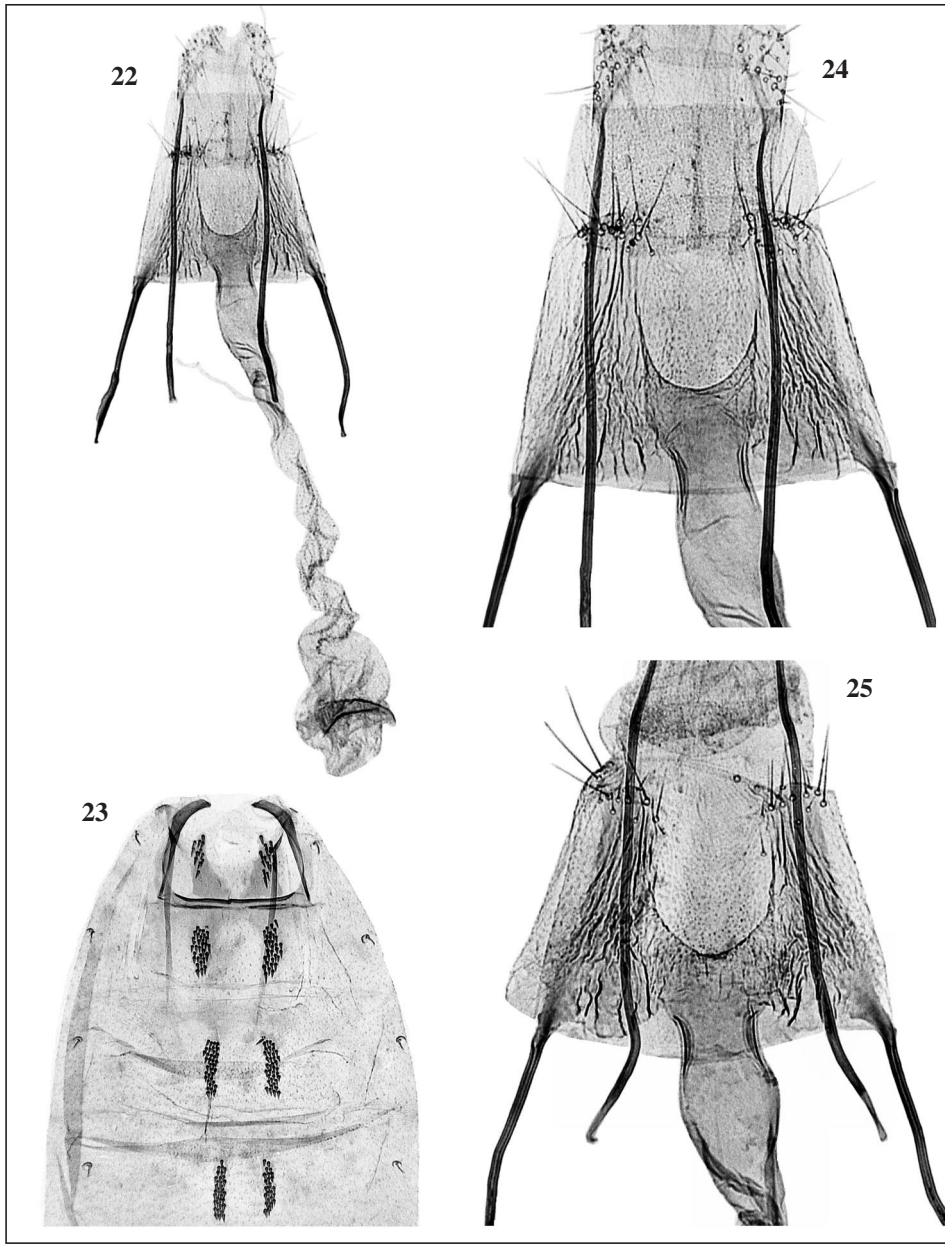
Figs 1-8.– *Coleophora* spp.: **1**. *C. pulchricornis* Walsingham, holotype ♀. **2**. Idem, ♂ "PERU, Dep. Ancash | 25: 15 km N Caras | Río Salta Valley | ca. 2000 m | 19-21-II-1987 | O. Karsholt leg.". **3**. *C. intexta* Meyrick ♂ "PERU: Dept. Lima | 2: 8 km E Chosica | San Bartolomé | 1900 m | 20-23-I-1987 | O. Karsholt leg.". **4**. Idem ♂, same label. **5**. *C. andina* Baldizzone, sp. n., holotype ♂. **6**. *C. aconcaguae* Baldizzone, sp. n., holotype ♂. **7**. *C. breyeri* Pastrana, paratype ♂ TIGRE | 10-1939 | J. A. Pastrana"; "*Coleophora breyeri* sp. n. | J. A. Pastrana det.". **8**. Idem ♀ "ARGENTINA: Río Negro | 7: S. C de Bariloche | Colonia Suiza | 610 m | 10-XII-1978 | Misión Científica Danesa".



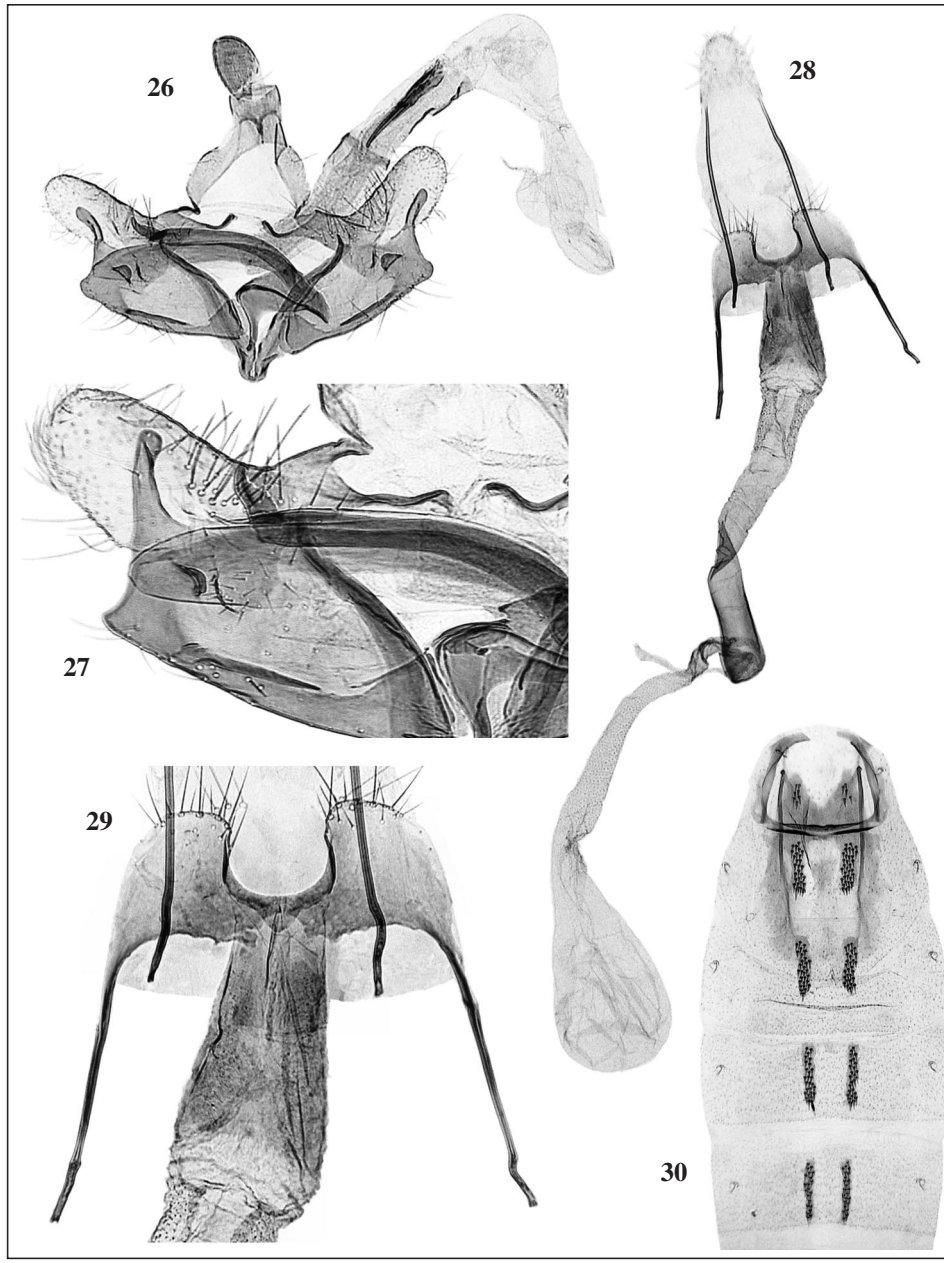
Figs 9-12.– *Coleophora* spp.: **9**. *C. breyeri* Pastrana "ARGENTINA: Río Negro | 7: S. C de Bariloche | Colonia Suiza | 610 m | 6-XII-1978 | Misión Científica Danesa". **10**. *C. haywardi* Pastrana, paratype ♂ "R. A.[rgentina], Prov. Salta | Cafayate | 1650 m | K. J. Hayward 1953. **11**. *C. rasmusseni* Baldizzone, sp. n., holotype ♂. **12.** *C. peruana* Baldizzone, sp. n., holotype ♂. **Figs 13-15.–** Larval cases. **13** *C. pulchricornis* Walsingham, holotype (13 mm): **a)** lateral view, **b)** ventral view (photo Alessandro Giusti, NHMUK. **14**. *C. intexta* Meyrick (5,5 mm): **a)** lateral view, **b)** ventral view (photo Rob de Vos, RMNH). **15**. *C. haywardi* Pastrana: **a)** immature case (7 mm), **b)** full developed case (14 mm).



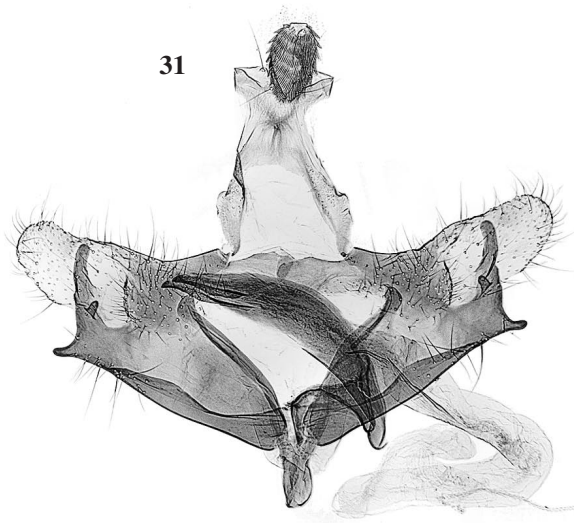
Figs 16-21.– *C. pulchricornis* Walsingham. **16**. Male genitalia (GP Bldz 2909, paratype). **17**. Abdomen. **18**. Detail of cornutus. **19**. Same detail (GP Bldz 9790) "PERU, Dept. Lima | 29: 10 km S Paramonga | Barranca | sea level | 22-23-II-1987, O. Karsholt leg.". **20**. Detail of cucullus, sacculus, phallotheca (GP Bldz 9798) "PERU, Dep. Ancash | 25: 15 km N Caras | Rio Salta Valley | ca. 2000 m | 19-21-II-1987 | O. Karsholt leg.". 21. Same detail (GP Bldz 9790).

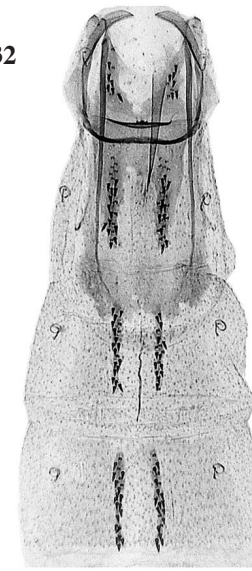


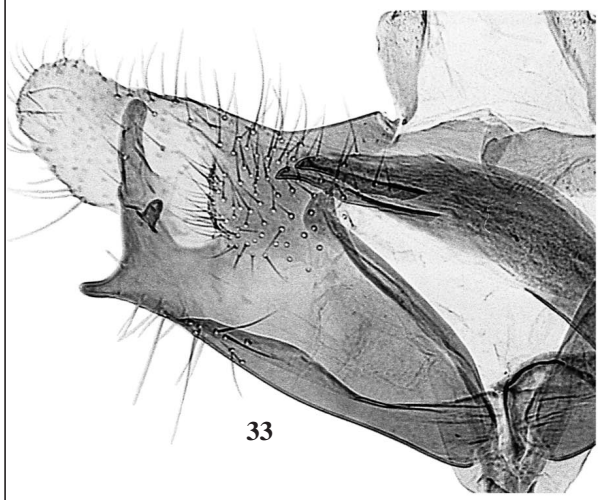
Figs. 22-25. - *C. pulchricornis* Walsingham. **22**. Female genitalia (GP Bldz 9801) "PERU, Dept. Lima | 30 m | Miraflores | 1-4-III-1987 | O. Karsholt leg". **23**. Abdomen. **24**. Detail of sterigma, ostium bursae, colliculum. **25**. Same detail (GP Bldz 9791) "PERU, Dept. Lima | 29: 10 km S Paramonga | Barranca | sea level | 22-23-II-1987, O. Karsholt leg.".

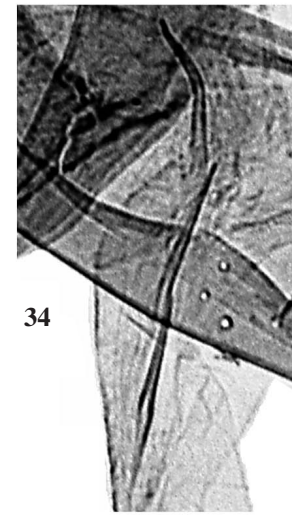


Figs 26-30. - *C. intexta* Meyrick. **26**. Male genitalia (GP Bldz 9796) "PERU: Dept. Lima | 2: 8 km E Chosica | San Bartolomé | 1900 m | 20-23-I-1987 | O. Karsholt leg.". **27**. Detail of cucullus, sacculus, phallotheca. **28**. Female genitalia (GP Bldz 9800) "PERU: Dep. Ancash | 25: 15 km N Caras | Rio Salta Valley | ca. 2000 m | 19-21-II-1987 | O. Karsholt leg.". **29**. Detail of sterigma, ostium bursae, colliculum. **30**. Abdomen.

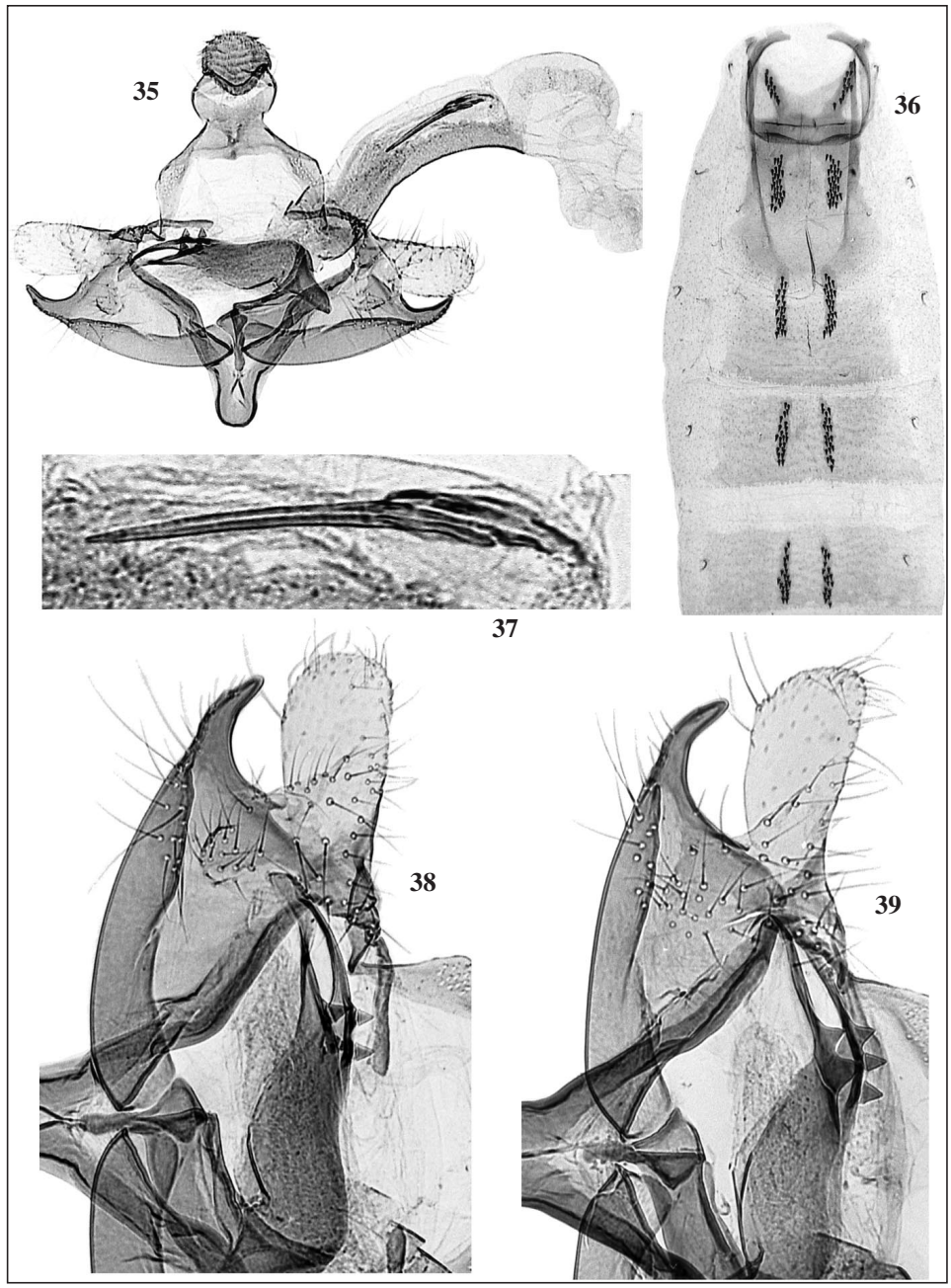




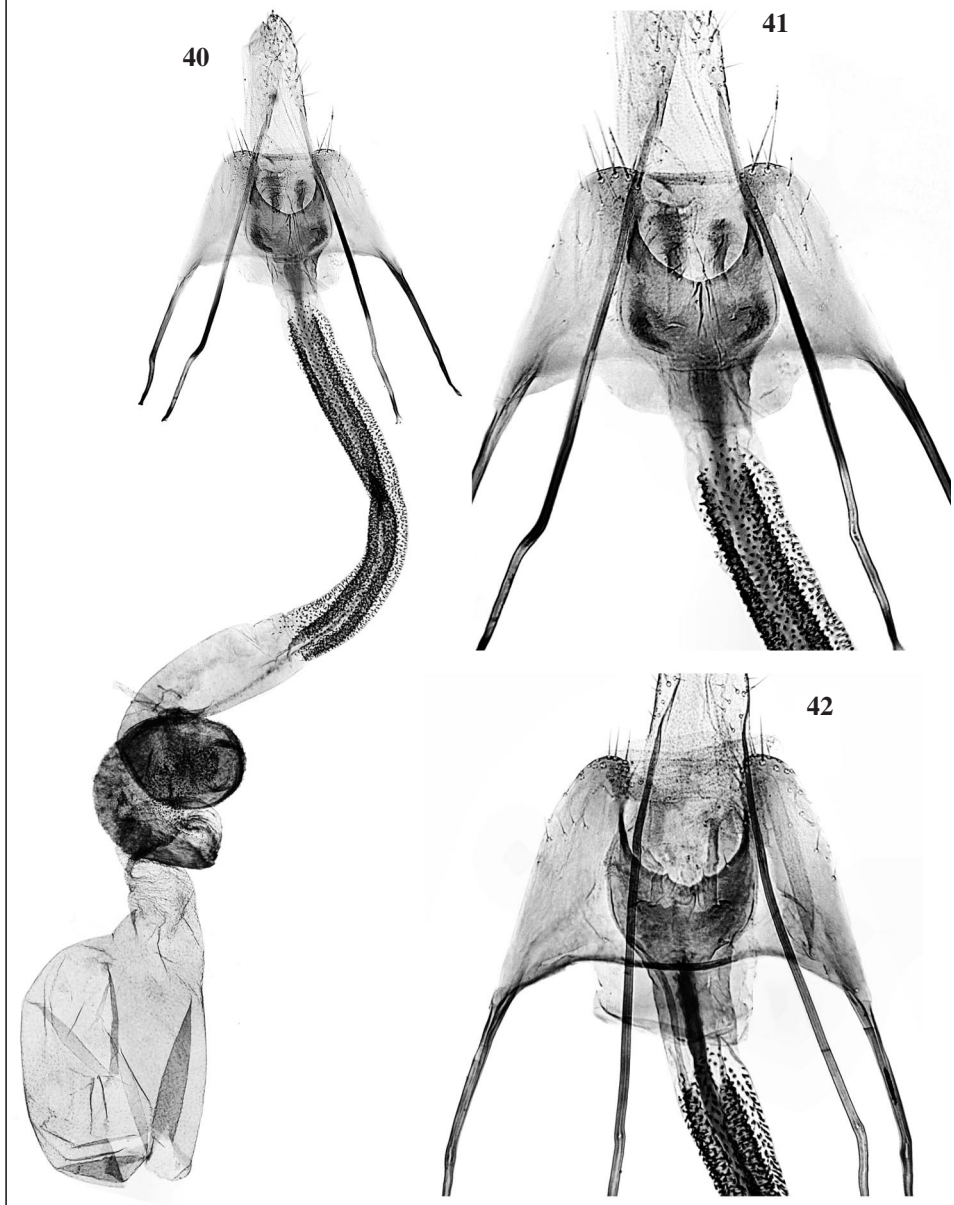




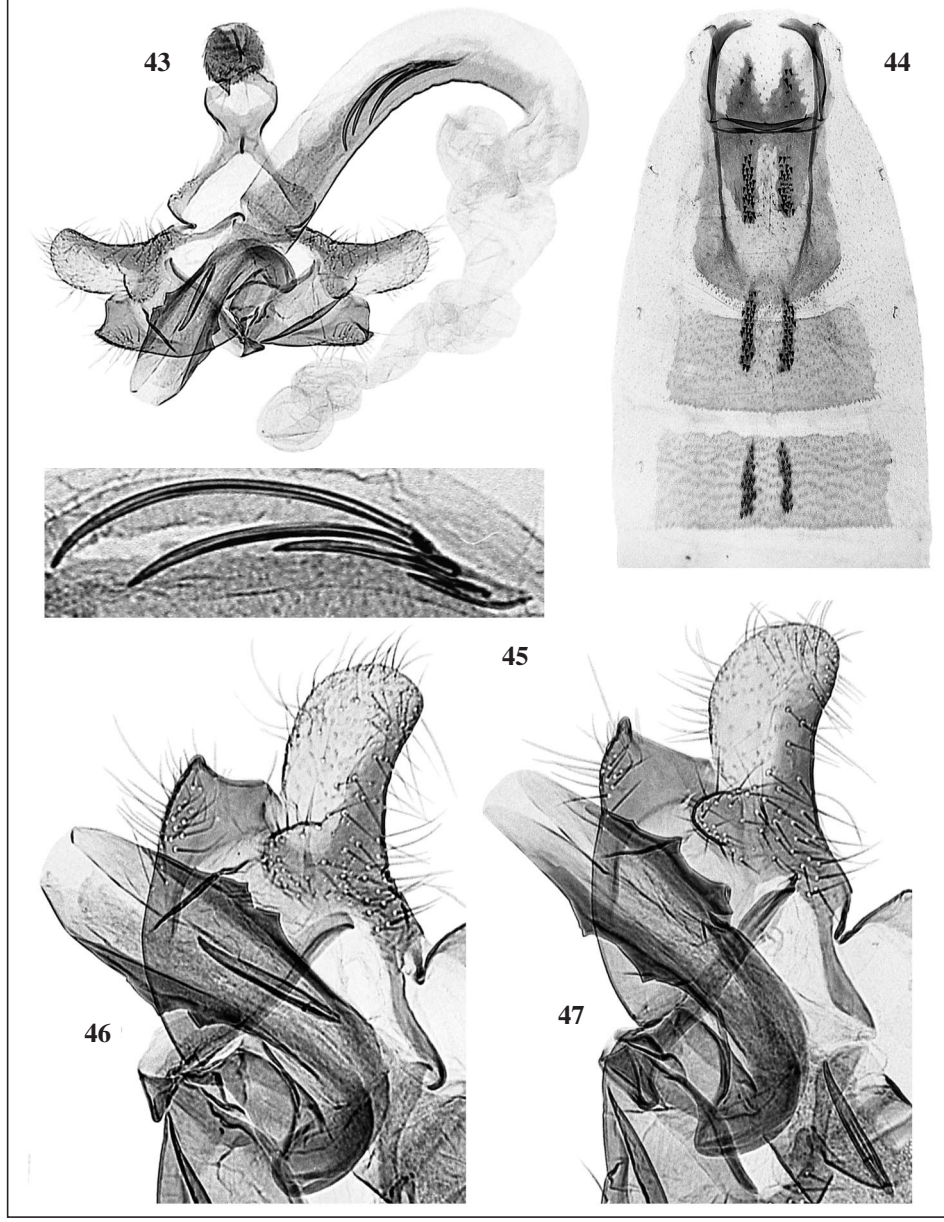
Figs 31-34.– *C. andina* Baldizzone, sp. n. **31**. Male genitalia (GP Bldz 9793, holotype). **32**. Abdomen. **33**. Detail of cucullus, sacculus, phallotheca. **34**. Detail of cornuti.



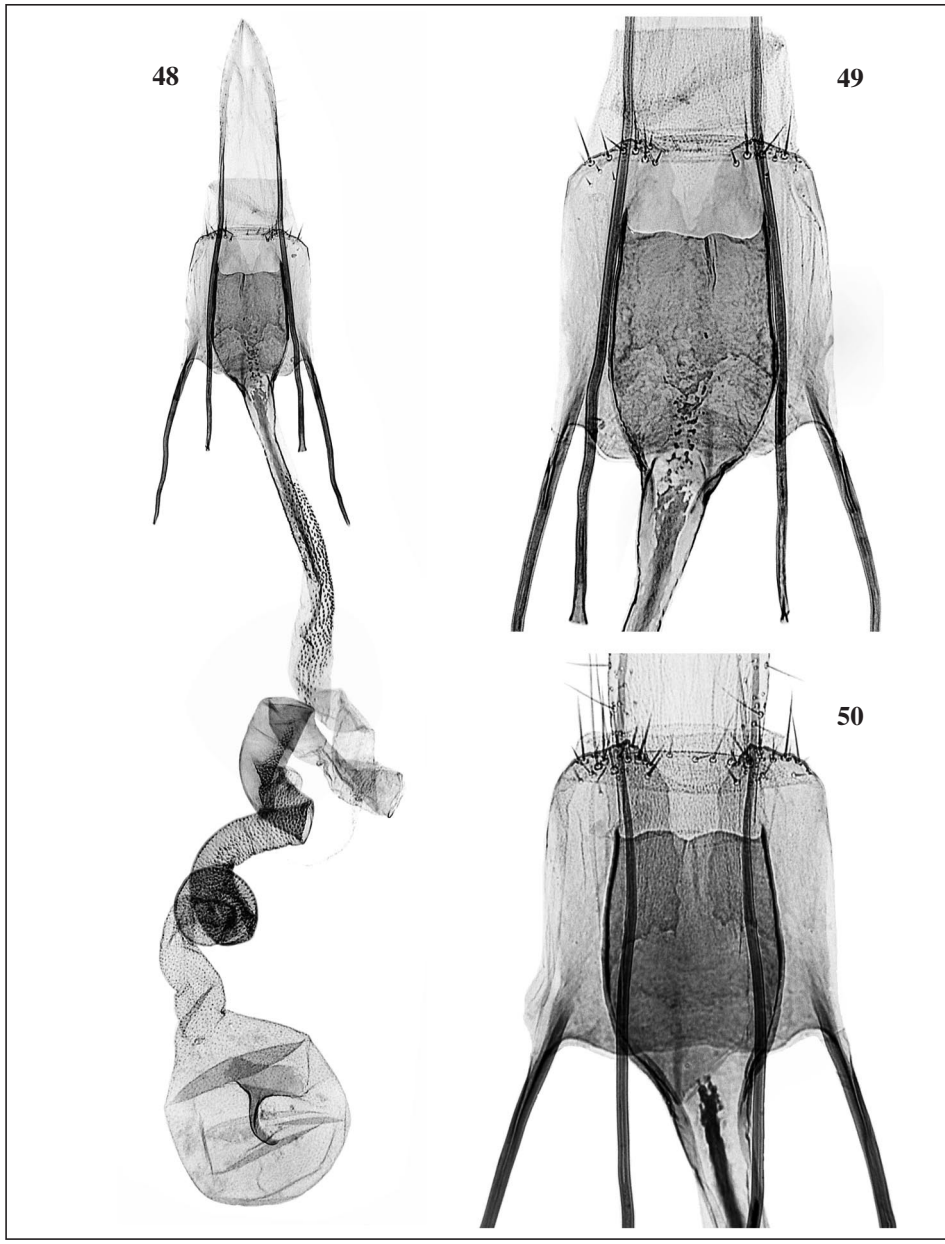
Figs 35-39.– *C. aconcaguae* Baldizzone, sp. n. **35**. Male genitalia (GP Bldz 11623, paratype). **36**. Abdomen. **37**. Detail of cornuti. **38**. Detail of cucullus, sacculus, phallotheca. **39**. Same detail (GP Bldz 5392, paratype).



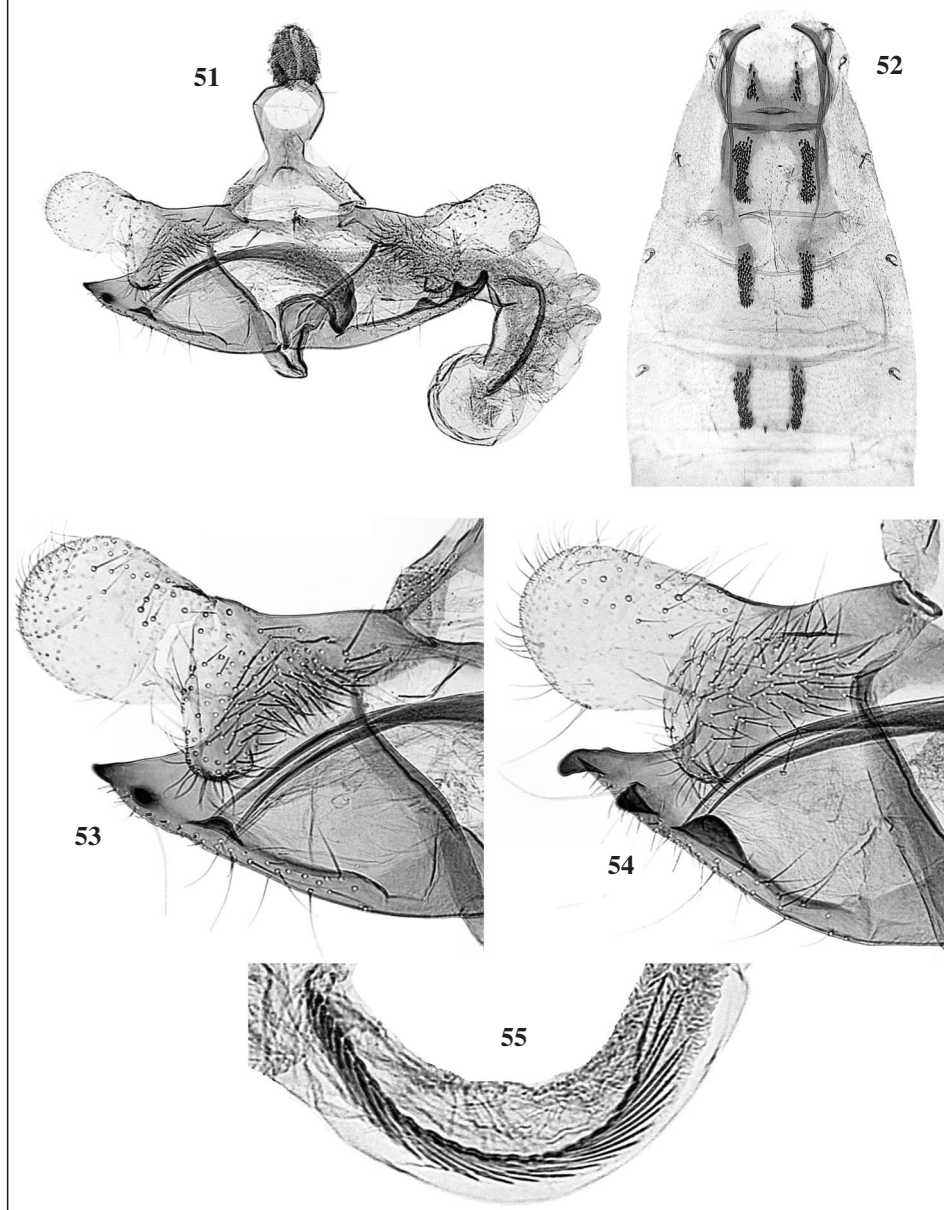
Figs 40-42.– *C. aconcaguae* Baldizzone, sp. n. **40**. Female genitalia (GP Bldz 12831, paratype). **41**. Detail of sterigma, ostium bursae, colliculum. **42**. Same detail (GP Bldz 12834, paratype).



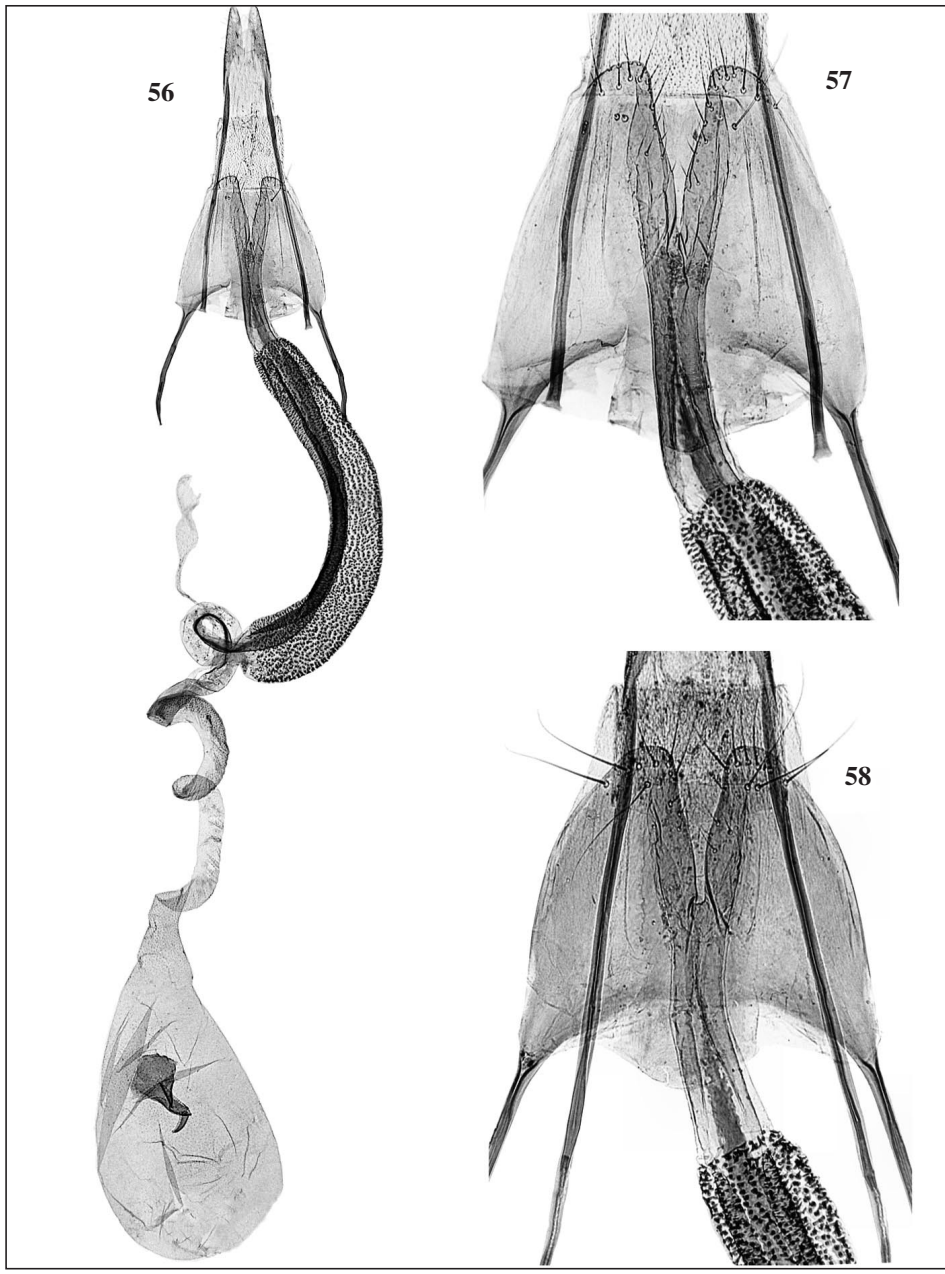
Figs 43-47.– *C. breyeri* Pastrana. **43**. Male genitalia (GP Bldz 11616). "ARGENTINA: Río Negro | 7: S. C de Bariloche | Colonia Suiza | 610 m | 24-XII-1978 | Misión Científica Danesa". **44**. Abdomen. **45**. Detail of distal cornuti. **46**. Detail of cucullus, sacculus, phallotheca and proximal cornutus. **47**. Same detail (GP Bldz 11621), ibidem, 5-7-I-1982.



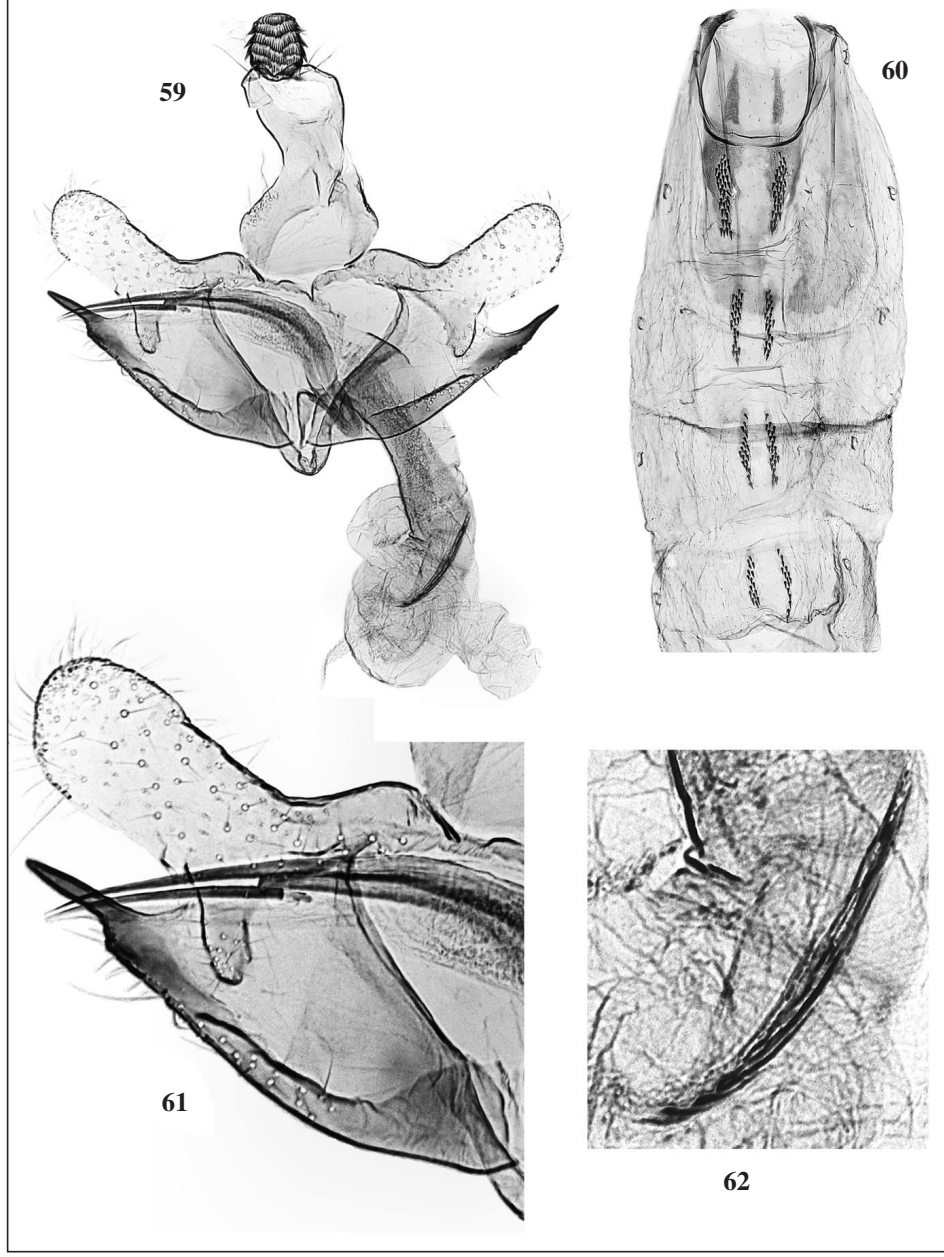
Figs 48-50.– *C. breyeri* Pastrana. **48**. Female genitalia (GP Bldz 11622) "ARGENTINA, Neuquén | 12: Río Limay | Arroyo | 22-XII-1978 | Misión Científica Danesa". **49**. Detail of sterigma, ostium bursae, colliculum. **50**. Same detail (PG Bldz 11617) "ARGENTINA: Río Negro | 7: S. C de Bariloche | Colonia Suiza | 610 m | 10-XII-1978 | Misión Científica Danesa".



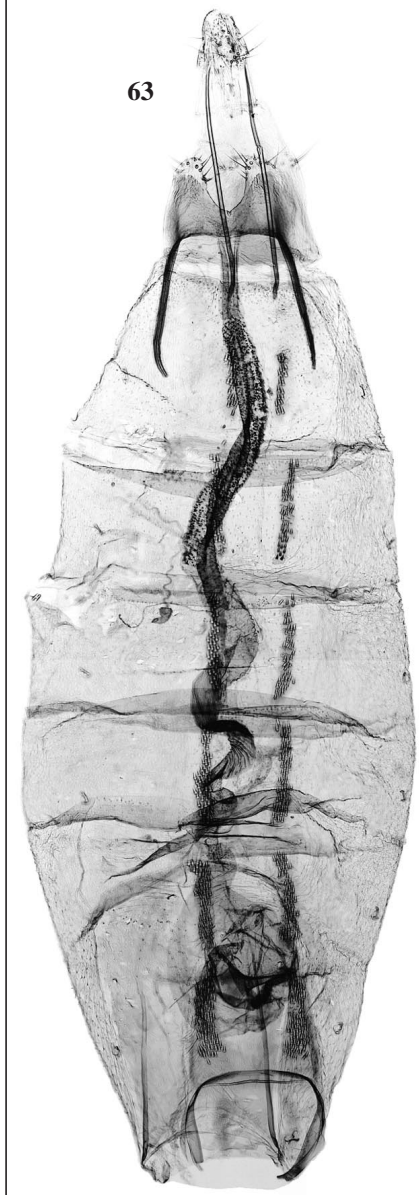
Figs 51-55.– *C. haywardi* Pastrana. **51**. Male genitalia (GP Bldz 11625) "R. ARGENTINA | Salta - Dep. Anta | Salta - Forestal | 50 km E | J. V. González | 15-22-I-1980 | Col: R. Golbach". **52**. Abdomen. **53**. Detail of cucullus, sacculus, phallotheca. **54**. Same detail (GP Bldz 11628, paratype). **55**. Detail of cornuti (GP 11626) same label as GP Bldz 11625.

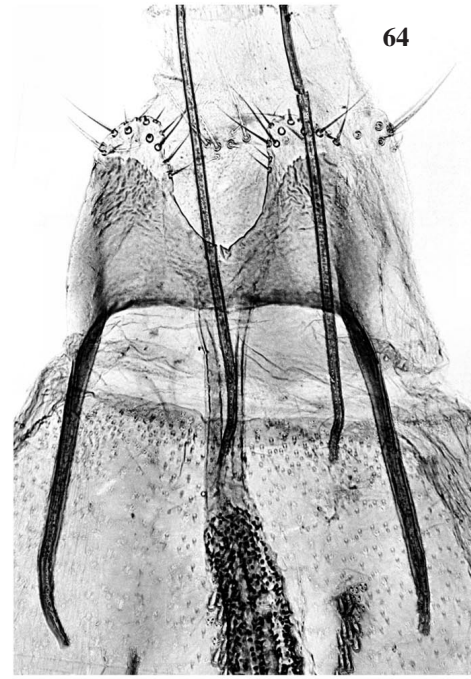


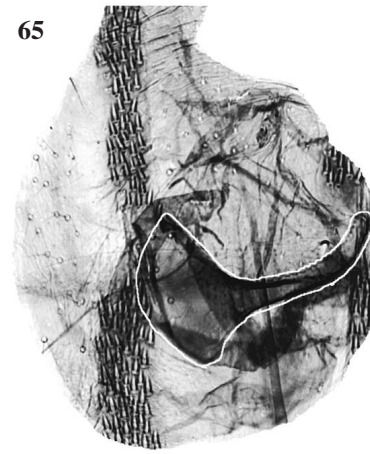
Figs 56-58.– *C. haywardi* Pastrana. **56**. Female genitalia (GP Bldz11624) "R. ARGENTINA | Salta - Dep. Anta | Salta - Forestal | 50 km E | J. V. González | 15-22-I-1980 | Col: R. Golbach". **57**. Detail of sterigma, ostium bursae, colliculum. **58**. Same detail (GP Bldz 11627) same label.



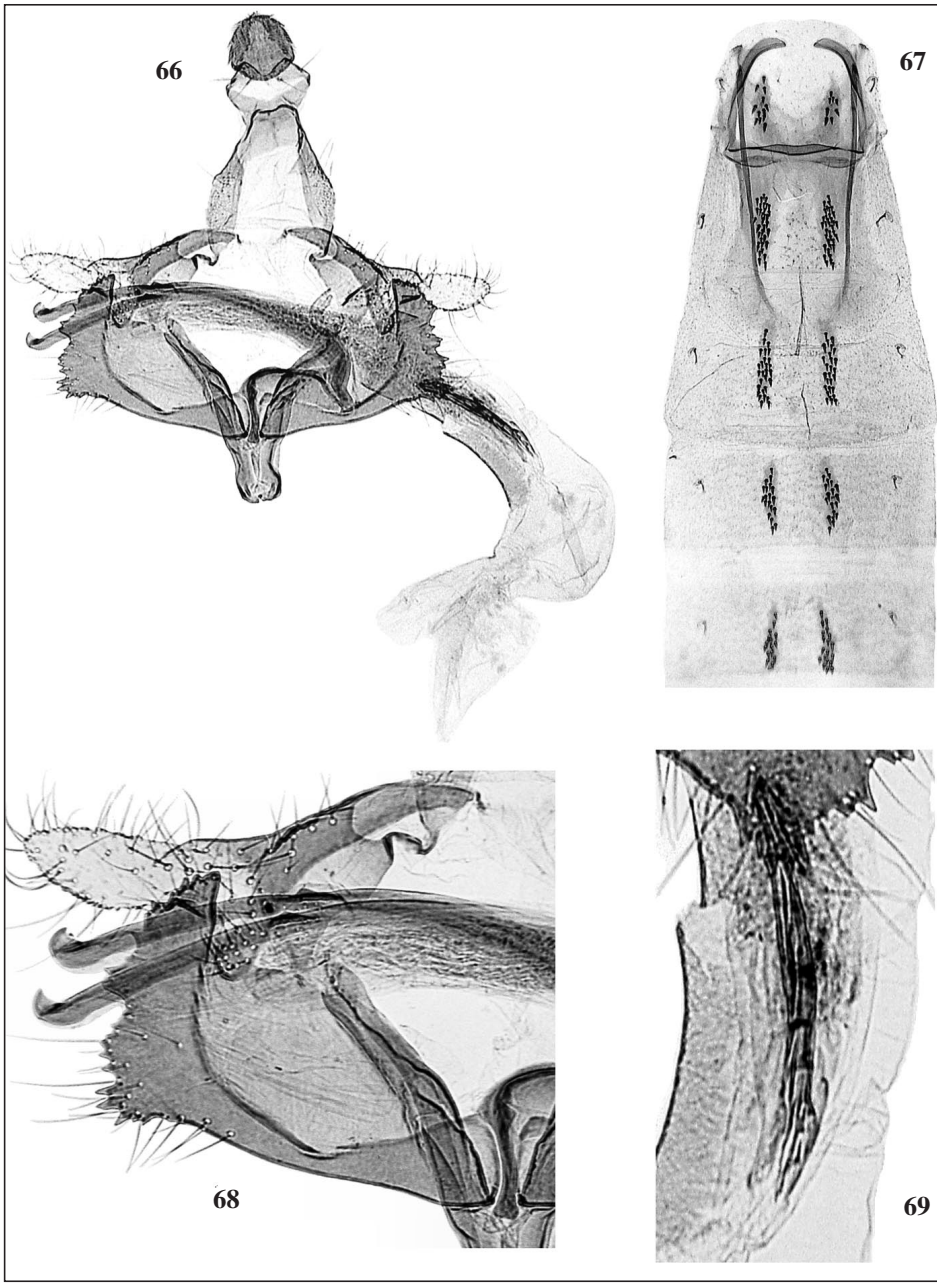
Figs 59-62.– *C. rasmusseni* Baldizzone, sp. n. **59**. Male genitalia (GP BWR 5129, holotype). **60**. Abdomen. **61**. Detail of cucullus, sacculus, phallotheca. **62**. Detail of cornuti.







Figs 63-65.– *C. rasmusseni* Baldizzone, sp. n. **63**. Female genitalia and abdomen (GP BWR 5128, paratype). **64**. Detail of sterigma, ostium bursae, colliculum. **65**. Detail of corpus bursae and signum.



Figs 66-69.– *C. peruana* Baldizzone, sp. n. **66**. Male genitalia (GP Bldz 9792, holotype). **67**. Abdomen. **68.** Detail of cucullus, sacculus, phallotheca. **69.** Detail of cornuti.

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 223-224 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.400

Stemmatophora combustalis (Fischer von Röslerstamm, 1842) new to the Maltese Islands (Lepidoptera: Pyralidae)

J. Agius & J. Formosa

Abstract

Stemmatophora combustalis (Fischer von Röslerstamm, 1842) is reported for the first time from the Maltese Islands. Distribution and habits of the adult and larvae are included. A Maltese name is proposed for this new record.
KEY WORDS: Lepidoptera, Pyralidae, *Stemmatophora combustalis*, Malta.

Stemmatophora combustalis **(Fischer von Röslerstamm, 1842) nueva para Malta (Lepidoptera: Pyralidae)**

Resumen

Stemmatophora combustalis (Fischer von Röslerstamm, 1842) se menciona por primera vez para Malta. Se incluye la distribución y hábitat del adulto y de la larva. Se propone un nombre maltés para este nuevo registro.
PALABRAS CLAVE: Lepidoptera, Pyralidae, *Stemmatophora combustalis*, Malta.

Introduction

The superfamily Pyraloidea is composed of about 16,000 described species worldwide (HEPPNER, 1991) with 914 species recorded from Europe (NUSS *et al*., 2004). On the Maltese Islands around 141 Pyraloidea species have been recorded so far with the latest addition being *Cydalima perspectalis* (Walker, 1859) (AGIUS, 2018).

The genus *Stemmatophora* Guenée, 1854 which is distributed in Europe, Africa and the Middle East is very often synonymised with the genus *Actenia* Guenée, 1854 and the genus *Scotomerodes* Ragonot, 1895. In SLAMKA (2006), all the three genera have been used however for the purpose of this paper, the genus *Stematophora Guenée*, 1854 has been selected based on the website (http://www.lepiforum.de/lepiwiki.pl?Pyralidae_Europa). Altogether there are 10 species in the genus *Stemmatophora* Guenée, 1854 in Europe and only *Stemmatophora brunnealis* (Treitschke, 1829) has so far been recorded for the Maltese Islands (SAMMUT, 2000). Normally *Stemmatophora* species are characterised by bipectinate or ciliate antennae of the male and filiform antennae of the female.

Material

MALTA, 1 ♂, Fomm ir-Rih, 20-VI-2019, leg. J. Formosa.

Discussion

Stemmatophora combustalis (Fischer von Röslerstamm, 1842) is distributed in South Europe from Portugal, South of France to Turkey including the neighbouring island of Sicily. The species inhabits dry open habitats. The larvae are detritophagus, that is they feed on dead or wilted leaves and flowers in silken tubes of *Helianthemum* sp., *Thymus* sp. and *Genista scorpius* (L.) DC (SLAMKA, 2006). In Malta, *Thymus capitata* (L.) Hoffmanns. & Link is a common species found in rocky places and garigue whilst *Helianthemum thymifolium* (L.) Webb and *Helianthemum arabica* (L.) Spach are frequent species found in garigue and rocky sites as well (WEBER, 2006). However so far there is no evidence that *Stemmatophora combustalis* (Fischer von Röslerstamm, 1842) is breeding in the Maltese Islands.

Fig. 1.– *Stemmatophora combustalis* (Fischer von Röslerstamm, 1842).

The species is new to the Maltese lepidopterofauna. The authors propose the Maltese name Stemmatofora mahruqa, after a transliteration of the scientific name.

Acknowledgments

The authors are grateful to Dr. Antonio Vives for the Spanish abstract.

BIBLIOGRAPHY

AGIUS, J., 2018.– Pest species *Cydalima perspectalis* (Walker, 1859) new to the Maltese Islands (Lepidoptera: Crambidae).– *SHILAP Revista de lepidopterología*, **46**(184): 577-579.

HEPPNER, J. B., 1991.– Faunal regions and diversity of Lepidoptera.– *Tropical Lepidoptera*, **2** (supplement 1): 185.

NUSS, M., SEGERER, A. & SPEIDEL, W., 2004.– Crambidae, Pyralidae, Thyrididae.– *In* O. KARSHOLT & E. J. VAN NIEUKURKEN. *Fauna Europaea: Lepidoptera, Moths*. Fauna Europaea version 1.1. Available from http://www.faunaeur.org.

RENNWALD, E., 2018. – Pyralidae of Europe. Available from http://www.lepiforum.de/lepiwiki.pl? Pyralidae_Europa (accessed 08th November 2019).

SAMMUT, P., 2000.– Kullana Kulturali. 12 - *Il-Lepidoptera*: X + 246 pp. Pubblikazzjonijiet Indipendenza, Malta.

SLAMKA, F., 2006.– *Pyraloidea of Europe*, **1**: 138 pp. František Slamka, Bratislava.

WEBER, H. C., 2006.– *Flora of the Maltese Islands*: 383 pp. Margraf Publishers.

*J. A.
166 'Infinity'
Vjal ix-Xarolla
MT-Zurrieq, ZRQ1617
MALTA / *MALTA*
E-mail: jonagius@msn.com
https://orcid.org/0000-0003-4875-0524

J. F.
270 Liedna Street
MT-Fgura, FGR1010
MALTA / *MALTA*
E-mail: justin_formosa@hotmail.com
https://orcid.org/0000-0002-5328-1876

*Autor para la correspondencia / *Corresponding author*

(Recibido para publicación / *Received for publication* 14-XI-2019)
(Revisado y aceptado / *Revised and accepted* 20-XII-2019)
(Publicado / *Published* 30-VI-2020)

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 225-237 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.394

Notes on some rare and elusive butterflies from Namdapha National Park, Arunachal Pradesh, India with rediscovery of two subspecies (Lepidoptera: Papilionoidea)

G. N. Das, A. Payra, Deepak CK & K. Chandra

Abstract

Namdapha National Park is situated in Changlang district of Arunachal Pradesh, roughly at the intersection of Palearctic and Indo-Malayan biogeographic realms. On account of its peculiar geographic position and diversity of vegetation and habitat types it encompasses, Namdapha is home to a wide variety of flora and fauna. Here we report the occurrence of eight rare and elusive species or subspecies of butterflies namely *Capila pieridoides* (Moore, 1878), *Plastingia naga* (de Nicéville, [1884]), *Salanoemia noemi* (de Nicéville, 1885), *Lotongus sarala* (de Nicéville, 1889), *Pieris naganum* (Moore, 1884), *Erites falcipennis* Wood-Mason & de Nicéville, 1883, *Coelites nothis adamsoni* Moore, 1891, *Bassarona durga splendens* (Tytler, 1915) in Namdapha National Park. The subspecies *C. nothis adamsoni* and *Pieris naganum naganum* are being reported for the first time after a gap of more than a century and we provide first ever photographs of live individuals of these subspecies. *E. falcipennis* is being reported for the first time from the country after its description in 1883. These findings emphasize the significance of Namdapha National Park as a crucial protected area for butterflies in North east India.
KEY WORDS: Lepidoptera, Papilionoidea, new records, distribution, *Coelites nothis adamsoni, Pieris naganum, Erites falcipennis*, India.

Notas sobre algunas mariposas infrecuentes y escurridizas del Parque Nacional de Namdapha, Arunachal Pradesh, India con el redescubrimiento de dos subespecies (Lepidoptera: Papilionoidea)

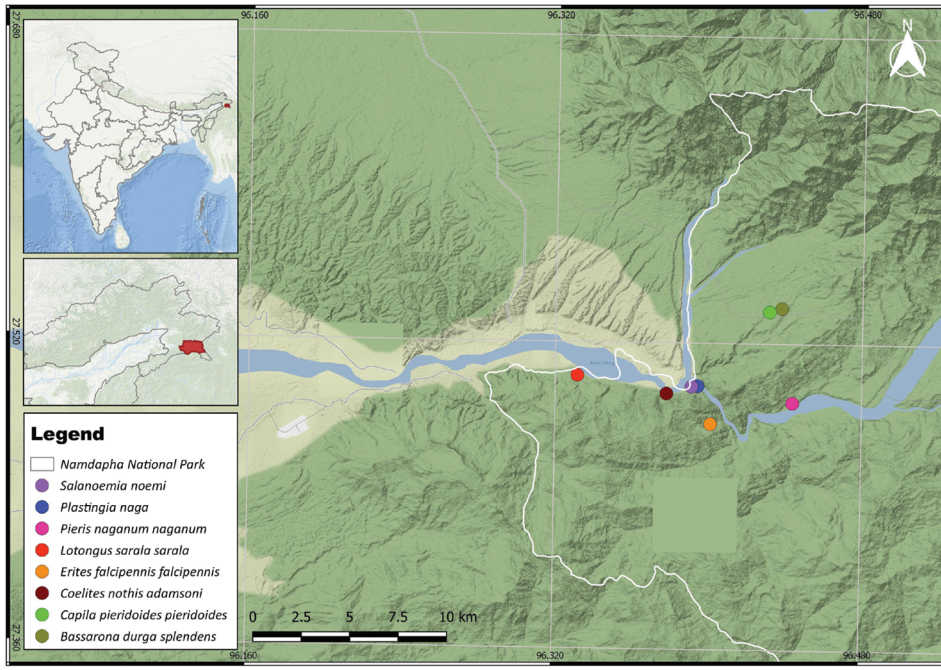
Resumen

El Parque Nacional de Namdapha está situado en el distrito de Changlang de Arunachal Pradesh, en la intersección de la zona de influencia biogeográfica Paleártica e Indo-Malaya. Por su puesto de esta peculiar posición abarca una vegetación y tipos de hábitats geográficos raros, Namdapha tiene una gran variedad de flora y fauna. Aquí informamos sobre la presencia ocho especies o subespecies infrecuentes y escurridizas en el Parque Nacional de Namdapha, concretamente *Capila pieridoides* (Moore, 1878), *Plastingia naga* (de Nicéville, [1884]), *Salanoemia noemi* (de Nicéville, 1885), *Lotongus sarala* (de Nicéville, 1885), *Pieris naganum* (Moore, 1884), *Erites falcipennis* Wood-Mason & de Nicéville, 1883, *Coelites nothis adamsoni* Moore, 1891, *Bassarona durga splendens* (Tytler, 1915). La subespecie *C. nothis adamsoni* y *Pieris naganum naganum* se citan por primera vez, después de un espacio de más de un siglo y suministramos fotografías por primera vez, de individuos vivos de estas subespecies. *E. falcipennis* se registra por primera vez para el país después de su descripción en 1883. Estas conclusiones enfatizan la trascendencia del Parque Nacional de Namdapha como un área crucial protegida para las mariposas en el nordeste de la India.
PALABRAS CLAVE: Lepidoptera, Papilionoidea, nuevos registros, distribución, *Coelites nothis adamsoni, Pieris naganum, Erites falcipennis*, India.

Introduction

Namdapha National park (27.391667ºN-27.661111ºN, 96.250556ºE-96.975833ºE, 200 m-4571 m) is in Changlang district of Arunachal Pradesh state in North east India and spans over an area of 1985.25 km^2. The park shares its boundary with Myanmar in the South and East and Kamlang Wildlife Sanctuary of Lohit district, Arunachal Pradesh in the North. The region experiences a tropical climate and annual precipitation varies between 1400-2500 mm, 75% of which falls between April and October. Temperature varies between 5ºC-35ºC at lower altitudes and reaches below 0ºC at higher elevations. Relative humidity varies between 47-93% annually (ARUNACHALAM *et al*., 2004).

Namdapha National Park lies at the intersection of Himalaya and Indo-Burma global biodiversity hotspots (MYERS *et al*., 2000; MITTERMEIER *et al*., 2011). Biogeographically, it falls under Eastern Himalaya (2D) biotic province which lies at the junction of Indo-Malayan (Oriental) and Palearctic biogeographic realms (RODGERS & PANWAR, 1988). The park has a rugged topography with steep hills and narrow valleys and harbours a wide range of vegetation and habitat types (DEB & SUNDRIYAL, 2007). It has all major forest types of the region and with increasing elevation there is a transition in habitat from tropical wet evergreen forests to subtropical broad-leaved forests, subtropical pine forests, temperate broad-leaved forests, alpine meadows and perennial snow (DUTTA *et al*., 2008). The region has faunal and floral affinities with adjoining forests of South east Asia (MANI, 1974). A total of 1119 species of plants belonging to 639 genera and 215 families are reported from Namdapha National Park (CHAUHAN *et al*., 1996). It is also rich in its faunal assemblage with over 1399 species recorded so far (GHOSH, 1987).



Map 1.– Map showing Eastern part of Namdapha National Park, Changlang district, Arunachal Pradesh with species or subspecies sampling localities.

One of the first inventory of butterfly fauna of the region after independence was undertaken by VARSHNEY & CHANDA (1971) where they documented butterflies from Tirap and Changlang districts. In their publication, 'Butterflies of the North-Eastern India' they reported six species of Pieridae, two species of Nymphalidae and one species of Lycaenidae from Arunachal Pradesh. BHATTACHARYA (1985) recorded a total of 84 species of butterflies from Namdapha National Park belonging to the family Papilionidae (21), Nymphalidae (42), Lycaenidae (10) and Pieridae (11). KUNTE (2010) rediscovered *Symbrenthia silana* de Nicéville, 1885 from North-east India where the species was reported from several localities including Namdapha National Park. SETHY *et al*. (2014) reported 113 species of butterflies under 73 genera from South-eastern part of Namdapha Tiger Reserve. Recently, a new species of *Hypolycaena*, *Hypolycaena narada* Kunte, 2015 was described from Namdapha National Park (KUNTE, 2015). THOMBRE & KEHIMKAR (2015) recorded *Ideopsis similis persimilis* (Moore, 1879) from Namdapha National Park, which was first record of the subspecies from mainland India. More recently, Zoological Survey of India (ZSI) conducted extensive surveys in Namdapha NP from 2016-2018 as part of a National Mission on Himalayan Studies (NMHS) project which has led to several interesting findings. Here we report the occurrence of eight rare and elusive species or subspecies of butterflies from Namdapha National Park (Map 1), including rediscovery of two subspecies after a gap of more than a century. Some of these findings significantly extend the known ranges of subspecies/species further North and all of them are new distributional records for the state of Arunachal Pradesh.

Notes on species

Family Hesperiidae Latreille, 1809
Subfamily Pyrginae Burmeister, 1878
Tribe Tagiadini Mabille, 1878

Capila pieridoides (Moore, 1878)

Calliana pieridoides Moore, 1878; *Proc. zool. Soc. Lond*., **1878**(3): 687

Type Locality: "NE Bengal" (West Bengal, India).

Distribution: NE India, China, Myanmar, N. Thailand, Malaysia, N. Vietnam.

The genus *Capila* Moore, [1866] consists of 13 species and is distributed throughout the Oriental region (SAVELA, 2019), ranging from India, China, Myanmar, Thailand and Vietnam up to Sundaland (CORBET & PENDLEBURY, 1978). In India, it is represented by six species (VARSHNEY & SMETACEK, 2015) among which *Capila pieridoides* (Moore, 1878) is the only species confined to Indo-Chinese subregion (EVANS, 1932). Within *C. pieridoides* three distinct subspecies are recognized, namely *Capila pieridoides chinensis* Evans, 1932 which occurs in China (EVANS, 1932; GOGOI *et al*., 2016), *Capila pieridoides sofa* Evans,1934 distributed from Thailand to Vietnam and *Capila pieridoides pieridoides* (Moore, 1878) ranging from NE India and Burma (Myanmar) to Vietnam (EVANS, 1949). *C. pieridoides pieridoides* is the only subspecies recorded from India and is characterised by prominent orange in head extending up to the abdomen (GOGOI *et al*., 2016). Subspecies *C. pieridoides chinensis* can be distinguished from *C. pieridoides pieridoides* in having pointed forewing apex and a black spot at mid space 1b on upper forewing, these being absent in the latter. Subspecies *C. pieridoides sofa* can be distinguished from *C. pieridoides pieridoides* in having darker cell and veins at apex of upper forewing (EVANS, 1932; 1949).

There are few known records of *C. pieridoides pieridoides* from mainland India. The species was described by MOORE (1878) based on a male specimen from NE Bengal (type locality was doubtfully marked as per SWINHOE, (1911-1912)) under the genus *Calliana*. Later DE NICÉVILLE (1891) described female of the species from Khasi Hills based on collection of Mr. H. J. Elwes. Subsequently, SWINHOE (1893) also recorded several males and a female from Khasi hills. As per SWINHOE (1911-1912), "Elwes and Doherty record it from Margherita in Upper Assam, and Leech from China also". EVANS (1949), in his revision of Oriental Hesperiidae listed 31 specimens from Khasi Hills, one

from Manipur, one from Lushai Hills (Mizoram) and one from Ataran (Myanmar). Recently, GHOSH & CHAUDHURY (1998) listed two specimens from Khasi Hills, Meghalaya (based on material collected earlier). More recently GOGOI *et al.* (2016) recorded it as "very rare" in Barail Range of Cachar, Assam although it is treated as rare by EVANS (1932).

A single individual (Male) of *C. pieridoides pieridoides* was spotted and captured on 4th November 2016 at 13:50 hrs from Hornbill Camp (27.538500ºN, 96.437817ºE, 658 m) of Namdapha NP (Figure 2a-b). It was found mudpuddling along the banks of a small stream with other species such as *Appias nero galba* (Wallace, 1867) and *Appias indra* (Moore, 1857). The habitat was characterized by dense canopy cover with sunlight sparsely reaching the forest floor. As we were observing the individual, a wasp (Family Vespidae) ambushed on it and killed it.

Remark: The current sighting of *C. pieridoides* from Namdapha is first record of this rare species from the state of Arunachal Pradesh.

Family Hesperiidae Latreille, 1809
Subfamily Hesperiinae Latreille, 1809
Tribe Aeromachini Tutt, 1906

Plastingia naga (de Nicéville, [1884])

Hesperia naga de Nicéville, [1884]. *J. Asiat. Soc. Bengal*, **52** (Pt II) (2/4): 89

Type Locality: "Sibsagar, Upper Assam" (India)

Distribution: NE India, Myanmar, W Malaysia, Thailand, Laos, Indonesia, Borneo and Philippines.

Genus *Plastingia* Butler, 1870 is widely distributed from North-east India to Sundaland, Philippines and Sulawesi, with seven species described (CORBET & PENDLEBURY, 1978; SAVELA, 2019). Two species of *Plastingia* Butler, 1870 are known to occur in mainland India, *P. naga* (de Nicéville, [1884]) and *P. pellonia* (Fruhstorfer, 1911) (KEHIMKAR, 2016). Previously *P. pellonia* was considered a synonym of *P. naga* (EVANS, 1932) but was removed from synonymy by EVANS (1949) based on external morphology and genital structure. *P. naga* (de Nicéville, [1884]) is one of India's poorly known species of *Plastingia* group (DAS *et al*., 2016). *P. naga* can be distinguished from *P. pellonia* in having white under hindwing markings instead of yellow (EVANS, 1949). It is a widely distributed species that occurs from North-east India to Philippines (EVANS, 1932, 1949). Earlier it was known only from India (Assam) from a total of eleven male and five female specimens (EVANS, 1949). *P. naga* was described from Sibsaghar (upper Assam) by DE NICÉVILLE (1884) as *Hesperia naga*. Later, in 1912-1913 a few samples were collected by Moore & Swinhoe from Khasi and Jaintia hills, Meghalaya. The species was not recorded for next 100 years from mainland India. On October 2014, a solitary individual was recorded from central Assam (DAS *et al*., 2016). Subsequently, it was recorded from South Garo Hills in 2015 (KARMAKAR, 2019) and again in the same year from Barail Range, Assam (GOGOI *et al*., 2016). However, this species is rare in North-east India (EVANS, 1932).

On 20th October 2016, at 14:15 hrs a single individual of *P. naga* was spotted near Noah Dehing Riverbed, Deban (27.497467ºN, 96.394267ºE, 350 m) of Namdapha NP (Figure 3a). The individual was mudpuddling along a small stream adjacent to a densely vegetated patch into which it flew away after few minutes.

Remark: The present sighting of *P. naga* from Namdapha adds a rare species to butterfly fauna of state of Arunachal Pradesh.

Family Hesperiidae Latreille, 1809
Subfamily Hesperiinae Latreille, 1809
Tribe Aeromachini Tutt, 1906

Salanoemia noemi (de Nicéville, 1885)

Plastingia noemi de Nicéville, 1885. *J. Asiat. Soc. Bengal*, **54** (Pt. II) (2): 120

Type Locality: "Sikkim" (India)

Distribution: Sikkim to NE India, Thailand, Vietnam.

ELIOT (1978) split the genus *Plastingia* into four genera, namely *Plastingia* Butler, 1870*, Salanoemia* Eliot, 1978*, Pemara* Eliot, 1978 and *Pyroneura* Eliot, 1978 (CORBET & PENDLEBURY, 1978). The genus *Salanoemia* can easily be differentiated from rest of the group in having rounded post discal spots and veins concolorous with ground colour (CORBET & PENDLEBURY, 1978). *Salanoemia* is a widely distributed genus and occurs from India to Sundaland with six known species (CORBET & PENDLEBURY, 1978; SAVELA, 2019) among which four are found in India; namely *S. fuscicornis* (Elwes & Edwards, 1897) (Assam and Myanmar to Borneo), *S. noemi* (de Nicéville , 1885) (Sikkim to NE India, Thailand and Vietnam), *S. sala* (Hewitson, [1866]) (Karnataka, Assam, Myanmar to Bali) and *S. tavoyana titei* Cantlie & Norman, 1960 (Manipur) (EVANS, 1949; VARSHNEY & SMETACEK, 2015; INAYOSHI, 2019).

Salanoemia noemi (de Nicéville, 1885) was described from Sikkim, under the genus *Plastingia* (DE NICÉVILLE, 1885). *S. noemi* differ from closely related species *S. tavoyana* (Evans, 1926) in having solid black spots on under hindwing compared to ring like spots of the latter. It differs from *Salanoemia similis* (Elwes & Edwards, 1897) another closely allied species from Malaya and Borneo (CORBET & PENDLEBURY, 1978) in having unequal cell spots on upper forewing compared to lack of cell spots or presence of a tiny dot in *S. similis* (EVANS, 1949). *S. noemi* was recently recorded from Kaziranga by GOGOI (2009). Subsequently there haven't been any report of the species from India. As per de Nicéville, the species appears to be rare and flew from May to August (DE NICÉVILLE, 1894).

A single individual of *S. noemi* was photographed on 21st October 2016 near Deban (27.497150ºN, 96.391117ºE, 345 m) along Miao-Vijoynagar road (Figure 4). The individual was sighted at 09:00 hours, basking on a rock about 0.5 m above the ground. The site was characterized by dense canopy cover with sunlight barely reaching the ground.

Remark: First record of the species from Arunachal Pradesh and extends the known distribution range of the species by at least 200 km.

Family Hesperiidae Latreille, 1809
Subfamily Hesperiinae Latreille, 1809
Tribe Aeromachini Tutt, 1906

Lotongus sarala (de Nicéville, 1889)

Parnara sarala de Nicéville, 1889. *J. Bombay Nat. Hist. Soc*., **4**(3): 173

Type Locality: "Khasi Hills" (Meghalaya, India)

Distribution: NE India.

Genus *Lotongus* Distant, 1886 is mostly confined to lowland forests of Indo-Malayan region and is represented by 3 species (SAVELA, 2019). Among these, *Lotungus sarala* (de Nicéville, 1889) is the only species that occurs in India (EVANS, 1949). *L. sarala* is very similar to *Lotongus avesta* (Hewitson, 1868) but can be distinguished from each other based on eye colour which is black in *L. sarala* whereas brownish red in *L. avesta* (CORBET & PENDLEBURY, 1978). *L. sarala* (de Nicéville, 1889) is represented by four subspecies: *Lotungus sarala sarala* (de Nicéville, 1889) (Northeast India), *Lotungus sarala conjuncta* Evans, 1932 (North Myanmar), *Lotungus sarala chinensis* Evans, 1932 (Myanmar, Thailand, Laos, China and North Vietnam) and *Lotungus sarala quinquepunctata* Joicey & Talbot, 1921 (Hainan) (EVANS, 1949; VARSHNEY & SMETACEK, 2015). *L. sarala sarala* differs from *L. sarala chinensis* and *L. sarala quinquepunctata* in having a yellow central band on upper hindwing, this being white in *L. sarala chinensis* and pale obsoleted in *L. sarala quinquepunctata* (EVANS, 1949). It differs from *L. sarala conjuncta* in having conjoined cell spots and spots in space 2 and 3 being overlapped whereas these spots are separate in *L. sarala conjuncta* (EVANS, 1949).

The species was described based on a female specimen under genus *Parnara* Moore, [1881] (as *Parnara sarala*) from Khasi hills by DE NICÉVILLE (1889). Later, SWINHOE (1912-1913) described the male specimen also from Khasi hills and regarded it as rare. Tytler reported it from Gasapani (current name Medziphema), Naga Hills and noted it as very rare (TYTLER, 1915b). After these earlier

records, it was not reported from India for a long time. Recently *L. sarala sarala* was photographed from Neora Valley National Park, Darjeeling, West Bengal in 2010 (SARKAR *et al*., 2019) and from Panbari Reserve Forest, Central Assam (GOGOI, 2013). GOGOI (2013) stated that the species was sighted around 20 times during the study period and is not a rare butterfly in Panbari Reserve Forest. However, this species is regarded as rare by EVANS (1932).

On 6th October 2016 at 14:05 hrs, a single individual of *L. sarala sarala* was sighted near 10th mile (27.502367ºN, 96.331517ºE, 319 m), Namdapha NP (Figure 5). The weather was sunny, and the individual was seen resting on ground along Miao-Vijoynagar road. After few minutes, it flew into dense forest surrounding the area.

Remark: This sighting of *L. sarala sarala* is first record of the species from Arunachal Pradesh. It also extends the known distribution range of this species to South east Arunachal Pradesh, at least 200 km away from its previous locality records (in Assam and Nagaland).

Family Pieridae Swainson, 1820
Subfamily Pierinae Swainson, 1820
Tribe Pierini Swainson, 1820

Pieris naganum (Moore, 1884)

Mancipium naganum Moore, 1884. *J. Asiat. Soc. Bengal*, **53** (Pt. II) (1): 45

Type Locality: "Naga Hills, Assam" [Nagaland, India]

Distribution: NE India, N Myanmar.

The Holarctic genus *Pieris* Schrank, 1801 is widely distributed across Himalayan region and Northeast India with 10 species known from India (MANI,1986; VARSHNEY & SMETACEK, 2015) among which *Pieris naganum* (Moore, 1884) is restricted to Nagaland within the country (VARSHNEY & SMETACEK, 2015). *P. naganum* was described based on a single male specimen from Naga Hills under the genus *Mancipium* Hübner, [1806] (MOORE, 1884). There are four subspecies of *P. naganum*, namely, *Pieris naganum naganum* (Moore, 1884) (Nagaland, N. Burma), *Pieris naganum cisseis* (Leech, 1890) (China), *Pieris naganum karumi* (Ikeda, 1973) (Taiwan) and *Pieris naganum pamsi* (Vitalis de Salvaza, 1921) (N. Thailand, Laos, Vietnam) (INAYOSHI, 2019; SAVELA, 2019). *P. naganum naganum* has a broad black band at apex of upper forewing; the inner border of which is slightly curved and more regular compared to other subspecies and narrowing at vein 3 (MOORE, 1884; TALBOT, 1939). After description, the subspecies has only been recorded from Sadon, N. Myanmar, based on Watson's collection of a male specimen (MOORE, 1903-1905). This subspecies is treated as very rare by EVANS (1932) and as one of the rarest of Indian butterflies by TALBOT (1939).

On 21st October 2016, more than 10 individuals of *P. naganum* were observed near 27th Mile (27.48916ºN, 96.44388ºE, 370 m), Namdapha NP (Figure 6a). They were seen mudpuddling near an open fast-flowing stream, along with other species of butterflies such as *Appias lyncida eleonora* (Boisduval, 1836), *Cepora nadina* (Lucas, 1852), *Cyrestis thyodamas* Boisduval, 1846, *Caleta elna noliteia* (Fruhstorfer, 1918) and *Prosotas nora* (C. Felder, 1860) (Figure 6b).

Remark: *P. naganum naganum* has never been seen in at least 111 years, prior to the present record. The sighting of *P. naganum naganum* from Namdapha is only third record of the subspecies from anywhere in the world and the photographs presented (Figure 6) are first ever photographs of live individuals. It also extends the known distribution range of the species further North and is at least 200 km away from closest known locality (Naga hills)

Family Nymphalidae Rafinesque, 1815
Subfamily Satyrinae Boisduval, 1833
Tribe Satyrini Boisduval, 1833

Erites falcipennis Wood-Mason & de Nicéville, 1883

Erites falcipennis Wood-Mason & de Nicéville, 1883. *Butts India Burmah Ceylon*, **1**(2): 237

Type Locality: "Cachar" (Assam, India)

Distribution: NE India, Myanmar, Thailand, Laos, Vietnam.

Erites Westwood, [1851] is a relatively small Indo-Malayan genus represented by five species, (MARSHALL & DE NICÉVILLE, 1882-1883) viz. *Erites angularis* Moore, 1878 (Myanmar to Sumatra); *Erites argentina* Butler, 1868 (Malaya Peninsular, Java, Sumatra, Borneo); *Erites elegans* Butler, 1868 (Malaya Peninsular, Sumatra, Borneo); *Erites falcipennis* Wood-Mason & de Nicéville, 1883 (India to Vietnam) and *Erites medura* (Horsfield, [1829]) (Myanmar, Thailand, Laos, Malaya Peninsular, Java) (SAVELA, 2019). Among these only *Erites falcipennis* Wood-Mason & de Nicéville, 1883 is known from mainland India (EVANS, 1932). *E. falcipennis* was described based on a male specimen, from Wood-Mason's collection from Cachar, Assam, India (WOOD-MASON & DE NICÉVILLE, 1883). Its distribution ranges from Assam in India to Myanmar, Thailand, Laos and Vietnam (INAYOSHI, 2019). It differs from closely allied species in having a prominent falcate shaped forewing (EVANS, 1932). According to MARSHALL & DE NICÉVILLE (1882-1883), *E. falcipennis* "appear to be local but not common even where they occurred". EVANS (1932) also considered it as rare and the species is protected under Schedule II of Indian Wildlife (Protection) Act, 1972.

On 24th December 2017 at 10:30 hrs, two individuals of *Erites falcipennis* were observed (Figure 7) near 19th Mile (27.477750ºN, 96.401200ºE, 467 m), Namdapha NP. They were resting along the road at an open and sunny spot. Occasionally, they flew close to the ground in a peculiar erratic manner.

Remark: The current sighting is first record of the species from India after its description from Cachar, Assam in 1883 and hence confirms its presence in the country. It also extends the known distribution range of the species further North, at East 400 km from Cachar, its closest previously recorded locality.

Family Nymphalidae Rafinesque, 1815
Subfamily Satyrinae Boisduval, 1833
Tribe Satyrini Boisduval, 1833

Coelites nothis adamsoni Moore, 1891

Coelites adamsoni Moore, 1891. *Lep. Ind*., **1**: 229-230

Type Locality: "Bhamo, Burma" [Myanmar]

Distribution: NE India, Myanmar, N. Thailand (?).

Coelites Westwood, [1850] is a small Indo-Malayan genus (MARSHALL & DE NICÉVILLE, 1882-1883) with 3 species, namely *Coelites nothis* Westwood, [1850] (NE India to N. Vietnam, Hainan); *Coelites epiminthia* Westwood, [1851] (S. Myanmar to Borneo); *Coelites euptychioides* C. & R. Felder, [1867] (Peninsular Malaya, Sumatra) (SAVELA, 2019). *Coelites nothis* Westwood, [1850] has four subspecies namely, *Coelites nothis adamsoni* Moore, 1891 (India, Myanmar, N. Thailand (?)), *Coelites nothis nothis* Westwood, [1850] (Burma, Thailand, Laos), *Coelites nothis sylvarum* Fruhstorfer, 1902 (N. Vietnam) and *Coelites nothis hainanensis* Gu, 1994 (Hainan) (SAVELA, 2019).

Coelites nothis adamsoni Moore, 1891 was described based on the collections of Major Adamson from Bhamo in Myanmar. According to MOORE (1891), *C. nothis adamsoni* is a shade loving forest species and generally flew in the month of September and October. Its distribution ranges from Nagaland (in India) to Myanmar (EVANS, 1932; SAVELA, 2019) along with two doubtful records from N. Thailand (INAYOSHI, 2019). *C. nothis adamsoni* is very close to *C. nothis nothis* in appearance but smaller in size (MOORE, 1891). It also differs from the nominotypical subspecies in having more prominent, distinct and narrower discal and marginal lines on underside of both wings (MOORE, 1891). The subspecies *adamsoni* is treated as very rare (EVANS, 1932) and is also protected under Schedule I of the Indian Wildlife (Protection) Act, 1972.

A single individual of *C. nothis adamsoni* was spotted (Figure 8) along the roadside near Anamika waterfalls (27.493383ºN, 96.378067ºE, 413 m), Deban on 10th October 2016 around 12: 10 hrs. It was seen perched on a shrub in an area with dense canopy cover.

Remark: Apart from two doubtful records from North Thailand (INAYOSHI, 2019), *C. nothis*

adamsoni has never been seen in last 125 years since its description. The sighting of *C. nothis adamsoni* from Namdapha is only second record of the subspecies from India and the photographs presented (Figure 8) are first ever photographs of live individuals.

Family Nymphalidae Rafinesque, 1815
Subfamily Limenitidinae Behr, 1864
Tribe Adoliadini Doubleday, 1845

Bassarona durga splendens (Tytler, 1915)

Dophla durga splendens Tytler, 1915. *J. Bombay Nat. Hist. Soc*., **23**: 504

Type Locality: "Foot of the Hills on the Ukral Road, about 28 miles east of Imphal" (Manipur, India)

Distribution: NE India (Arunachal Pradesh, Manipur, Nagaland).

Genus *Bassarona* Moore, [1897] is widely distributed from India to Sundaland and Philippines and is represented by eight species. Out of these, four species are known to occur in India and are primarily restricted to North-eastern part of the country with just one species, *Bassarona teuta teutoides* (Moore, 1877) distributed up to Andaman Islands (CORBET & PENDLEBURY, 1978; SAVELA, 2019). *Bassarona durga* (Moore, [1858]) can clearly be distinguished from its congeners in having outwardly black edged white discal band. The species has two subspecies viz. and *Bassarona durga durga* (Moore, [1858]) and *Bassarona durga splendens* (Tytler, 1915) (EVANS, 1932).

B. durga splendens was described based on a single male specimen collected near Imphal (Manipur) (YOKOCHI, 2010). *B. durga splendens* is recorded from Nagaland and Manipur, whereas nominotypical *B. durga durga* ranges from Sikkim to Arunachal Pradesh (EVANS, 1932). The subspecies *B. durga splendens* differs from *B. durga durga* in having a complete series of blue lunule marking on the outer edge of discal band of upper hindwing (TYTLER, 1915; EVANS, 1932). There are very few published records of the species from India. Recently it was recorded from Kuwari in Chizami, Nagaland (NARO & SONDHI, 2014). The subspecies *splendens* is legally protected under Schedule I of the Indian Wildlife (Protection) Act, 1972. It is noted as a very rare species by EVANS (1932).

A single individual of *Bassarona durga splendens* was photographed on 1st November 2016 at 09:00 hrs near Hornbill camp (27.538500ºN, 96.437817ºE, 658 m), Namdapha NP (Figure 9). The individual was observed basking on small shrubs near to the ground.

Remark: The current sighting of *B. durga splendens* from Namdapha, extends its known distribution range by at least 150 km and is first record for the state of Arunachal Pradesh.

Most of the sightings detailed above are northern most distribution records of the species/subspecies studied. Species tend to occur in lower abundances at their range limits (SAGARIN & GAINES, 2002). This is perhaps why the species/subspecies recorded in the current study are rarely encountered in Namdapha and other parts of Eastern Himalayas and North east hills. Two of them namely, *Coelites nothis adamsoni and Bassarona durga splendens* are protected under schedule I and *Erites falcipennis* under Schedule II of Indian Wildlife (Protection) Act, 1972 while others are not protected legally in India. Rarity (with respect to abundance) and limited range of distribution of these species within the country warrants the need for legal protection. Forests of Namdapha NP is considered as the northern limit of lowland evergreen tropical rainforests in the world (PROCTOR & HARIDASAN, 1998). The forests here are largely intact compared to other regions of North east India and probably act as a refugia for forest butterfly species with Indo-Chinese and Malayan affinities at their range periphery. Thus, Namdapha National Park may not only be a significant Protected Area for mammals and others charismatic vertebrates but also for lesser known invertebrates like butterflies in north eastern extremity of the country.

Acknowledgements

The field work leading to the present findings was part of the project entitled "Biodiversity Assessment through Long-term Monitoring Plots in Indian Himalayan Landscape" (Grant No:

NMHSLG2016/0011/8509, Dated 31.03.2016) funded by the Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India and sanctioned to Zoological Survey of India (ZSI) and Botanical Survey of India (BSI) by National Mission on Himalayan Studies (NMHS). Authors are grateful to the funding agency for providing financial support. We would like to thank Arunachal Pradesh Forest Department and forest officials and staff of Namdapha National Park, Changlang, Arunachal Pradesh for providing logistic support and necessary permits for conducting the study. We express our sincere thanks to Dr. Gopinathan Maheswaran (ZSI) for his various help during field. We are especially thankful to Mr. Tajum Yumcha, Research Officer, Namdapha Tiger Reserve and field assistant Mr. Atum Rumdo for facilitating the field work. We would also like to acknowledge Dr. Krushnamegh Kunte, Dr. Song-Yun Lang, Monsoon Jyoti Gogoi and Paul Van Gasse for their valuable inputs and encouragement. Authors are indebted to fellow researchers of the project Dr. Jagdish Saini, Dr. Hirdesh Kumar and Mr. S. K. Sajan. We would also like to thank Mr. Lokesh Mahato, Mr. Amit Gogoi, Mr. Sumit Gogoi, Mr. Wangda Drukpa, Mr. Sonam Rangpo for their valuable assistance in field.

BIBLIOGRAPHY

ARUNACHALAM, A., ADHIKARI, D., SARMAH, R., MAJUMDER, M. & KHAN, M. L., 2004.– Population and conservation of *Sapria himalayana* Griffith in Namdapha national park, Arunachal Pradesh, India.– *Biodiversity & Conservation,* **13**(13): 2391-2397.

CHAUHAN, A. S., SINGH, K. P. & SINGH, D, K., 1996.– *A Contribution to the Flora of Namdapha, Arunachal Pradesh*: VIII + 422 pp. Botanical Survey of India, Calcutta.

CORBET, A. S. & PENDLEBURY, H. M., 1978.– *The Butterflies of the Malay Peninsula*: XIV + 578 pp., 36 pls. (3rd Edition, revised by J. N. Eliot). Malayan Nature Society, Kuala Lumpur.

DAS, G., PAYRA, A. & BORUAH, B., 2016.– A sighting of *Plastingia naga* (de Nicéville, [1884]) (Lepidoptera: Hesperiidae: Hesperiinae) from central Assam, India.– *Journal of Threatened Taxa*, **8**(11): 9382-9383. Doi: https://doi.org/10.11609/jott.1985.8.11.9382-9383.

DATTA, A., ANAND, M. O. & NANIWADEKAR, R., 2008.– Empty forests: Large carnivore and prey abundance in Namdapha National Park, north-east India.– *Biological Conservation,* **141**(5): 1429-1435.

DE NICÉVILLE, L., 1884.– On new and little known Rhopalocera from the Indian Region.– *Journal of Asiatic Society of Bengal,* **52** (Pt. II) (2/4): 65-91.

DE NICÉVILLE, L., 1885.– Descriptions of some new Indian Rhopalocera.– *Journal of Asiatic Society of Bengal,* **54** (Pt. II) (2): 117-124.

DE NICÉVILLE, L., 1889.– On new and little-known Butterflies from the Indian Region, with Revision of the Genus *Plesioneura* of Felder and of Authors.– *Journal of the Bombay Natural History Society,* **4**(3): 163-194.

DE NICÉVILLE, L., 1891.– On new and little-known butterflies from the Indo-Malayan region.– *Journal of the Bombay Natural History Society,* **6**: 341-398.

DE NICÉVILLE, L., 1894.– A list of the butterflies of Sikhim.– *The Gazetteer of Sikhim,* **1894**: 116-187.

DEB, P. & SUNDRIYAL, R. C., 2007.– Tree species gap phase performance in the buffer zone area of Namdapha National Park, Eastern Himalaya, India.– *Tropical Ecology,* **48**(2): 209.

EVANS, W. H., 1932.– *The Identification of Indian Butterflies*: X + 423 pp., 32 pls. Diocesan Press, Madras.

EVANS, W. H., 1949.– *A Catalogue of the Hesperiidae of Europe, Asia and Australia in the British Museum (Natural History)*: XIX + 502 pp., 53 pls. Trustees of the British Museum, London.

GHOSH, A. K., 1987.– *Qualitative analysis of faunal resources. Proposed Namdapha Biosphere Reserve*: 129 pp. Zoological Survey of India, Calcutta.

GHOSH, S. K. & CHAUDHURY, M., 1998.– *Insecta: Lepidoptera: Hesperiidae. State Fauna Series 4: Fauna of Meghalaya. Part 6*: 269-341. Zoological Survey of India.

GOGOI, M. J., 2009.– *Kaziranga National Park, Biodiversity: Fauna - Butterflies: The butterflies of Kaziranga-Karbi Anglong hills, Assam, India*. Available from http://103.8.249.31/assamforest/knposc/linkpages.php?u=bd&sm=fn&tlb=6&category=butterflies.

GOGOI, M. J., 2013.– Notes on some skipper butterflies (Lepidoptera: Hesperiidae) from Panbari Forest and its adjoining areas, Kaziranga-Karbi Anglong, upper Assam, India.– *Journal of Threatened Taxa,* **5**(13): 4759-4768. Doi: http://dx.doi.org/10.11609/JoTT.o3340.4759-68.

GOGOI, M. J., SINGHA, H. J. & DEB, P., 2016.– Butterfly (Lepidoptera) Diversity in Barail Wildlife Sanctuary, Assam, India.– *Journal of Entomology and Zoology Studies,* **4**(4): 547-560.

INAYOSHI, Y., 2019.– *A Check List of Butterflies in Indochina; Chiefly from Thailand, Laos & Vietnam*. Available from http://yutaka.it-n.jp/sati.html (accessed September 2019).

KARMAKAR, T., 2019.– *Plastingia naga* de Nicéville, 1883 - Silver-spotted Lancer.– *In* K. KUNTE, S. SONDHI & P. ROY (Chief Editors). *Butterflies of India*, v. 2.60. Indian Foundation for Butterflies. Available from http://www.ifoundbutterflies.org/sp/2950/salaingia-naga.

MANI, M. S., 1974.– *Ecology and biogeography in India*: XIX + 773 pp. Dr. W. Junk, Publishers, The Hague.

MARSHALL, G. F. L. & DE NICÉVILLE, L., 1882-1883.– *The butterflies of India, Burmah and Ceylon. A descriptive handbook of all the known species of Rhopalocerous Lepidoptera inhabiting that region, with notices of allied species occurring in the neighbouring countries along the border; with numerous illustrations*, **1**: 327 pp. Calcutta Central Press.

MITTERMEIER, R. A., TURNER, W. R., LARSEN, F. W., BROOKS, T. M. & GASCON, C., 2011.– Global biodiversity conservation: the critical role of hotspots.– *In* F. ZACHOS & J. HABEL (eds). *Biodiversity hotspots*: 3-22. Springer, Berlin, Heidelberg.

MOORE, F., 1878.– Descriptions of new Asiatic Hesperidae.– *Proceedings of the Zoological Society of London,* **1878**(3): 686-695.

MOORE, F., 1884.– Descriptions of some new Asiatic diurnal Lepidoptera; chiefly from specimens contained in the Indian Museum, Calcutta.– *Journal of Asiatic Society of Bengal,* **53** (Pt. II) (1): 16-52.

MYERS, N., MITTERMEIER, R. A., MITTERMEIER, C. G., DA FONSECA, G. A. & KENT, J., 2000.– Biodiversity hotspots for conservation priorities.– *Nature,* **403**(6772): 853.

NARO, T. & SONDHI, S., 2014.– Butterflies (Lepidoptera) of Chizami, Phek District, Nagaland, India.– *Journal of Threatened Taxa,* **6**(13): 6593-6634. Doi: http://dx.doi.org/10.11609/JoTT.o3995.6593-634.

PROCTOR, J. & HARIDASAN, K., 1998.– How far north does lowland evergreen tropical rain forest go?.– *Global Ecology & Biogeography Letters,* **7**(2): 141-146.

RODGERS, W. A. & PANWAR, H. S., 1988.– *Planning of Wildlife Protected Area Network in India*, **1**: 339 pp., **2**: 267 pp. Wildlife Institute of India, Dehradun.

SAGARIN, R. D. & GAINES, S. D., 2002.– The "abundant centre" distribution: to what extent is it a biogeographical rule?.– *Ecology letters,* **5**(1): 137-147.

SARKAR, V., KARMAKAR, T. & NARAYANAN, G., 2019.– *Lotongus sarala* de Nicéville, 1889 - Yellow-banded Palmer.– *In* K. KUNTE, S. SONDHI & P. ROY (Chief Editors). *Butterflies of India*, v. 2.60. Indian Foundation for Butterflies. Available from http://www.ifoundbutterflies.org/sp/2791/Lotongus-sarala.

SAVELA, M., 2019.– *Lepidoptera and some other life forms*. Available from http://ftp.funet.fi/pub/sci/bio/life/insecta/lepidoptera/ditrysia/papilionoidea/ (accessed September 2019).

SWINHOE, C., 1893.– XVIII. A list of the Lepidoptera of the Khasia Hills-part I.– *Transactions of the Entomological Society of London,* **41**(3): 267-330.

SWINHOE, C., 1911-1912.– *Lepidoptera Indica. Rhopalocera, Family Lycaenidae (continued). Sub-Families Horaginae, Deudorixinae, Hypolycaeninae, Zesiusinae, Aphnaeinae, Biduandinae, Cheritrinae, Loxurinae. Family Hesperiidae. Sub-Families Ismeneinae, Achlarinae,* **9**: 175 pp., 706-756 pls. Lovell, Reeve & Co., Limited, London.

SWINHOE, C., 1912-1913.– *Lepidoptera Indica. Rhopalocera. Family Hesperidae (concluded). Sub-Families Celaenorrhinae, Hesperiinae, Pamphilinae, Astictopterinae, Suastinae, Erionotinae, Matapinae, Notocryptinae, Plastingiinae, Erynninae. Followed by Addenda of New Genera and Species, a synopsis of Families and Sub-Families, and an index of Genera and Species for the complete work*, **10**: 364 pp., 757-835 pls. Lovell, Reeve & Co., Limited, London.

TYTLER, H. C., 1915b.– Notes on some new and interesting butterflies from Manipur and the Naga Hills. Part III.– *Journal of the Bombay Natural History Society,* **24**: 119-155.

VARSHNEY, R. K. & SMETACEK, P., 2015.– *A Synoptic Catalogue of the Butterflies of India*: 261 pp. Butterfly Research Centre, Bhimtal and Indinov Publishing, New Delhi.

WESTWOOD, J. O., 1850-1852.– *The Genera of Diurnal Lepidoptera: comprising their generic characters, a notice of their habits and transformations, and a catalogue of the species of each genus*, **2**: 243-534, XXXI-LXXX + 1 pls.

WOOD-MASON, J. & DE NICÉVILLE, L., 1883.– *In* G. F. L. MARSHALL & L. DE NICÉVILLE. *The Butterflies of India, Burmah and Ceylon: A descriptive Handbook of all the known Species of Rhopalocerous Lepidoptera*

inhabiting that Region, with Notices of allied Species occurring in the neighbouring countries along the Border, with numerous Illustrations, **1**(2): 95-327, X-XVII pls.

YOKOCHI, T., 2010.– Revision of the Subgenus *Limbusa* Moore, [1897] (Lepidoptera, Nymphalidae, Adoliadini) Part 1. Systematic arrangement and taxonomic list.– *Bulletin of Kitakyushu Museum of Natural History & Human History,* (Ser. A) **8**: 19-67.

*G. N. D., A. P., D. CK., K. C.
Zoological Survey of India
Prani Vigyan Bhawan, M-Block
New Alipore, Kolkata-700053 West Bengal
INDIA / *INDIA*
*E-mail: gaurab68nandidas@gmail.com
https://orcid.org/0000-0002-4722-3100

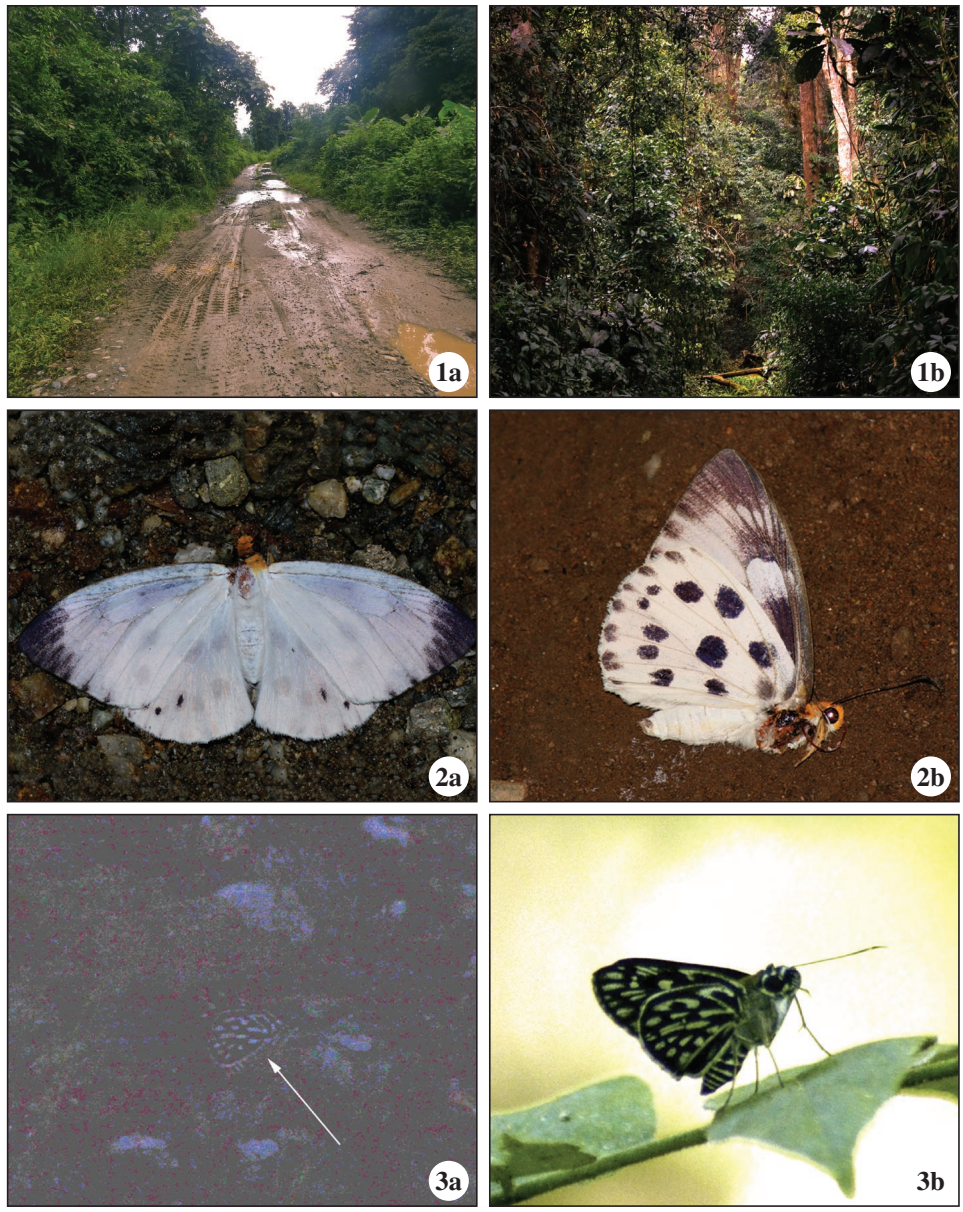
E-mail: arajushpayra@gmail.com
https://orcid.org/0000-0003-0858-7339

E-mail: deepakck8@gmail.com
https://orcid.org/0000-0002-3827-9452

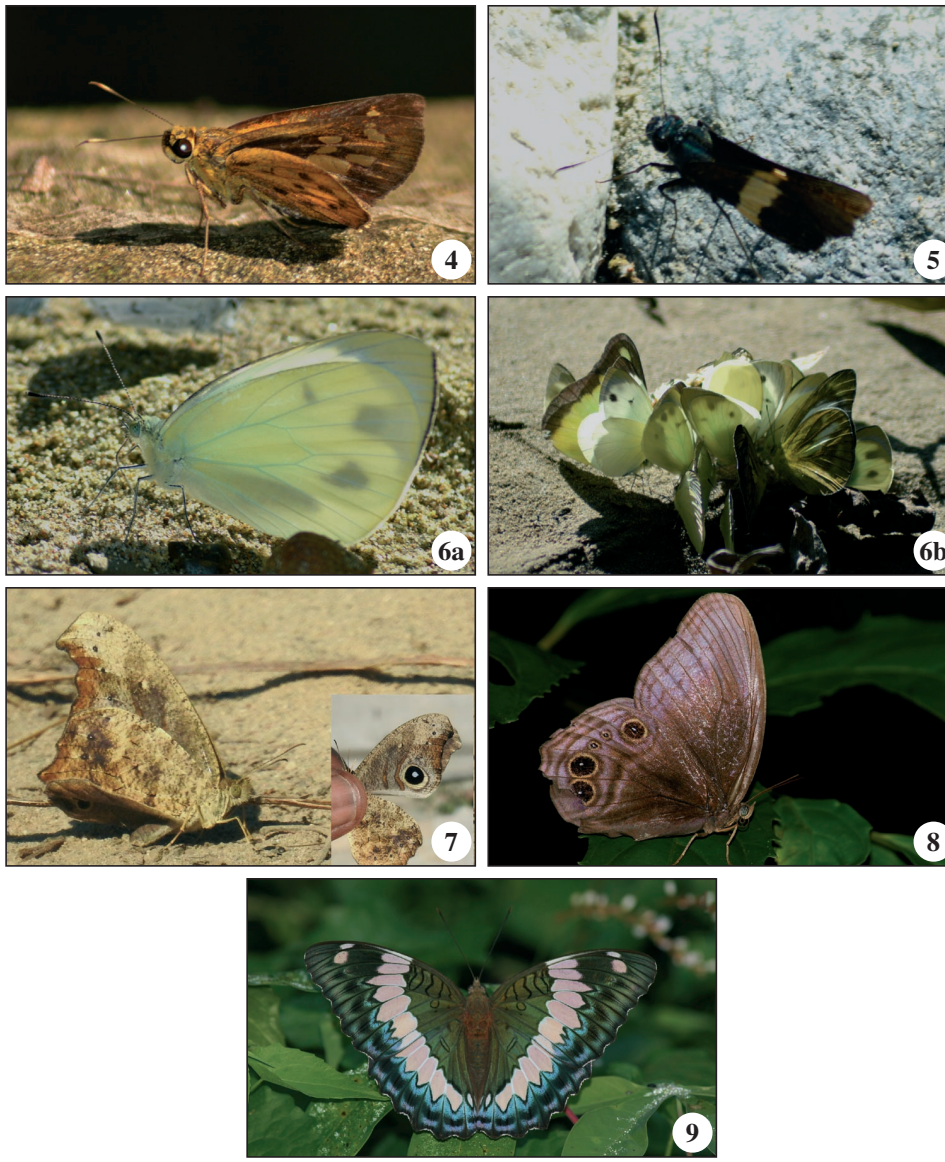
E-mail: kailash611@rediffmail.com
https://orcid.org/0000-0001-9076-5442

*Autor para la correspondencia / *Corresponding author*

(Recibido para publicación / *Received for publication* 20-IX-2019)
(Revisado y aceptado / *Revised and accepted* 19-XII-2019)
(Publicado / *Published* 30-VI-2020)



Figures 1-3.– 1. Sampling sites in Namdapha National Park; **a**) Transect along Miao-Vijoynagar road near Deban, **b**) Transect near Hornbill camp. **2.** *Capila pieridoides* (Moore, 1878) from Hornbill camp, Namdapha National Park, Arunachal Pradesh; **a**) Dorsal view of dead specimen, **b**) Ventro-lateral view of the specimen. **3.** *Plastingia naga* (de Nicéville, [1884]) from India; **a**) *P. naga* was photographed in insufficient light, from Deban, Namdapha National Park, Arunachal Pradesh, **b**) A clear image of *P. naga* from Central Assam. Copyright: Figures **1**(**a-b**), **2b**, Deepak CK; Figures **2a**, **3**(**a-b**), Arajush Payra.

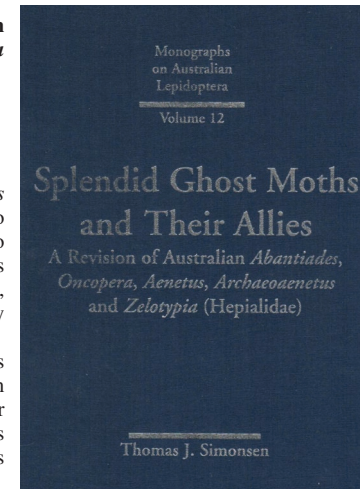


Figures 4-9.– 4. *Salanoemia noemi* (de Nicéville, 1885) from Deban, Namdapha National Park, Arunachal Pradesh. **5.** *Lotongus sarala* (de Nicéville, 1889) from 10th Mile, Namdapha National Park, Arunachal Pradesh. **6.** *Pieris naganum naganum* (Moore, 1884) from 27th Mile, Namdapha National Park, Arunachal Pradesh; **a**) An individual of *P. naganum naganum* showing mudpuddling behaviour, **b**) Aggregation of butterflies mudpuddling near a stream bed. **7.** *Erites falcipennis* Wood Mason & de Nicéville, 1883 from 19th Mile, Namdapha National Park, Arunachal Pradesh. **8.** *Coelites nothis adamsoni* Moore, 1891 from Anamika waterfalls, Deban, Namdapha National Park, Arunachal Pradesh. **9.** *Bassarona durga splendens* (Tytler, 1915) from Hornbill camp, Namdapha National Park, Arunachal Pradesh. Copyright: Figures **4-7**, Arajush Payra; Figures **8-9**, Deepak CK.

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 238 eISSN: 2340-4078 ISSN: 0300-5267

REVISION DE PUBLICACIONES
BOOK REVIEWS

T. J. Simonsen
Splendid Ghost Moths and Their Allies. A Revision of Australian *Abantiades*, *Oncopera*, *Aenetus*, *Archaeoaenetus* and *Zelotypia* (Hepialidae)
312 páginas
Formato: 25'5 x 17'5 cm
CSIRO Publishing, Clayton South, VIC, 2018
ISBN: 978-1-486-30747-0



Aparece un nuevo volumen 12 de la ya clásica serie *Monographs on Australian Lepidoptera*, en este caso se trata la revisión de cinco géneros de la familia Hepialidae Stephens, 1829 de la mano del conocido especialista el Dr. Thomas J. Simonsen y más concretamente de los géneros *Abantiades* Herrich-Schäffer, 1855, *Oncopera* Walker, 1856, *Aenetus* Herrich-Schäffer, 1855, *Archaeoaenenetus* Simonsen, gen. n. y *Zelotypia* Scott, 1869.

Es conocido que los Hepialidae son una las familias más primitivas del Orden Lepidoptera, siendo la fauna australiana muy interesante con más de 100 especies y de ellas se conocen los ejemplares de mayor envergadura, como ocurre en los géneros *Zelotypia* y *Abantiades,* de las bellas especies del género *Aenetus* y de las plagas causadas por las especies del género *Oncopera*.

Este trabajo aumenta su importancia, si tenemos en cuenta que se describe un género nuevo *Archaeoaenenetus*, se establecen dos nuevas sinonimias para el género *Abantiades* y se describen trece nuevas especies.

Después de los Agradecimientos, Introducción, Material y métodos, es de destacar el capítulo Morphology of Hepialidae, que recomendamos vivamente; continuando con el interesante capítulo sobre su Biología.

Ya dentro de la parte taxonómica de los Hepialidae, de cada uno de los géneros considerados, nos dan las reseñas sinonímicas y una clave dicotómica de todas y cada una de las especies consideradas. De cada especie nos da las referencias bibliográficas, sobre el material examinado, su distribución y biología, diagnosis, descripción del macho y de la hembra, así como dibujos de sus respectivas genitalias. Finaliza la obra con una Bibliografía específica, dibujos anatómicos, mapas de distribución y 48 planchas con fotografías en color de los adultos tomadas en colección y en vivo, acabando con el Índice.

No podemos terminar estas líneas, sin felicitar al autor, por tan detallado trabajo sobre la fauna australiana, así como al CSIRO que continúa patrocinando tan importante y esencial obra, por lo que recomendamos vivamente su adquisición y no pudiendo faltar en cualquier biblioteca que se precie, sobre todo para aquellos interesados en esta magnífica fauna.

El precio de este libro es de 185 dólares australianos y los interesados deben dirigirse a:

CSIRO Publishing
Locked Bag, 10
Clayton South, VIC 3169
AUSTRALIA / *AUSTRALIA*
E-mail: publishing.sales@csiro.au

A. Vives Moreno
E-mail: avives1954@outlook.es
https://orcid.org/0000-0003-3772-2747

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 239-252 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.392

Faunistic records of Noctuidae from Iran, with two new records for the country (Insecta: Lepidoptera)

S. Shahreyari-Nejad, M. Esfandiari, A. Rasekh,
M. S. Mossadegh & A. Shirvani

Abstract

Noctuidae species are mostly plant feeding as caterpillars and nectar feeding as adults, functioning as herbivores, pollinators and prey, as well as include many species of economic importance. Here we intended to contribute to the fauna of seven Noctuidae subfamilies Metoponinae, Eustriotinae, Acontiinae, Cuculliinae, Oncocnemidinae, Psaphidinae and Eriopinae in some Iranian provinces. Numerous samplings were carried out in Khuzestan, Ilam, Fars, Kerman, and Khorasan-e Razavi provinces. A total of 31 Noctuidae taxa were collected and identified, among which there are 22 new provincial records from Kerman, Khuzestan, Fars and Ilam provinces. The species *Oncocnemis rhodophaea* Ebert, 1978 and nominotypical subspecies *Asteroscopus syriaca* (Warren, 1910) are newly reported for the fauna of Iran. Furthermore, three taxa *Cucullia cineracea argyllacea* Hacker, Ronkay & Ronkay, 1990, *Pseudozarba bipartita* (Herrich-Schäffer, 1850) and *Pamparama acuta* (Freyer, 1838) were recorded for the second time from Iran. Adults and genitalia of new records for Iran are illustrated with notes on distribution of the species.
KEY WORDS: Insecta, Lepidoptera, Noctuidae, new record, *Oncocnemis*, *Asteroscopus*, distribution, Iran.

Registros faunísticos de Noctuidae de Irán, con dos nuevos registros para el país (Insecta: Lepidoptera)

Resumen

Las especies de Noctuidae alimentándose de platas como oruga y de néctar como adulto, funcionando como herbívoros, polinizadores y presa, también podemos incluir muchas especies de importancia económica. Aquí aportamos una contribución a la fauna de siete subfamilias de Noctuidae: Metoponinae, Eustriotinae, Acontiinae, Cuculliinae, Oncocnemidinae, Psaphidinae y Eriopinae presentes en algunas provincias iraníes. Las numerosas muestras efectuadas fueron realizadas en las provincias de Khuzestan, Ilam, Fars, Kerman, Khorasan y Razavi. Fueron recogidas e identificadas un total de 31 taxas de Noctuidae, entre las cuales 22 son nuevos registros provinciales para Kerman, Khuzestan, Fars e Ilam. Las especies *Oncocnemis rhodophaea* Ebert, 1978 y *Asteroscopus syriaca* (Warren, 1910) la subespecie nominotíca, se indican como nuevos para la fauna de Irán. Además, tres taxas *Cucullia cineracea argyllacea* Ronkay & Ronkay, 1990, *Pseudozarba bipartita* (Herrich-Schäffer, 1850) y *Pamparama acuta* (Freyer, 1838) son citados por segunda vez de Irán. Se ilustran el adulto y la genitalia de los nuevos registros para Irán, con notas sobre la distribución de las especies.
PALABRAS CLAVE: Insecta, Lepidoptera, Noctuidae, nuevos registros, *Oncocnemis*, *Asteroscopus*, distribución, Irán.

Introduction

Noctuidae are a strongly supported clade containing what are informally known as the ‘trifine’ subfamilies, as well as some groups that have a so-called quadrifine hindwing venation (ZAHIRI *et al.*,

2013). They are a prominent characteristic of terrestrial insect faunas and food webs and exhibit great heterogeneity in hostplant specificity and other life history features affecting their ecological roles and impact (MITCHEL *et al.*, 2006). Larvae of many species feed on different parts of plants and have a massive economic impact annually (KITCHING, 1984).

New generation of Iranian lepidopterists started to publish faunistic and taxonomic reports on Noctuidae in Iran since last decade (e.g. ZAHIRI & FIBIGER, 2006; SHIRVANI *et al.*, 2008; ESFANDIARI *et al.*, 2010). Since then, many publications dealt with Noctuidae and were reported new taxa, new distributional records and local revisions. However, some of subfamilies were less explored by native lepidopterists. Here we contribute to the fauna of seven subfamilies in some Iranian provinces, viz. Metoponinae, Eustriotinae, Acontiinae, Cuculliinae, Oncocnemidinae, Psaphidinae and Eriopinae. Nevertheless, there are recent records of these subfamilies by Iranian lepidopterists. For example, two Acontiinae, one Oncocnemidinae and one Eustriotinae species by SHIRVANI *et al.* (2008), two records of Acontiinae by ESFANDIARI *et al*. (2011), two records of Metoponinae by RABIEH *et al.* (2013) and one record of Psaphidinae by FEIZPOOR & SHIRVANI (2014) are available among publications.

Material and methods

Multiple sampling was done during recent years to study Noctuidae fauna. Sampling was carried out at different altitudes and vegetation types of the sampling localities including Ilam, Khuzestan, Fars, Kerman, and Khorasan-e Razavi provinces. However, the mountainous regions in Khuzestan and Kerman provinces were focused. Sampling was carried out by light traps powered by 12 volt batteries and 8 watt UVB light tubes. The specimens and slides of their genitalia were deposited in the Insect and Mite Collection of Ahvaz (IMCA), Plant Protection Department, Shahid Chamran University of Ahvaz. Genitalia slides of the specimens were prepared following FIBIGER (1997). Identifications were done according to available literatures such as LÖDL *et al.* (2012) and by studying museum materials at Hungarian Natural History Museum, Budapest by the second author. Systematics and nomenclature are according to LÖDL *et al.* (2012), RONKAY & RONKAY (2009) and RONKAY *et al.* (2011).

Results and discussion

A total of 31 Noctuidae taxa belonging to seven subfamilies namely, Metoponinae, Eustriotinae, Acontiinae, Cuculliinae, Oncocnemidinae, Psaphidinae and Eriopinae were collected and identified. Among them, there are 22 new provincial records from Kerman, Khuzestan, Fars and Ilam. The species *Oncocnemis rhodophaea* Ebert, 1978 and nominotypical subspecies *Asteroscopus syriaca* (Warren, 1910) are newly reported for the fauna of Iran. Furthermore, three taxa *Cucullia cineracea argyllacea* Hacker, Ronkay & Ronkay, 1990, *Pseudozarba bipartita* (Herrich-Schäffer, 1850) and *Pamparama acuta* (Freyer, 1838) were recorded for the second time from Iran. Studied materials are listed here, together with adults and genitalia of new records for Iran as well as provincial distribution for each taxon.

Subfamily Cuculliinae Herrich-Schäffer, 1850

The phylogenetic concept of the subfamily Cuculliinae has markedly changed since 1990's. The subfamily Cuculliinae s. str. contains, as a large and phylogenetically compact group, only the tribe Cuculliini. This tribe contains three separate clades. One of the clades contains two genera, the Palaearctic *Calocucullia* and *Shargacucullia* (the "yellow *Cucullia*" species). In these genera the ductus ejaculatorius is the direct continuation of the main tube of the vesica, and the female genitalia has the ductus seminalis arising from the caudal end of the bursa copulatrix. They have well-developed and most often basally bulbed cornuti in the vesica. The most developed clade comprises the species-groups of *Cucullia* s. str.. Members of this clade are characterized by the ductus ejaculatorius originating from the lateral side of the large sac of the vesica and the ductus seminalis from the bottom (the cephalic

end) of the bursa copulatrix. The corpus bursae is fully reduced and the appendix bursae took over its role (RONKAY & RONKAY, 2009).

Genus *Cucullia* Schrank, 1802

Cucullia hemidiaphana Graeser, 1892

General distribution: It is distributed from Morocco, the Near East and Arabia throughout the western and Central Asiatic arid regions (Turkey, Azerbaijan, Iran, Turkmenistan, Tajikistan and Afghanistan) to the eastern Hindukush Mts in Pakistan and the eastern parts of the Tien Shan massif in Kazakhstan and China (RONKAY & RONKAY, 2009).

Distribution in Iran: Khorasan-e Razavi (Kouh-Binaloud) (EBERT & HACKER, 2002), Fars (KOÇAK & KEMAL, 2014) and Kerman (SHIRVANI, 2012).

Material examined: Kerman Prov., Jiroft, Sangdan, 2966 m, 29º 06' 06" N 57º 33' 12" E, 1 ♂, 03-IX-2015.

Cucullia cineracea argyllacea Hacker, Ronkay & Ronkay, 1990

General distribution: The nominate subspecies occurs in Europe, Caucasus and northeast Turkey. The subspecies *argyllacea* is distributed in Iran, Afghanistan, Uzbekistan, Tajikistan, and southwestern Mongolia (RONKAY & RONKAY, 2009).

Distribution in Iran: Kerman (SHIRVANI, 2012). This is the second report of this taxon from Iran.

Material examined: Kerman Prov., Jiroft, Omrudoieh, 2971 m, 29º 05' 55" N 57º 33' 13" E, 1 ♂, 18-VI-2015; Sangdan, 2966 m, 29º 06' 06" N 57º 33' 12" E, 1 ♂, 05-VIII-2016.

Cucullia achalina Püngeler, 1901

General distribution: The species is distributed in Turkmenistan (Kopet-Dagh), Iran (Aborz and Zaghros Mts), Afghanistan (Ghazni, Paghman) and Pakistan (Ziarat, Baluchistan) (RONKAY & RONKAY, 2009).

Distribution in Iran: Alborz and Zagros Mts (RONKAY & RONKAY, 2009). This species is newly reported from Kerman province.

Material examined: Kerman Prov., Jiroft, Omrudoieh, 2971 m, 29º 05' 55" N 57º 33' 13" E, 2 ♂♂, 23-IV-2015.

Cucullia tecca Püngeler, 1906

General distribution: The nominate subspecies occurs from the southeastern Caucasus throughout the northern Iranian high mountains to the Kopet-Dagh Mts (RONKAY & RONKAY, 2009).

Distribution in Iran: South and southwestern Iran (HACKER, 1990) including Fars (KOÇAK & KEMAL, 2014). This species is newly reported from Kerman province.

Material examined: Kerman Prov., Baft, Dehsard, 1811 m, 28º 40' 39" N 56º 33' 02" E, 1 ♀, 03-II-2016.

Cucullia calendulae Treitschke, 1835

General distribution: It occurs in the entire Mediterranean basin in Europe and North Africa, in Asia Minor (Syria, Iraq, and Turkey), Transcaucasia, Iran, Turkmenistan and Afghanistan (RONKAY & RONKAY, 2009).

Distribution in Iran: Khuzestan (KOÇAK & KEMAL, 2014).

Material examined: Khuzestan Prov., Baghmalek, Malaqa, 1100 m, 31º 35' 57" N 50º 00' 50" E, 1 ♀, 24-III-2016; 1 ♀, 11-III-2016.

Cucullia santonici (Hübner, [1813])

General distribution: A widespread Palaearctic species, its range extending from the Alpes Maritimes to the Tien Shan and the Pamir (RONKAY & RONKAY, 2009).

Distribution in Iran: Tehran, Mazandaran (Alborz Mts) (EBERT & HACKER, 2002), Fars, Khorasan, Sistan-va Baluchestan and Kerman (SHIRVANI, 2012).

Material examined: Kerman Prov., Jiroft, Omrudoieh, 2971 m, 29º 05' 55" N 57º 33' 13" E, 1 ♂, 1 ♀, 08-VII-2015; Sangdan, 2966 m, 29º 06' 06" N 57º 33' 12" E, 1 ♂, 05-VII-2016.

Subfamily Psaphidinae Grote, 1896

The recognizable common diagnostic feature of the majority (but far not all) of the Psaphidinae tribes is the distinctive transverse row of pits along the anterior margin of the pupal segment 10, and with larvae that feed on tree foliage (FIBIGER & LAFONTAINE, 2005; RONKAY & RONKAY, 2009).

This generally Holarctic subfamily contains a few Palaearctic genera occurring in the high mountainous areas along the border zone of the Palaearctic and the Oriental regions (RONKAY & RONKAY, 2009).

Genus *Asteroscopus* Boisduval, 1828

Asteroscopus syriaca (Warren, 1910)

Identification adult female and its genitalia (fig. 1): Wingspan 28 mm. Pubescence of head and thorax dark grey, abdomen brownish yellow; antennae finely bipectinate, covered with white scales; forewings elongate, triangular, with acute apex, ground color dark ashy-grey, black basal dash present, antemedial and postmedial lines obsolescence, wedge shaped, arrowheads of the subterminal line suffused with blackish scales, terminal line well defined, dark. Hindwing rounded, whitish with brown-grey scales, discal spot present, terminal line present, brownish, fringes grey.

The diagnostic characteristics of *A. syriaca* in the male genitalia are the much smaller, lobe-like, densely setose ampulla, the much smaller number of shorter fine cornuti of the vesica which are arranged into two-subbasal and terminal groups and also the terminal group of cornuti is consisted of a single, comparatively large spine (RONKAY *et al.,* 2011).

In the female genitalia, the ovipositor is remarkably long, thin, with slenderer papillae anales and long apophyses, the ostium bursae is membranous and more or less funnel-like, the ductus bursae is short, thick and its anterior two-thirds strongly sclerotized-wrinkled, the appendix bursae is proportionally considerably large, semiglobular and densely ribbed-wrinkled, and the corpus bursae is smaller, elliptical-ovoid, without signa (RONKAY *et al.,* 2011).

The female genitalia of *A. syriaca* differ from those of *A. sphinx* (Hufnagel, 1766) by the presence of a sclerotized antero-lateral plate at junction of ductus bursae to corpus bursae directed towards appendix bursae which is absent in *A. sphinx*; the ductus bursae is somewhat narrower and the sclerotized ribs are mentionable weaker than in *A. sphinx* (RONKAY *et al.,* 2011).

General distribution. *A. syriaca* has three geographic subspecies. The nominotypical subspecies of this Ponto-Mediterranean-Iranian species occurs in the central and eastern parts of Turkey and in most areas of Armenia. The ssp. *decipulae* (Kovács, 1966) occurs very locally in the Carpathian Basin and the Balkan Peninsula. The ssp. *wieseri* Ronkay, Ronkay & Gyulain, 2011 occurs in the Golestan province of Iran (RONKAY *et al*., 2011).

Distribution in Iran: This taxon is **new to the Iranian fauna**.

Material examined: Khuzestan Prov., Baghmalek, Malaqa, 1100 m, 31º 35' 57" N 50º 00' 50" E, 1 ♀, 15-VII-2011, slide No. 3230 Peter Gyulai (deposited in the IMCA).

Genus *Ostheldera* Nye, 1975

Ostheldera persa Ronkay & Varga, 1994

General distribution: It is rather widespread in the western and southwestern mountainous areas of Iran (RONKAY *et al*., 2011).

Distribution in Iran: It is more frequent in the western parts of the Alborz Mts and the southern half of the Zaghros Mts (in the provinces Kordestan, Esfahan, Fars and Kohgiluyeh-va Boyerahmad), while it

is recorded as rare and more sporadic in the other mountains (RONKAY *et al*., 2011). This species is newly reported to the Kerman province.

Material examined: Kerman Prov., Jiroft, Dochar, 3223 m, 29º 04' 40" N 57º 37' 01" E, 1 ♂, 10-IX-2015; Sangdan, 2966 m, 29º 06' 06" N 57º 33' 12" E, 1 ♂, 30-IX-2015, 1 ♂, 01-X-2015.

Genus *Valeria* Stephens, 1829

Valeria schreieri Hacker & Ebert, 2002

General distribution: It is known from the southern and southwestern parts of Iran (EBERT & HACKER, 2002; RONKAY *et al.*, 2011).

Distribution in Iran: Fars and Bushehr (EBERT & HACKER, 2002; LEHMANN & ZAHIRI, 2011). This species is newly reported to the Kerman and Khuzestan provinces.

Material examined: Kerman Prov., Jiroft, Dochar, 3223 m, 29º 04' 40" N 57º 37' 01" E, 1 ♂, 10-IX-2015; Sangdan, 2966 m, 29º 06' 06" N 57º 33' 12" E, 1 ♂, 30-IX-2015, 1 ♂, 01-X-2015; Khuzestan Prov., Baghmalek, Malaqa, 1100 m, 31º 35' 57" N 50º 00' 50" E, 1 ♂, 4 ♀♀, 26-XII-2011.

Valeria carducha (Wiltshire, 1957)

General distribution: Iran and Iraq (Kurdistan) (RONKAY *et al*., 2011).

Distribution in Iran: It has been recorded from western half of Iran, from the Alborz range to the Central Zaghros (Fars) (RONKAY *et al*., 2011). This species is newly reported from Ilam, Khuzestan and Kerman provinces, and from Khorasan.

Material examined: Fars Prov., Neyriz, 1800 m, 29º 07' 27" N 54º 22' 10" E, 1 ♂, 21-III-2017; Kerman, Prov., Baft, Dehsard,1811 m, 28º 40' 39" N 56º 33' 02" E, 1 ♀, 1 ♂, 02- II-2016; Ilam, Chavar, Banvizeh, 600 m, 33º 36' 02" N 46º 07' 08" E, 19 ♂♂, ♀♀, 21-III-2017.

Genus *Allophyes* Tams, 1942

Allophyes renalis (Wiltshire, 1941)

General distribution: The species has reported from the southeastern Turkey, northern Iraq, Armenia, Azerbaijan and Iran (RONKAY *et al.*, 2011).

Distribution in Iran: It is distributed from the northwestern parts throughout the Zaghros Mts to the SE chains of the mountain, in provinces such as Markazi, Lorestan, Fars, Hormozgan and Bushehr (EBERT & HACKER, 2002; LEHMANN *et al.*, 2009; RONKAY *et al.*, 2011; DEHLAGHI *et al.*, 2012; KOÇAK & KEMAL, 2014).

Material examined: Fars Prov., Nurabad, 1100 m, 29º 55' 56" N 51º 35' 52" E, 1 ♂, 03-VI-2011; Fars Prov., Nurabad, Babameidan, 1000 m, 2 ♂♂, 1 ♀, 30º 11' 36" N 51º 31' 27" E, 15-V-2011; Fars Prov., Kazerun, Dasht-e Barm, 1050 m, 29º 44' 09" N 51º 44' 27" E, 1 ♀, 10-XI-2016.

Subfamily Metoponinae Herrich-Schäffer, 1851

The majority of species are small sized, the general lack the foretibial claw and the field of enlarged cornuti in the vesica. The larvae do not specialize on seeds of Asteraceae. They differ from the Acontiinae in having a raised nodular sclerite on the tympanic membrane, quadrifine hindwing venation; and by lacking setae on the scaphium, the enlarged alula and reduced hood of the ear, and the saccular dorsal crest. This is an exclusively Old World subfamily (FIBIGER *et al.*, 2009).

Genus *Haemerosia* Boisduval, 1840

Haemerosia renalis (Hübner, [1813])

General distribution: Southern Europe, Near East, Turkey, Iraq and western Iran (FIBIGER *et al*., 2009).

Distribution in Iran: Tehran, Kordestan, Fars (EBERT & HACKER, 2002) Lorestan, Kohgiluyeh-va Boyerahmad, Khorasan and Sistan-va Baluchestan (KOÇAK & KEMAL, 2014). This species is newly reported from Kerman province.

Material examined: Kerman, Prov., Jiroft, Omrudoieh, 2971 m, 29º 05' 55" N 57º 33' 13" E, 1 ♂, 1 ♀, 08-VII-2015.

Subfamily Eustrotiinae Grote, 1882

Relatively small moths with slender bodies, labial palpi short, slightly upturned, second segment two to three times longer than third; tibia without spurs. Forewing with rounded apex, usually colorful, well patterned and the white patches are often rosy tined in fresh specimens, usually all lines and stigmata present, veins R3 and R4 of similar length. Hindwing usually unicolorous, greyish, vein M2 often present, though slightly reduced than M3 and it meets the cell at about fl of the way down the cell. Abdomen usually with 1-4 dorsal crests on 1st -5th segments (FIBIGER *et al.*, 2009). The larvae of most Eustrotiinae possess seta SV2 on the first abdominal segment (FIBIGER & LAFONTAINE, 2005).

Genus *Deltote* Reichenbach, 1817

Deltote iranica (Kotzsch, 1940)

General distribution: Iran (HACKER, 1990).

Distribution in Iran: Central and Eastern Iran (HACKER, 1990).

Material examined: Khorasan-e Razavi Prov., Binaloud, Dolat Abad, 1558 m 36º 25' 56" N 59º 09' 41" E, 1 ♂, 27-V-2011.

Genus *Pseudozarba* Warren, 1913

Pseudozarba bipartita (Herrich-Schäffer, 1850)

General distribution: The Mediterranean area, Israel, Turkey and Iran (FIBIGER *et al*., 2009).

Distribution in Iran: Hormozgan (SHIRVANI *et al.*, 2008). This is the second report of this species from Iran and is a new record for the Kerman province.

Material examined: Kerman, Baft, Khabr National Park, 1920 m, 28º 39' 19" N 56º 26' 46" E, 1 ♂, 1 ♀, 20-VIII-2015.

Subfamily Oncocnemidinae Forbes & Franclemont, 1954

This subfamily was formerly considered as a tribe of the Cuculliinae because of the biordinal larval crochets, but the association based on this character is weak. For this reason, and because molecular results based on two nuclear genes fail to recover the Cuculliinae and Oncocnemidinae as sister groups, Oncocnemidinae should be treated as a separate subfamily. The subfamily is characterised by the long vesica with an elongated field of spines on the apical half of the vesica. The spinneret is long and tubular (unlike the Stiriinae) and the apical seta on the labial palpus is usually long (unlike the Cuculliinae) (FIBIGER & LAFONTAINE, 2005).

Genus *Pamparama* Ronkay & Ronkay, 1995

Pamparama acuta (Freyer, 1838)

General distribution: Levante area, Asia Minor, Turkey, north Iraq and Iran (HACKER, 2001).

Distribution in Iran: Alborz and Hormozgan (EBERT & HACKER, 2002). This is the second report of this species from Iran and is a new record for the Kerman province.

Material examined: Kerman Prov., Jiroft, Hishin, 1341 m, 28º 38' 23" N 57º 56' 43" E, 1 ♂, 05-II-2016.

Genus *Oncocnemis* Lederer, 1853

Oncocnemis erythropsis Brandt, 1938

General distribution: Afghanistan and Iran (HACKER, 1990).

Distribution in Iran: Fars, Tehran, Kermanshah (BRANDT, 1938; KOÇAK & KEMAL, 2014) and Kerman (SHIRVANI, 2012).

Material examined: Fars Prov., Sivand, 1700 m, 30º 05' 17" N 52º 54' 58" E, 1 ♂, 18-VIII-2011.

Oncocnemis rhodophaea Ebert, 1978

Adult female and its genitalia (fig. 2): Wingspan 30 mm. Head, thorax and abdomen light brown; head small, eyes globular, palpi upright; antennae ciliate; forewing ground color grayish light brown, spotted with reddish scales, crosslines well developed, postmedial and terminal areas covered with blackish scales; Orbicular and reniform stigmata present outlined with bright, terminal line present, fringes light brown. Hindwing whitish, outer half margin with blackish brown scales, veins covered with brown, fringes as forewing.

As described by EBERT (1978), valvae almost simple, costal margin straight, ventral margin slightly convex. Cucullus gently rounded, corona present. Harpe long, finger-shaped, set off from the sacculus at a right angle, terminated in hook-like curved tip. Full length aedeagus filled with closely spaced cornuti, which open distally into a spiky pad, and into a split chitin plate proximally.

In the female genitalia, ovipositor short, apophyses very long. Ductus bursae membranous; cervix bursae long; corpus bursae long, elliptical, signum-fields missing. Ductus seminalis branching off at the apex of the bursa copulatrix.

Members of *O. rhodophaea* species-group (*O. confusa* (Freyer, [1839]) and *O. nigricula* (Eversmann, 1847)) have slightly developed and less prominent appendix bursae and hence their corpus bursae seem to be one-piece. In other congener species, appendix bursae is well developed and saccate, therefore corpus bursae seems to be bipartite. *O. rhodophaea* differs from its close relatives by lacking a projection in distal part of the corpus bursae.

General distribution: Afghanistan (type locality: Kabul) (EBERT, 1978).

Distribution in Iran: **This species is new to the Iranian fauna**. It has already been found in Iran (Fars and Kerman), but never published.

Material examined: Kerman Prov., Baft, Dehsard, 1811 m, 28º 40' 39" N 56º 33' 02" E, 1 ♀, 15-X-2015, slide No. 959 S. Shahreyari-Nejad (deposited in the IMCA).

Oncocnemis strioligera anatolica Hacker, 1986

General distribution: It ranges from Asia Minor throughout Iran to Afghanistan and Turkestan (HACKER, 2001).

Distribution in Iran: Lorestan, Khorasan, central and south Iran (HACKER, 2001; EBERT & HACKER, 2002; KOÇAK & KEMAL, 2014). This species is newly reported from Fars province.

Material examined: Fars Prov., Kamfiruz, 1700 m, 30º 20' 28" N 52º 13' 13" E, 1 ♀, 25- VIII-2011.

Oncocnemis exacta Christoph, 1887

General distribution: It ranges in xerothermic mountain of Near and Middle East and central and inner Asia (HACKER, 2001).

Distribution in Iran: North Iran and southwest Iran in provinces of Khorasan, Tehran, Kermanshah, Kordestan, Lorestan, Fars and Kohgiluyeh-va Boyerahmad (HACKER, 2001; KOÇAK & KEMAL, 2014). This species is newly reported from Kerman province.

Material examined: Kerman Prov., Jiroft, Omrudoieh, 2971 m, 29º 05' 55" N 57º 33' 13" E, 1 ♀, 08-VII-2015.

Genus: *Stilbina* Staudinger, 1892

Stilbina hypaenides Staudinger, 1892

General distribution: Levante area, Turkey, Iraq and southwest Iran (HACKER, 2001).

Distribution in Iran: Gilan, Mazandaran and Lorestan (EBERT & HACKER, 2002). This species is newly reported from Khuzestan and Fars provinces.

Material examined: Khuzestan Prov., Baghmalek, Malaqa, 1100 m, 31º 35' 57" N 50º 00' 50" E, 1 ♂, 14-VI-2015; Fars Prov., Sivand, 1770 m, 30º 07' 29" N 52º 54' 30" E, 1 ♂, 13-V-2016.

Genus *Cleonymia* Berio, 1966

Cleonymia baetica klapperichi Hacker, 2001

General distribution: It occurs in SE Turkey, Iraq, SW Iran, Syria, Jordan, Israel, Saudi Arabia and E. Africa (SALDAITIS & IVINSKIS, 2006).

Distribution in Iran: Hormozgan, Fars and Khuzestan (EBERT & HACKER, 2002).

Material examined: Fars Prov., Neyriz, 1800 m, 29º 07' 27" N 54º 22' 15" E, 1 ♂, 06-IV-2016.

Cleonymia chabordis (Oberthür, 1876)

General distribution: Widely distributed in North Africa, Near and Middle East (HACKER, 2001).

Distribution in Iran: Fars, Sistan-va Baluchestan, Bushehr and Hormozgan (EBERT & HACKER, 2002; KOÇAK & KEMAL, 2014). This species is newly reported from Kerman province.

Material examined: Kerman, Jiroft, Hishin, 1341 m, 28º 38' 23" N 57º 56' 43" E, 1 ♂, 05-II-2016.

Subfamily Eriopinae Herrich-Schäffer, 1851

Some characters which shed light on the relationships of Eriopinae are the highly modified valve and clasper, the presence of a basal brush on the abdomen that appears to be independent in origin from that of other Noctuidae, and the aedeagus which is heavily sclerotized only apically and ventrally with the sides and dorsum very lightly sclerotized. There are also peculiar characters such as eversible coremata on the sacculus and the spinneret which has an apical pair of flaps that cover the opening of the spinneret (FIBIGER & LAFONTAINE, 2005).

Characteristics of the Eriopinae that suggest closeness with the Erebidae are the rod-like posterior apophyses (without the posterior rectangular or diamond-shaped plates characteristic of the Noctuidae), absence of a free pleural sclerite in the male genitalia, enlarged apical setae on the tarsi of the larvae, and the heavily sclerotized scaphium (FIBIGER & LAFONTAINE, 2005).

On the other hand, characters that suggest affinities with the Noctuidae include 1) SD1 seta on A9 of the larva is hair-like and in an enlarged sclerotized pocket, and 2) the spinneret has a dorsal groove. These are characteristics of a group of subfamilies that includes Condicinae, Xyleninae, Hadeninae, and Noctuinae. The Eriopinae are distinguished from these subfamilies in that the pale lateral line extends across the posterior part of the abdomen (but not the anal shield as in the Cuculliinae s. l.) rather than extending down the hind proleg (FIBIGER & LAFONTAINE, 2005).

Genus *Callopistria* Hübner, [1821]

Callopistria latreillei (Duponchel, 1827)

General distribution: Europe, northern Africa, Arabian Peninsula, Turkey, Armenia, Iran, Afghanistan and Turkestan (FIBIGER & HACKER, 2007).

Distribution in Iran: Fars, Kerman (HACKER & KAUTT, 1999), Gilan, Sistan-va Baluchestan

(EBERT & HACKER, 2002), Golestan (WIESER & STANGELMAIER, 2005), Mazandaran (LEHMANN & ZAHIRI, 2011), Hormozgan and Khorasan (KOÇAK & KEMAL, 2014). This species is newly reported from Khuzestan province.

Material examined. Kerman, Jiroft, Hishin, 1341 m, 28º 38' 23" N 57º 56' 43" E, 1 ♀, 15-II-2016; Khuzestan Prov., Baghmalek, Malaqa, 1100 m, 31º 35' 57" N 50º 00' 50" E, 1 ♂, 14-VI-2015; 1 ♂, 11-V-2012; Khuzestan Prov., Izeh, Karun3 Dam, 900 m, 31º 46' 54" N 50º 06' 13" E, 1 ♂, 04-VI-2011.

Subfamily Acontiinae Guenée, 1841

The family Acontiinae is characterized by the following character states, 1) relatively small and color full species which many of them are bird-dropping mimics, a feature which has arisen independently in many groups of Lepidoptera; 2) tympanum with alula enlarged and made a flap which covers the tympanic opening to some extent; 3) tympanum with the hood reduced or absent; 4) scaphium membranous, with hair-like setae apomorphic arranged in each of the four tribes (lost in Aediini); 5) two SV setae on first abdominal segment of larvae (in this regard differing from those in Eustrotiinae and Bagisarinae) (FIBIGER *et al.*, 2009).

Other features are the cylindrical, smoothly curved uncus, which tapers to pointed tip; valvae which are broadest medially or subapically; the more or less asymmetrical sacculi and their processes; the sacculi most often with a heavily sclerotized dorsal crest or lobe; the asymmetrical clasper and ampullae; the rather short medial part of transtilla; and the short aedeagus, widened at ductus ejaculatorius (FIBIGER *et al.*, 2009).

Genus *Acontia* Ochsenheimer, 1816

Acontia lucida (Hufnagel, 1766)

General distribution: The whole Palearctic (HACKER *et al.*, 2008).

Distribution in Iran: Tehran, Fars, Hormozgan (EBERT & HACKER, 2002), Golestan, Khorasan (GUTLEB & WIESER 2002; WIESER & STANGELMAIER, 2005), Khuzestan (ESFANDIARI *et al.*, 2011), Mazandaran (LEHMANN & ZAHIRI, 2011), Gilan and Sistan-va Baluchestan (KOÇAK & KEMAL, 2014). This species is new to the Kerman province.

Material examined: Kerman Prov., Jiroft, Alaadin-Olia, 581 m, 28º 31' 16.5" N 57º 45' 04.9" E, 1 ♂, 21-IX-2015; Hishin, 1341 m, 28º 38' 23" N 57º 56' 43" E, 2 ♂♂, 05-II-2015.

Acontia trabealis (Scopoli, 1763)

General distribution: From Europe to Japan and Korea, also in North Africa, Arabian Peninsula and Iran (HACKER *et al.*, 2008).

Distribution in Iran: Azarbayejan-e Gharbi, Mazandaran, Tehran, Kordestan, Lorestan, Khuzestan (EBERT & HACKER, 2002; ESFANDIARI *et al.*, 2011), Kermanshah, Chaharmahal-va Bakhtiari, Fars, Hormozgan, Kohgiluyeh-va Boyerahmad (HACKER *et al.*, 2008), Sistan-va Baluchestan, Zanjan (KOÇAK & KEMAL, 2014) and Golestan (GUTLEB & WIESER, 2002). This species is new to the Kerman province.

Material examined: Kerman Prov., Jiroft, Ali-Abad, 656 m, 28º 32' 56" N 57º 51' 39" E, 1 ♂, 11-IX-2015.

Genus *Metalopha* Staudinger, 1892

Metalopha liturata (Christoph, 1887)

General distribution: Irano-Turanian. Near and Middle East, Central Asia, and western Himalaya (KRAVCHENKO *et al.*, 2007).

Distribution in Iran: Azarbayejan-e Gharbi, Azarbayejan-e Sharghi, Alborz, Tehran, Khorasan-e

Razavi, Fars, Hamadan, Hormozgan and Sistan-va Baluchestan (KALALI, 1976; EBERT & HACKER, 2002; KOÇAK & KEMAL, 2014).

Material examined: Khorasan-e Razavi Prov., Shirahmad, 985 m, 36º 07' 09" N 57º 51' 08" E, 1 ♀, 02-V-2011.

Metalopha sp.

This species differs from those *Metalopha* species which have yet recorded in Iran. However, its identification needs more examination of the material.

Material examined: Khuzestan Prov., Baghmalek, Malaqa, 1100 m, 31º 35' 57" N 50º 00' 50" E, 2 ♂♂, 21-IV-2016.

Genus *Metopoceras* Guenée, 1892

Metopoceras omar (Oberthür, 1887)

General distribution: From northwestern Africa to the Levante area, south Italy, the Arabian Peninsula, coasts of the Caspian Sea, Turkmenistan, the Near and Middle East (KRAVCHENKO *et al.*, 2007).

Distribution in Iran: Fars, Mazandaran, Bushehr, Hormozgan (EBERT & HACKER, 2002), Golestan and Sistan-va Baluchestan (KOÇAK & KEMAL, 2014). This species is newly reported from Kerman province.

Material examined: Kerman Prov., Jiroft, Hishin, 1341 m, 28º 38' 23" N 57º 56' 43" E, 2 ♂♂, 05-II-2015.

Metopoceras solituda (Brandt, 1938)

General distribution: Saudi Arabia, southwestern Iran and Levante area (KRAVCHENKO *et al.*, 2007).

Distribution in Iran: Bushehr, Hormozgan and Sistan-va Baluchestan (EBERT & HACKER, 2002; KRAVCHENKO, 2007; KOÇAK & KEMAL, 2014). This species is newly reported from Kerman province.

Material examined: Kerman Prov., Baft, Sohan Darreh, 1920 m, 28º 39' 43" N 56º 26' 50" E, 1 ♂, 20-VII-2015.

Genus *Tarachephia* Hampson, 1926

Tarachephia panaceorum (Ménétriés, 1848)

General distribution: North Africa, Near and Middle East, Kazakhstan, Afghanistan, Mongolia and Tibet (HACKER, 2001).

Distribution in Iran: Tehran, Azarbayjan-e Gharbi, Azarbayjan-e Sharghi, Khorasan-e Razavi, Qom, Sistan-va Baluchestan and Hormozgan (KALALI, 1976; EBERT & HACKER, 2002). This species is newly reported from Khuzestan province.

Material examined: Khuzestan Prov., Ahvaz, 1975 m, 1 ♂, with no more data; Khorasan-e Razavi Prov., Shirahmad, 958 m, 36º 07' 09" N 57º 51' 08" E, 2 ♂♂, 1 ♀, 02-V-2011.

Genus *Armada* Staudinger, 1884

Armada dentata Staudinger, 1884

General distribution: Egypt, Arabian Peninsula, Caucasia, southern Iran and Afghanistan (HACKER, 1990).

Distribution in Iran: Fars, Sistan-va Baluchestan and Khorasan-e Razavi (KALALI, 1976; EBERT & HACKER, 2002).

Material examined: Khorasan-e Razavi Prov., Shirahmad, 985 m, 36º 07' 09" N 57º 51' 08" E, 1 ♂, 2 ♀♀, 02-V-2011.

Conclusion

In this research seven species with Iranian type locality, *Ostheldera persa*, *Valeria schreieri*, *Allophyes renalis*, *Deltote iranica*, *Oncocnemis erythropsis*, *Metalopha liturata* and *Metopoceras solituda* are reported, of those, five species were discovered in Fars province and adjacent areas. Furthermore, two new records for the fauna of Iran and 22 new provincial records are reported. Our results indicate that there are still many unexplored regions and species, in spite of the huge Noctuidae records from Iran, that require more intensive local faunal surveys. The less explored areas of southern Iran which are affected by Afrotropical and Oriental climate, have diverse vegetation than other parts of the country and are the subject of faunistic and biogeographical interest.

The presence of *O. rhodophaea* in Khabr National Park of Kerman province (fig. 3) emphasis on conducting more investigations in south and southeastern parts of Iran to discover more species connected to Afghanistan and Pakistan fauna. As the same way, the faunistic surveys in southwest Iran, where *A. syriaca* was collected (fig. 3), will uncover species connected to fauna of western areas of Iran.

Most of the collected species have a wide range of distributed in Europe, Mediterranean area, and Central Asia but a species like *Valeria schreieri* is so far locally distributed in south and southwest Iran. As like other Noctuidae moths there is still poor information on the bionomics of the most known species in Iran. Studies on the distribution, larval food plants, biology and ecology of the Noctuidae species must be considered as an priority by Iranian biologists and entomologists.

Acknowledgement

All supports provided by the Shahid Chamran University of Ahvaz are greatly appreciated. The authors thank Dr. László Ronkay and Dr. Peter Gyulai for their kind help in identification/confirmation of the material. A special thank is extended to Dr. László Ronkay the curator of Noctuoidea collection of Hungarian Natural History Museum for his support during collection visit of M. Esfandiari. We also thank Dr. M. M. Rabieh and Dr. M. Arab for generous help during field sampling. This study was financially supported by the Iran National Science Foundation (INSF).

BIBLIOGRAPHY

BRANDT, W., 1938.– Beitrag zur Lepidopteren-fauna von Iran. Neue Gattungen, Arten und Formen (Macrolepidoptera).– *Entomologische Rundschau*, **55**: 517-523.

DEHLAGHI, E., SHIRVANI, A. & VAFAEI SHUSHTARI, R., 2012.– New records of two noctuid moths (Lep.: Noctuidae) from Iran.– *20th Iranian Plant Protection Congress*, *Shiraz*, *Iran*: p. 203.

EBERT, G. & HACKER, H. H., 2002.– Beitrag zur Fauna der Noctuidae des Iran: Verzeichnis der bestande im staatlichen Museum für Naturkunde Karlsruhe, taxonomische Bemerkungen und beschreibung neuer Taxa.– *Esperiana*, **9**: 237-409.

EBERT, G., 1978.– Neue Taxa paläarktischer Noctuidae aus dem wissenschaftlichen Nachlaß von Charles Boursin.– *Beiträge zur naturkundlichen Forschung in Südwestdeutschland*, **37**: 193-207.

ESFANDIARI, M., MOSSADEGH, M. S. & SHISHEHBOR, P., 2011.– Noctuidae s. l. (Lepidoptera) from sugarcane fields of SW Iran.– *Fragmenta Faunistica*, **54**(2): 137-147.

ESFANDIARI, M., MOSSADEGH, M. S., SHISHEHBOR, P., MIKKOLA, K. & HODJAT, S. H., 2010.– Four noctuid (Lepidoptera, Noctuidae) taxa new for the fauna of Iran.– *Phegea*, **38**(1): 62-67.

FEIZPOOR, S. H. & SHIRVANI, A., 2014.– First report of seven noctuid species (Insecta, Lepidoptera) from Khorasan Shomali province.– *Plant Pest Research*, **4**(1): 11-19. (In Persian with English abstract).

FIBIGER, M., 1997.– Noctuinae III.– *Noctuidae Europaeae,* **3**: 418 pp. Entomological Press, Sorø.

FIBIGER, M. & LAFONTAINE, J. D., 2005.– A review of the higher classification of the Noctuoidea (Lepidoptera) with special reference to the Holarctic fauna.– *Esperiana*, **11**: 7-92.

FIBIGER, M. & HACKER, H. H., 2007.– Amphipyrinae, Condicinae, Eriopinae, Xyleninae (PART).– *Noctuidae Europaeae,* **9**: 358 pp. Entomological Press. Sorø.

FIBIGER, M., RONKAY, L., STEINER, A. & ZILLI, A., 2009.– Pantheinae, Dilobinae, Acronictinae, Eustrotiinae, Nolinae, Bagisarinae, Acontiinae, Metoponiinae, Heliothinae and Bryophilinae.– *Noctuidae Europaeae*, **11**: 504 pp. Entomological Press, Sorø.

GUTLEB, V. B. & WIESER, CH., 2002.– Ergebnisse einer zoologischen Exkursion in den Nordiran, 2001. Arthropoda (Lepidoptera, Trichoptera, Neuroptera, Heteroptera, Coleoptera, Opiliones, Araneae, Decapoda) und Vertebrata (Amphibia, Reptilia, Aves, Mammalia).– *Carinthia II*, **112**: 33-140.

HACKER, H. H., 1990.– Die Noctuidae Vorderasiens (Lepidoptera). Systematische list mit einer ubersicht uber die verbreitung unter besondere Berucksichtigung der fauna der Turkei (einschlieblich der nachbargebiete Balkan, Sudrubland, Westturkestan, Arabische Halbinsel, Agypten).– *Neue Entomologische Nachrichten*, **27**: 1-707.

HACKER, H. H., 2001.– Fauna of the Nolidae and Noctuidae of the Levante with descriptions and taxonomic notes (Lepidoptera, Noctuoidea).– *Esperiana*, **8**: 7-398.

HACKER, H. H. & KAUTT, P., 1999.– Noctuoidea aus dem Iran, gesamelt 1997 von A. Hofmann und P. Kautt (Insecta, Lepidoptera).– *Esperiana*, **14**: 1-686.

HACKER, H. H. LEGRAIN, A. & FIBIGER, M., 2008.– Revision of the genus *Acontia* Ochsenheimer, 1816 and the tribus Acontiini Guenée, 1841 (Old World) (Lepidoptera: Noctuidae: Acontiinae).– *Esperiana,* **14**: 1-686.

LEHMANN, L., STADIE, D. & ZAHIRI, R., 2009.– Zum winteraspekt der makrolepidopteren fauna südirans mit anmerkungen zur biologie einiger Arten (Lepidoptera: Bombycoidea, Papilionoidea, Geometroidea, Noctuoidea).– *Nachrichten des Entomologischen Vereins Apollo*, **30**(3): 105-119.

LEHMANN, L. & ZAHIRI, R., 2011.– Results of a lepidopterological expedition to North and Northwest Iran in summer 2007 with new records for Iran (Lepidoptera) (plates 19-22).– *Esperiana*, **16**: 135-165.

LÖDL M., GAAL-HASZLER S., JOVANOVIC-KRUSPEL S., RONKAY, G., RONKAY L. & VARGA Z., 2012.– The Vartian Collection. Part I. Noctuoidea.– *Fibigeriana*, **1**: 303 pp. Heterocera press. Budapest.

KALALI, G. H., 1976.– A list of Lepidoptera from Province of Khorasan (Iran).– *Journal of Entomological Society of Iran*, **3**(1/2): 131-135.

KITCHING, I. J., 1984.– An historical review of the higher classification of the Noctuidae (Lepidoptera).– *Bulletin of the British Museum (Natural History) Entomology*, **49**: 153-234.

KOÇAK, A. Ö. & KEMAL, M., 2014.– Lepidoptera of Iran based upon the Info-system of the Cesa. Centre.– *Entomological Studies Ankara*, **31**: 1015-8243.

KRAVCHENKO, V. D., FIBIGER, M., HAUSMANN, A. & MÜLLER, G. C., 2007.– The Lepidoptera of Israel.– *Noctuidae*, **2**: 320 pp. Pensoft Series. Moscow.

MITCHEL, A., MITTER, C. & REGIER, J. C., 2006.– Systematics and evolution of the cutworm moths (Lepidoptera: Noctuidae): evidence from two protein-coding nuclear genes.– *Systematic Entomology*, **31**(1): 21-46.

RABIEH, M. M., ESFANDIARI, M. & SERAJ, A. A., 2013.– A contribution to the fauna of subfamilies Metoponiinae, Bryophilinae and Xyleninae (Lepidoptera; Noctuidae) in NE Iran.– *Iranian Journal of Animal Biosystematics*, **9**(1): 1-16.

RONKAY, G. & RONKAY, L., 2009.– Cuculliinae 1.– *A Taxonomic Atlas of the Eurasian and North African Noctuoidea,* **2**: 365 pp. Heterocera Press. Budapest.

RONKAY, G., RONKAY, L. & GYULAI, P., 2011.– Cuculliinae II and Psaphidinae.– *A Taxonomic Atlas of the Eurasian and North African Noctuoidea,* **5**: 380 pp. Heterocera Press, Budapest.

SALDAITIS, A. & IVINSKIS, P., 2006.– Three new Noctuidae taxa from the Macaronesian archipelago.– *Atalanta*, **37**(1/2): 291-300.

SHIRVANI, A., 2012.– Noctuidae (Lepidoptera) species sampled from Khabr National Park, Kerman, Iran.– *Journal of the Lepidopterists' Society*, **66**(3): 121-132.

SHIRVANI, A., KAMALI, K., RONKAY, L. & TALEBI, A. A., 2008.– Taxonomic and Faunistic notes of certain Noctuidae species (Lepidoptera) for Iran.– *Esperiana,* **14**: 565-571.

WIESER, V. CH. & STANGELMAIER, G., 2005.– Zwischenergebnisse einer lepidopterologischen Forschungsreise in den Nordiran, Oktober 2003 (Insecta: Lepidoptera).– *Carinthia II*, (**195/115**): 659-674.

WILTSHIRE, E. P., 1979.– A Revision of the Armadini (Lep., Noctuidae).– *Entomonograph*, **2**: 1-109.

ZAHIRI, R. & FIBIGER, M., 2006.– A new species of *Amphipoea* Billberg, 1820, from northwestern Iran (Lepidoptera: Noctuidae).– *Zootaxa,* **1244**: 33-39.

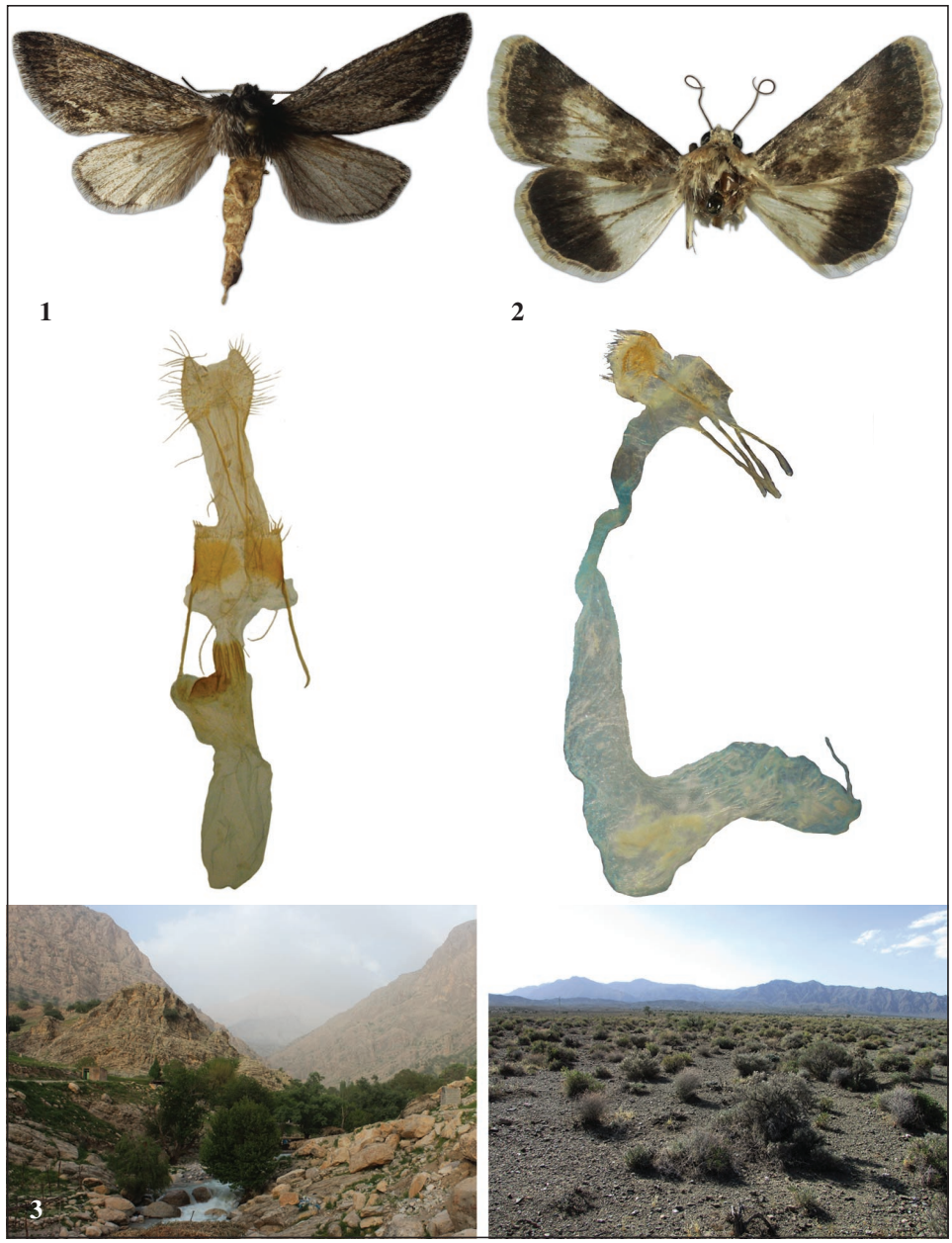
ZAHIRI, R., LAFONTAINE, J. D., SCHMIDT, B. C., HOLLOWAY, J. D., KITCHING, I. J., MUTANEN, M. & WAHLBERG, N., 2013.– Relationships among the basal lineages of Noctuidae (Lepidoptera: Noctuoidea) based on eight gene regions.– *Zoologica Scripta*, **42**: 488-507.

S. S. N., *M. E., A. R., M. S. M.
Department of Plant Protection
College of Agriculture
Shahid Chamran University of Ahvaz
Ahvaz
IRÁN / *IRAN*
E-mail: ssaideh@gmail.com
https://orcid.org/0000-0002-5390-6717
*E-mail: esfandiari@scu.ac.ir
https://orcid.org/0000-0002-0949-5180
E-mail: a.rasekh@scu.ac.ir
https://orcid.org/0000-0002-4688-5049
E-mail: mossadegh_ms@yahoo.com
https://orcid.org/0000-0002-8166-0611

A. S.
Department of Plant Protection
College of Agriculture
Shahid Bahonar University of Kerman
Kerman
IRÁN / *IRAN*
E-mail: shirvani@mail.uk.ac.ir
https://orcid.org/0000-0002-4647-1030

*Autor para la correspondencia / *Corresponding author*

(Recibido para publicación / *Received for publication* 7-X-2019)
(Revisado y aceptado / *Revised and accepted* 20-XII-2019)
(Publicado / *Published* 30-VI-2020)



Figs. 1-3.– 1. Adult wing pattern (up) and female genitalia (down) of *Asteroscopus syriaca* (Warren, 1910); **2.** Adult wing pattern (up) and female genitalia (down) of *Oncocnemis rhodophaea* Ebert, 1978; **3.** Habitats of *Asteroscopus syriaca* in the Malaqa region in Khuzestan province, southwest Iran (left) and *Oncocnemis rhodophaea* in Dehsard region of Baft in Kerman province, south Iran (right).

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 253-255 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.391

Una nueva especie del género *Synegia* Guenée, 1858 de las Islas Molucas: Ceram-Seram, Indonesia (Lepidoptera: Geometridae, Ennominae, Baptini)

A. Expósito-Hermosa

Resumen

Se describe *Synegia fernandezi* Expósito, sp. n. de la isla de Ceram-Seram. Se muestran imágenes del anverso y reverso del adulto así como de la genitalia de la hembra.
PALABRAS CLAVE: Lepidoptera, Geometridae, Ennominae, Baptini, *Synegia,* nueva especie, Ceram-Seram, Indonesia.

A new species of the genus *Synegia* Guenée, 1858 from the Moluccas Islands: Ceram-Seram, Indonesia (Lepidoptera: Geometridae, Ennominae, Baptini)

Abstract

Synegia fernandezi Expósito, sp. n. from the Ceram-Seram islands, it is described. Images of the front and back of the adult as well as of the female's genitalia are present.
KEY WORDS: Lepidoptera, Geometridae, Ennominae, Baptini, *Synegia*, new species, Ceram-Seram, Indonesia.

Introducción

El género *Synegia* fue descrito por GUENÉE ([1858]: 423), teniendo como especie tipo del género a la especie *Synegia botydaria* Guenée, [1858] descrita de Borneo.

PARSONS *et al.* (1999: 915-917) censaron en su catálogo a cincuenta y siete especies en el género *Synegia*.

Por su morfología externa el género *Synegia*, se podría dividir en dos subgéneros: *Synegia* Guenée, [1858] y *Eugnesia* Warren, 1897, este segundo subgénero con la especie tipo *Eugnesia correspondens* Warren, 1897, de Filipinas.

Un interesante estudio de este género, con especies de Borneo, lo efectuó HOLLOWAY (1993: 74-80) censando trece especies de esta isla. Asimismo, Holloway (comunicación personal) ha registrado siete especies de la isla de Ceram-Seram casi todas pertenecientes al grupo *Synegia* (*Eugnesia).*

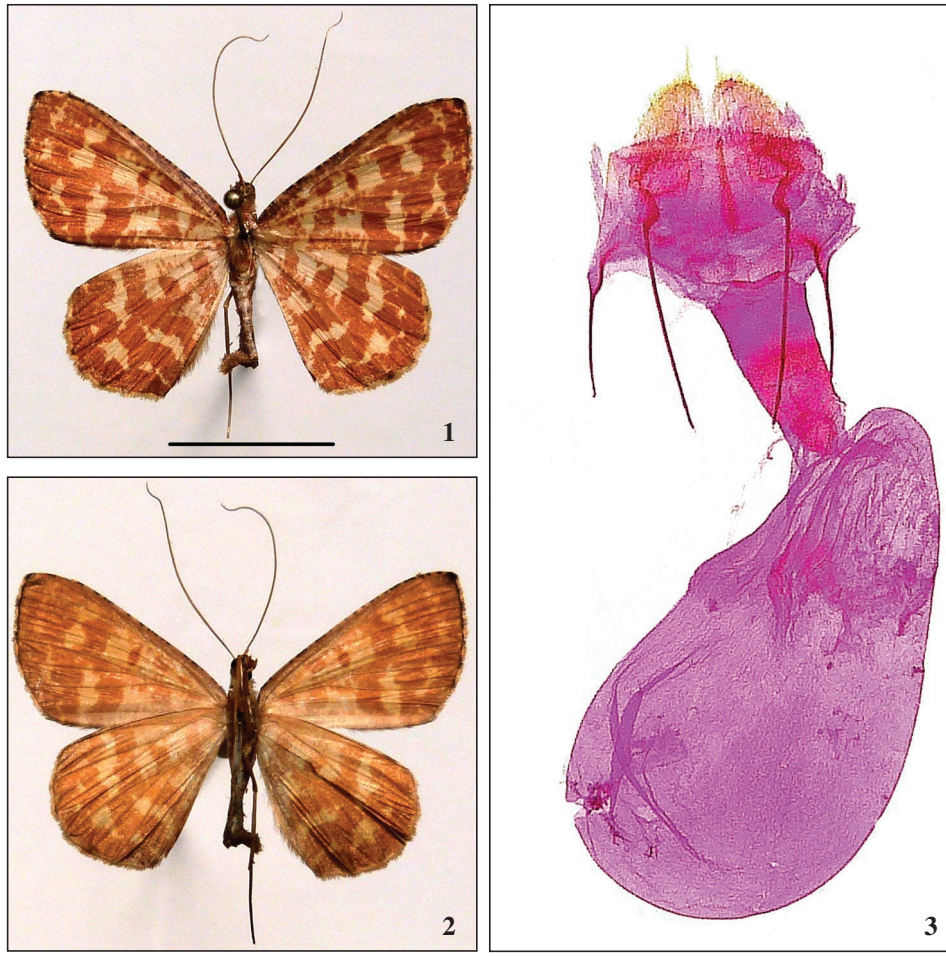
Se ha estudiado una serie de ejemplares correspondiente al grupo de *Synegia (Synegia)* que seguidamente se describe como especie nueva.

Taxonomía y descripción

***Synegia fernandezi* Expósito, sp. n.** (Figs. 1-3)

Material: Holotipo 1 ♀, genitalia hembra con preparación número AEH 3355 y etiquetado con data:

INDONESIA, W. Seram, Elpaputih area, a 200 m, X-2016, colector local. El ejemplar así como la preparación de la genitalia, están depositadas en la colección de Andrés Expósito-Hermosa, Móstoles, Madrid (España).



Figs 1-3.– 1. Holotipo ♀ anverso. **2.** Reverso. **3.** Genitalia hembra preparación AEH 3355 (escala 1 cm)

Descripción de la hembra (Figs. 1-2): Antenas extremadamente finas y largas alcanzando el ápice de las alas anteriores; un caso semejante se da en especies del género *Eumelea* Duncan [& Westwood, 1841] *in* Jardine; Desmobathrinae, Eumeleini. La expansión alar de la hembra es de 34 mm menor que la de *Synegia fasciata* Warren, 1899 que es de 36 mm. La morfología externa es semejante a *fasciata,* pero con apreciables diferencias, pues las alas anteriores tienen la costa menos recta; el fondo de las alas con brillo más vivo así como sus facies de tonos rojos; punto apical de las alas anteriores más grueso; base con manchas, en su área costal; fondo de alas en el área del termen y zona caudal diferentes a *fasciata*. En las alas posteriores se hallan variaciones semejantes siendo muy significativo que el termen, en la especie nueva, sea curvo y sin el pico en M5 de *fasciata*. Reverso con el mismo modelo que el anverso, pero de tono más mate.

Genitalia ♀ (Fig. 3): Apófisis posteriores más largas que las anteriores y de sección similar. Ductus bursae subrectangular, con forma de M en su zona distal, más ancha que en la zona proximal a la bursae copulatrix que es más estrecha y algo menos escleritificada. La bursae copulatrix en su zona periférica distal es esférica, con una visible protuberancia cerca de la zona del ductus y con estrías verticales, también se aprecia un proceso en forma de cruz con los extremos de los brazos puntiagudos. En la (Fig. 3) también aparecen, en el interior de la bursae copulatrix, algunas manchas que no tienen ningún valor y que podrían deberse a suciedad y tintado de la preparación.

Macho desconocido.

Diagnosis: La nueva especie tiene morfología externa semejante a *S. fasciata* Warren, 1899, con la que - hasta la fecha - se podría haber confundido; pudiendose considerar como especies crípticas o hermanas. La localidad tipo de *fasciata* es del grupo Louisiade (ahora Misima I.) que se encuentra en el extremo sureste de Nueva Guinea, a una gran distancia de Ceram-Seram. Los registros de *Synegia* de este tipo rastreados en localidades intermedias - incluso si los hay - del territorio continental de Nueva Guinea son más probable que sean similares a *S. botydaria* que al material de Ceram-Seram.

Distribución: En la actualidad, solo se la conoce de las islas Molucas: Ceram o Seram, Indonesia.

Etimología: Se dedica esta nueva especie al Profesor Dr. Jesús María Fernández Sánchez y se la denomina *fernandezi*.

Agradecimientos

Sinceramente se agradece la ayuda prestada por el Dr. J. D. Holloway; el Dr. D. Stüning y el Dr. A. Vives.

BIBLIOGRAFÍA

DUNCAN, J., 1841.– Entomology. Exotic Moths.– *The Naturalist's Library,* **32**: 229 pp., 34 pls. W. H. Lizars, Edinburgh.

GUENÉE, A., 1857.– Uranidaes et Phalénites.– *Histoire Naturelle des Insectes. Species Général des Lépidoptères*, **9**(I): 515 pp. Librairie Encyclopédique de Roret, Paris.

HOLLOWAY, J. D., 1993.– The Moths of Borneo, part. 11: Geometridae, Ennominae.– *Malayan Nature Journal,* **47**: 1-309, 19 pls.

PARSONS, M. S., SCOBLE, M. J., HONEY, M. R., PITKIN, L. M. & PITKIN, B. R., 1999.– *Geometrid Moths of the World: A Catalogue (Lepidoptera, Geometridae)*: 1016 pp. + Index 129 pp. CSIRO Publishing / Apollo Books. Collingwood / Stenstrup.

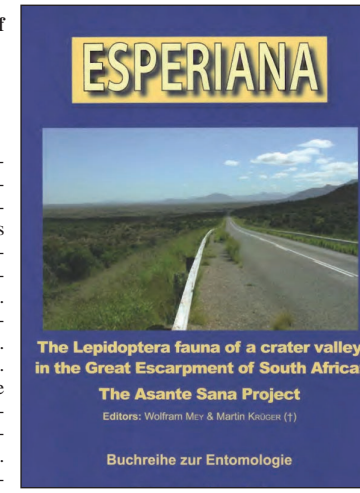
WARREN, W., 1897.– New Genera and Species of Moths from the Old-World Regions in the Tring Museum.– *Novitates Zoologicae,* **4**: 12-178.

A. E. H.
Gardenia, 25
E-28933 Móstoles (Madrid)
ESPAÑA / *SPAIN*
E-mail: aexposih@telefonica.net
https://orcid.org/0000-0003-4475-4974

(Recibido para publicación / *Received for publication* 25-XII-2019)
(Revisado y acpetado / *Revised and accepted* 25-I-2020)
(Publicado / *Published* 30-VI-2020)

REVISION DE PUBLICACIONES
BOOK REVIEWS

W. Mey & M. Krüger (†)
The Lepidoptera fauna of a crater valley in the Great Escarpment of South Africa: The Asante Sana Project
550 páginas
Formato: 24'5 x 18 cm
Hermann H. Hacker, Bad Staffelstein, 2019
ISBN: 978-3-9820357-1-0



Tenemos en nuestra manos el volumen el 8 de la ya clásica serie *Esperiana Memoir*, en este caso bajo la dirección de mis estimados amigos y colegas el Dr. Mey (Alemania) y el Dr. Krüger (Suráfrica, desgraciadamente fallecido en 2019, antes de ver terminado este volumen), que han aunado esfuerzos y contado con los mejores especialistas en cada una de las familias consideradas, a saber: Hepialidae (W. Mey), Nepticulidae (E. J. van Nieukerken), Tischeriidae (J. R. Stonis, A. Diskus & W. Mey), Cecidosiidae y Adelidae (W. Mey), Eriocottidae (W. Mey & T. Sobczyk), Psychidae (T. Sobczyx), Cryadulidae, Tineidae (W. Mey), Gracillariidae (P. Triberti), Bucculatricidae (W. Mey), Yponomeutidae y Plutellidae (D. Agassiz), Lyonetidae y Bedellidae (W. Mey), Elachistidae (L. Kaila), Coleophoridae (G. Baldizzone), Scythrididae (B. Å. Begtsson), Gelechiidae (O. Bidzilya), Carposinidae (W. Mey), Crambidae (G. Bassi), Tortricidae (L. Aarvik), Lacturidae (W. Mey), Cossidae, Metarbelidae (W. Mey), Geometridae (M.. Krüger), Erebidae: Thyritini (Ł. Przybyłowiz), Erebidae: Lithosiinae (M. Krüger) y Erebidae: Nolidae, Noctuidae (H. H. Hacker), para finalizar este trabajo ya de por sí interesante, su importancia se ve aumentada con la descripción de cuatro nuevos géneros y 124 nuevas especies.

Este libro es, la primera parte, del resultado del proyecto de investigación qué, a lo largo de cuatro años, se ha realizado sobre la fauna de Lepidoptera en la granja privada de Asante Sana, cerca de Ciudad del Cabo, en Suráfrica.

Después de la Introducción en la que nos detallan la zona de exploración (M. Mey & M. Krüger) y se detalla el tipo de vegetación que allí se encuentra con numerosos endemismos (V. R. Clark & J. D. Vidal), entramos en la parte científica del libro y donde podemos ver, a lo largo de 26 capítulos, de todas y cada una de las familias consideradas, los diferentes autores comienzan con una introducción, datos sobre su biología, material y métodos y ya en la parte taxonómica nos hablan de cada una de las especies estudiadas, el material que se ha obtenido, descripción de las nuevas especies y detalles a tener en cuenta, finalizando con una bibliografía específica.

Para finalizar la obra, nos presentan nueve planchas fotográficas de la genitalia de las nuevas especies y, también a veces, de especies próximas; de igual modo se presenta a lo largo de catorce planchas, a todo color, fotografías de los adultos, perfectamente detalladas, finalizando con un Índice.

No podemos terminar estas líneas, sin felicitar a los autores de los diferentes capítulos, por tan detallados trabajos sobre la fauna lepidopterológica surafricana, así como al Dr. Hacker que continúa editando tan importante y esencial obra, por lo que recomendamos vivamente su adquisición y no pudiendo faltar en cualquier biblioteca que se precie, sobre todo para aquellos interesados en esta magnífica fauna africana.

El precio de este libro es de 148 euros y los interesados deben dirigirse a:

Hermann H. Hacker
Janstraße, 6a
D-96231 Bad Staffelstein
ALEMANIA / *GERMANY*
E-mail: herman-heinrich.hacker@t-online.de

A. Vives Moreno
E-mail: avives1954@outlook.es
https://orcid.org/0000-0003-3772-2747

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 257-283 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.386

Butterfly diversity of Lička Plješevica Mountain chain, Croatia (Lepidoptera: Papilionoidea)

T. Koren, B. Lauš, N. Tvrtković & R. Verovnik

Abstract

Lička Plješevica is an elongated mountain massif situated in the Croatian Lika region, at the border with Bosnia and Herzegovina. It was never a target of any systematic butterfly surveys, and its butterfly fauna was poorly studied. During our surveys from 2007 to 2019, we recorded 142 butterfly species on 71 localities. Along with the records from the available literature, a total of 152 species were recorded from Lička Plješevica massif. This is the second most diverse butterfly fauna of a mountain chain in Croatia, lagging just behind Velebit Mts. with 153 species. Faunal composition of both mountain chains is however similar with exception of montane species which are less numerous on Lička Plješevica. For some species with scarce records from Croatia like: *Colias caucasica*, *Cupido osiris, Eumedonia eumedon, Plebejus argyrognom, Thecla betulae, Melitaea britomartis, Araschnia levana* and *Neptis rivularis* new records are discussed. Abandonment and subsequent overgrowing has been recognized as the most important factor potentially causing long term butterfly declines in the region.
KEY WORDS: Lepidoptera, Papilionoidea, distribution, diversity, conservation, Croatia.

Diversidad de las mariposas de la cadena montañosa de Lička Plješevica, Croacia (Lepidoptera: Papilionoidea)

Resumen

Lička Plješevica es un alargado macizo montañoso situado en la region croata de Lika, en la frontera con Bosnia y Herzegovina. No fue una meta, de ninguna investigación sistemática de las mariposas y su fauna está pobremente estudiada. Durante nuestras inspeciones de 2007 a 2019, registramos 142 especies de mariposas de 71 localidades. Al mismo tiempo con los datos disponibles en la literatura, se registró un total de 152 especies localizadas en el macizo de Licka Plješevica. Esta es la segunda fauna más diversa de mariposas de una cadena de montaña en Croacia, detrás de la montaña de Velebit con 153 especies. No obstante, la composición de la fauna de ambas cadenas montañosas es similar, con, más o menos, la excepción de las especies de las montañas de Lička Plješevica. Se discuten nuevas localidades de algunas especies con escasos registros en Croacia: *Colias caucasica*, *Cupido osiris, Eumedonia eumedon, Plebejus argyrognom, Thecla betulae, Melitaea britomartis, Araschnia levana* y *Neptis rivularis*. El abandono y la sobreesplotación han sido reconocidos como los factores potenciales más importantes de la causa, a largo plazo, de la disminución de las mariposas en la región.
PALABRAS CLAVE: Lepidoptera, Papilionoidea, distribución, diversidad, conservación, Croacia.

Introduction

Lička Plješevica massif is an elongated mountain chain that extends more than 100 kilometres in the northwest-southeast direction from Medveđak and Velika Plješevica in the north-eastern part of Croatian Lika region, through Mala Plješevica, Ozeblin peak, and complex of several lower mountains

like Kremen, Mazinske planine and Urljaj in the south-eastern part of the chain. Isolated peaks Lisac east of Gračac and Mt. Poštak northwest of Knin are also considered as part of the massif (HORVAT, 1925; POLJAK, 1974). The whole range runs in parallel but further inland to Velebit Mts. while the southern part including Mt. Poštak is inserted between Velebit and Dinara Mountain chains. The north-western border, right side of Upper Korana Gorge, Medveđak Hill, Donja Jezera, right bank of Kozjak Lake and Prijeboj are situated in National Park Plitvice Lakes. The western slopes of Lička Plješevica massif rise from the several karst poljes in Lika region: Koreničko polje, Bjelopolje, Krbavsko polje and Gračačko polje, while its eastern slopes descend into the gorges of upper Una River, Srebrenica and Butižnica which represent the natural boundary between Croatia and Bosnia and Herzegovina. Within Lička Plješivica range there are several small valleys and two karst poljes, the Lapačko polje and Gubavčevo polje. The highest peaks of the mountain chain are located in the northern part of the massif, Ozeblin (1657 m a.s.l.) and Gola Plješevica (1647 m a.s.l.) where the subalpine altitudinal belt with dwarf pine (*Pinus mugo* Turro) and alpine meadows is developed near the peaks above 1600 m a.s.l. (HORVAT, 1925). About 85 % of northern part of Mt. Lička Plješevica is covered with dense forests mostly of Euro-Siberian forest belt, with only small remnants of alpine and montane grasslands and pastures, usually in the upper parts of the mountains (POLJAK, 1998). Open dry calcareous grasslands and pastures in different stages of abandonment characterised by the presence of some typical sub-Mediterranean plants are still abundant in the central and southern part of the massif at lower elevations (TRINAJSTIĆ & ŠUGAR, 1968; ŠUGAR & PLAZIBAT, 1988).

The entire region has a very complex geological structure composed of diverse rocks, mostly of carbonate and dolomite originating from the Mesozoic period (the main ridge of Gola Plješivica is from Cretaceous carbonate and dolomite), but with incorporated mosaic of other types of rocks like Triassic siltstones and micaceous sandstones between Glogovo and Lisac hill (ANONYMUS, 1978: Geological map SFRJ 1:500000). The Lička Plješevica massif is located in continental region with strong influence of Mediterranean climate which penetrates deep into continent along Butižnica Valley and Una River Gorge, and along karst poljes west of the mountain chain (TRINAJSTIĆ & ŠUGAR, 1968). The average temperature in January is -4,5ºC and in July between 12ºC and 14ºC (BOGNAR *et al.,* 1975).

The historical data about the butterfly fauna of Lička Plješevica chain are relatively few and scattered across a wide time frame. First record was published by Gjuro Koča (KOČA, 1901) who reported *Erebia ligea* (Linnaeus, 1758) in 1891, and the German malacologist Rudolf Sturany who collected *Spialia sertorius* (Hoffmansegg, 1804) (possibly *S. orbifer* (Hübner, [1823])), *Vanessa atalanta* (Linnaeus, 1758), *Euphydras aurinia* (Rottemburg, 1775), *Melitaea aurelia* Nickerl, 1850, *M. didyma* (Esper, 1778), *Boloria euphrosyne* (Linnaeus, 1758), and *Cupido minimus* (Fuessly, 1775) in the foothills of Velika Lička Plješevica near Plitvice Lakes (REBEL, 1895). Additionally, Hochetlinger noted *Parnasius mnemosyne* (Linnaeus, 1758) as "common species around touristic house below Plješevica peak" (Gola Plješevica), together with records of three rare species in the region *Apatura ilia* ([Denis & Schiffermüller], 1775), *Limenitis populi* (Linnaeus, 1758), and probably regionally extinct *Nymphalis vaualbum* ([Denis & Schiffermüller], 1775) which he also observed near Plitvice Lakes (FRANIĆ, 1910).

In last week of July to 2nd August 1922, students from Zagreb University Zdravko Lorković and Zvonimir Badovinac collected butterflies from Zrmanja River spring (LORKOVIĆ, 1974), near Dabašnica (LORKOVIĆ, 1989), on Ozeblin peak, in vicinity of forest hut near Karlović Korita, from alpine meadow Ruda Poljana on Mala Plješivica Mountain (MLADINOV & LORKOVIĆ, 1979), and near Plitvice Lakes. Based on this collection STEINER (1938) published unexpected finding of a new butterfly species for the fauna of Croatia *Boloria titania* (Esper, 1793) from "Lička Plješivica". The record was later confirmed by MLADINOV & LORKOVIĆ (1985) based on observations of Badovinac from Ruda Poljana, 1616 m a.s.l. Another 43 species observed in the area were noted in Lorković's manuscript from 1954, which was published only recently after he passed away (LORKOVIĆ, 2009). Lorković also added his observation of *Hipparchia statilinus* (Hufnagel, 1766) from Zrmanja River spring (LORKOVIĆ, 1974), first record of *Pieris balcana* Lorković, 1969 near Dabašnica and after chromosome analysis also confirmed the contact zone between *P. napi* (Linnaeus,

1758) and *P. balcana* Lorković, 1969 at Plitvice Lakes (LORKOVIĆ, 1970, 1989). MLADINOV (1973) added records for eight additional species originating from the area, stored in the collection of Natural History Museum in Zagreb. MLADINOV & LORKOVIĆ (1979) additionally included a montane species *Erebia oeme* (Hübner, [1804]).

Recently, KOREN (2010) published first findings of *Polyommatus ripartii* (Freyer, 1830), and KOREN *et al.* (2010) the observations of *Proterebia phegea* (Borkhausen, 1788) both from the Zrmanja spring area. KOREN *et al.* (2011) and KOREN *et al.* (2015) reviewed rich butterfly fauna of Zrmanja River source and Mt. Poštak (92 and 108 recorded species respectively). KOREN & ŠTIH (2013) noted *Melitaea ornata* Christoph, 1893 from Zrmanja spring area, and TVRTKOVIĆ *et al.* (2015) added some interesting species records from Lisac peak, Kremen Mt. and Una Gorge including *Euphydrias maturna* (Linnaeus, 1758). Taxonomical status and occurrence of species of the *Polyommatus* subgenus *Agrodiaetus* in this region was also recently discussed (KOREN & LAUŠ, 2015; LOVRENČIĆ *et al.,* 2016).

The goal of this contribution is to present the overview of the butterfly diversity of the Lička Plješevica massif based on the recent faunistic surveys of the authors (2007 - 2019), with explanatory notes for some rare and interesting species recorded in the area. A comparison with neighbouring Velebit and Dinara Mountain chains is discussed in terms of diversity and zoogeography. We also discuss the main threats that could on a long run cause the decline of the high butterfly diversity in the region.

Materials and methods

Field surveys specifically addressing the butterfly fauna of the region were carried out mostly during the last five years, from 2014 onwards. Topography and habitat diversity were used to select the best suitable localities in the region. A total of 71 localities were visited during the surveys, some of them with butterfly rich habitats were visited on several occasions (Figure 1). The spatial processing and visualisation of data was made in the program ARC GIS desktop. Butterflies were identified using standard field guides (LAFRANCHIS, 2004; TOLMAN & LEWINGTON, 2008). Additionally, specimens of the genera *Leptidea*, *Melitaea* and *Plebejus* were collected and their genitalia were examined for correct identification. Revision of collected specimens from *Pieris napi* / *balcana* aggregate were examined with help of wing-markings (LORKOVIĆ, 1970). The nomenclature follows WIEMERS *et al.* (2018). The biogeographical affiliation adheres to KUDRNA *et al*. (2016).

List of localities

The list of localities contains the relevant toponyms, a short description of the habitat, altitude, coordinates, dates of the visits and observers. Localities are mostly arranged in geographical order from northwest towards southeast (Fig. 1).

1. Prijeboj, meadows toward Ličko Petrovo Selo, N: 44,846625, E: 15,682131, 661 m, 2-VIII-2015, BL, MZ
2. Medveđak Hill, N of Prijeboj settlement, spring Dražica, forest edge, grasslands, N: 44,856174, E: 15,691113, 672 m, 28-VI-2015, TK
3. Velika Plješevica, N of Korenica, meadows between Krgin vršak and Jukanova draga, bushy meadow surrounded by forest, N: 44,801503, E: 15,694054, 773 m, 25-VII-2015, BL, MZ
4. Velika Plješevica, N of Korenica, Stare paljevine, forest edge, N: 44,812725, E: 15,709914, 982 m, 25-VII-2015, BL, MZ
5. Velika Plješevica, N of Korenica, between Jarača and Torovi, forest edge, small patches of grasslands, N: 44,815631, E: 15,722884, 1015 m, 25-VII-2015, BL, MZ, 21-V-2016, TK, MZ
6. Udbina, Kurjak, small hill with a transmitter near the turn for the village, dry grasslands, abandoned quarry, N: 44,486958, E: 15,732503, 775 m, 13-VIII-2016, RV, 6-VIII-2019, RV
7. Velika Plješevica, Osinjak, toward the peak Gola Plješevica, forest edge, N: 44,799754, E: 15,738640, 1365 m, 1-VIII-2007, NT, MV; 25-VII-2015, BL, MZ

8. Velika Plješevica, Gola Plješevica, grasslands and forest edge near the peak, N: 44,791911, E: 15,745421, 1455 m, 1-VIII-2007, NT, MV, 25-VII-2015, BL, MZ, 21-V-2016, TK, MZ
9. Mala Plješevica, Ponor Koreničk, banks of Matica River, grasslands, forest edge, N: 44,728688, E: 15,763533, 712 m, 29-VII-2015, TK
10. Ozeblin, Kozja Draga, slopes at the entrance to the valley NE of Danilovac hamlet, owergrown grasslands, forest edge, N: 44,546395, E: 15,810098, 818 m, 21-V-2016, TK, MZ
11. Ozeblin, Frkašić, surroundings of pond Jezero, forest edge and grasslands, N: 44,676879, E: 15,815090, 840 m, 29-VI-2015, TK
12. Mt. Kremen: Ondić settlement, slopes above peak Rteševo, grasslands, forest edge, N: 44,483984, E: 15,821597, 1359 m, 23-VII-2014, BL
13. Lička Plješevica, area between Ondić and Rudopolje, overgrown dry grasslands, N: 44,437113, E: 15,825760, 735 m, 25-VI-2014, BL
14. Mala Plješevica, E of Frkašić, Škorina poljana, dry grasslands, N: 44,701803, E: 15,826848, 1204 m, 24-VII-2015, BL, MZ
15. Udbina, middle part of the Kozja draga Valley, rocky meadows along the road, N: 44,558682, E: 15,828372, 884 m, 2-VIII-2014, BL, 1-VI-2015, TK, 29-VII-2015, TK, 21-V-2016, TK, MZ, 13-VIII-2016, RV, 6-VIII-2019, RV
16. Mala Plješevica, Frkašić, Đevina uvala, meadows, N: 44,699963, E: 15,832812, 1168 m, 24-VII-2015, BL, MZ, 3-VII-2018, TK, BL, MZ
17. Lička Plješevica, NE of Vučja poljana, grasslands at the forest edge, N: 44,585483, E: 15,839517, 1292 m, 2-VIII-2014, BL
18. Mala Plješevica, road Korenica - Doni Lapac, turning toward Bijeli potoci village, *Fagus* forest, N: 44,670477, E: 15,842894, 1067 m, 24-VII-2015, BL, MZ
19. Mala Plješevica, Bijeli potoci, Poljane meadows, forest edge, N: 44,679578, E: 15,845102, 1294 m, 3-VI-2015, NT, LL, 29-VI-2015, TK, 7-VII-2015, NT, 16-IX-2015, NT, 21-V-2016, TK, MZ, 2-VII-2018, TK, 12-VII-2018, TK
20. Lička Plješevica, SE of Frkašić, meadows Unjka, dry grasslands, forest edge, N: 44,654388, E: 15,845329, 1129 m, 23-VII-2015, BL, MZ
21. Lička Plješevica, W of Ruda Polja, forest path with flowering patches, N: 44,691139, E: 15,848, 1294 m, 3-VII-2018, TK, BL, MZ
22. Lička Plješevica, E of peak Trla, forest glade, N: 44,581353, E: 15,851600, 1291 m, 2-VIII-2014, BL
23. Mala Plješevica, SE of Frkašić, old quarry NW of hill Šišinov tavan, forest clearing, N: 44,660843, E: 15,855764, 1165 m, 23-VII-2015, BL, MZ
24. Rudopolje Bruvanjsko, area of Gornja Klapavica, dry grassland, N: 44,439344, E: 15,858142, 746 m, 26-VII-2014, BL
25. Lička Plješevica, Trlska draga, partially overgrown forest edge, N: 44,572187, E: 15,858182, 1206 m, 2-VIII-2014, NT
26. Lička Plješevica, E of Frkašić, Ruda Polja meadows, owergrown grasslands, forest edge, N: 44,687917, E: 15,862389, 1294 m, 3-VII-2018, TK, BL, MZ
27. Lička Plješevica, Donji Lapac, hill Pogledalo, meadow Veliko Kamensko, grasslands, forest edge, N: 44,638324, E: 15,866548, 1051 m, 23-VII-2015, BL, MZ
28. Lička Plješevica, Debeli Vrh, grasslands, N: 44,683239, E: 15,868475, 1294 m, 3-VII-2018, TK, BL, MZ
29. Mt. Kremen, meadow Sarajevo, overgrown grasslands, N: 44,494742, E: 15,875780, 982 m, 22-VII-2014, BL
30. Lika, Plješevica, Ozeblin, Trl peak, small forest glade, forest edge, N: 44,578888, E: 15,880833, 1536 m, 22-V-2016, TK
31. Mt. Kremen, Međugorje, Magarčev do, karstic grasslands, N: 44,513609, E: 15,888295, 1072 m, 4-VI-2015, NT, LL, 8-VII-2015, NT, LL, 23-IX-2015, NT, LL
32. Mt. Kremen, large abandoned meadow S of the main ridge, overgrown grasslands, N: 44,459733, E: 15,888683, 1330 m, 1-VII-2015, RV
33. Mt. Kremen, along the ridge above the tree line, montane grasslands, rocky slopes, N: 44,463333, E: 15,889583, 1500 m, 1-VII-2015, RV
34. Lička Plješevica, Donji Lapac, meadow Malo Kamensko, grasslands, N: 44,617204, E: 15,896684, 1007 m, 1-VIII-2014, BL, 18-V-2017, MZ, 19-V-2017, MZ, 29-VI-2017, MZ
35. Gračac, Mt. Kremen, near the road SE of the peak, dry grassland, forest edge, N: 44,460183, E: 15,8989, 1160 m, 1-VII-2015, RV, 14-VII-2015, NT
36. Donji Lapac, Dnopolje, grasslands around a pond, N: 44,588682, E: 15,921794, 777 m, 29-VI-2015, TK

37. Mala Plješevica, Kalinovača, cca 7km N/NW of Donji Lapac, overgrown grassland, N: 44,612924, E: 15,935532, 758 m, 30-VII-2014, BL
38. Gubavčevo polje, NE part, dry grassland, N: 44,349671, E: 15,944296, 757 m, 27-VI-2014, BL
39. Lička Plješevica, Glogovo, Cvijetkovići, overgrown grasslands, N: 44,310367, E: 15,944637, 845 m, 19-V-2015, NT
40. Mt. Lisac, in the valley NE of the village towards Surle, partially overgrown meadows, N: 44,320513, E: 15,967480, 870 m, 26-VI-2014, BL, 26-VI-2017, RV
41. Mala Plješevica, meadow Lažipolje, cca 4km N/NE of Donji Lapac, dry grassland, forest edge, N: 44,588987, E: 15,971300, 748 m, 31-VII-2014, BL
42. Mt. Lisac, middle and lower part of Borovačka jaruga, dry grasslands, N: 44,318739, E: 15,973722, 920 m, 26-VII-2017, RV
43. Mt. Lisac, ridge to the NW and above Borovačka jaruga, rocky slopes with sparse vegetation, N: 44,324497, E: 15,981747, 1070 m, 18-IX-2015, NT, 26-VI-2017, RV
44. Vršina peak between Mazin and Brezovac Dobroselski, grassland surrounded by forest, N: 44,447506, E: 15,981851, 1068 m, 12-VII-2013, NT
45. Mt. Lisac, road Surle - Strmica and the trail to Lisac between 860 - 1160 m, abandoned grasslands, mixed woods, N: 44,334173, E: 15,988206, 1019 m, 27-VI-2015, 17-IX-2015, NT
46. Mt. Lisac, plateau below Lisac peak, western slopes between 1200 - 1340 m, dry grasslands, N: 44,330084, E: 15,990722, 1206 m, 26-VI-2014, BL, 29-VII-2015, NT, LL, 28-VII-2017, BL, 29-VII-2017, BL
47. Mt. Lisac, near the peak and southern slopes, dry rocky grasslands, tall grass meadow, N: 44,333575, E: 15,994503, 1300 m, 26-VI-2017, RV, 28-30-VII-2017, BL
48. Ozeblin, Gornji Lapac, settlement Gajine, dry grasslands with bushes and trees, N: 44,526731, E: 16,000374, 597 m, 28-VII-2014, BL
49. Mazin, SE of the village, Bukovačka Draga, forest path, N: 44,435060, E: 16,008641, 1146 m, 12-VII-2013, NT
50. Mt. Kremen, Gornji Lapac, Poljana, meadow surrounded by forest, N: 44,482173, E: 16,011506, 1032 m, 29-VII-2014, BL
51. Brezovac Dobroselski, SW of the village, toponym Klanci, forest edge and forest glades, N: 44,442276, E: 16,028719, 996 m, 12-VII-2013, NT
52. Gornja Suvaja, Čemernica meadows west of the settlement, N: 44,402098, E: 16,035524, 1094 m, 23-VI-2014, BL
53. Veliko Popinsko polje, W of Lukići and toward Srpski Klanac, partially overgrown pastures, N: 44,282385, E: 16,043992, 668 m, 20-VII-2016, 26-VII-2016, 7-VII-2017, NT
54. Gračac, Zrmanja, at a large spring at the N edge of the village, forest edge, abandoned dry grassland, N: 44,196406, E: 16,056494, 297 m, 8-VIII-2014, RV, 5-VIII-2015, RV, 13-VII-2018, RV, 6-VIII-2019, RV
55. Gračac, Zrmanja, pastures on the E side of the river E of village Zrmanja Vrelo, N: 44,194686, E: 16,059772, 380 m, 9-VII-2011, RV
56. Gornji Srb, meadows Mala Čemernica, 5km NW of the settlement, forest edge, grasslands, N: 44,374213, E: 16,064198, 1124 m, 24-VI-2014, BL
57. Gornja Suvaja, surroundings of Ćopići settlement, pastures, ruderal habitats, N: 44,406314, E: 16,071493, 571 m, 23-VI-2014, BL
58. Gračac, Zrmanja, valley at the spring of the river NE of village Zrmanja Vrelo, woods along the stream, rocky slopes with sparse vegetation, N: 44,203889, E: 16,074061, 303 m, 9-VII-2011, RV, 11-VIII-2011, RV, 8-VIII-2014, RV, 5-VIII-2015, RV, 20-VII-2016, NT, 26-VI-2017, RV
59. Mt. Poštak, along the road NE fo Otrić, plateau at Kamenita glavica, abandoned dry grasslands, N: 44,261569, E: 16,089089, 980 m, 22-VI-2014, RV, 8-VIII-2014, RV, 1-VII-2015, RV, 5-VIII-2015, RV, 26-VI-2017, RV, 13-VII-2018, RV
60. Kupirovo, between Srb and Srpski klanac, dry grasslands, N: 44,301546, E: 16,089298, 789 m, 6-VI-2015, NT
61. Mt. Poštak, grasslands near small quarry at Ljubina Poljana, N: 44,261226, E: 16,102745, 1094 m, 7-VI-2014, NT, 22-VI-2014, RV, 1-VII-2015, RV, 5-VIII-2015, RV, 8-12-VII-2017, BL, 13-VII-2018, RV
62. Mt. Poštak, pastures near the top of the mountain and on SW slopes, N: 44,252803, E: 16,105508, 1250 - 1420 m, 22-VI-2014, RV, 1-VII-2015, RV, 11-VII-2017, BL
63. Mt. Poštak, meadow Ljubina poljana, northern slopes, dry grasslands, N: 44,262974, E: 16,106546, 1067 m, 21-VI-2014, BL
64. Mt. Poštak, Međugorje, N of Kirin vrh, near road to Jelovi Tavani, forest track, mixed woods, N: 44,287901, E: 16,109056, 1066 m, 7-VI-2014, 23-IX-2014, NT

65. Mt. Poštak, E slopes, dry rocky grasslands, N: 44,255135, E: 16,113831, 1374 m, 9-11-VII-2017, BL
66. Srb, Donja Suvaja, along forest track E of Zalužje village, N: 44,417961, E: 16,121569, 390 m, 22-VI-2014, RV
67. Kunovac Kupirovački, at Velika bara, wooded stream banks, dry grasslands, N: 44,345097, E: 16,135991, 446 m, 22-VI-2014, BL
68. Srb, Kunovac Kupirovački, along forest road in a valley SE of the village, N: 44,321044, E: 16,136575, 530 m, 22-VI-2014, RV
69. Srb, Donja Suvaja, along a track in the gorge of Una river E of Zalužje village, dry grasslands, rocky slopes, N: 44,418592, E: 16,137892, 380 m, 22-VI-2014, RV
70. Mt. Poštak, NE slopes of hill Visočica, meadows Palež, forest edge, N: 44,267572, E: 16,148236, 933 m, 21-VI-2014, BL, 31-VII-2014, BL
71. Gornji Srb, Zavlaka village, meadows and forest edge, N: 44,315826, E: 16,176171, 749 m, 22-VI-2014, BL

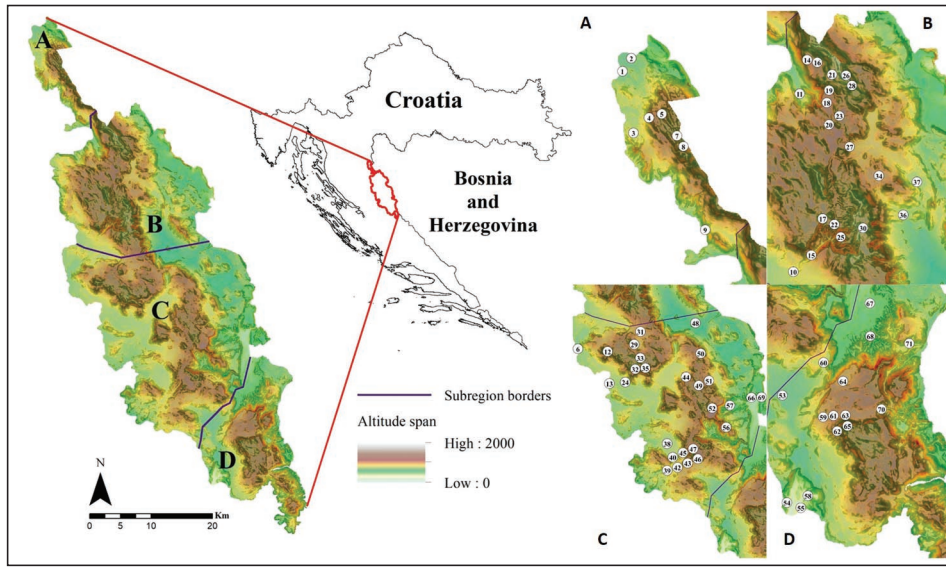


Figure. 1.– Map of sampling locations and delimitation of the surveyed area of Lička Plješevica range.

Results and discussion

In total, 142 species were recorded during our surveys of Mt. Lička Plješevica range, including 12 new for this region (*Heteropterus morpheus* (Pallas, 1771), *Colias caucasica* Staudinger, 1871, *Favonius quercus* (Linnaeus, 1758), *Leptotes pirithous* (Linnaeus, 1767), *Plebejus argyrognomon* (Bergsträsser, 1779), *Thecla betulae* (Linnaeus, 1758), *Araschnia levana* (Linnaeus, 1758), *Boloria selene* ([Denis & Schiffermüller], 1775), *Erebia aethiops* (Esper, 1777), *Melitaea britomartis* Assmann, 1847, *Melitaea ornata* Christoph, 1893, and *Minois dryas* (Scopoli, 1763). In the previous surveys in the southern part of the massif, in particularly Mt. Poštak and the source of Zrmanja River (KOREN *et al.,* 2015), three additional species not recorded during our survey were found: *Polyommatus escheri* (Hübner, [1823]), *Proterebia phegea (*Borkhausen, 1788), and *Melanargia larissa* (Geyer, [1828]). Additional species mentioned for Mt. Plješevica but not confirmed during recent surveys are *Euphydryas maturna* (Linnaeus, 1758) found in Una River canyon (TVRTKOVIĆ *et al.,* 2015), *Boloria titania* (Esper, 1793) recorded almost 100 years ago (STEINER, 1938) and *Nymphalis vaualbum* ([Denis & Schiffermüller], 1775) recorded by Hochetlinger in 1909 (FRANIĆ, 1910) and Lorković in

1923 (LORKOVIĆ, 2009). With these records, the butterfly fauna of Lička Plješevica range comprises 152 species. This positions the Lička Plješevica range as the second butterfly richest mountain chain in Croatia, just after Velebit Mts., for which a total of 153 species were recorded (TVRTKOVIĆ *et al.,* 2015).

The comparison of biogeographical affiliation between Mts. Lička Plješevica, Velebit and Dinara revealed a similar number of species per affiliation type (Table III). The most noticeable difference is in the smaller number of montane (MON) species on Lička Plješevica (5) in comparison with Velebit (10) and Dinara (7). This is likely a result of general lower altitude of Lička Plješivica and very small and isolated subalpine habitats limited to a few highest peaks in the range. Entire Lička Plješevica massif is also shorter than Velebit Mountain chain. Throughout its length, it stretches in the northwest-southeast direction - the position supporting microrefugia's and north south migrations of more northern continental species during climatic fluctuations.

Table III.– Differences in biogeographical affiliation of butterflies of Lička Plješevica, Velebit and Dinara. The abbreviations of biogeographic affiliations are as follows: ES - Euro-Siberian, EO - Euro-Oriental, Mon - Montane, Hol - Holarctic, EM - Euro-Meridional, BM - Boreo-Montane, MED - Mediterranean, TRO - Tropical, COS - Cosmopolitan.

	Lička Plješevica	**Velebit**	**Dinara**
BM	1	1	1
COS	1	1	1
EM	9	8	7
EO	45	44	42
ES	76	74	61
HOL	11	8	6
MED	3	3	2
MON	5	10	7
TRO	1	4	1

Among the species listed, several were recorded at 30 or more sites and could be considered common and widespread in the Lička Plješevica range: *Ochlodes sylvanus* (Esper, 1777), *Papilio machaon* Linnaeus, 1758*, Colias crocea* (Geoffroy, 1785), *Gonepteryx rhamni* (Linnaeus, 1758), *Aporia crataegi* (Linnaeus, 1758), *Polyommatus icarus* (Rottemburg, 1775), *Vanessa cardui* (Linnaeus, 1758), *Maniola jurtina* (Linnaeus, 1758), *Melanargia galathea* (Linnaeus, 1758), and *Coenonympha arcania* (Linnaeus, 1760).

On the other hand, several species were observed only at a single location and are possibly extremely rare in the region: *Heteropterus morpheus* (Pallas, 1771), *Colias caucasica* Staudinger, 1871, *Favonius quercus* (Linnaeus, 1758), *Iolana iolas* (Ochsenheimer, 1816), *Boloria selene* ([Denis & Schiffermüller], 1775), *Aphantopus hyperantus* (Linnaeus, 1758), *Hyponephele lycaon* (Kühn, 1774), *Hyponephele lupinus* (Costa, 1836), *Limenitis populi* (Linnaeus, 1758), *Melitaea ornata* Christoph, 1893, and *Neptis rivularis* (Scopoli, 1763).

According to the Red Data List of Croatian Butterflies (ŠAŠIĆ *et al.,* 2015), four of the recorded species are considered vulnerable (VU): *Phengaris alcon* f. *rebeli* (Hirschke, 1904), *Phengaris arion* (Linnaeus, 1758), *Polyommatus damon* ([Denis & Schiffermüller], 1775), and *Parnassius apollo* (Linnaeus, 1758). Additionally, 11 species among those observed are considered near threatened (NT): *Heteropterus morpheus* (Pallas, 1771), *Papilio machaon* Linnaeus, 1758*, Zerynthia polyxena* ([Denis & Schiffermüller], 1775), *Parnassius mnemosyne* (Linnaeus, 1758), *Glaucopsyche alexis* (Poda, 1761), *Polyommatus thersites* (Cantener, 1835), *Pseudophilotes vicrama* (Moore, 1865), *Scolitantides orion* (Pallas, 1771), *Apatura ilia* ([Denis & Schiffermüller], 1775), *A. iris* (Linnaeus, 1758), *Euphydryas*

maturna (Linnaeus, 1758), *Euphydras aurinia* (Rottemburg, 1775), and *Erebia medusa* ([Denis & Schiffermüller], 1775). Four species *Thymelicus action* (Rottemburg, 1775), *Pieris brassicae* (Linnaeus, 1758), *Melitaea aurelia* Nickerl, 1850, and *M. britomartis* Assmann, 1847 are considered as data deficient (DD).

The highest diversity with more than 50 species per locality was recorded in the southernmost part of the range near Zrmanja Vrelo (KOREN *et al.,* 2011: 86 species), in the Ozeblin Mt. - Kozja Draga (76 species), Mala Plješevica Mt.: Bijeli potoci, Poljane (68), Mt. Poštak: plateau at Kamenita glavica (66) and grasslands at Ljubina Poljana (56).

Faunistically all compared mountain ranges are similar in composition. For example, Mt. Dinara when compared to Lička Plješevica, has only four additional species, all limited to highest elevations: *Polyommatus eros* (Ochsenheimer, 1808), *Erebia euryale* (Esper, 1805), *Erebia ottomana* Herrich-Schäffer, 1847, and *Erebia triarius* (Prunner, 1798) (TVRTKOVIĆ *et al.,* 2012; KOREN & LAUŠ, 2013). The Velebit Mts. however, host 18 additional species so far not recorded on Mt. Lička Plješevica (MIHOCI *et al.,* 2007; TVRTKOVIĆ *et al.,* 2015). Among these, *Gegenes pumilio* (Hoffmansegg, 1804), *Cacyreus marshalli* Butler, 1898, *Lampides boeticus* (Linnaeus, 1767), *Tarucus balkanica* (Freyer, 1844), *Charaxes jasius* (Linnaeus, 1767), *Polygonia egea* (Cramer, 1775), and *Gonepteryx cleopatra* (Linnaeus, 1767) are Mediterranean species, mostly confined to the coastal areas at lower elevations and the foothills of Velbit Mts., and are not to be expected so far inland on Lička Plješevica. Velebit Mts. also harbour some high alpine species not present on Lička Plješevica: *Polyommatus eros* (Ochsenheimer, 1808), *Erebia epiphron* (Knoch, 1783), *Erebia euryale* (Esper, 1805), *Erebia gorge* (Hübner, [1804]), *Erebia ottomana* Herrich-Schäffer, 1847, *Erebia pronoe* (Esper, 1780), and *Erebia stiria* (Godart, 1824). Additionally, there are single records form Velebit Mts. of species that could eventually be found also on Lička Plješevica such as *Satyrium pruni* (Linnaeus, 1758), *Cupido alcetas* (Hoffmansegg, 1804), *Colias hyale* (Linnaeus, 1758), and *Neptis sappho* (Pallas, 1771).

During this survey, several interesting or unexpected species were recorded. For each of them additional information on their ocurrence and distribution in Croatia is discussed.

Pyrgus serratulae (Rambur, 1839)

This species was considered very local and rare in Croatia, with only several existing records from Velebit Mts. (LORKOVIĆ, 2009). However, in the recent surveys it was recorded on several new mountain ranges including Mt. Poštak (KOREN *et al.,* 2015a), Dinara Mts. (TVRTKOVIĆ *et al.,* 2012, Tvrtković pers. obs. from 550 to 1450 m a.s.l.), Biokovo Mts. (KAČÍREK, 2017) and Mt. Kozjak (KOREN *et al.,* 2019). We recorded it at seven localities: Frkašić - surroundings of pond Jezero, Kozja draga valley, Bijeli potoci - Poljane meadow, Međugorje - Magarčev do, Mt. Kremen, and Mt. Lisac. The species is not rare on Mt. Plješevica and in some localities it was even abundant. The main reasons for the lack of records in Croatia are the similarity with the other larger *Pyrgus* species and the absence of targeted surveys.

Pyrgus sidae (Esper, 1784)

One of the most local and rare species of the genus *Pyrgus* in Croatia was not even included in the overview of the butterflies of Croatia written by Zdravko Lorković in the 1950's (LORKOVIĆ, 2009), and neither was it represented in the collection of Croatian National Zoological Museum (today Croatian Natural History Museum) in Zagreb (MLADINOV, 1975). So far this species has been recorded from Josipdol, Gorski Kotar (MANN, 1867), Mt. Poštak (KOREN *et al.,* 2015), Mt. Dinara, from 250-780 m a.s.l. (TVRTKOVIĆ *et al.,* 2012; KOREN & LAUŠ, 2013) in NW Dalmatia (HABELER, 1976) and Mt. Biokovo at 650 and 700 m a.s.l. (MIHOCI *et al.,* 2011). While most of the records originate from montane areas, the records from Tisno and Vodice, near the sea level in Dalmatia (HABELER, 1976) show that it also inhabits lowland calcareous areas. Beside the above mentioned record for Mt. Poštak, we recorded this species at two new localities, between Ondić and Rudopolje Bruvanjsko and on Mt. Lisac. The species was recently recorded also from further localities in central and Southern Dalmatia (KOREN *et al.,* 2019).

Colias caucasica Staudinger, 1871

This species has been only recently added as a member of the fauna of Croatia, with several males collected and observed at Mt. Dinara but whithout finding of the larval host-plant (TVRTKOVIĆ *et al.*, 2011). The observation from Mt. Poštak represents the second sighting for this species in Croatia, and it is at a distance of about 30 km north-west from Mt. Dinara. Only a single fresh male was observed so far, despite repeated efforts to make additional observations in the main flight period for the species. The potential host plant of the genus *Chamaecytisus* sp. is abundant on the southern slopes of Mt. Poštak, indicating a possible residence of the species on the mountain. It is also possible that it will be recorded in other high alititude grassland areas of southern Lička Plješevica range in the future.

Pieris napi / balcana

With the chromosome examination of *Pieris napi* and *P. balcana,* LORKOVIĆ (1989) found their contact zone and noted hybridisation in Plitvice area in the foothills of the Velika Plješevica. We confirmed another contact zone in Mala Plješevica. From the collected specimens, several were barcoded (Lovrenčić, personal information). *Pieris napi* was recorded in Bijeli potoci: Poljana (specimen with typical *P. napi* wing markings), and *P. balcana* from Poštak Mt. (890 m a.s.l,), Glogovo (830 m a.s.l.), Brezovac Dobroselski: Klanci (950 m a.s.l.) and Kremen: Kremenščak (110 m a.s.l.). Typical *P. balcana* wing characters were found in collected specimens from Ponor Korenički, Bijeli Potoci, Lisac, Surle, Glogovo, Kremen, Brezovac Dobroselski, Zrmanja Vrelo and Poštak (W-slope and Ljubina Poljana). Published records for *P. napi* based only on observaions (KOREN *et al.,* 2011; KOREN *et al.,* 2015) in the southern part of the range require confirmation.

Eumedonia eumedon (Esper, 1780)

Most records of *E. eumedon* in Croatia originate from the mountains located along the coastline of Croatia, from Mt. Učka (WITHRINGTON, 1984; MLADINOV & LORKOVIĆ, 1985), to Gorski Kotar (MLADINOV & LORKOVIĆ, 1985; KOREN, 2012), and across Velebit Mts. (GRUND, 1916; MLADINOV, 1973; LORKOVIĆ, 2009). During our surveys it was recorded on Mala Plješevica (Bijeli potoci), Mt. Kremen, Mt. Lisac, Gornja Suvaja, and confirmed for Mt. Poštak. These records, along with a recent record from Markov grob, Dinara (Verovnik, pers. obs) represent the southernmost records in Croatia, and fill the distribution gap towards known range in the neighbouring Bosnia and Herzegovina (LELO, 2008).

Cupido osiris (Meigen, 1829)

This species is very locally distributed in Croatia (LORKOVIĆ, 2009), with only a few historical records. MANN (1869) reports it from Central Dalmatia, HABELER (1976) from Podgora at the foothills of Mt. Biokovo, HAFNER (1994) from surroundings of Knin and BURGERMEISTER (1964) from Ombla. Recently it was found on Dinara Mt. (TVRTKOVIĆ *et al.,* 2012; Verovnik pers. obs.) and Mt. Poštak (KOREN *et al.,* 2015). During this survey, we recorded it on two localities, Bijeli potoci (Mala Plješevica Mt.) and Zrmanja spring. Only individual specimens were observed on both localities. Despite its limited distribution and specific habitat requirements (VEROVNIK, 2011a) it is not listed in the Red book of butterflies of Croatia (ŠAŠIĆ *et al.,* 2015), therefore its status in Croatia should be rewised.

Phengaris arion (Linnaeus, 1758)

This is a rather localised but widely distributed species in montaneous parts of Croatia (ŠAŠIĆ *et al.,* 2015). It inhabits the continental area of Croatia, where it is very local and always connected to thermophilous slopes with larval host plants (*Thymmus* sp., *Origanum* sp.). It is more widespread in the mountainous areas of Gorski Kotar and Velebit Mts. In the surveyed area, we recorded it at 12 localities, with several observed specimens. Highest densities were noted on Mt. Lisac and Mt. Poštak, while in other localities only single specimens were observed.

Plebejus argyrognom / idas

The Reverdin's Blue is distributed in Croatia only in northern lowland part of the country (LORKOVIĆ, 2009), with the southernmost locality near Bosiljevo, in the northern foothills of the Mt. Velika Kapela. (Gorski Kotar) (MLADINOV, 1973). New records from the localities in Lička Plješevica range (Zrmanja source, Donja Suvaja near Srb, Kupirevo) are important because they represent isolated populations at the southern border of species distribution in Croatia. Two previusly published records of *P. argyrognomon* from Velebit Mts. and Dinara Mt. (MIHOCI *et al.,* 2007; TVRTKOVIĆ *et al.,* 2012), are possibly not valid. MIHOCI *et al.* (2007) repeated the quotation of KUČINIĆ *et al.* (1995) who erroneously listed the species after GRUND (1916). In Grund's time (see GRUND, 1913) *P. idas* was considered as a subspecies of *P. argyrognomon*. The findings from Velebit's localities are correctly interpreted by MLADINOV (1973) as *P. idas*. TVRTKOVIĆ *et al.* (2012) wrongly noted *P. argyrognomon* for Dinara Mt. based on barcoded female with identical barcode as several *P. argyrognomon* specimens from Europe (GenBank, accessed on 3-XII-2012). Later all collected males from the same locality on Dinara Mt. showed genitalia typical for *P. idas*. Specimens of *P. idas* from the area have very variable wing-markings, sometimes similar to those of *P. argyrognomon*.

Polyommatus thersites (Cantener, 1835)

As it is the case with many species in Croatia, our knowledge about the occurrence and distribution of the species has considerably improved in the past several years. Only a decade ago, less than ten localities were known for this species in Croatia (HABELER, 2003; MIHOCI & ŠAŠIĆ, 2006). It has been recently recorded also from Istria Peninsula (KOREN & LADAVAC, 2010), northern Dalmatia hinterland (VEROVNIK *et al*., 2015), in different localities in southern part of Lička Plješivica range (KOREN *et al.,* 2011; KOREN *et al.,* 2015), south-eastern Velebit Mts. (Javornik, leg. NT, July 2016), and Dinara Mt. (TVRTKOVIĆ *et al.,* 2012; KOREN & LAUŠ, 2013). During this survey it was recorded at four new localities: Udbina near Kurjak, Kozja draga valley, Mt Lisac Surle - Strmica, and Veliko Popinsko polje. Additionally, it was confirmed at Zrmanja vrelo and Mt. Poštak. It was usually found in open dry grasslands or road verges with abundance of its larval hostplant, *Onobrychis arenaria* (Kit.) DC and/or *O. vicifollia* Scop. The species was moderately abundant at most localities with suitable habitat. Additional efforts are needed in order to remove potential gaps in the knowledge of its distribution in Croatia.

Thecla betulae (Linnaeus, 1758)

The Brown Hairstreak is one of the last species of butterflies to emerge in late summer, and due to that and its secretive lifestyle it may be easily overlooked during the butterfly surveys. Adults are generally scarce and local, usually flying in the treetops of ash trees and rarely visiting flowers, like *Eupatorium cannabinum* L. In Croatia, this is a rather local species, distributed in the continental biogeographic region, while in the coastal region it is extremely local, so far recorded only from Plitvice spring, Drežnik and Ogulin (LORKOVIĆ, 2009). Recently it was for the first time recorded on Velebit Mts. in Paklenica Gorge (TVRTKOVIĆ *et al.*, 2015). Our records from Mt. Velika Plješevica and Ličko Petrovo selo represent important new records and fill a distribution gap towards the known range in Bosnia and Herzegovina (LELO, 2004).

Brenthis ino (Rottemburg, 1775)

The species was considered to be one of the rarest nymphalids in Croatia (MIHOCI & ŠAŠIĆ, 2005), however, it has been recorded in several new regions during the last years, although not from Mt. Poštak (KOREN *et al.,* 2015a) or Dinara Mt. (KOREN & LAUŠ, 2013). The closest records to the study area are from northern Velebit Mts., where it was recorded only a decade ago (MIHOCI *et al.*, 2007). Its distribution in Croatia includes northern Istria, and stretches across the montaneous parts of Croatia to the north as far as Hrvatsko Zagorje (KOREN *et al.,* 2017), and parts of Slavonia (KOREN & LETIĆ, 2014). During our survey, we recorded it at nine localities at Velika Plješevica (meadows

between Krgin vršak and Jukanova draga), Mala Plješevica (Bijeli potoci, Ruda Polja), Mt Kremen, Mt. Lisac and Mt. Poštak. (Tab. 1). It is possible that it will be recorded in other humid grassland areas in the region.

Limenitis populi (Linnaeus, 1758)

This species has very limited records in Croatia, and is mostly confined to the woodland areas of the north-western part of the country, with only a few scattered records from Gorski Kotar (Fužine) region (LORKOVIĆ, 2009). A single specimen was observed at the locality Bukovačka Draga at 1138 m a.s.l.. This is only the second record for Mt. Plješevica (FRANIČ, 1910), with the closest records originating from Velebit Mts. (BERRA, 1982; MIHOCI *et al.,* 2007). The species is listed as near threatened in Croatia (ŠAŠIĆ *et al.,* 2015), therefore further studies in suitable forest dominated areas are required to assess its distribution and endangerment.

Neptis rivularis (Scopoli, 1763)

In the view of the recent observations from Dinara Mts. (TVRTKOVIĆ *et al.,* 2012) and Mt. Kamešnica (KOREN & LAUŠ, 2013), the record from Lička Plješevica fills the distribution gap of this species in Croatia, and indicates it has a wider distribution in the region. Several individuals were observed gliding near the forest edge at the locality Kozja Draga. The species was recently observed also in other lower parts of the Lika region outside studied area (personal observations of the authors).

Melitaea britomartis Assmann, 1847

The distribution of this species in Croatia has been poorly known until recently (KOREN & JUGOVIC, 2012). In general, this species is distributed in north-western part of Croatia, with a single record from the Lika region, and one from the Mt. Troglav in Bosnia and Herzegovina (KOREN & JUGOVIC, 2012). During this survey, it was recorded on Mt. Plješevica at the locality Bijeli Potoci. This is the second record of this species for Lika region. It indicates that further records of this species may be expected, so sampling of small *Melitaea* in the region is mandatory.

Araschnia levana (Linnaeus, 1758)

According to Lorković manuscript from 1954 (LORKOVIĆ, 2009) this species is widespread in most of the northern continental part of Croatia, especially near rivers. This species is notably absent from Istria, and across most of the Adriatic coastline. The only notable exceptions are the records from Split (STAUDER, 1922), Mljet Island (KUČINIĆ *et al.,* 2011) and Vis Island (WITHRINGTON & VEROVNIK, 2008), but these findings were not confirmed by recent surveys (TVRTKOVIĆ *et al.,* 2010; TVRTKOVIĆ *et al.,* 2015; KOREN *et al.,* 2015). During our surveys, we recorded the species at four localities in the Lička Plješivica range at Prijeboj, meadows between Krgin vršak and Jukanova draga, Bijeli potoci at Poljane, and along forest track E of Zalužje village near Donja Suvaja. These are the first records of this species for the Lika region.

Conclusions

During the last decade, a significant increase in the number of publications dealing with the butterfly fauna of previously understudied areas of Croatia is evident. This includes the studies of the butterfly diversity of the Adriatic islands (WITHRINGTON & VEROVNIK, 2008; KOREN *et al.,* 2014; KUČINIĆ *et al.*, 2011; VEROVNIK, 2011b), coastal areas of Dalmatia (KUČINIĆ *et al.,* 2015; VEROVNIK *et al.,* 2015) as well as the montaneous areas in southern Croatia (MIHOCI *et al.,* 2011; KOREN & LAUŠ, 2013; KOREN *et al.,* 2015; KOREN *et al.,* 2019). Still, many areas remain poorly surveyed, and their fauna almost completely unknown. One of such areas was Lička Plješevica range which has proved to host one of the most diverse butterfly faunas in Croatia.

Such high species diversity could be explained by high habitat heterogenity, especially with pastures and grasslands in different stages of abandonment. For many centuries, herdsmen from the

Lika and Velebit Mts. region led their livestock to summer pastures at higher elevations throughout most of the Lička Plješevica range (HORVAT, 1925; MARKOVIĆ, 2003). These practices are nowadays almost completely abandoned, and almost no pasturing was observed in the region during our visits. The only exception is Mt. Lisac, where small number of cows and sheep were observed grazing at lower altitudes. Although mowing is still practiced in the region, it is only evident near the settlements where people still persist. One of the highest species diversity was observed at Kozja Draga where some of the grasslands are still mowed. Such open-grassland localities are in danger of disappearing in the near future as grazing and mowing in the region of Lička Plješevica are almost entirely abandoned. Even within the span of our surveys in the last decade the succession is already visible, with small patches of previously open meadows becoming almost entirely covered with bushes. While it is difficult, or almost impossible to return the farming practices common only few decades ago, given the current demographic trends in the region, it is important to survey all remaining butterfly suitable areas in the region and maintain at least some sort of management in the areas with high diversity or presence of threatened butterfly species.

Acknowledgments

We are grateful to Mladen Zadravec (MZ), Leona Lovrenačić (LL), Marijana Vuković (MV) and Ivona Burić for the help during the field trips.

BIBLIOGRAPHY

ANONYMUS, 1978.– *Geological maps SFRJ* (maps Zagreb and Sarajevo) 1:500000. Federal Geological Institute, Belgrade (Lička Plješevica part was compiled from maps 1:100000 of Institute of Geology, Zagreb: (Bihać) Polšak *et al.,* 1967, (Udbina) Šušnjar *et al.,* 1966, (Drvar) Šušnjar *et al.,* 1969 and (Obrovac) Ivanović *et al.,* 1976).

BERRA, M., 1982.– Velebit. I spedizione del Giornale italiano di Entomologia.– *Giornale italiani di Entomologia*, **1**: 43-47.

BOGNAR, A., PAVIĆ, R., RIĐANOVIĆ, J., ROGIĆ, V. & ŠEGOTA, T., 1975.– *Gorska Hrvatska, Geografija SR Hrvatske*: 195 pp. Školska knjiga, Zagreb.

BURGERMEISTER, F., 1964.– Makrolepidopteren aus dem Raume Dubrovnik (Süddalmatien, FVR Jugoslavien).– *Zeitschrift der Wiener Entomologischen Gesellschaft,* **49**: 137-52.

FRANIĆ, D., 1910.– *Biološke prilike Plitvičkih Jezera i okolice, in: Plitvička jezera i njihova okolica*: 246-253. Zagreb.

GRUND, A., 1913.– Ueber neue und bekannte Lepidopteren-Formen der kroatisch-slavonischen Fauna.– *Internationale Entomologische Zeitschrift*, **7**: 127-128.

GRUND, A., 1916.– Beiträge zur kroatischen Lepidopteren-Fauna.– *Glasnik Hrvatskog prirodoslovnog društva*, **28**: 95-105, 114-168.

HABELER, H., 1976.– Beiträge zur Lepidopterenfauna Dalmatiens.– *Acta Entomologica Jugoslavica*, **12**(1-2): 67-87.

HABELER, H., 2003.– *Die Schmetterlinge der Adria-Insel Krk. Eine ökofaunistische Studie. Delta Druck*: 221 pp. Verlag Heinz Peks, Graz.

HAFNER, I., 1994.– Verzeichnis der bei Knin gesammelten Schmetterlinge (Lepidoptera).– *Natura Croatica,* **3**(2): 119-84.

HORVAT, I., 1925.– Über die Vegetation des Plješevica-Gebirges in der Lika.– *Geografski vestnik*, **1**: 113-123.

KAČÍREK, A., 2017.– Contribution to the knowledge of the butterfly fauna (Lepidoptera: Papilionoidea, Hesperioidea) of the Biokovo and Rilić mountain ranges (Croatia, Central Dalmatia).– *Klapalekiana*, **53**, 27-50.

KOČA, Gj., 1901.– Prilog fauni leptira (Lepidoptera) Hrvatske i Slavonije.– *Glasnik rvatskoga Naravoslovnoga Društva*, **13**: 1-67.

KOREN, T., 2010.– First finding of Ripart's Anomalous Blue *Polyommatus (Agrodiaetus) ripartii* (Freyer, 1830) (Lepidoptera, Lycaenidae) in Croatia.– *Natura Croatica*, **19**: 463-467.

KOREN, T., 2012.– New records of three species of the genus *Aricia* Reichenbach, 1817 (Lepidoptera, Lycaenidae) in Croatia.– *Acta Entomologica Slovenica*, **20**(2): 135-146.

KOREN, T., BJELIĆ, M., BOŽINOVSKA, E., ŠTIH, A. & BURIĆ, I., 2011.– Contribution to the knowledge of butterly fauna (Lepidoptera: Rhopalocra) of Zrmanja river region, Croatia.– *Acta Entomologica Slovenica*, **19**(2): 155-168.

KOREN, T., BURIĆ, I., ŠTIH, A., ZAKŠEK, V. & VEROVNIK, R., 2010.– New data about the distribution and altitudinal span of the dalmatian ringlet, *Proterebia afra dalmata* (Godart, [1824]) (Lepidoptera: Satyrinae) in Croatia.– *Acta Entomologica Slovenica*, **18**: 143-150.

KOREN, T., BJELIĆ, M., ŠKULJEVIĆ, P. & GOMBOC, S., 2014.– Contribution to the knowledge of the butterfly fauna (Insecta: Lepidoptera) of the Adriatic island Hvar, Croatia.– *Acta Entomologica Slovenica,* **22**: 29-44.

KOREN, T., ČRNE, M., PAVLIHA, G. & TRKOV, D., 2015.– Mountain Poštak, a new hotspot for the Lepidoptera of Croatia (Lepidoptera: Rhopalocera).– *SHILAP Revista de lepidopterología*, **43**: 145-155.

KOREN, T. & JUGOVIC, J., 2012.– New data on the presence of three similar species of the genus *Melitaea*: *M. athalia*, *M. aurelia* and *M. britomartis* (Lepidoptera: Nymphalidae) in the North-Western Balkans.– *Annales Series Historia Naturalis*, **22**: 25-34.

KOREN, T. & ŠTIH, A., 2012.– On the occurrence of Eastern knapweed fritillary, *Melitaea ornata* (Lepidoptera: Nymphalidae) in Croatia.– *Phegea*, **41**(3): 63-66.

KOREN, T. & LADAVAC, L., 2010.– Butterfly fauna (Lepidoptera: Hesperioidea & Papilionoidea) of Central Istria (Croatia).– *Natura Croatica*, **19**: 369-380.

KOREN, T. & LAUŠ, B., 2015.– The Grecian anomalous blue *Polyommatus* (*Agrodiaetus*) *aroaniensis* (Brown, 1976) (Lepidoptera: Lycaneidae) discovered in Croatia, at the north-western edge of its distribution.– *Natura Sloveniae*, **17**: 47-57.

KOREN, T. & LAUŠ, B., 2013.– Dinara Massif-a new hotspot for the butterfly (Papilionoidea) diversity of the Dinaric Arc.– *Nota lepidopterologica*, **36**: 109-126.

KOREN, T., LAUŠ, B., ŠAŠIĆ, M., MIHOCI, I., ŠTIH, A., BRALIĆ, P. & GOMBOC, S., 2017.– Contribution to the knowledge of the butterfly fauna (Lepidoptera: Papilionoidea) of Hrvatsko zagorje, Croatia.– *Natura Croatica*, **26**: 167-196.

KOREN, T. & LETIĆ, G., 2014.– Butterfly fauna (Lepidoptera: Rhopalocera) of Donji Emovci, Požega, Croatia.– *Natura Sloveniae*, **16**: 5-16.

KUČINIĆ, M., IGALFFY, K., ŠAŠIĆ, M. & BALEN, S., 1995.– Istraženost faune leptira (Insecta, Lepidoptera) Gorskog kotara s posebnim osvrtom na šire područje NP "Risnjak".– *Zbornik Radova "40 Godina Nacionalnog Parka Risnjak*: 91-99.

KUČINIĆ, M., MIHOCI, I., TVRTKOVIĆ, N., ŠAŠIĆ, M., BOJANIĆ-VAREZIĆ, D., JOKOVIĆ, S., MAZIJA, M. & POPIJAČ, A., 2011.– Raznolikost danjih leptira (Insecta: Lepidoptera, Rhopalocera) otoka Mljeta, in: Proceedings of the Symposium Branimir Gušić Days - Mljet 2010. Presented at the Branimir Gušić Days - Mljet 2010.– *Hrvatsko ekološko društvo*: 111-125.

KUČINIĆ, M., MIHOCI, I., DELIĆ, A. & MARGUŠ, D., 2015.– Faunističke i biogeografske značajke danjih leptira (Insecta: Lepidoptera) Nacionalnog parka "Krka".– *Zbornik radova sa znanstveno-stručnog skupa Vizija i izazovi upravljanja zaštićenim područjima prirode u Hrvatskoj : Aktivna zaštita i održivo upravljanje u Nacionalnom parku "Krka"*: 269-292.

KUDRNA, O., PENNERSTORFER, J. & LUX, K., 2015.– *Distribution Atlas of European Butterflies and Skippers*: 632 pp. Peks, Schwanfeld.

LAFRANCHIS, T., 2004.– *Butterflies of Europe. New field guide and key*: 351 pp. Diatheo, Paris.

LELO, S., 2004.– *Revizija Rebelovog popisa leptira Bosne i Hercegovine*: 295 pp. CORON'S d.o.o., Sarajevo.

LELO, S., 2008.– *Dnevni leptiri Bosne i Hercegovine (Lepidoptera: Papilionoidea i Hesperioidea): Ključ za determinaciju vrsta sa osnovnim monografskim podacima*: 333 pp. Prirodno-matematički fakultet Univerziteta u Sarajevu, Sarajevo.

LORKOVIĆ, Z., 1970.– Karyologischer Beitrag zur Frage der Fortpflanzungverhaltnisse Südeuropäischer Taxone vod *Pieris napi* (L.) (Lep., Pieridae).– *Biološki Glasnik*, **21**(1968): 95-136.

LORKOVIĆ, Z., 1974.– Die verteilung der variabilität von *Hipparchia statilinus* Hufn. (Lepid., Satyridae) in beziehung zum Karstboden des ostadriatischen Küstenlandes.– *Acta Entomologica Jugoslavica*, **10**: 41-53.

LORKOVIĆ, Z., 1989.– Der Karyotypus und die reproduktiven Bezeihungen des Taxon *balcana* Lorković 1968. zu *Pieris napi* Linnaeus, 1758 und *P. pseudorapae* Verity, 1908 (Lepidoptera, Pieridae).– *Glasnik Zemaljskog muzeja Bosne i Hercegovine*, **28**: 155-175.

LORKOVIĆ, Z., 2009.– The Rhopalocera Fauna of Croatia with Special Respect to the Fauna of Plitvice Lakes.– *Entomologica Croatica*, **13**: 15-78.

LOVRENČIĆ, L., PODNAR, M., ŠAŠIĆ, M., KOREN, T. & TVRTKOVIĆ, N., 2016.– Molecular data do not

confirm the Grecian anomalous blue *Polyommatus (Agrodiaetus) aroaniensis* (Brown, 1976) as a member of the Croatian fauna.– *Natura Croatica*, **25**: 119-129. https://doi.org/10.20302/NC.2016.25.8.

MANN, J., 1867.– Schmetterlinge gesammelt im J. 1866 um Josefsthal in der croat. Militärgrenze.– *Verhandlungen der zoologisch-botanischen Gesellschaft in Wien*, **17**: 63-76.

MANN, J., 1869.– Lepidopteren gesammelt während dreier Reisen nach Dalmatien in den Jahren 1850, 1862 und 1868.– *Verhandlunden der zoologisch-botanischen Gesellschaft in Wien*, **19**: 371-388.

MARKOVIĆ, M., 2003.– *Stočarska kretanja na Dinarskim planinama*: 202 pp. Jesenski i Turk, Zagreb.

MIHOCI, I. & ŠAŠIĆ, M., 2005.– New finding of the butterfly *Brenthis ino* (Rottemburg, 1775) (Lepidoptera: Nymphalidae) in Croatia.– *Entomologica Croatica*, **9**: 77-83.

MIHOCI, I. & ŠAŠIĆ, M., 2006.– New data on the distribution of the Chapman's Blue *Polyommatus thersites* (Cantener, 1835) (Lepidoptera: Lycaenidae) in Croatia.– *Entomologia Croatica*, **10**: 7-14.

MIHOCI, I., ŠAŠIĆ, M. & VUKOVIĆ, M., 2007.– Contribution to the butterfly fauna (Hesperoidea & Papilionoidea) of the Velebit mountain, Croatia.– *Natura Croatica*, **16**: 29-62.

MIHOCI, I., HRŠAK, V., KUČINIĆ, M., MIČETIĆ STANKOVIĆ, V., DELIĆ, A. & TVRTKOVIĆ, N., 2011.– Butterfly diversity and biogeography on the Croatian karst mountain Biokovo: Vertical distribution and preference for altitude and aspect?- *European Journal of Entomology,* **108**: 623-633.

MLADINOV, L., 1973.– *Lepidoptera (Rhopalocera) zbirki Hrvatskog narodnog zoološkog muzeja u Zagrebu*: 125 pp. Hrvatski narodni zoološki muzej, Zagreb.

MLADINOV, L., 1975.– *Lepidoptera - Hesperiidae (Rhopalocera) u zbirci Hrv. Zoološkog muzeja u Zagrebu*: 14 pp. Hrvatski narodni zoološki muzej, Zagreb.

MLADINOV, L. & LORKOVIĆ, Z., 1979.– Usporedba dolinske *Erebia oeme* Hbn. ssp. nov. iz SZ Jugoslavije s planinskim populacijama (Lepidoptera, Satyridae).– *Acta entomologica Jugoslavica,* **15**: 35-55.

MLADINOV, L. & LORKOVIĆ, Z., 1985.– Rasprostranjenje montanih Macrolepidoptera u fauni SR Hrvatske, Jugoslavija.– *Acta entomologica Jugoslavica*, **21**: 17-36.

MOUCHA, J., 1966.– Zur Kenntnis der Schmetterlingsfauna Jugoslawiens (Lepidoptera).– *Entomologische Nachrichten*, **10**: 49-53.

POLJAK, Ž., 1974.– *Planine Hrvatske, planinarsko - turistički vodić*: 544 pp. Planinarski savez Hrvatske, Zagreb.

POLJAK, Ž., 1998.– *Hrvatske planine: planinarsko-turistički vodić s atlasom od 40 stranica, 260 slika u tekstu i 40 slika u boji na prilogu*: 540 pp. Golden marketing, Zagreb.

REBEL, H., 1895.– Verzeichnis der von Dr. R. Sturany im Jahre 1895 in Croatien gesammelten Lepidopteren.– *Verhandlunden der zoologisch-botanischen Gesellschaft in Wien*, **45**: 390-392.

SIJARIĆ, R., 1991.– Katalog naučne zbirke Lepidoptera (Insecta) donatora Bore Mihljevića iz Sarajeva.– *Glasnik Zemaljskog muzeja Bosne i Hercegovine u Sarajevu*, **30**: 169-360.

STEINER, S., 1938.– Der heutige Stand der Rhopalocera - und Hesperiidae-Arten für die Lepidopterenfauna Kroatiens.– *International Entomologische Zeitschrifft,* **42**: 373-375.

STAUDER, H., 1922.– Die Schmetterlingsfauna der illyro-adriatischen Festland- und Inselzone (Faunula Illyro-Adriatica).– *Zeitschrift für wissenschaftliche Insektenbiologie Berlin*, **17**: 14-21, 58-64, 83-92, 35-147, 156-176.

ŠAŠIĆ, M., MIHOCI, I. & KUČINIĆ, M., 2015.– *Crvena knjiga danjih leptira Hrvatske*: 180 pp. Ministarstvo zaštite okoliša i prirode, Državni zavod za zaštitu prirode, Hrvatski prirodoslovni muzej, Zagreb.

ŠUGAR, I. & PLAZIBAT, M., 1988.– Vegetation of Gornje Pounje - Phytogeographical position and division. Zbornik referata naučnog skupa "Mineralis, stijene, izumrli i živi svijet BiH", Sarajevo, 7-810.1988.– *Zemaljski muzej Bosne i Hercegovine, Sarajevo*: 387-397.

TOLMAN, T. & LEWINGTON, R., 2008.– *Butterflies of Britain & Europe*: 384 pp. Harper Collins Publishers, London.

TRINAJSTIĆ, I. & ŠUGAR, I., 1968.– Sur la zonation biogeographique de la région de Gorski Kotar et de Lika.– *Geografski glasnik*, **30**: 40-59.

TVRTKOVIĆ, N., MIHOCI, I. & ŠAŠIĆ, M., 2011.– *Colias caucasica balcanica* Rebel, 1901 (Pieridae) in Croatia - the most western distribution point.– *Natura Croatica*, **20**: 375-385.

TVRTKOVIĆ, N., ŠAŠIĆ, M., MIHOCI, I., VUKOVIĆ, M. & BJELIĆ, M., 2012.– Review of the Butterfly fauna (Hesperioidea & Papilionoidea) of the Dinara mountain range.– *Natura Croatica*, **21**(2): 471-481.

TVRTKOVIĆ, N., VEROVNIK, R., LOVRENČIĆ, L., VUKOVIĆ, M. & ŠAŠIĆ, M., 2015.– New contributions to the butterfly fauna of Mt Velebit and the neighbouring area of Lika (Croatia).– *Natura Croatica,* **24**(2): 281-292.

VEROVNIK, R., 2011a.– *Cupido osiris* (Lepidoptera, Rhopalocera): an overlooked species of the Slovenian butterfly fauna.– *Natura Sloveniae*, **13**(2): 45-49.

VEROVNIK, R., 2011b.– Butterflies (Lepidoptera: Rhopalocera) of the Croatian islands: an update on published records and new surveys of Pašman and Ugljan.– *Entomologist's Gazette*, **62**: 251-263.

VEROVNIK, R., KOREN, T. & GLAVAN, G., 2015.– Contribution to the knowledge of the butterfly and skipper fauna of northern Dalmatia mainland.– *Natura Croatica*, **24**: 265-280.

WIEMERS, M., BALLETTO, E., DINCĂ, V., FRIC, Z. F., LAMAS, G., LUKHTANOV, V., MUNGUIRA, M. L., VAN SWAAY, C. A. M, VILA, R., VLIEGENTHART, A., WAHLBERG, N. & VEROVNIK, R., 2018.– An updated checklist of the European Butterflies (Lepidoptera: Papilionoidea).– *Zookeys*, **811**: 9-45.

WITHRINGTON, D., 1984.– Butterflies in Nothern Yugoslavia.– *The Bulletin of the Amateur Entomologists' Society*, **43**: 32-38, 76-81.

WITHRINGTON, D. & VEROVNIK, R., 2008.– Butterflies (Rhopalocera) of the Croatian islands.– *Entomologist's Gazette*, **59**: 3-25.

T. K., B. L.
Association Hyla
Lipovac 7
HR-10000 Zagreb
CROACIA / *CROATIA*
E-mail: koren.toni1@gmail.com
https://orcid.org/0000-0002-4776-6287

N. T.
Association Natura
Alagovićeva, 21
HR-10000 Zagreb
CROACIA / *CROATIA*
E-mail: nikolatvrtkovic71@gmail.com
https://orcid.org/0000-0002-1775-0292

E-mail: boris.laus@hhdhyla.hr
https://orcid.org/0000-0003-0880-0558

*R. V.
Biotechnical Faculty
Department of Biology
University of Ljubljana
Jamnikarjeva, 101
SI-1000 Ljubljana
ESLOVENIA / *SLOVENIA*
E-mail: Rudi.Verovnik@bf.uni-lj.si
https://orcid.org/0000-0002-5841-5925

*Autor para la correspondencia / *Corresponding author*

(Recibido para publicación / *Received for publication* 28-XI-2019)
(Revisado y aceptado / *Revised and accepted* 29-XII-2019)
(Publicado / *Published* 30-VI-2020)

Table I.– Cheklist of species recorded so far on Lička Plješevica with current distribution records and data from the literature. Locality numbers correspond to those in Materials and methods section and figure 1.

List of species		Locality number	References
	Hesperiidae		
1.	*Hesperia comma* (Linnaeus, 1758)	6, 15, 43, 58	LORKOVIĆ (2009), KOREN *et al. (*2011), KOREN *et al. (*2015)
2.	*Ochlodes sylvanus* (Esper, 1777)	3, 5, 8, 9, 11, 13, 14, 15, 16, 19, 21, 23, 26, 27, 28, 31, 33, 38, 40, 41, 43, 45, 47, 56, 57, 58, 59, 61, 62, 65, 67, 69	LORKOVIĆ (2009), KOREN *et al. (*2011), KOREN *et al. (*2015)
3.	*Thymelicus acteon* (Rottemburg, 1775)	58, 59	KOREN *et al. (*2011), KOREN *et al. (*2015)
4.	*Thymelicus lineola* (Ochsenheimer, 1808)	2, 6, 11, 15, 19, 26, 31, 33, 40, 42, 43, 45, 59, 61, 62, 65, 69	KOREN *et al. (*2011), KOREN *et al. (*2015)
5.	*Thymelicus sylvestris* (Poda, 1761)	2, 8, 11, 15, 19, 31, 33, 36, 40, 42, 43, 45, 59, 61, 65	KOREN *et al. (*2011), KOREN *et al. (*2015)
6.	*Carterocephalus palaemon* (Pallas, 1771)	15, 28, 31	TVRTKOVIĆ *et al. (*2015)
7.	*Heteropterus morpheus* (Pallas, 1771)	37	
8.	*Carcharodus alceae* (Esper, 1780)	54, 58	KOREN *et al. (*2011), KOREN *et al. (*2015)
9.	*Carcharodus floccifera* (Zeller, 1847)	40, 42	KOREN *et al. (*2011)
10.	*Carcharodus lavatherae* (Esper, 1783)	59, 68, 69	KOREN *et al. (*2011)
11.	*Erynnis tages* (Linnaeus, 1758)	3, 5, 10, 15, 19, 31, 32, 38, 39, 40, 41, 42, 45, 47, 48, 54, 55, 58, 59, 60, 61	KOREN *et al. (*2011), KOREN *et al. (*2015)
12.	*Pyrgus alveus* (Hübner, [1803])	19, 31, 61	KOREN *et al. (*2015)
13.	*Pyrgus armoricanus* (Oberthür, 1910)	15, 58, 69	KOREN *et al. (*2011), KOREN *et al. (*2015)
14.	*Pyrgus carthami* (Hübner, [1813])	15, 19, 31, 33, 61	LORKOVIĆ (2009), KOREN *et al. (*2015)
15.	*Pyrgus malvae* (Linnaeus, 1758)	5, 10, 15, 31, 39, 60, 61	LORKOVIĆ (2009), KOREN *et al. (*2011), KOREN *et al. (*2015)
16.	*Pyrgus serratulae* (Rambur, 1839)	11, 15, 19, 31, 33, 43, 47	KOREN *et al. (*2015)
17.	*Pyrgus sidae* (Esper, 1784)	13, 43	KOREN *et al. (*2015)
18.	*Spialia orbifer* (Hübner, [1823])	15, 31, 42, 52, 54, 58, 59, 62, 64	KOREN *et al. (*2015)
19.	*Spialia sertorius* (Hoffmansegg, 1804)		FRANIĆ (1910)
	Papilionidae		
20.	*Iphiclides podalirius* (Linnaeus, 1758)	1, 3, 8, 10, 15, 38, 39, 46, 47, 54, 55, 58, 59, 61, 63, 64, 65, 70	FRANIĆ (1910), KOREN *et al. (*2011), KOREN *et al. (*2015)
21.	*Papilio machaon* Linnaeus, 1758	1, 8, 15, 19, 21, 26, 27, 28, 33, 34, 38, 40, 43, 45, 46, 47, 54, 58, 61, 62, 63, 65, 66	FRANIĆ (1910), KOREN *et al. (*2011), KOREN *et al. (*2015)
22.	*Zerynthia polyxena* ([Denis & Schiffermüller], 1775)	15, 31, 34	KOREN *et al. (*2011)
23.	*Parnassius apollo* (Linnaeus, 1758)	5, 8, 12, 14, 16, 23, 59, 61, 65	LORKOVIĆ (2009), MLADINOV (1973), MLADINOV& LORKOVIĆ (1985), KOREN *et al. (*2015)

24.	*Parnassius mnemosyne* (Linnaeus, 1758)	5, 16, 21, 26, 28, 33, 56, 61, 63	FRANIĆ (1910), KOREN *et al.* (2011), KOREN *et al.* (2015)
	Pieridae		
25.	*Colias alfacariensis* Ribbe, 1905	6, 9, 15, 19, 31, 36, 39, 40, 41, 43, 45, 47, 48, 54, 55, 60, 61	KOREN *et al.* (2011)
26.	*Colias caucasica* Staudinger, 1871	62	
27.	*Colias crocea* (Geoffroy, 1785)	1, 5, 6, 8, 9, 10, 15, 16, 19, 24, 28, 31, 36, 38, 40, 41, 43, 45, 46, 47, 48, 53, 54, 55, 56, 57, 58, 59, 61, 63, 67, 69	KOREN *et al.* (2011), KOREN *et al.* (2015)
28.	*Gonepteryx rhamni* (Linnaeus, 1758)	1, 3, 5, 8, 10, 15, 16, 19, 23, 27, 31, 32, 33, 34, 35, 39, 42, 43, 45, 46, 47, 52, 55, 56, 57, 58, 59, 61, 62, 63, 65, 67, 68, 71	KOREN *et al.* (2011), KOREN *et al.* (2015)
29.	*Leptidea* cf. *sinapis* (Linnaeus, 1758)	2, 5, 10, 15, 19, 26, 28, 31, 39, 42, 45, 47, 54, 55, 58, 59, 60, 61, 62, 63, 65, 66, 69, 70	LORKOVIĆ (2009), SIJARIĆ (1964, 1991) KOREN *et al.* (2011), KOREN *et al.* (2015)
30.	*Anthocharis cardamines* (Linnaeus, 1758)	5, 10, 15, 19, 39	LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)
31.	*Aporia crataegi* (Linnaeus, 1758)	2, 11, 13, 19, 26, 28, 31, 32, 33, 34, 35, 36, 38, 40, 42, 43, 45, 46, 47, 52, 56, 57, 59, 60, 61, 62, 63, 65, 66, 67, 68, 69, 71	FRANIĆ (1910), KOREN *et al.* (2011), KOREN *et al.* (2015)
32.	*Pieris balcana* Lorkovič, 1969	19, 21, 26, 28, 31, 33, 39, 43, 45, 51, 54, 58, 59, 61	LORKOVIĆ (1989), KOREN *et al.* (2015)
	Pieris napi - balcana complex	2, 4, 6, 7, 12, 15, 22, 30, 31, 43, 47, 48, 50, 51, 66, 67, 69	LORKOVIĆ (1989), KOREN *et al.* (2011), KOREN *et al.* (2015)
33.	*Pieris napi* (Linnaeus, 1758)	11	FRANIĆ (1910), LORKOVIĆ (2009)
34.	*Pieris brassicae* (Linnaeus, 1758)	1, 5, 7, 15, 16, 19, 21, 26, 27, 28, 42, 54, 56, 58, 59, 60, 61, 63, 65, 67	LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)
35.	*Pieris ergane* (Geyer, [1828])	15, 21, 26, 28, 31, 33, 42, 47, 54, 58, 59, 60, 65, 68, 69	LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)
36.	*Pieris mannii* (Mayer, 1851)	15, 16, 19, 21, 26, 27, 28, 31, 43, 56, 58, 59, 61, 63, 64, 65	LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)
37.	*Pieris rapae* (Linnaeus, 1758)	9, 15, 19, 21, 26, 28, 31, 32, 45, 54, 56, 58, 59, 61, 63, 65, 66, 69, 70	FRANIĆ (1910), KOREN *et al.* (2011), KOREN *et al.* (2015)
38.	*Pontia edusa* (Fabricius, 1777)	61	KOREN *et al.* (2015)
39.	*Euchloe ausonia* (Hübner, [1804])		KOREN *et al.* (2011)

	Riodinidae		
40.	*Hamearis lucina* (Linnaeus, 1758)	19, 56	KOREN *et al. (*2015)
	Lycaenidae		
41.	*Lycaena alciphron* (Rottemburg, 1775)	32, 40, 43, 47, 56, 59, 61, 65	KOČA (1901), FRANIĆ (1910), MLADINOV (1973), KOREN *et al. (*2015)
42.	*Lycaena candens* (Herrich-Schäffer, 1844)	16, 19, 28, 32, 61	LORKOVIĆ (2009), KOREN *et al. (*2015)
43.	*Lycaena phlaeas* (Linnaeus, 1760)	15, 54, 55, 58, 59, 60, 61, 65	KOREN *et al. (*2011), KOREN *et al. (*2015)
44.	*Lycaena thersamon* (Esper, 1784)		KOREN *et al. (*2011)
45.	*Lycaena tityrus* (Poda, 1761)	1, 6, 15, 40, 47, 57, 61, 63	KOREN *et al. (*2015)
46.	*Lycaena virgaureae* (Linnaeus, 1758)	1, 3, 15, 16, 19, 23, 27, 29, 40, 41, 42, 46, 47, 59, 61, 65	FRANIĆ (1910), LORKOVIĆ (2009), KOREN *et al. (*2015)
47.	*Aricia agestis* ([Denis & Schiffermüller], 1775)	1, 3, 6, 8, 9, 13, 14, 15, 16, 19, 24, 27, 31, 38, 41, 46, 47, 48, 52, 54, 55, 56, 57, 58, 59, 61, 63, 65, 70	KOREN *et al. (*2011), KOREN *et al. (*2015)
48.	*Aricia anteros* (Freyer, 1838)	8, 59, 62	KOREN (2012), KOREN *et al. (*2015)
49.	*Aricia artaxerxes* (Fabricius, 1793)	11, 15, 19, 31, 40, 42, 45, 59, 61	KOREN (2012), KOREN *et al. (*2015)
50.	*Eumedonia eumedon* (Esper, 1780)	19, 33, 40, 47, 52, 62	KOREN *et al. (*2015)
51.	*Celastrina argiolus* (Linnaeus, 1758)	1, 15, 16, 19, 21, 26, 27, 41, 54, 58, 59, 61, 69	FRANIĆ (1910), KOREN *et al. (*2011), KOREN *et al. (*2015)
52.	*Cupido minimus* (Fuessly, 1775)	8, 10, 11, 15, 16, 19, 21, 26, 27, 28, 31, 33, 39, 40, 42, 45, 55, 58, 59, 61, 62, 65	REBEL (1895), LORKOVIĆ (2009), KOREN *et al. (*2011), KOREN *et al. (*2015)
53.	*Cupido osiris* (Meigen, 1829)	19, 58	KOREN *et al. (*2015)
54.	*Cupido argiades* (Pallas, 1771)	54, 58	KOREN *et al. (*2011)
55.	*Cyaniris semiargus* (Rottemburg, 1775)	13, 15, 16, 19, 21, 26, 28, 31, 40, 42, 43, 45, 46, 56, 57, 59, 60, 61, 62, 65	KOREN *et al. (*2011)
56.	*Glaucopsyche alexis* (Poda, 1761)	10, 15, 19, 39, 60	KOREN *et al. (*2011), KOREN *et al. (*2015)
57.	*Iolana iolas* (Ochsenheimer, 1816)	58	KOREN *et al. (*2011)
58.	*Leptotes pirithous* (Linnaeus, 1767)	19, 54	
59.	*Phengaris alcon* ([Denis & Schiffermüller], 1775)	1, 15, 17, 19, 20, 27, 31, 34, 40, 42, 43, 44, 45, 46, 47, 50, 61	LORKOVIĆ (2009), KOREN *et al. (*2015)
60.	*Phengaris arion* (Linnaeus, 1758)	13, 15, 25, 35, 40, 42, 44, 48, 57, 59, 61, 65	KOREN *et al. (*2015)
61.	*Plebejus argus* (Linnaeus, 1758)	6, 9, 11, 15, 19, 31, 40, 42, 45, 47, 54, 55, 58, 59, 60	REBEL (1895), KOREN *et al. (*2011), KOREN *et al. (*2015)
62.	*Plebejus argyrognomon* (Bergsträsser, 1779)	9, 15, 19, 58, 60, 69	
63.	*Plebejus idas* (Linnaeus, 1761)	47, 59, 61, 69	KOREN *et al. (*2015)
64.	*Lysandra bellargus* (Rottemburg, 1775)	6, 15, 40, 42, 54, 58, 60, 68, 69	MLADINOV (1973), KOREN *et al. (*2015)

65.	*Lysandra coridon* (Poda, 1761)	1, 3, 6, 9, 15, 19, 24, 27, 31, 41, 43, 46, 47, 53, 54, 58, 59, 61	FRANIĆ (1910), LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)
66.	*Polyommatus admetus* (Esper, 1783)	19, 46, 54, 55, 58, 61, 65	KOREN *et al.* (2011), KOREN *et al.* (2015)
67.	*Polyommatus damon* ([Denis & Schiffermüller], 1775)	15, 54, 58, 61, 65	KOREN *et al.* (2011), KOREN *et al.* (2015)
68.	*Polyommatus ripartii* (Freyer, 1830)	6, 15, 46, 47, 53, 58, 61, 65	KOREN *et al.* (2011), KOREN *et al.* (2015)
69.	*Polyommatus daphnis* ([Denis & Schiffermüller], 1775)	15, 16, 27, 41, 47, 53, 55, 58, 59, 61, 65	LORKOVIĆ (2009), KOREN *et al.* (2011)
70.	*Polyommatus amandus* (Schneider, 1792)	16, 19, 26, 31, 32, 33, 39, 40, 42, 43, 45, 47, 56, 59, 60, 61, 62, 63, 65, 69, 70	KOREN *et al.* (2011), KOREN *et al.* (2015)
71.	*Polyommatus dorylas* ([Denis & Schiffermüller], 1775)	8, 15, 19, 31, 40, 45, 46, 47, 52, 55, 56, 57, 58, 59, 60, 61, 62, 69	LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)
72.	*Polyommatus escheri* (Hübner, [1823])		KOREN *et al.* (2015)
73.	*Polyommatus icarus* (Rottemburg, 1775)	1, 3, 6, 8, 9, 14, 15, 16, 19, 23, 24, 26, 27, 28, 38, 39, 40, 42, 43, 45, 47, 48, 52, 53, 54, 55, 57, 58, 59, 60, 61, 62, 63, 65, 70	LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)
74.	*Polyommatus thersites* (Cantener, 1835)	6, 15, 42, 43, 45, 53, 54, 58, 61, 65	KOREN *et al.* (2011)
75.	*Scolitantides orion* (Pallas, 1771)	4, 5, 27, 59, 61, 65, 70	LORKOVIĆ (2009), KOREN *et al.* (2015)
76.	*Pseudophilotes vicrama* (Moore, 1865)	40, 46, 47, 59, 61, 62, 65	KOREN *et al.* (2011), KOREN *et al.* (2015)
77.	*Callophrys rubi* (Linnaeus, 1758)	15, 19, 31, 39, 52, 60, 61, 63, 70	KOREN *et al.* (2011), KOREN *et al.* (2015)
78.	*Satyrium acaciae* (Fabricius, 1787)	11, 42, 58, 59, 65	KOREN *et al.* (2011), KOREN *et al.* (2015)
79.	*Satyrium ilicis* (Esper, 1779)	7, 16, 19, 36, 58, 59	KOREN *et al.* (2011), KOREN *et al.* (2015)
80.	*Satyrium spini* ([Denis & Schiffermüller], 1775)	1, 5, 7, 8, 14, 15, 16, 31, 42, 47, 58, 59, 61, 65	LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)
81.	*Satyrium w-album* (Knoch, 1782)	1, 15, 19, 27, 65	KOREN *et al.* (2011)
82.	*Favonius quercus* (Linnaeus, 1758)	15	
83.	*Thecla betulae* (Linnaeus, 1758)	1, 7, 8	
	Nymphalidae		
84.	*Apatura ilia* ([Denis & Schiffermüller], 1775)	66, 69	FRANIĆ (1910)
85.	*Apatura iris* (Linnaeus, 1758)	15, 16, 68	FRANIĆ (1910)
86.	*Argynnis paphia* (Linnaeus, 1758)	1, 3, 5, 7, 15, 16, 19, 21, 23, 26, 27, 28, 31, 35, 41, 43, 46, 47, 54, 55, 56, 58, 59, 61, 65, 66, 68, 70	FRANIĆ (1910), LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)
87.	*Argynnis pandora* ([Denis & Schiffermüller], 1775)	15, 52, 56, 57, 58, 59, 61, 68, 7	LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)

88.	*Fabriciana adippe* ([Denis & Schiffermüller], 1775)	1, 5, 15, 16, 19, 23, 26, 31, 32, 33, 35, 40, 42, 43, 45, 47, 61, 65	KOREN *et al. (*2011), KOREN *et al. (*2015)
89.	*Fabriciana niobe* (Linnaeus, 1758)	15, 19, 36	KOREN *et al. (*2011), KOREN *et al. (*2015)
90.	*Speyeria aglaja* (Linnaeus, 1758)	3, 5, 7, 15, 16, 19, 21, 23, 26, 27, 28, 31, 32, 33, 35, 41, 43, 46, 47, 59, 61, 62, 65	FRANIĆ (1910), LORKOVIĆ (2009), KOREN *et al. (*2015)
91.	*Boloria dia* (Linnaeus, 1767)	40, 42, 61	LORKOVIĆ (2009), KOREN *et al. (*2011), KOREN *et al. (*2015)
92.	*Boloria euphrosyne* (Linnaeus, 1758)	15, 19, 31, 33, 61, 63	REBEL (1895), KOREN *et al. (*2015)
93.	*Boloria selene* ([Denis & Schiffermüller], 1775)	3	
94.	*Boloria titania* (Esper, 1793)		STEINER (1938), LORKOVIĆ (2009)
95.	*Brenthis daphne* (Bergsträsser, 1780)	2, 3, 13, 15, 19, 22, 26, 28, 41, 52, 56, 57, 58, 59, 61, 65, 66, 69	KOREN *et al. (*2011), KOREN *et al. (*2015)
96.	*Brenthis hecate* ([Denis & Schiffermüller], 1775)	13, 16, 19, 21, 26, 27, 28, 31, 32, 40, 42, 43, 45, 46, 47, 56, 58, 59, 61, 62, 65	KOREN *et al. (*2011), KOREN *et al. (*2015)
97.	*Brenthis ino* (Rottemburg, 1775)	3, 19, 26, 33, 40, 43, 45, 59, 61	KOČA (1901)
98.	*Issoria lathonia* (Linnaeus, 1758)	3, 15, 19, 21, 26, 28, 32, 33, 40, 41, 42, 46, 47, 52, 56, 57, 59, 61, 62, 65, 69	LORKOVIĆ (2009), KOREN *et al. (*2011), KOREN *et al. (*2015)
99.	*Libythea celtis* (Laicharting, 1782)	19, 35, 54, 56, 58, 59, 61, 65, 66, 68, 69, 71	KOREN *et al. (*2011), KOREN *et al. (*2015)
100.	*Limenitis camilla* (Linnaeus, 1764)	26, 7	LORKOVIĆ (2009)
101.	*Limenitis populi* (Linnaeus, 1758)	49	FRANIĆ (1910)
102.	*Limenitis reducta* Staudinger, 1901	1, 15, 16, 19, 40, 42, 54, 58, 61, 69	KOREN *et al. (*2011), KOREN *et al. (*2015)
103.	*Neptis rivularis* (Scopoli, 1763)	15	LORKOVIĆ (1923), LORKOVIĆ (2009)
104.	*Euphydryas aurinia* (Rottemburg, 1775)	13, 15, 19, 31, 38, 45, 47, 56, 60, 61, 62, 64, 71	REBEL (1895), KOREN *et al. (*2011), KOREN *et al. (*2015)
105.	*Euphydryas maturna* (Linnaeus, 1758)		TVRTKOVIĆ *et al. (*2015)
106.	*Melitaea athalia* (Rottemburg, 1775)	15, 16, 19, 21, 26, 28, 31, 35, 40, 42, 43, 45, 47, 58, 59, 60, 61, 62, 68, 69	LORKOVIĆ (2009), KOREN *et al. (*2011), KOREN *et al. (*2015)
107.	*Melitaea aurelia* Nickerl, 1850	15, 19, 40, 42, 45, 69	REBEL (1895), KOREN *et al. (*2011), KOREN *et al. (*2015)
108.	*Melitaea britomartis* Assmann, 1847	19, 26, 40, 43	
109.	*Melitaea cinxia* (Linnaeus, 1758)	15, 19, 31, 32, 33, 39, 42, 43, 56, 59, 60, 61, 62	KOREN *et al. (*2011), KOREN *et al. (*2015)
110.	*Melitaea diamina* (Lang, 1789)	19, 26, 28, 61	LORKOVIĆ (2009), KOREN *et al. (*2011), KOREN *et al. (*2015)
111.	*Melitaea didyma* (Esper, 1778)	15, 19, 31, 42, 45, 47, 58, 59, 61, 63, 68, 70, 71	REBEL (1895), KOREN *et al. (*2011), KOREN *et al. (*2015)

112.	*Melitaea ornata* Christoph, 1893	59	KOREN & ŠTIH (2013)
113.	*Melitaea phoebe* ([Denis & Schiffermüller], 1775)	13, 38, 40, 42, 43, 59, 60, 61	FRANIĆ (1910), LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)
114.	*Melitaea trivia* ([Denis & Schiffermüller], 1775)	21, 26, 40, 43, 47, 59, 62, 63	LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)
115.	*Aglais io* (Linnaeus, 1758)	1, 8, 16, 19, 21, 23, 26, 27, 28, 31, 32, 33, 35, 36, 45, 46, 56, 59, 61, 62, 66, 71	FRANIĆ (1910), KOREN *et al.* (2011), KOREN *et al.* (2015)
116.	*Aglais urticae* (Linnaeus, 1758)	1, 8, 16, 19, 21, 23, 26, 28, 33, 46, 47, 52, 56, 61, 62, 65, 71	LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)
117.	*Araschnia levana* (Linnaeus, 1758)	1, 3, 19, 66	
118.	*Nymphalis antiopa* (Linnaeus, 1758)	10, 18	KOREN *et al.* (2011)
119.	*Nymphalis polychloros* (Linnaeus, 1758)	10, 15, 19, 52, 56, 66, 69, 71	FRANIĆ (1910), LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)
120.	*Nymphalis vaualbum* ([Denis & Schiffermüller], 1775)		FRANIĆ (1910), MOUCHA (1966), LORKOVIĆ (2009)
121.	*Polygonia c-album* (Linnaeus, 1758)	1, 3, 5, 7, 8, 9, 11, 15, 16, 19, 21, 23, 26, 28, 36, 41, 46, 54, 56, 58, 59, 61, 65, 66	FRANIĆ (1910), MLADINOV (1973), KOREN *et al.* (2015)
122.	*Vanessa atalanta* (Linnaeus, 1758)	1, 5, 7, 8, 9, 15, 16, 19, 23, 26, 28, 34, 36, 38, 56, 58, 61, 65, 66	REBEL (1895), KOREN *et al.* (2015)
123.	*Vanessa cardui* (Linnaeus, 1758)	1, 3, 5, 6, 8, 9, 11, 15, 16, 19, 23, 26, 27, 28, 31, 32, 33, 36, 38, 39, 40, 45, 46, 52, 56, 57, 58, 59, 60, 61, 62, 65, 67	FRANIĆ (1910), LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)
124.	*Coenonympha arcania* (Linnaeus, 1760)	2, 13, 15, 16, 19, 21, 26, 27, 28, 31, 32, 33, 35, 36, 40, 41, 42, 43, 45, 46, 47, 52, 56, 57, 58, 59, 60, 61, 62, 65, 67, 68, 69	KOREN *et al.* (2011), KOREN *et al.* (2015)
125.	*Coenonympha glycerion* (Borkhausen, 1788)	2, 11, 13, 19, 22, 31, 32, 33, 35, 40, 42, 43, 45, 47, 56, 58, 59, 61, 62, 68	KOREN *et al.* (2011), KOREN *et al.* (2015)
126.	*Coenonympha pamphilus* (Linnaeus, 1758)	6, 13, 15, 19, 31, 38, 39, 40, 41, 42, 43, 45, 46, 52, 54, 55, 56, 57, 58, 59, 60, 61, 62, 65, 67, 68, 69, 71	LORKOVIĆ (2009), MLADINOV (1973), KOREN *et al.* (2011), KOREN *et al.* (2015)
127.	*Coenonympha rhodopensis* Elwes, 1900	32, 33, 47, 61, 62, 64	KOREN *et al.* (2015)
128.	*Lasiommata maera* (Linnaeus, 1758)	15, 19, 21, 26, 31, 32, 33, 47, 57, 58, 59, 61, 65	LORKOVIĆ (2009), MLADINOV (1973), KOREN *et al.* (2015)
129.	*Lasiommata megera* (Linnaeus, 1767)	8, 13, 15, 16, 30, 35, 38, 39, 40, 43, 47, 54, 55, 56, 58, 59, 61, 62, 65	LORKOVIĆ (2009), KOREN *et al.* (2011), KOREN *et al.* (2015)

130.	*Pararge aegeria* (Linnaeus, 1758)	9, 16, 19, 27, 39, 58	LORKOVIĆ (2009), KOREN *et al. (*2011)
131.	*Erebia aethiops* (Esper, 1777)	7, 9	
132.	*Erebia ligea* (Linnaeus, 1758)	5, 16, 19, 21, 22, 26, 28, 31, 65	KOČA (1901), LORKOVIĆ (2009), MLADINOV (1973)
133.	*Erebia medusa* ([Denis & Schiffermüller], 1775)	10, 13, 15, 19, 31, 32, 33, 39, 40, 46, 47, 56, 59, 60, 61, 62, 64	LORKOVIĆ (2009), LORKOVIĆ (2009), LORKOVIĆ (2009), KOREN *et al. (*2015)
134.	*Erebia melas* (Herbst, 1796)	8, 16, 23, 27	LORKOVIĆ (2009)
135.	*Erebia oeme* (Hübner, [1804])	19, 26, 28, 32, 33, 47, 61	LORKOVIĆ (2009)
136.	*Proterebia phegea* (Borkhausen, 1788)		KOREN *et al. (*2010), KOREN *et al. (*2011), KOREN *et al. (*2015)
137.	*Aphantopus hyperantus* (Linnaeus, 1758)	9	
138.	*Hyponephele lupinus* (Costa, 1836)	58	
139.	*Hyponephele lycaon* (Kühn, 1774)	58	LORKOVIĆ (2009), KOREN *et al. (*2015)
140.	*Maniola jurtina* (Linnaeus, 1758)	1, 2, 3, 6, 8, 9, 11, 13, 14, 15, 16, 19, 21, 23, 24, 26, 27, 28, 31, 33, 36, 38, 40, 41, 42, 43, 45, 46, 47, 48, 54, 55, 56, 57, 58, 59, 60, 61, 62, 65, 66, 67, 68, 69, 71	FRANIĆ (1910), LORKOVIĆ (2009), MLADINOV (1973), KOREN *et al. (*2011), KOREN *et al. (*2015)
141.	*Pyronia tithonus* (Linnaeus, 1767)	54, 58	KOREN *et al. (*2011)
142.	*Melanargia galathea* (Linnaeus, 1758)	1, 2, 3, 8, 9, 11, 13, 14, 15, 16, 19, 21, 23, 24, 26, 27, 28, 31, 34, 36, 38, 40, 41, 42, 43, 45, 46, 47, 48, 53, 55, 56, 57, 58, 59, 61, 62, 65, 67, 68, 69, 71	LORKOVIĆ (2009), MLADINOV (1973), KOREN *et al. (*2011), KOREN *et al. (*2015)
143.	*Melanargia larissa* (Geyer, [1828])		KOREN *et al. (*2015)
144.	*Arethusana arethusa* ([Denis & Schiffermüller], 1775)	6, 15, 46, 47, 54, 58, 59, 61, 65	FRANIĆ (1910), KOREN *et al. (*2011), KOREN *et al. (*2015)
145.	*Brintesia circe* (Fabricius, 1775)	1, 11, 15, 16, 27, 41, 42, 46, 47, 54, 55, 58, 59, 61, 65	KOREN *et al. (*2011), KOREN *et al. (*2015)
146.	*Chazara briseis* (Linnaeus, 1764)	6, 8, 15, 42, 43, 46, 47, 55, 58, 59, 61, 65	KOREN *et al. (*2011)
147.	*Hipparchia fagi* (Scopoli, 1763)	15, 41, 43, 58	KOREN *et al. (*2011), KOREN *et al. (*2015)
148.	*Hipparchia syriaca* (Staudinger, 1871)	54, 58	KOREN *et al. (*2011)
149.	*Hipparchia semele* (Linnaeus, 1758)	13, 15, 19, 26, 33, 35, 40, 41, 43, 46, 47, 56, 57, 58, 59, 61, 62, 63, 65, 67, 68, 69, 70, 71	LORKOVIĆ (2009), MLADINOV (1973), KOREN *et al. (*2011), KOREN *et al. (*2015);
150.	*Hipparchia statilinus* (Hufnagel, 1766)		LORKOVIĆ (1974), KOREN *et al. (*2011)
151.	*Minois dryas* (Scopoli, 1763)	1, 7	
152.	*Satyrus ferula* (Fabricius, 1793)	40, 42, 43, 45, 46, 58, 59, 61, 65	KOREN *et al. (*2015)

Table II.– Comparisson of the butterfly diversity on three Croatian mountain chains, Velebit, Dinara and Lička Plješevica. Biogeographical affiliation of species is in line with KUDRNA *et al*. (2016).

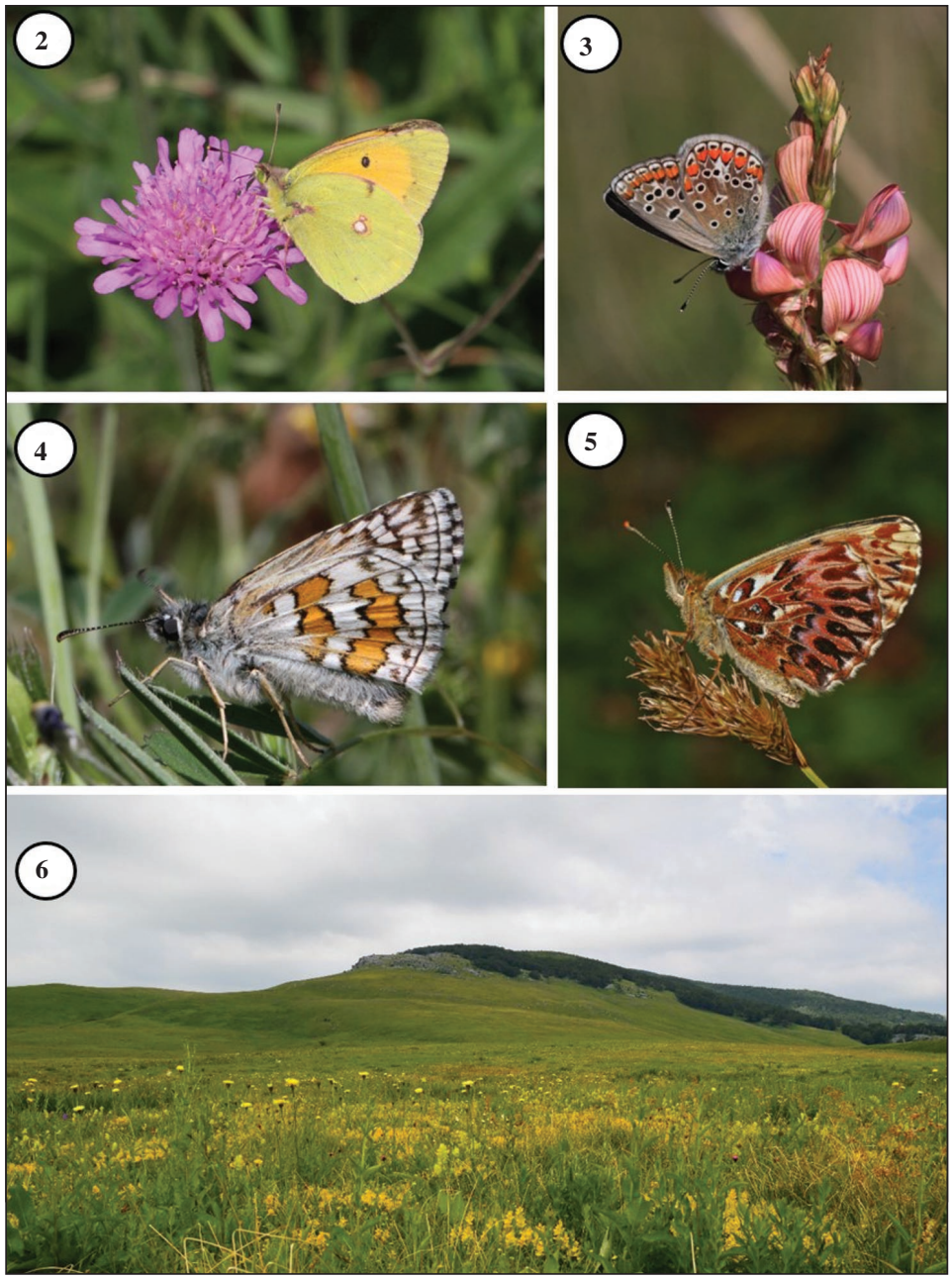
	List of species	Lička Plješevica	Velebit	Dinara	Biogeographical affiliation*
1.	*Hesperia comma* (Linnaeus, 1758)	1	1	1	HOL
2.	*Ochlodes sylvanus* (Esper, 1777)	1	1	1	ES
3.	*Thymelicus acteon* (Rottemburg, 1775)	1	1	1	EO
4.	*Thymelicus lineola* (Ochsenheimer, 1808)	1	1	1	HOL
5.	*Thymelicus sylvestris* (Poda, 1761)	1	1	1	EO
6.	*Carterocephalus palaemon* (Pallas, 1771)	1	1		HOL
7.	*Heteropterus morpheus* (Pallas, 1771)	1			ES
8.	*Carcharodus alceae* (Esper, 1780)	1	1	1	MED
9.	*Carcharodus floccifera* (Zeller, 1847)	1	1	1	EO
10.	*Carcharodus lavatherae* (Esper, 1783)	1	1		EM
11.	*Erynnis tages* (Linnaeus, 1758)	1	1	1	ES
12.	*Pyrgus alveus* (Hübner, [1803])	1	1	1	ES
13.	*Pyrgus armoricanus* (Oberthür, 1910)	1	1	1	EO
14.	*Pyrgus carthami* (Hübner, [1813])	1	1		EO
15.	*Pyrgus malvae* (Linnaeus, 1758)	1	1	1	ES
16.	*Pyrgus serratulae* (Rambur, 1839)	1	1	1	ES
17.	*Pyrgus sidae* (Esper, 1784)	1		1	EO
18.	*Spialia orbifer* (Hübner, [1823])	1	1	1	EO
19.	*Spialia sertorius* (Hoffmansegg, 1804)	1			EM
20.	*Gegenes pumilio* (Hoffmansegg, 1804)		1		EO
21.	*Iphiclides podalirius* (Linnaeus, 1758)	1	1	1	ES
22.	*Papilio machaon* Linnaeus, 1758	1	1	1	ES
23.	*Zerynthia polyxena* ([Denis & Schiffermüller], 1775)	1	1	1	EO
24.	*Parnassius apollo* (Linnaeus, 1758)	1	1	1	ES
25.	*Parnassius mnemosyne* (Linnaeus, 1758)	1	1	1	EO
26.	*Colias alfacariensis* Ribbe, 1905	1	1	1	EO
27.	*Colias caucasica* Staudinger, 1871	1		1	MON
28.	*Colias crocea* (Geoffroy, 1785)	1	1	1	EO
29.	*Colias hyale* (Linnaeus, 1758)		1		ES
30.	*Gonepteryx cleopatra* (Linnaeus, 1767)		1		MED
31.	*Gonepteryx rhamni* (Linnaeus, 1758)	1	1	1	ES
32.	*Leptidea sinapis* (Linnaeus, 1758)	1	1	1	ES
33.	*Anthocharis cardamines* (Linnaeus, 1758)	1	1	1	ES
34.	*Aporia crataegi* (Linnaeus, 1758)	1	1	1	ES
35.	*Pieris balcana* Lorkovič, 1969	1	1	1	ES
36.	*Pieris napi* (Linnaeus, 1758)	1	1	1	ES
37.	*Pieris brassicae* (Linnaeus, 1758)	1	1	1	ES
38.	*Pieris ergane* (Geyer, [1828])	1	1	1	EO
39.	*Pieris mannii* (Mayer, 1851)	1	1	1	EO
40.	*Pieris rapae* (Linnaeus, 1758)	1	1	1	HOL
41.	*Pontia edusa* (Fabricius, 1777)	1	1	1	ES
42.	*Euchloe ausonia* (Hübner, [1804])	1			MED
43.	*Hamearis lucina* (Linnaeus, 1758)	1	1	1	EM
44.	*Lycaena alciphron* (Rottemburg, 1775)	1	1	1	EO

45.	*Lycaena candens* (Herrich-Schäffer, 1844)	1	1	1	MON
46.	*Lycaena phleas* (Linnaeus, 1760)	1	1	1	HOL
47.	*Lycaena thersamon* (Esper, 1784)	1	1		EO
48.	*Lycaena tityrus* (Poda, 1761)	1	1	1	ES
49.	*Lycaena virgaureae* (Linnaeus, 1758)	1	1	1	ES
50.	*Aricia agestis* ([Denis & Schiffermüller], 1775)	1	1	1	ES
51.	*Aricia anteros* (Freyer, 1838)	1	1		MON
52.	*Aricia artaxerxes* (Fabricius, 1793)	1	1	1	BM
53.	*Eumedonia eumedon* (Esper, 1780)	1	1	1	ES
54.	*Cacyreus marshalli* Butler, 1898		1		TRO
55.	*Celastrina argiolus* (Linnaeus, 1758)	1	1	1	ES
56.	*Cupido minimus* (Fuessly, 1775)	1	1	1	EO
57.	*Cupido osiris* (Meigen, 1829)	1		1	ES
58.	*Cupido alcetas* (Hoffmansegg, 1804)		1		ES
59.	*Cupido argiades* (Pallas, 1771)	1			HOL
60.	*Cyaniris semiargus* (Rottemburg, 1775)	1	1	1	ES
61.	*Glaucopsyche alexis* (Poda, 1761)	1	1	1	ES
62.	*Iolana iolas* (Ochsenheimer, 1816)	1	1	1	EO
63.	*Lampides boeticus* (Linnaeus, 1767)		1		TRO
64.	*Leptotes pirithous* (Linnaeus, 1767)	1	1	1	TRO
65.	*Phengaris alcon* ([Denis & Schiffermüller], 1775)	1	1	1	ES
66.	*Phengaris arion* (Linnaeus, 1758)	1	1	1	ES
67.	*Plebejus argus* (Linnaeus, 1758)	1	1	1	ES
68.	*Plebejus argyrognomon* (Bergsträsser, 1779)	1	1	1	ES
69.	*Plebejus idas* (Linnaeus, 1761)	1	1		HOL
70.	*Lysandra bellargus* (Rottemburg, 1775)	1	1	1	EO
71.	*Lysandra coridon* (Poda, 1761)	1	1	1	EO
72.	*Polyommatus admetus* (Esper, 1783)	1		1	EO
73.	*Polyommatus damon* ([Denis & Schiffermüller], 1775)	1		1	ES
74.	*Polyommatus ripartii* (Freyer, 1830)	1		1	EO
75.	*Polyommatus daphnis* ([Denis & Schiffermüller], 1775)	1	1	1	EO
76.	*Polyommatus amandus* (Schneider, 1792)	1	1	1	ES
77.	*Polyommatus dorylas* ([Denis & Schiffermüller], 1775)	1	1	1	EO
78.	*Polyommatus eros* (Ochsenheimer, 1808)		1	1	ES
79.	*Polyommatus escheri* (Hübner, [1823])	1	1	1	EM
80.	*Polyommatus icarus* (Rottemburg, 1775)	1	1	1	ES
81.	*Polyommatus thersites* (Cantener, 1835)	1		1	ES
82.	*Pseudophilotes vicrama* (Moore, 1865)	1	1	1	EO
83.	*Scolitantides orion* (Pallas, 1771)	1	1	1	ES
84.	*Tarucus balkanicus* (Freyer, 1844)		1		EO
85.	*Callophrys rubi* (Linnaeus, 1758)	1	1	1	ES
86.	*Satyrium acaciae* (Fabricius, 1787)	1		1	EO
87.	*Satyrium ilicis* (Esper, 1779)	1	1	1	EO
88.	*Satyrium pruni* (Linnaeus, 1758)		1		ES
89.	*Satyrium spini* ([Denis & Schiffermüller], 1775)	1	1	1	EO
90.	*Satyrium w-album* (Knoch, 1782)	1	1		ES
91.	*Favonius quercus* (Linnaeus, 1758)	1	1	1	EO
92.	*Thecla betulae* (Linnaeus, 1758)	1	1		ES
93.	*Apatura ilia* ([Denis & Schiffermüller], 1775)	1			ES

94.	*Apatura iris* (Linnaeus, 1758)	1	1		ES
95.	*Charaxes jasius* (Linnaeus, 1767)		1		TRO
96.	*Argynnis paphia* (Linnaeus, 1758)	1	1	1	ES
97.	*Argynnis pandora* ([Denis & Schiffermüller], 1775)	1	1	1	EO
98.	*Fabriciana adippe* ([Denis & Schiffermüller], 1775)	1	1	1	ES
99.	*Fabriciana niobe* (Linnaeus, 1758)	1	1		ES
100.	*Speyeria aglaja* (Linnaeus, 1758)	1	1	1	ES
101.	*Boloria dia* (Linnaeus, 1767)	1	1		ES
102.	*Boloria euphrosyne* (Linnaeus, 1758)	1	1	1	ES
103.	*Boloria selene* ([Denis & Schiffermüller], 1775)	1			HOL
104.	*Boloria titania* (Esper, 1793)	1			HOL
105.	*Brenthis daphne* (Bergsträsser, 1780)	1	1	1	ES
116.	*Brenthis hecate* ([Denis & Schiffermüller], 1775)	1	1	1	ES
107.	*Brenthis ino* (Rottemburg, 1775)	1	1		ES
108.	*Issoria lathonia* (Linnaeus, 1758)	1	1	1	ES
109.	*Libythea celtis* (Laicharting, 1782)	1	1	1	EO
110.	*Limenitis camilla* (Linnaeus, 1764)	1	1		ES
111.	*Limenitis populi* (Linnaeus, 1758)	1	1		ES
112.	*Limenitis reducta* Staudinger, 1901	1	1	1	EO
113.	*Neptis rivularis* (Scopoli, 1763)	1	1	1	ES
114.	*Neptis sappho* (Pallas, 1771)		1		ES
115.	*Euphydryas aurinia* (Rottemburg, 1775)	1	1	1	ES
116.	*Euphydryas maturna* (Linnaeus, 1758)	1			ES
117.	*Melitaea athalia* (Rottemburg, 1775)	1	1	1	ES
118.	*Melitaea aurelia* Nickerl, 1850	1	1		EO
119.	*Melitaea britomartis* Assmann, 1847	1	1	1	ES
120.	*Melitaea cinxia* (Linnaeus, 1758)	1	1	1	ES
121.	*Melitaea diamina* (Lang, 1789)	1	1	1	ES
122.	*Melitaea didyma* (Esper, 1778)	1	1	1	ES
123.	*Melitaea phoebe* ([Denis & Schiffermüller], 1775)	1	1	1	ES
124.	*Melitaea ornata* Christoph, 1893	1			ES
125.	*Melitaea trivia* ([Denis & Schiffermüller], 1775)	1	1	1	EO
126.	*Aglais io* (Linnaeus, 1758)	1	1	1	ES
127.	*Aglais urticae* (Linnaeus, 1758)	1	1	1	ES
128.	*Araschnia levana* (Linnaeus, 1758)	1	1		ES
129.	*Nymphalis antiopa* (Linnaeus, 1758)	1	1	1	HOL
130.	*Nymphalis polychloros* (Linnaeus, 1758)	1	1	1	EO
131.	*Nymphalis vaualbum* ([Denis & Schiffermüller], 1775)	1	1		ES
132.	*Polygonia c-album* (Linnaeus, 1758)	1	1	1	ES
133.	*Polygonia egea* (Cramer, 1775)		1		EO
134.	*Vanessa atalanta* (Linnaeus, 1758)	1	1	1	HOL
135.	*Vanessa cardui* (Linnaeus, 1758)	1	1	1	COS
136.	*Coenonympha arcania* (Linnaeus, 1760)	1	1	1	EM
137.	*Coenonympha glycerion* (Borkhausen, 1788)	1	1	1	ES
138.	*Coenonympha pamphilus* (Linnaeus, 1758)	1	1	1	EO
139.	*Coenonympha rhodopensis* Elwes, 1900	1	1	1	MED
140.	*Lasiommata maera* (Linnaeus, 1758)	1	1	1	ES
141.	*Lasiommata megera* (Linnaeus, 1767)	1	1	1	EO
142.	*Pararge aegeria* (Linnaeus, 1758)	1	1	1	EO

143.	*Erebia aethiops* (Esper, 1777)	1	1	1	EO
144.	*Erebia epiphron* (Knoch, 1783)		1		MON
145.	*Erebia euryale* (Esper, 1805)		1	1	MON
146.	*Erebia gorge* (Hübner, [1804])		1		MON
147.	*Erebia ligea* (Linnaeus, 1758)	1	1	1	ES
148.	*Erebia medusa* ([Denis & Schiffermüller], 1775)	1	1	1	ES
149.	*Erebia melas* (Herbst, 1796)	1	1	1	MON
150.	*Erebia oeme* (Hübner, [1804])	1	1	1	MON
151.	*Erebia ottomana* Herrich-Schäffer, 1847		1	1	MON
152.	*Erebia pronoe* (Esper, 1780)		1		MON
153.	*Erebia stiria* (Godart, 1824)		1		MON
154.	*Erebia triarius* (Prunner, 1798)			1	MON
155.	*Proterebia phegea* (Borkhausen, 1788)	1	1	1	EO
156.	*Aphantopus hyperantus* (Linnaeus, 1758)	1	1		ES
157.	*Hyponephele lupinus* (Costa, 1836)	1	1	1	ES
158.	*Hyponephele lycaon* (Kühn, 1774)	1	1	1	ES
159.	*Maniola jurtina* (Linnaeus, 1758)	1	1	1	ES
160.	*Pyronia tithonus* (Linnaeus, 1771)	1	1	1	EM
161.	*Melanargia galathea* (Linnaeus, 1758)	1	1	1	EO
162.	*Melanargia larissa* (Geyer, [1828])	1	1	1	EO
163.	*Arethusana arethusa* ([Denis & Schiffermüller], 1775)	1	1	1	EO
164.	*Brintesia circe* (Fabricius, 1775)	1	1	1	EO
165.	*Chazara briseis* (Linnaeus, 1764)	1	1	1	ES
166.	*Hipparchia fagi* (Scopoli, 1763)	1	1	1	EM
167.	*Hipparchia syriaca* (Staudinger, 1871)	1	1	1	EO
168.	*Hipparchia statilinus* (Hufnagel, 1766)	1	1	1	EM
169.	*Hipparchia semele* (Linnaeus, 1758)	1	1	1	EM
170.	*Minois dryas* (Scopoli, 1763)	1	1		ES
171.	*Satyrus ferula* (Fabricius, 1793)	1	1	1	EO
	Total number of species:	152	153	128	

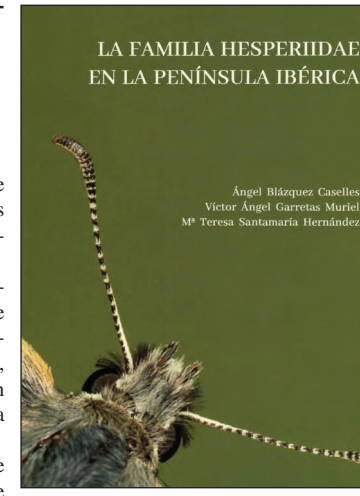
*ES - Euro-Siberian, EO - Euro-Oriental, Mon - Montane, Hol - Holarctic, EM - Euro-Meridional, BM - Boreo-Montane, MED - Mediterranean, TRO - Tropical, COS - Cosmopolitan.



Figures 2-6.– 2. *Colias caucasica* was observed only once at Mt. Poštak. **3.** *Polyommatus thersites* was localy common where sainfoins grow. **4.** *Pyrgus sidae* is a rare species in Croatia. **5.** *Boloria titania* was recorded at Badovinac almost 100 years ago. **6.** Preserved and butterfly rich Čemernica meadows near Gornja Suvaja

REVISION DE PUBLICACIONES
BOOK REVIEWS

A. Blázquez-Caselles, V. A. Garretas-Muriel & Mª T. Santamaría-Hernández
La familia Hesperiidae en la Península Ibérica
447 páginas
Formato: 29'5 x 21 cm
Gráficas Romero, Plasencia (Cáceres), 2019
ISBN: 978-84-09-09861-3



Tenemos en nuestras manos una obra bien ejecutada y de excelente calidad, que trata una de nuestras familias preferidas de Rhopalocera los Hesperiidae, siendo el resultado final de una labor de investigación realizada por los autores, a lo largo de quince años.

Después de un Prólogo, Agradecimientos, e Introducción, nos presenta la taxonomía de las especies consideradas, seguido por interesante capítulo sobre la Familia Hesperiidae en el que nos hablan de la sistemática y taxonomía, características generales, distribución y diversidad, morfología, biología, fenología, depredadores y parásitos. Continúa con los procesos de obtención y gestión de datos, así como de una detallada clave dicotómica.

Ya dentro de la parte principal del libro, tenemos la monografía de los Hesperiidae de la Península Ibérica, tratándose todas y cada una de las especies conocidas de las que nos presenta la nomenclatura actual y las sinonimias consideradas, subespecies, formas, aberraciones, variedades y formas e incluso podemos ver especies recientemente descubiertas como *Spialia rosae* Hernández-Roldán *et al*., 2016.

De cada especie, nos hablan del huevo, biología, ecología y descripción, la larva, las plantas nutricias, la pupa, el imago, las subespecies, biotopos, presentan la genitalia del macho y de la hembra, así como sobre la distribución. Todas las especies tiene fotografías de los adultos en vivo y de colección, de los biotopos y la genitalia del macho y de la hembra, así como un mapa con cuadrículas UTM. Finaliza el libro con una bibliografía específica, un índice alfabético y un interesante Anexo I con datos inéditos.

No podemos terminar estas líneas, sin felicitar a los autores, por tan detallado y bien realizado trabajo sobre esta interesante familia y a la Editorial, por una excelente impresión del libro, por lo que recomendamos vivamente su adquisición y no pudiendo faltar en cualquier biblioteca que se precie, sobre todo para aquellos interesados en esta interesante familia.

El precio de este libro es de 80 euros y los interesados deben dirigirse a:

José María Jiménez Barco
Rosas, 14
E-10680 Malpartida de Plasencia (Cáceres)
ESPAÑA / *SPAIN*
E-mail: chemabarco@yahoo.com

A. Vives Moreno
E-mail: avives1954@outlook.es
https://orcid.org/0000-0003-3772-2747

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 285-287 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.387

Desertoplusia bella (Christoph, 1887) - a new noctuid moth species from Armenia (Lepidoptera: Noctuidae)

R. Wąsala & J. Nowacki

Abstract

This is the first record of *Desertoplusia bella* (Christoph, 1887) for Armenia. It was found in Vayots Dzor Province, south-western Armenia.
KEY WORDS: Lepidoptera, Noctuidae, *Desertoplusia bella*, new record, Armenia.

Desertoplusia bella **(Christoph, 1887) - una nueva especie para Armenia (Lepidoptera: Noctuidae)**

Resumen

Este es el primer registro de *Desertoplusia bella* (Christoph, 1887) para Armenia. Fue encontrado en la provincia de Vayots Dzor, sudoeste de Armenia.
PALABRAS CLAVE: Lepidoptera, Noctuidae, *Desertoplusia bella*, nuevo registro, Armenia.

Introduction

The Ponto-Turkestanian genus *Desertoplusia* Klyuchko, 1984 was separated from the genus *Plusia* Ochseinheimer, 1861 for a group of species occurring from eastern Turkey through Iran and Turkmenistan to north-eastern Afghanistan (KLYUCHKO, 1984). Later, a new genus - *Platoplusia* Ronkay, Ronkay & Behounek, 2008 - was created out of *Desertoplusia* Klyuchko for the species *Platoplusia tancrei* (Staudinger, 1895) (RONKAY *et al*., 2008). *Desertoplusia bella* (Christoph, 1887) is a sibling species of the recently described *D. colornata* Varga & Ronkay, 1991. Both are quite readily distinguished on the basis of both wing colour and pattern, and evident differences in the structures of the male and female genitalia (RONKAY *et al*., 2008). Knowledge of the distribution of *D. bella* is incomplete. It had been reported from Iran and Turkmenistan as endemic to the Kopet Dagh Mts (RONKAY *et al*., 2008; ZAHIRI & FIBIGER, 2008), but it was subsequently found in Van Province in eastern Turkey (no details of the time and place of the record provided) (KOÇAK & KEMAL, 2012).

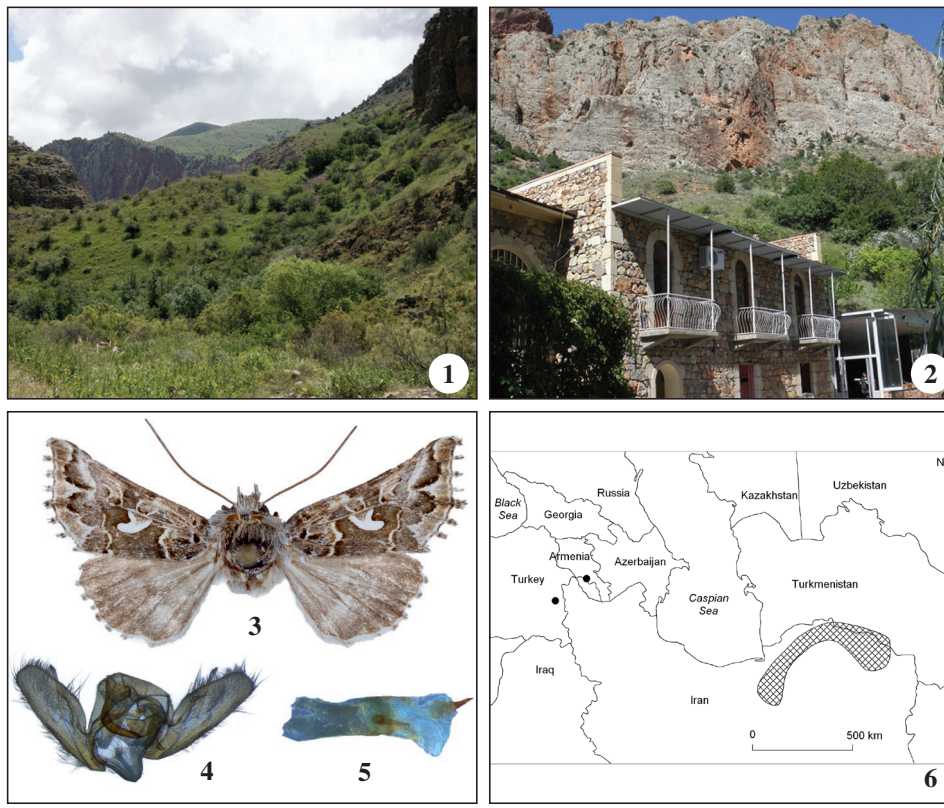
Material and method

During an entomological expedition to Armenia in 2014, we came across *D. bella* in Vayots Dzor Province - this was the first record of this species for this country. The place where we trapped it is part of the Gnisheek Prime Butterfly Area and the Noravank Important Bird Area. These Areas lie on the north-eastern flanks of the Hayots Dzor mountain range, varying in altitude from 1200 to 2320 m. a.s.l.,

through which the deep Zangezur Canyon has cut. The slopes of the canyon from bottom to top support a great diversity of habitats out of which many different ecosystems have evolved: alluvial forests, deciduous woodlands, semi-desert scrub, tragacanth hedgehog-heaths, mountain steppes, patches of rock sward, subalpine meadows (Figs 1-2).

Locality: Armenia, Prov. Vayots Dzor, Noravank Monastery - 6 km SE ad Areni, (39º41'05'' N; 45º14'02'' E), 1510 m a.s.l., 1 ♂, 1-VI-2014, leg. R. Wąsala & R. Zamorski (Figs 3-5). The material deposited in the author's collection (Poznań University of Life Sciences).

The specimen was attracted, along with many other moths, to a white screen illuminated with a 250 W mercury vapour lamp.



Figs 1-6.– 1. The slope of the Hayots Dzor mountain range where *Desertoplusia bella* (Christoph, 1887) was trapped. **2.** The trapping site of *Desertoplusia bella* (Christoph, 1887) - Armenia, Noravank Monastery. **3-5.** *Desertoplusia bella* (Christoph, 1887) - Armenia, Noravank Monastery, 1-VI-2014, leg. R. Wąsala and R. Zamorski: **3.** imago; **4.** male genitalia; **5.** aedeagus**. 6.** An outline of the distribution of *Desertoplusia bella* (Christoph, 1887) (hatched area) in the Caspian Sea region. The black dots show the localities of *D. bella* in Armenia and Turkey.

Discussion

Not much is known about the biology and environmental preferences of *D. bella*. Its caterpillar and host plant(s) are as yet unknown. In the Kopet Dagh Mts, a known biodiversity hotspot

(GILLESPIE *et al*., 2012), the species was found at altitudes from 1070 to 2950 m a.s.l.; the flight season lasts from mid-May until early August (ZAHIRI & FIBIGER, 2008). Our finding of the species in Armenia in early June at 1510 m a.s.l. corroborates that information.

Previous findings of *D. bella* are from localities in Turkmenistan and Iran, and also in Van Province, Turkey, disjunctive regions that are ca 1000-1400 km apart latitudinally. The site in Armenia where we found the species lies in between these extremes: 1000-1300 km to the west of the Kopet Dagh Mts in Iran-Turkmenistan and ca 200 km north-east of the site in eastern Turkey (Fig. 6). *D. bella* is probably more widely distributed, occurring in suitable biotopes in eastern Turkey, southern Armenia and northern Iran.

Acknowledgements

We are very grateful to Grzegorz Bistuła-Prószyński, Roman Zamorski and Dariusz Wasiluk for accompanying us during the trip and helping with the field research.

BIBLIOGRAPHY

GILLESPIE, T. W., LIPKIN, B., SULLIVAN, L., BENOWITZ, D. R., PAU, S. & KEPPEL, G., 2012.– The rarest and least protected forests in biodiversity hotspots.– *Biodiversity Conservation*, **21**: 3597-3611.

KLYUCHKO, Z. F., 1984.– Two new Noctuid moth genera (Lepidoptera: Noctuidae).– *Vestnik Zoologii*, **1984**(3): 73-74. (in Russian).

KOÇAK, A. Ö. & KEMAL, M., 2012.– List of two thousand species of pterygot insects in Van Province (East Turkey) (Results of the entomofauna project of Turkey - 7).– *Cesa News*, **81**: 2-86.

RONKAY, L., RONKAY, G. & BEHOUNEK, G., 2008.– Plusiinae 1. *A Taxonomic Atlas of the Euroasian and North African Noctuoidea*, **1**: 342 pp. Heterocera Press, Budapest.

ZAHIRI, R. & FIBIGER, M., 2008.– The Plusiinae of Iran (Lepidoptera: Noctuidae).– *SHILAP Revista de lepidopterología*, **36**(143): 301-339.

*R. W.
Department of Entomology and Environmental Protection
Poznań University of Life Sciences
Dąbrowskiego, 159
PL-60-594 Poznań
POLONIA / *POLAND*
E-mail: roman.wasala@up.poznan.pl
https://orcid.org/0000-0002-7825-3273

J. N.
Department of Entomology and Environmental Protection
Poznań University of Life Sciences
Dąbrowskiego, 159
PL-60-594 Poznań
POLONIA / *POLAND*
E-mail: janusz.nowacki@up.poznan.pl
https://orcid.org/0000-0003-0221-0282

*Autor para correspondencia / *Corresponding author*

(Recibido para publicación / *Received for publication* 16-I-2020)
(Revisado y aceptado / *Revised and accepted* 28-II-2020)
(Publicado / *Published* 30-VI-2020)

NOTICIAS GENERALES / *GENERAL NEWS*

CORRECCIÓN / *CORRECTIONS*.– En T. Revilla & J. Gastón, 2019, *SHILAP Revta. lepid*., **47**(185): 57-64, se cita a *Parectopa robiniella* Clemens, 1863, como nueva para España, cuando ya se había citado anteriormente por E. Olivella, 2005, *Ses. Entom. ICHN-SCL*, **13**(2003): 3-11.– **DETALLES / *DETAILS***: Javier Gastón; Amboto, 7-4º-Dcha.; E-48993 Getxo (Vizcaya); ESPAÑA / *SPAIN*. E-mail: fjgaston@yahoo.es.

SHILAP REVISTA DE LEPIDOPTEROLOGÍA, RENUEVA LA EXCELENCIA 2018-2020 / *SHILAP REVISTA DE LEPIDOPTEROLOGIA, RENOVATES THE EXCELLENCE* 2018-2020.– Tenemos el placer de anunciar que nuestra publicación *SHILAP Revista de lepidopterología* ha superado el proceso de evaluación de calidad de las revistas científicas españolas que la Fundación Española para la Ciencia y la Tecnología (FECYT) ha llevado a cabo durante el año 2018. Después de este arduo proceso, la resolución definitiva de la convocatoria establece que *SHILAP Revista de lepidopterología* ha logrado superar los 12 indicadores de calidad y ha obtenido la certificación de FECYT que selecciona y califica nuestra publicación como **EXCELENTE**, junto con otras 125 revistas. / *We have the pleasure of announcing that our publication* SHILAP Revista de lepidopterología *has successfully passed the quality evaluation process of Spanish scientific magazines carried out by the Spanish Foundation for Science and Technology (FECYT) during 2018. After this complicated process, the final finding establishes that* SHILAP Revista de lepidopterología *has passed the 12 indicators of quality and obtained the certificate of FECYT that selects and qualifies our publication as* ***EXCELLENT****, together with 125 other journals*.– **DETALLES / *DETAILS*:** SHILAP, Apartado de correos, 331, E-28010 Madrid, ESPAÑA / *SPAIN* (E-mail: avives1954@outlook.es).

CORRECCIÓN / *CORRECTIONS*.– En J. Gastón, V. Redondo & T. Revilla, 2020, *SHILAP Revta. lepid*., **48**(189): 65-70, se cita a *Denisa similella* (Hübner, 1796), como nueva para España, cuando ya se había citado anteriormente por J. Dantart, 2017, *Butll. Soc. Cat. Lep*., **108**: 61-85.– **DETALLES / *DETAILS*:** Javier Gastón; Amboto, 7-4º-Dcha.; E-48993 Getxo (Vizcaya); ESPAÑA / *SPAIN*. E-mail: fjgaston@yahoo.es.

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 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)	8,50 euros / 100 alfileres
Minucias: 0,10, 0,15 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	5,50 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).

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 289-297 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.395

The first DNA barcoding records of three *Evergestis* Hübner, [1825] species in Turkey with molecular evaluations (Lepidoptera: Crambidae, Glaphyriinae)

S. Kızıldağ

Abstract

Turkish populations of *Evergestis nomadalis* Lederer, 1870, *Evergestis boursini* Amsel, 1939, and *Evergestis pazukii* Alipanah, 2018 were barcoded and presented detailed morphologies for the first time herein. Species delimination of the *Evergestis* Hübner, [1825] populations were evaluated based on the mitochondrial sitochrom oxidase I subunit gene. In the consensus tree, which was constructed using the neighbor joining, Bayesian inference, and maximum likelihood algorithms, the molecular relationships of genera/tribus in the subfamily Glaphyriinae were shown with some evaluations.
KEY WORDS: Lepidoptera, Crambidae, Glaphyriinae, *Evergestis nomadalis*, *Evergestis boursini*, *Evergestis pazukii*, barcoding, Turkey.

El primer registro del AND código de barras de tres especies de *Evergestis* Hübner, [1825] en Turquía con evaluación molecular (Lepidoptera: Crambidae, Glaphyriinae)

Resumen

Las poblaciones turcas de *Evergestis nomadalis* Lederer, 1870, *Evergestis boursini* Amsel, 1939 y *Evergestis pazukii* Alipanah, 2018 fueron etiquetadas con el código de barras y presentada su morfología por primera vez aquí. La delimitación de las poblaciones de las especies de *Evergestis* Hübner, [1825] fueron consensuadas basándose sobre el gen subunidad I de la citocromo c oxidasa. El árbol fue construido con algunas evidencias, usando la asociación de proximidad, la inferencia bayesiana y algoritmos de probabilidad máximos, así como las relaciones moleculares de los géneros / tribus en la subfamilia Glaphyriinae.
PALABRAS CLAVE: Lepidoptera, Crambidae, Glaphyriinae, *Evergestis nomadalis*, *Evergestis boursini*, *Evergestis pazukii*, código de barras, Turquía.

Introduction

The subfamily Glaphyriinae is now represented by its new combination of 51 genera and over 300 species (REGIER *et al*., 2012; ALIPANAH *et al*., 2018). Since the Evergestinae (ten genos) and Noordinae (a genus) species are paraphyletic with Glaphyriinae species through molecular phylogeny, these subfamilies are synonyms for Glaphyriinae. Recently, although molecular phylogeny studies between family/subfamily and even lower taxonomic groups have been generally compatible with the morphological systematics, new taxonomic status recommendations have been rapidly increasing for Lepidoptera (BAUM, 1992; HALL, 2003; ADUSE-POKU *et al*., 2009; SILVA-BRANDÃO *et al*.,

2009; BRABY, 2010; BRABY & EASTWOOD, 2019). A main problem has been that some of the genus-containing species have been shown to be more closely related to species containing other genera rather than their congeners (REGIER *et al*., 2009; REGIER *et al*., 2012). It was stated that this mismatch was caused by the lack of a rich molecular dataset containing different species in different geographies and also because the morphological features used in species identification do not reflect enough synapomorphic characters (HALL, 2003; YOUNG, 2006; ADUSE-POKU *et al*., 2009; HAUSMANN *et al*., 2009; BRABY, 2010; KAWAHARA *et al*., 2017; BRABY & EASTWOOD, 2019; KEMAL *et al*., 2019; KIZILDAĞ *et al*., 2019). Therefore, it is highly preferred to test morphologically-identified species with their molecular barcodes in order to represent phylogeny at upper taxonomic levels for their correct systematic studies (SOLIS & MITTER, 1992; ÖUNAP *et al*., 2008; ÖUNAP & VIIDALEPP, 2009; ÖUNAP *et al*., 2011; ÖUNAP *et al*., 2016; MURILLO-RAMOS *et al*., 2019). Traditionally, taxa with correctly identified genera delimination have to be phylogenetically monophyletic groups in the same subfamily (KRISTENSEN *et al*., 2007).

In this study, relationships between genera in Glaphyriina were investigated using the new taxonomic status advice. The phylogeny estimation of *Evergestis* Hübner, [1825] was presented for the first time herein, with the molecular barcoding of three *Evergestis* species from Turkey.

Methods

The photograps of morphological and genital preparation, materials for this study, the *Evergestis pazukii* specimen (Van-Turkey/Lep-Pyr003), *Evergestis boursini* specimen (Van-Turkey/Lep-Pyr008) and *Evergestis nomadalis* specimen (Van-Turkey/Lep-Pyr024) were obtained from the Centre for Entomological Studies Ankara (Cesa) Collection.

The legs from each sample were washed thoroughly with ethanol and dried. Genomic DNA extraction and polymerase chain reaction (PCR) amplification of the mtCOI gene were performed used the RED Extract-N-Amp Tissue PCR Kit (Sigma-Aldrich, St. Louis, Missouri, USA) according to the method of KEMAL *et al*. (2018). The PCR products were purified before being bidirectional sequenced with the universal primers (LepF1/R1) by Macrogen (Macrogen, Amsterdam, Netherlands).

In the present study of the 3 new mtCOI gene sequences, the sequences of another 237 closely-related species/populations were also downloaded from GenBank (https://www.ncbi.nlm.nih.gov/) and the Boldsystem database (http://www.boldsystems.org/index.php/), and used for the analyses. Some species the subfamily Odontiinae were chosen as the outgroup. Multiple sequence alignment was performed using the ClustalW algorithm in MEGA 7.0 software (Pennsylvania State University, Pennsylvania, USA). A total of 243 taxa were used for the phylogeny estimation of the genus *Evergestis*.

Genetic distances based on a 658-bp sequence of the COI subunit gene were calculated using the Kimura 2-parameter distance model (KIMURA, 1980). The neighbor-joining (NJ) tree was constructed used the Kimura 2-Parameter distance model in MEGA 7.0 software. Maximum-likelihood (ML) bootstrapping analyses were achieved with 1000 replicates using RA×ML Blackbox on XSEDE v.8.2.4 (STAMATAKIS *et al*., 2008) on the CIPRES Science Gateway. A Bayesian inference (BI) analysis was performed in MrBayes 3.2.6 (RONQUIST & HUELSENBECK, 2003) with the Markov chain Monte Carlo algorithm. The program JModeltest v.2.1.7 (POSADA, 2008) selected the JC+G evolutionary model as the best model according to the akaike information criterion for Bayesian inference. The program was run for 10,000,000 generations, with a sample frequency of 100 and a burn-in of 25,000.

Results

Description of the Turkish populations

Evergestis nomadalis Lederer, 1870

Material examined: TR - Van Pr. Gürpınar, Ba¸et Mt. 2800 m, 7-VIII-2018, M. Kemal & A. Koçak leg. (Cesa).

Upperside of wings: Forewing ground colouration uniformly yellowish brown. Post-discal band broad. Post discal dark spots well marked at inner side of band. Ciliae uniformly developed, not chequered, darker basally. Hind-wing ground colouration pure white. Submarginal band poorly developed, very light brown. Ciliae uniformly developed, slightly darker basally otherwise whitish (Fig. 1.1a).

Male genitalia (Cesa pre-no/GP3183): Uncus long, broader than *boursini*, slightly narrower than *pazukii*. Gnathos broader, pointed at tip, with a row of spinules dorsally. At base, gnathos protruds shoulder-like (Fig. 1.2a-3a). Dorsal and ventral margins of valva more or less parallel, rounded apically (Fig. 1.2a). Distal end of aedeagus with a broad plate covered by minute spicules. Inside, a row of long teeth well developed (Fig. 1.2a-4a).

Evergestis boursini Amsel, 1939

Material examined: TR-Van Pr. Çatak, Saklıvadi 1-IX-2016, M. Kemal & A. Koçak leg. (Cesa).

Upperside of wings: Forewing bi-coloured light brown and greyish-brown. Veins whitish, especially at outer margin well-developed. Discal and post-discal whitish lines parallel and well marked. Spindle-shaped discal marking distinct, bordered by dark brown scales. Ciliae chequered by white and brown. Hind-wing ground colouration dirty cream. Submarginal band unsharp, at anal region indistinct. Marginal line dark brown. Ciliae weakly chequered by dark brown, at anal region almostt whitish (Fig. 1.1b).

Male genitalia (Cesa pre-no/GP2555): Uncus long, slender. Remarkably narrower than those of *nomadalis* and *pazukii*. Gnathos broader at base, shorter, with a row of spinules dorsally (Fig. 1.2b-3b). Dorsal and ventral margins of valva not parallel, more pointed apically (Fig. 1.2b). Distal end of aedeagus with a plate covered by minute spicules. Inside, three minute teeth rows well distinguished (Fig. 1.2b-4b).

Evergestis pazukii Alipanah, 2018

Material examined: TR–Van Pr. Başkale, Ziyanis 9 7 2015, M. Kemal & A. Koçak leg. (Cesa)

Upperside of wings: Forewing general colouration dirty grey-brown. Markings rather weak. Post-discal area paler. Marginal line slightly undulated, dark brown. Ciliae chequered. Hind-wing dirty creamy, suffused with dark brown scales, submarginal area dark brown with partly developedcreamy marginal lunules. Ciliae chequered especially at apical region (Fig. 1.1c).

Male genitalia (Cesa pre-no/GP2537): Uncus long, straight, well chitinized. Comparing with nomadalis and boursini, broader than those of others. Gnathos shorter, slender, with a row of spinules dorsally (Fig. 1.2c-3c). Dorsal and ventral margins of valva almost parallel, roundish apically (Fig. 1.2c). Distal end of aedeagus with a broad plate covered by minute spicules. Inside, two parallel spindle-shaped minute teeth rows well marked (Fig. 1.2c-4c).

MTCOI GENE-BASED MOLECULAR EVALUATION OF *EVERGESTIS* SPECIES

The newly characterized mtCOI DNA gene sequences were deposited in GenBank with GC contents and accession numbers as follows: *Evergestis pazukii* 29.78%, MN259518; *Evergestis boursini* 30.09%, MN259521; *Evergestis nomadalis* 29.93%, MN259519.

Subfamily Glaphyriinae contains 51 genera, according to the new combination and only the COI barcode (658 bp) belonging to the species/populations of 24 genera, which are available in the Boldsystem/Genbank. With the new data presented, phylogeny estimates were therefore performed with the existing barcode records. The topologies of the three trees were quite compatible with each other. Therefore, three support values were shown in the NJ tree. In the presented phylogenetic tree, the populations of some species were narrowed; respectively, *E. pallidata* (Hufnagel, 1767) 32 populations, *E. limbata* (Linnaeus, 1767) 11 populations, *E. caesialis* (Herrich-Schäffer, 1849) 10 populations, *E. unimacula* (Grote & Robinson, 1867) 7 populations, *E. aenealis* ([Denis & Schiffermüller], 1775) 10 populations, *E. extimalis* (Scopoli, 1763) 10 populations, *E. simulatilis* (Grote, 1880) 4 populations, *E.*

dumerlei Leraut, 2003 5 populations, *E. sophialis* (Fabricius, 1787) 8 populations, *E. rimosalis* Guenée, 1854 13 populations, *E. forficalis* (Linnaeus, 1758) 26 populations, *E. subterminalis* Barnes & McDunnough, 1914 17 populations, and *E. isatidalis* (Duponchel, [1833]) 3 populations.

In the presented phylogenetic tree, the inner group was divided into two main clades (A1 and A2 nodes with red points). The A1 node lineage was divided into two subclades (B1 and B2 nodes with blue points). The B1 clade included all *Evergestis* species and species of *Prorasea* Grote, 1878, *Crocidolomia* Zeller, 1952, *Orenaia* Duponchel, [1845], *Cylindrifrons succandidalis* (Hulst, 1886), *Dichogoma prognealis* (Druce, 1895), and *Trischistognatha* Warren, 1892. The B2 clade included all *Glaphyria* Hübner, [1823] species and species of *Nephrogramma* Munroe, 1964, *Scybalistodes* Munroe, 1964, *Lipocosma* Lederer, 1863, *Schacontia themis* Solis & Goldstein, 2013, *Lipocosmodes fuliginosalis (*Fernald, 1888), *Dicymolomia* Zeller, 1872, *Stegea salutalis* (Hulst, 1886), *Chalcoela* Zeller, 1872, *Abegesta* Munroe, 1964, *Xanthophysa psychialis* (Hulst, 1886), and *Aethiophysa* Munroe, 1964. The A2 node lineage contained *Noorda blitealis* (Walker, 1859), *Alatuncusia bergii* (Möschler, 1890), *Dichogama* Lederer, 1863, and *Hellula* Guenée, 1854 (Figure 2).

The Turkish population of *E. pazukii* was closest to the *E. dumerlei* Leraut, 2003 clade, with high support values (91/1.00/92), and the two species had a sister position to *E. lupalis* Zerny, 1928, *E. frumentalis* (Linnaeus, 1761), and *E. sophialis* (Fabricius, 1787). The sister groups clustered *E. aridalis* Barnes & McDunnough, 1914 and *E. extimalis* (Scopoli, 1763) in the basal position. The species *Prorasea* Grote, 1878 was the closest to the *E. simulatilis* (Grote, 1880) group and both were also basal to the *E. pazukii* clade. The species *Crocidolomia* Zeller, 1852 was also the closest to *E. boursini* (Turkish population), following the basal *E. nomadalis* (Turkish population) and *Orenaia* Duponchel, 1845 species, which had a sister position to this clade and low support values. In the presented phylogenetic tree, the genetic distances between the species presented in the same clade with the other species of the genus are shown in the K2P model (Table 1).

Table 1.– K2P-genetic distances between the species in same clade with species of the presented *Evergestis*.

ID	Taxa	Accession Numbers	K2P-genetic distance %		
–	*Evergestis pazukii*	MN259518			
–	*Evergestis boursini*	MN259521	10.70		
–	*Evergestis nomadalis*	MN259519	7.90	9.20	
PHLAB721-10	*Evergestis dumerlei*	HQ968734	5.20	10.50	9.40
PHLAH487-12	*Evergestis lupalis*	–	7.60	10.00	8.30
LEFIL642-10	*Evergestis frumentalis*	KX041562	7.00	8.10	6.90
LEFIG593-10	*Evergestis sophialis*	HM876264	7.10	8.30	8.30
ODOPE530-11	*Evergestis extimalis*	KX045338	7.40	10.90	8.50
LBCG203-80	*Evergestis simulatilis*	–	6.50	7.00	6.50

Discussion and conclusions

In this study, it was determined that three populations evaluated morphologically were typical *nomadalis* / *boursini* / *pazukii* members. For the first time detailed genital characteristics of the species are presented. Today, with the understanding of the importance of genetic barcoding, a significant number of European insects have been barcoding, and this process is rapidly ongoing (HAUSMANN *et al*., 2013; HENDRICH *et al*., 2014; KUMAR *et al*., 2019). The genus *Evergestis* Hübner, [1825], which is mostly distributed in the Holarctic region, is globally known as having 79 species. Today, only a quarter of the species have been barcoded and almost all of the records have been obtained from USA and Canada. In this study, new barcode records, obtained from different geographies and different species, were presented for the first time.

The species of *Evergestis* were spread out with the species of the other genera in the clade represented by the B1 node. *E. pazukii* had the closest relationship with *E. dumerlei* Leraut, 2003.

When *E. pazukii* was described by ALIPANAH *et al*. (2018), it was suspected to be a morphologically similar species to *E. russulatalis* (Hampson, 1900). The identity of this species remains controversial, as no molecular data has been obtained. Therefore, no molecular comparison was made between them.

The *E. boursini* Amsel, 1939 and *E. nomadalis* Lederer, 1870 populations were closer to the *Crocidolomia* Zeller, 1852 and *Orenaia* Duponchel, 1845 than to the other *Evergestis* species. The genus *Orenaia* is known to be closely related to *Evergestis*, like *Cornifrons* Lederer, 1858, but the distinction of the genera has been based on strong sinapomorphic characters at the morphological level. AMSEL (1939) reported that *E. boursini* was close to *E. serratalis* Staudinger, 1870 (forewing pattern), and it was reported to be more similar to *E. spiniferalis* (Staudinger, 1900) (valve shape and size) (ALIPANAH *et al*., 2018). However, since neither species has molecular data, the genetic distance and phylogeny between them could not be estimated. Equivalent data should be presented for both evaluations in order to evaluate the morphological systematic and molecular taxonomy of *Evergestis* together. However, due to the lack of molecular data of this genus, the relationships between both intragenus and within intergenera remains unsolved. Hence, it seems difficult to test whether conventional taxonomy reflects phylogeny in light of molecular data.

In the presented phylogeny tree, the *Orenaia* and *Crocidolomia* species were monophyletic, but the phylogenetic relationships of the genera were unsolved because of their low support values. The COI barcode length of *Cornifrons* was less than 658 bp, and thus was not evaluated in this study.

The new combinations of the subfamily Glaphyriinae have been reported in several studies, and three synonymic (Dichogominae, Evergestinae, and Noordinae) subfamily members were evaluated in subtaxonomic categories. According to the results of the present study, two tribus were recommended in Glaphyriinae, where the A1 node represents Glaphyriini and the A2 node represents Noordiini. Glaphyriini was divided into two2 subtribus, where the B1 node represents Evergestiina and the B2 node represents Glaphyriina. The genus *Dichogama* was not monopyletic like *Evergestis*. It was aimed to analyze the phylogeny of this subfamily via a cladistic analysis and different gene sequences (SOLIS & MITTER, 2008; REGIER *et al*., 2012). However, one of the biggest problems was the lack of morphological and molecular data of the different species from different geographies. Although the distribution areas of these three species have been reported in this study, there are no molecular records for any of them (GOATER, 2005; KOÇAK & KEMAL, 2014; KEMAL & KOÇAK, 2017; ALIPANAH *et al*., 2018). Moreover, there are no current molecular data for any member of *Upiga* Capps, 1964, *Paregesta* Munroe, 1964, *Plumegesta* Munroe, 1972, *Ennomosia* Amsel, 1956, or *Cornifrons* (length less 658 bp). In this study, three new barcode records and generic/tribus-level phylogeny estimations are presented. The phylogenetic analyses reveal that the genus *Evergestis* is not monophyletic. The new molecular data of the three species obtained in the presented study provides the chance to understand the evolutionary relationships of *Evergestis*. Further studies will require a large number of barcoding to determine the limits of the genera and tribes of Glaphyriinae.

Acknowledgments

Special thanks are given to Prof. Dr. Ahmet Ömer Koçak and Dr. Muhabbet Kemal for their continuous help, comments, and use of the Cesa Collection. This work was supported by the Research Council of Van Yüzüncü Yıl University (YYUBAP, Project No: FAP-2018-7229), Van, Turkey.

BIBLIOGRAPHY

ADUSE-POKU, K., VINGERHOEDT, E. & WAHLBERG, N., 2009.– Out-of-Africa again: a phylogenetic hypothesis of the genus *Charaxes* (Lepidoptera: Nymphalidae) based on 5 gene regions.– *Molecular Phylogenetics and Evolution*, **53**: 463-478.

ALIPANAH, H., KHODADAD, M., RAJAEI, H. & HASELI, M., 2018.– Taxonomic study of the genus *Evergestis* Hübner, 1825 (Lepidoptera: Crambidae: Glaphyriinae) in Iran with description of a new species.– *Zootaxa*, **4420**(1): 1-33.

BAUM, D. A., 1992.– Phylogenetic species concepts.– *Trends in Ecology and Evolution,* **7**: 1-2.

BRABY, M. F., 2010.– The merging of taxonomy and conservation biology: a synthesis of Australian butterfly systematics (Lepidoptera: Hesperioidea and Papilionoidea) for the 21st century.– *Zootaxa*, **2707**: 1-76.

BRABY, M. F. & EASTWOOD, R., 2019.– Revised taxonomic status of *Pseudalmenus barringtonensis* Waterhouse, 1928 stat. rev. (Lepidoptera: Lycaenidae): uncovering Australia's greatest taxonomic fraud.– *Invertebrate Systematics,* **33**(3): 530-543.

GOATER, B., 2005.– Evergestinae: 69-107, 182-183, 190-193, 208-223, 244-256.– *In* B. GOATER, M. NUSS & W. SPEIDEL. Pyraloidea I (Crambidae: Acentropinae, Evergestoinae, Heliothelinae, Schoenobiinae, Scopariinae).– *In* P. HUEMER & O. KARSHOLT. *Microlepidoptera of Europe,* **4**: 304 pp. Apollo Books, Stenstrup.

HALL, J. P. W., 2003.– Phylogenetic reassessment of the five forewing radial-veined tribes of Riodininae (Lepidoptera: Riodinidae).– *Systematic Entomology,* **28**: 23-37.

HAUSMANN, A., HEBERT, P. D. N., MITCHELL, A., ROUGERIE, R., SOMMERER, M. E., TED, Y. & CATHERINE, J., 2009.– Revision of the Australian *Oenochroma vinaria* Guenée, 1858 species-complex (Lepidoptera: Geometridae, Oenochrominae): DNA barcoding reveals cryptic diversity and assesses status of type specimen without dissection.– *Zootaxa*, **2239**: 1-21.

HAUSMANN, A., GODFRAY, H. C. J., HUEMER, P., MUTANEN, M., ROUGERIE, R., VAN NIEUKERKEN, E. J., RATNASING-HAM, S. & HEBERT, P. D. N., 2013.– Genetic patterns in European geometrid moths revealed by the Barcode Index Number (BIN) system.– *PLoS One*, **8**(12): e84518.

HENDRICH, L., MORINIÈRE, J., HASZPRUNAR, G., HEBERT, P., HAUSMANN, A., KÖHLER, F. & BALKE, M., 2014.– A comprehensive DNA barcode database for Central European beetles: adding more than 3,500 identified species to BOLD.– *Molecular Ecology*, **15**(4): 795-818.

KAWAHARA, A. Y., PLOTKIN, D., OHSHIMA, I., LOPEZ-VAAMONDE, C., HOLIHAN, P. R., BREINHOLT, J. W., KAWAITA, A., XIAO, L., REGIER, J. C., DAVIS, D. R., KUMATA, T., SOHN, J-C, DE PRINS, J. & MITTER, C., 2016.– A molecular phylogeny and revised higher-level classification for the leaf-mining moth family Gracillariidae and its implications for larval host-use evolution.– *Systematic Entomology*, **42**(1): 60-81.

KEMAL, M. & KOÇAK, A. Ö., 2017.– New and little known Pyraloidea of Turkey, with some faunistical notes.– *Cesa News,* **130**: 1-43.

KEMAL, M., YILDIZ, I., KIZILDAĞ, S., UÇAK, H. & KOÇAK, A. Ö., 2018.– Taxonomical and molecular evaluation of *Apochima agassiz* in East Turkey, with a description of a new genus (Lepidoptera, Geometridae, Ennominae).– *Miscellaneous Papers*, **169**: 1-14.

KEMAL, M., KIZILDAĞ, S. & KOÇAK, A. Ö., 2019.– On the Heterocera of Mt. Caragan (Philippines, Mindanao Is.) with some remarks (Lepidoptera).– *Miscellaneous Papers*, **190**: 1-51.

KIMURA, M., 1980.– A simple method for estimating evolutionary rate of base substitutions through comparative studies of nucleotide sequences.– *Journal of Molecular Evolution,* **16**: 111-120.

KIZILDAĞ, S., KEMAL, M. & KOÇAK, A. Ö., 2019.– Comments on the taxonomic status of "marchandi De Freina" in SE Turkey (Lepidoptera, Arctiidae).– *Miscellaneous Papers*, **189**: 1-4.

KOÇAK, A. Ö. & KEMAL, M., 2014.– Lepidoptera of Iran based upon the infosystem of the Cesa.– *Priamus (Supplement),* **31**: 1-487.

KRISTENSEN, N. P., SCOBLE, M. J. & KARSHOLT, O., 2007.– Lepidoptera phylogeny and systematics: the state of inventorying moth and butterfly diversity.– *Zootaxa*, **1668**: 699-747.

KUMAR, V., KUNDU, S., CHAKRABORTY, R., SANYAL, A., RAHA, A., SANYAL, O., RANJAN, R., PAKRASHI, A., TYAGI, K. & CHANDRA, K., 2019.– DNA barcoding of Geometridae moths (Insecta: Lepidoptera): a preliminary effort from Namdapha National Park, Eastern Himalaya.– *Mitochondrial DNA Part B*, **4**(1): 309-315.

MURILLO-RAMOS, L., BREHM, G., SIHVONEN, P., HAUSMANN, A., HOLM, S., GHANAVI, H. R., ÖUNAP, E., TRUUVERK, A., STAUDE, H., FRIEDRICH, E., TAMMARU, T. & WAHLBERG, N., 2019.– A comprehensive molecular phylogeny of Geometridae (Lepidoptera) with a focus on enigmatic small subfamilies.– *PeerJ* 7: e7386. Available from https://doi.org/10.7717/peerj.7386.

ÖUNAP, E., VIIDALEPP, J. & SAARMA, U., 2008.– Systematic position of Lythriini revised: transferred from Larentiinae to Sterrhinae (Lepidoptera, Geometridae).– *Zoologica Scripta*, **37**(4): 405-413.

ÖUNAP, E. & VIIDALEPP, J., 2009.– Description of *Crypsiphona tasmanica* sp. nov. (Lepidoptera: Geometridae: Geometrinae), with notes on limitations in using DNA barcodes for delimiting species.– *Australian Journal of Entomology*, **48**(2): 113-124.

ÖUNAP, E., JAVOIŠ, J., VIIDALEPP, J. & TAMMARU, T., 2011.– Phylogenetic relationships of selected European Ennominae (Lepidoptera: Geometridae).– *European Journal of Entomology*, **108**(2): 267-273.

ÖUNAP, E., VIIDALEPP, J. & TRUUVERK, A., 2016.– Phylogeny of the subfamily Larentiinae (Lepidoptera: Geometridae): integrating molecular data and traditional classifications.– *Systematic Entomology*, **21**(4): 824-843.

POSADA D., 2008.– jModelTest: phylogenetic model averaging.– *Molecular Biology Evolution*, **25**(7): 1253-1256.

REGIER, J. C., ZWICK A., CUMMINGS, M. P., KAWAHARA, A. Y. CHO, S., WELLER, S., ROE, A., BAIXERAS, J., BROWN, J. W., PARR, C., DAVIS, D. R., EPSTEIN, M., HALLWACHS, W., HAUSMANN, A., JANZEN, D. H., KITCHING, I. J., SOLIS, M. A., YEN, S. H., BAZINET, A. L. & MITTER, C., 2009.– Toward reconstructing the evolution of advanced moths and butterflies (Lepidoptera: Ditrysia): an initial molecular study.– *BioMed Central Evolutionary Biology*, **9**: 280-301.

REGIER, J. C., MITTER, C., SOLIS, M. A., HAYDEN, J. E., LANDRY, B., NUSS. M., SIMONEN. T. J., YEN. S. H., ZWICK. A. & CUMMINGS, M. P., 2012.– A molecular phylogeny for the pyraloid moths (Lepidoptera: Pyraloidea) and its implications for higher-level classification.– *Systematic Entomology*, **37**: 635-656.

RONQUIST, F. & HUELSENBECK, J. P., 2003.– MRBAYES 3: Bayesian phylogenetic inference under mixed models.– *Bioinformatics,* **19**: 1572-1574.

SILVA-BRANDÃO, K. L., LYRA, M. L. & FREITAS, A. V. L., 2009.– Barcoding Lepidoptera: Current Situation and Perspectives on the Usefulness of a Contentious Technique.– *Neotropical Entomology*, **38**(4): 441-451.

SOLIS, M. A. & MITTER, C., 1992.– Review and preliminary phylogenetic analysis of the subfamilies of the Pyralidae (sensu stricto) (Lepidoptera: Pyraloidea).– *Systematic Entomology*, **17**: 79-90.

STAMATAKIS, A., HOOVER, P. & ROUGEMONT, J., 2008.– A rapid bootstrap algorithm for the RAxML Web servers.– *Systematic Biology*, **57**(5):758-771.

YOUNG, C. J., 2006.– Molecular relationships of the Australian Ennominae (Lepidoptera: Geometridae) and implications for the phylogeny of the Geometridae from molecular and morphological data.– *Zootaxa*, **1264**(1): 1-147.

S. K.
Van Yuzuncu Yil University
Faculty of Science
Department of Biology
Tusba
TR-65080 Van
TURQUÍA / *TURKEY*
E-mail: sibelkizildag@yyu.edu.tr
https://orcid.org/0000-0003-0182-5154

(Recibido para publicación / *Received for publication* 14-I-2020)
(Revisado y aceptado / *Revised and accepted* 27-II-2020)
(Publicado / *Published* 30-VI-2020)

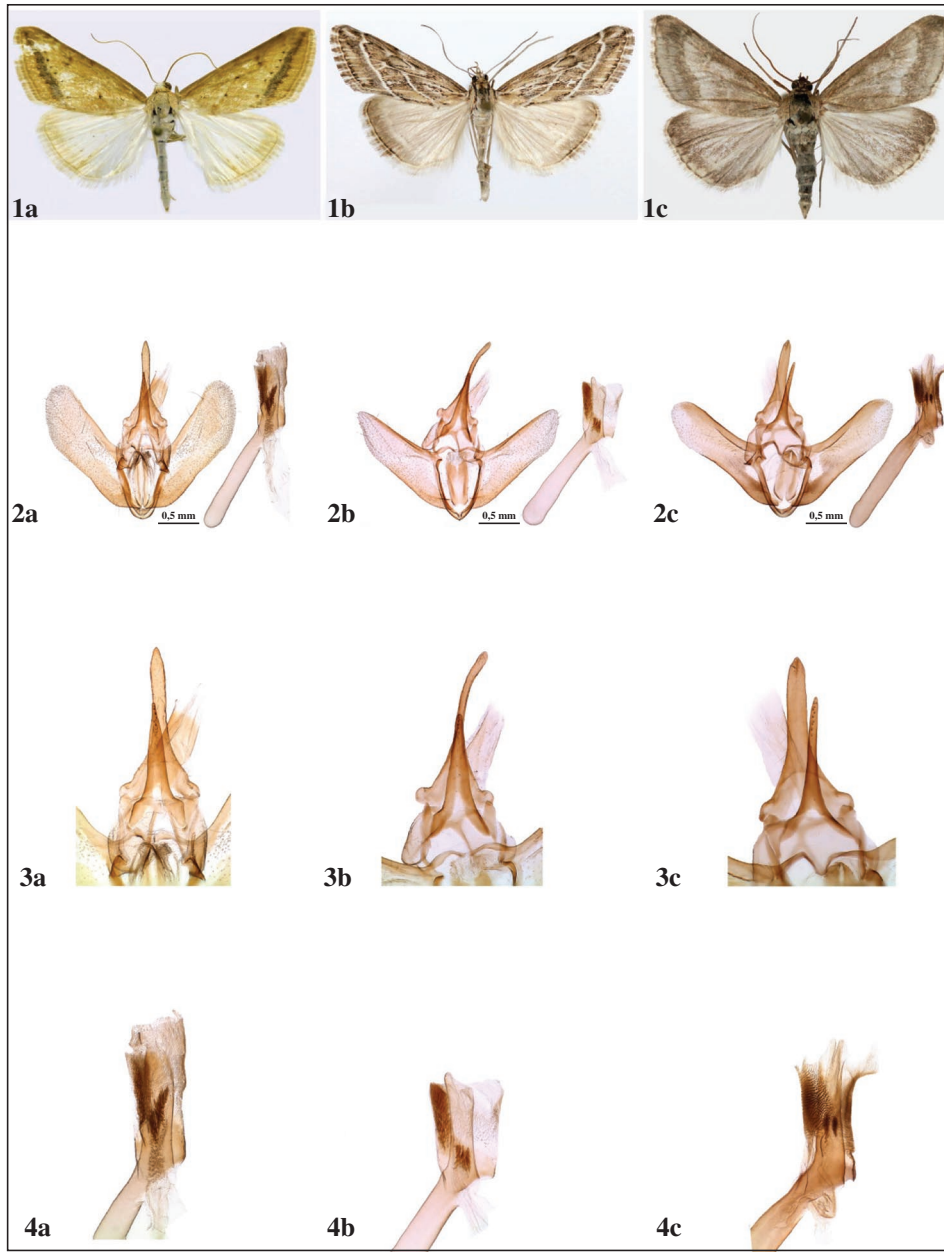


Fig. 1.– Diagnostic characters of three *Evergestis* species based upon the wing markings and male genitalia. Line 1: Upperside of the males of *Evergestis nomadalis* (**a**), *Evergestis boursini* (**b**), *Evergestis pazukii* (**c**). Line 2: total view of the male genitalia. Line 3: ventral view of uncus and gnathos (enlarged). Line 4: distal end of aedeagus (enlarged).

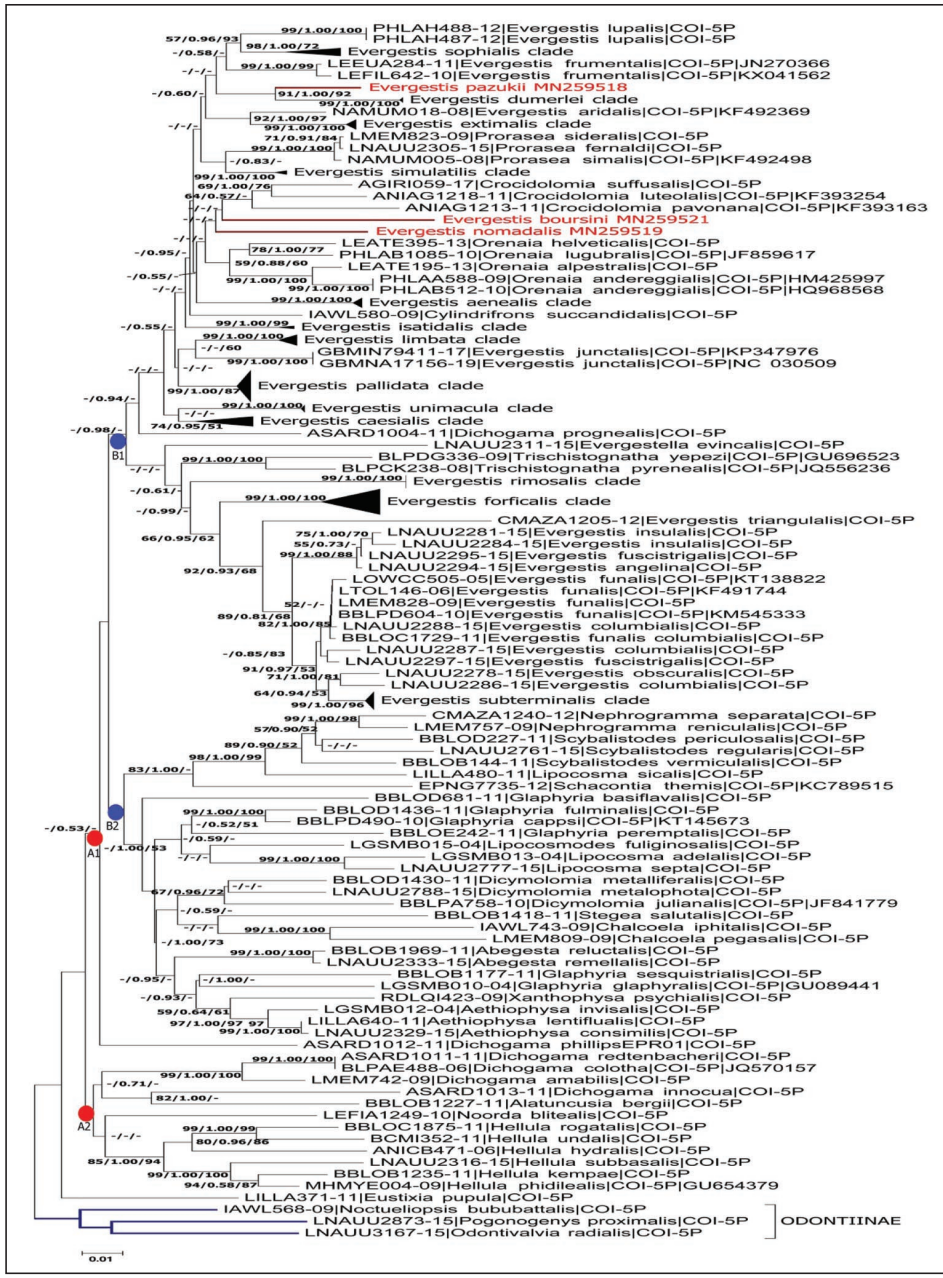
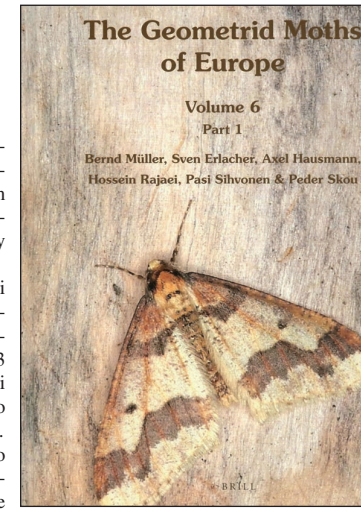


Fig. 2.– The phlogenetic tree of Glaphyriinae populations constucted with NJ, BI and ML algorhitims. Numbers at the nodes indicate the NJ bootstrap values, the BI posterior probability and the ML bootstrap values. A dash indicates a value less than 0.50 or 50%. Bar, 1 substitutions per 100 nucleotide positions.

REVISION DE PUBLICACIONES
BOOK REVIEWS

B. Müller, S. Erlacher, A. Hausmann, H. Rajaei, P. Sihvonen & P. Skou
The Geometrid Moths of Europe. Volume 6. Subfamily Ennominae II
906 páginas
Formato 24,5 x 17 cm
Brill, Leiden, 2019
ISBN: 978-90-04-25222-6



Un nuevo tomo de esta magnífica serie sobre los Geometridae que se encuentran en Europa acaba de aparecer, si bien se ve ampliada en las zonas de influencia con las especies que se halla en el norte de África y en Asia Menor. En concreto se trata del volumen 6 de la serie, que se encuentra dividido en dos volúmenes, el primero de texto y el segundo con 30 láminas a color de los adultos y 202 fotografías de la genitalia de las especies consideradas.

Dentro de la subfamilia Ennominae, nos presentan las tribus Boarmiini con 100 especies y Gnophini (segunda parte) con 68 especies, consiguiendo reunir y estudiar 141 especies agrupadas en 59 géneros. También realizan una actualización de otras tribus reflejadas en el volumen anterior como Abraxini con 3 especies, Cassymini con 2 especies, Macariini con 1 especie y Prosopolophini con 2 especies. También se tratan las nuevas especies que han ido apareciendo después de la publicación de los 5 anteriores volúmenes, con 21 nuevas especies.

En este volumen se describen cuatro nuevas especies, se establece como válido, el género *Phyllometra* Boisduval, 1840; se establecen cuatro nuevas sinonimias de género y ciento once nuevas sinonimias de especie; así como doce nuevas combinaciones de género y ocho de ellos, que cambian de tribu.

De todas las especies tratadas se dan las referencias originales de su descripción, así como de todas las sinonimias consideradas. Igualmente se presenta una diagnosis de los adultos y de la genitalia del macho y de la hembra, datos sobre su distribución (con su correspondiente mapa), fenología, biología, parásitos, hábitat y las especies similares con las que se podría confundir. Todas las especies tratadas han sido fotografiadas a todo color con detalle y excelente calidad, lo que facilita su identificación, también se presentan fotografías de la genitalia del macho y de la hembra.

La obra termina con dos Apéndices, uno con los datos de las preparaciones microscópicas de la genitalia de los machos y otro de la genitalia de las hembras, seguido de una nueva lista actualizada de la familia Geometridae, así como de una detallada bibliografía y de un índice.

Como ha ocurrido en otras ocasiones, la calidad científica del libro, así como su detallada edición, nos hace recomendar vivamente el mismo a todos los interesados en los Geometridae, que nos constan que son muchos y con la aparición de esta serie, no hay duda qué contribuirá a aumentar los estudiosos de tan interesante familia.

No queremos terminar estas líneas, sin felicitar a los autores por tan encomiable trabajo y a la editorial Brill, por su continuidad en la presentación de esta serie con esta calidad científica, así como el esfuerzo que conlleva su edición y nos consta que, con este volumen, finaliza la serie.

El precio de este libro es de 199 euros y los interesados deben dirigirse a:

BRILL
P. O. Box
9000 NL-2300 PA Leiden
HOLANDA / *THE NETHERLANDS*
http://www.brill.com

A. Vives Moreno
E-mail: avives1954@outlook.es
https://orcid.org/0000-0003-3772-2747

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 299-305 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.399

Estados inmaturos de Lepidoptera (LIX). *Nemapogon nevadella* (Caradja, 1920) en Huelva, España (Lepidoptera: Tineidae, Nemapogoninae)

M. Huertas-Dionisio & P. M. Bernabé-Ruiz

Resumen

Se describen e ilustran los estados inmaturos de *Nemapogon nevadella* (Caradja, 1920), así como una muestra de las alas, su ciclo biológico y su distribución en la provincia de Huelva (España).
PALABRAS CLAVE: Lepidoptera, Tineidae, Nemapogoninae*, Nemapogon nevadella,* estados inmaturos, Huelva, España.

Immature stages of Lepidoptera (LIX). *Nemapogon nevadella* **(Caradja, 1920) in Huelva, Spain (Lepidoptera: Tineidae, Nemapogoninae)**

Abstract

The Immature stages of *Nemapogon nevadella* (Caradja, 1920), are described and illustrated, as well as a sample of wings patterns, their biological cycle and its distribution in the province of Huelva (Spain).
KEY WORDS: Lepidoptera, Tineidae, Nemapogoninae, *Nemapogon nevadella,* immature stages, Huelva, Spain.

Introducción

Nemapogon nevadella (Caradja, 1920) fue descrita de Sierra Nevada (Granada, España) como variedad de *Tinea arcella* Fabricius, 1777 anotándose que era del mismo tamaño y color que *T. arcella*, pero con manchas repartidas por el ala anterior, por lo que se concluyó que podía tratarse de una forma local de ésta. El examen de la genitalia de los ejemplares de Sierra Nevada y Sierra de Alfacar de Granada (PETERSEN, 1957), coincide con la descripción de Caradja, indicando claras diferencias específicas con *T. arcella.* El andropigio se recoge en PETERSEN (1957, 1960) y el ginopigio en PETERSEN (1964). La descripción de los adultos, con una envergadura de 10 a 16 mm y su genitalia, se detallan en GAEDIKE (2015). Este autor especifica que la figura del andropigio de PETERSEN (1957), nombrada como *"nevadellus*", es la de *Nemapogon agenjoi* Petersen, 1957 y el ginopigio de *Nemapogon hispanellus* Gozmány, 1960 pertenece a *N. nevadella.* Debido a esto, se ha señalado a *N. hispanellus* como sinónimo de *N. nevadella* (VIVES MORENO, 1986, 2014) y de *N. agenjoi* (GAEDIKE, 2015). Como es un poco variable, en el presente trabajo, representamos el andropigio (fig. 6) y cinco ejemplares ex larvas obtenidos en Huelva (figs. 1-4, Barranco de Carabaña y fig. 5, Fuente la Corcha), con la cabeza y el tórax blanco, las alas anteriores blancas con manchas castaño oscuro a negras, y otras de color canela; las alas posteriores grises.

Material y métodos

Las especies de la familia Tineidae, raramente acuden a la luz, aunque se trate del método más uti-

lizado para obtenerlas, pero hay otros procedimientos con los que se pueden conseguir ejemplares perfectos, como el logrado al observar un ramillete de ejemplares secos del hongo *Mycena haematopus* (Pers) P. Kumm, sujetos a una raíz seca (fig. 22) en Fuente la Corcha (Beas-Huelva) el 1 de marzo de 2008. En ellos había pequeños agujeros, excrementos con seda y galerías en el sombrero y pie. Los hongos recolectados se introdujeron en una caja de plástico transparente donde se observó la salida de los adultos en marzo y abril, confirmándose por genitalia que pertenecían a *Nemapogon nevadella* (fig. 6) y, a la vez, se describieron y dibujaron los estados inmaturos.

El segundo procedimiento consistió en utilizar una trampa-cebo en el Barranco de Carabaña (Cortegana-Huelva), elaborada con una bolsa de 10×15 cm, construida con una malla o red de plástico de 1×1 mm de hueco y cosida con grapas, en cuyo interior se introdujo como cebo trozos secos del hongo *Boletus aereus* Bull. Esta bolsa se colgó de la rama de un castaño (*Castanea sativa* Mill.) en una zona sombría el 31 de mayo de 2019 y se recogió el 31 de julio de 2019, vertiendo el contenido en una caja de plástico transparente, donde se observó la salida de los adultos desde el 22 de agosto hasta el 5 de octubre de 2019.

Para la preparación de genitalia se ha seguido a ROBINSON (1976). Para conservar cierto volumen, se han montado sobre portaobjetos con superficie cóncava y se ha empleado una resina sintética soluble al agua para conservar las preparaciones.

Estados inmaturos

En la bibliografía consultada no hay descripciones de sus estados inmaturos, por lo que aquí se hace por primera vez El huevo (fig. 21), es elíptico, de 0,50×0,20 mm, corion liso, pardo muy claro brillante. La oruga de última edad (figs. 7-8) mide de 6 a 7 mm de longitud, blanca con tonalidad amarillenta, con pináculos poco marcados, que portan setas translúcidas a rubio claro (fig. 9). Espiráculos elípticos y muy pequeños Tabula (zona del protórax, que incluye las setas L1, L2 y L3) redondeada (fig. 15). Patas torácicas translúcidas y las ventrales del color del cuerpo, portando (de forma oval) ganchos pardo claro, mayores en la zona exterior y más pequeños en la interior, no cerrando el círculo, con un número de uñas entre 17 y 24 (fig. 13), y las patas anales entre 7 y 9 uñas (fig. 14) La cápsula cefálica (fig. 10) mide 0,60 mm de ancho, pardo claro, con la frente, el anteclípeo, el postlabro y el labro más oscuros. En las antenas, la antacoria, y los artejos basal y terminal son translúcidos y el artejo medio pardo claro. El escudo protorácico (fig. 11) translúcido, con la zona posterior rugosa y amarillenta. El escudo anal (en la figura 12 con el noveno urito) blanco amarillento y ligeramente rugoso, con la seta D1 muy cerca del borde.

La crisálida (figs. 16-18), mide de 5 a 5,50 mm de longitud; color pardo claro brillante, con la zona superior de la cabeza cónica. Las antenas llegan hasta el final de las alas, abriéndose éstas en su extremo, sobresaliendo las patas metatorácicas. El dorso de los uritos uno y dos liso; en los uritos tres a siete se aprecia una doble hilera de espinas muy pequeñas castaño oscuro: las de la zona anterior llegan hasta los espiráculos, y las de la zona posterior son más cortas; en los uritos ocho y nueve sólo tiene una hilera de espinas. En la zona ventral y entre la depresión genital y anal, tiene una espina a cada lado de color castaño (figs. 19-20). Pasa a crisálida dentro de la galería hecha por la oruga, sacando medio cuerpo fuera cuando sale el adulto.

Quetotaxia

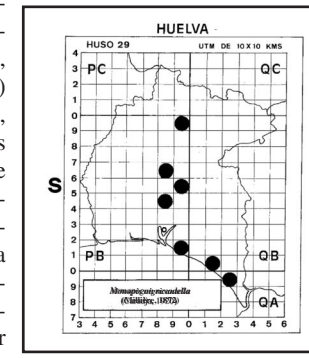
La distribución de las setas sigue el mismo criterio que la quetotaxia de *Nemapogon granella* (Linnaeus, 1758) (HINTON, 1956), pero con pequeños detalles que la diferencia de *N. nevadella* (fig. 15), por ejemplo la seta L3 del protórax, está más separada del grupo L1 L2, aunque dentro del círculo En el octavo urito, la seta D1 está más separada del dorso que la D2, y a la misma altura ambas en *granella*, y la L2 (numerada como L1 en *granella*) más separada del espiráculo. En los demás segmentos, las setas están prácticamente en el mismo lugar, solo que en el noveno urito y en los otros segmentos de *granella,* las setas L tienen la numeración cambiada, porque en la familia Tineidae, las setas cambian

de lugar según las subfamilias y géneros, provocando una confusión (HUERTAS-DIONISIO, 2005), por eso, en este trabajo, consideramos que sea la seta más larga la L1, estando más cerca del dorso la L2 y más abajo la L3, aunque en algunos segmentos la L1 no es la seta más larga, pero la distribución coincide con lo expresado por GERASIMOV (1935), HINTON (1946), STEHR (1987) y HUERTAS-DIONISIO (1987, 2006) (fig. 15). En el escudo anal (fig. 12), la seta D1 está más cerca del borde, igual que en *Tinea murariella* Staudinger, 1859 (HUERTAS-DIONISIO, 2005).

Ciclo biológico y distribución

Según GAEDIKE (2015) vuela de mayo a octubre, alimentándose las orugas de los hongos *Pleorotus dryinus* (Pers) P. Kumm y *Ionotus hispidus* (Bull.) P. Karst. En Huelva hemos verificado que también se alimenta de *Mycena haematopus* (Pers) P. Kumm y de *Boletus aereus* Bull., y que vuela en marzo-abril, mayo-junio y agosto-octubre, en tres generaciones, pero puede tener otras fuera de estas fechas y posiblemente solapadas.

Según PETERSEN & GAEDIKE (1992), está muy extendida por España y ha sido citada de Cádiz, Granada, Madrid, Teruel, Cataluña, sur de Portugal, sur de Francia y Cerdeña (PETERSEN 1960, 1964; PETERSEN & GAEDIKE, 1979); añadiéndose la región de Valencia (HUEMER & WIESER, 2006; GAEDIKE, 2013), las Islas Baleares e Italia (GAEDIKE, 2015) y las Islas Canarias (GAEDIKE, 2019). De Huelva ha sido citada de Mazagón (Palos de la Frontera) (Huelva no Sevilla) UTM 29SPB91 (PETERSEN & GAEDIKE, 1979); del Coto de Doñana (Almonte) UTM 29SQA29 y de Calañas UTM 29SPB86 (PETERSEN & GAEDIKE, 1992); del Barranco de Carabaña (Cortegana) UTM 29SPB99 (BERNABÉ-RUIZ & HUERTAS-DIONISIO, 2018). También ha sido localizada ex larva en Fuente la Corcha (Beas) UTM 29SPB95 y con trampas de luz actínica en la Laguna de El Jaral (Almonte) UTM 29SQB10; en la finca La Chaparrera (Gibraleón) UTM 29SPB84 y en el Cerro de San Cristóbal (Almonaster la Real) UTM 29SPB99, por lo que debe estar extendida por toda la provincia (ver mapa).



Discusión

Las especies del género *Nemapogon* Schrank, 1802 son tan parecidas entre sí que es necesario recurrir al examen de la genitalia para poder diferenciarlas. Aun así, en especies próximas con genitalia similar, resulta conveniente observar, simultáneamente, la descripción de los adultos y la de los estados inmaturos para identificarlas correctamente. En el presente trabajo se describen los tres elementos para *N. nevadella*.

BIBLIOGRAFÍA

BERNABÉ-RUIZ, P. M. & HUERTAS-DIONISIO, M., 2018.– Lepidópteros identificados en el paraje Barranco de Carabaña (Cortegana-Huelva-España). Apuntes sobre sus singularidades y las de su hábitat (Insecta: Lepidoptera).– *Revista Gaditana de Entomología,* **9**(1): 241-272.

CARADJA, A., 1920.– Beitrag zur Kenntnis der geographischen Verbreitung der Mikrolepidopteren des palaearktischen Faunengebietes nebst Beschreibung neuer Formen (Fortsetzung und Schlub) III Teil.– *Deutsche Entomologische Zeitschrift, Iris,* **34**(1/2): 75-179.

GAEDIKE, R., 2013.– Interessante Tineidae (Echte Motten) aus der Sammlung des Landesmuseums für Kärnten in Klagenfurt (Lepidoptera).– *Carinthia II,* (203/123): 469-480.

GAEDIKE, R., 2015.– Tineidae I: (Dryadaulinae, Hapsiferinae, Euplocaminae, Scardiinae, Nemapogoninae and Meessiinae).– *Microlepidoptera of Europe*, **7**: 308 pp. Brill, Leiden, Boston.

GAEDIKE, R., 2019.– Tineidae II: (Myrmecozelinae) Perissomasticinae, Tineinae, Hieroxestinae, Teichobiinae and Stathmopolitinae).– *Microlepidoptera of Europe*, **9**: 248 pp. Brill, Leiden, Boston.

GERASIMOV, A. M., 1935.– Zur Frage der Homodynamie der Borsten von Schmetterlingsraupen.– *Zoologischer Anzeiger,* **112**(7/8): 177-194.

GOZMÁNY, L., 1960.– New and rare Tineids from the Palearctic Region and one from Ethiopia (Lepidopt.).– *Acta Zoologica Academiae Scientiarum Hungaricae,* **6**(1/2): 103-115.

HINTON, H. E., 1946.– On the homology and nomenclature of the setae of lepidopterous larvae, with some notes on the phylogeny of the Lepidoptera.– *Transactions of the Royal Entomological Society of London,* **97**: 1-37.

HINTON, H. E., 1956.– The larvae of the species of Tineidae of economic importante.– *Bulletin of Entomological Research,* **47**(2): 251-346.

HUEMER, P. & WIESER, C., 2006.– Additions to the Faunistics of Lepidoptera in the Comunidad Valenciana (Spain). Part I.– *Boletín Sociedad Entomológica Aragonesa,* **39**: 271-283.

HUERTAS-DIONISIO, M., 1987.– Estados inmaturos de Lepidoptera III. Quetotaxia del escudete anal y situación de las setas L1 y L2 en el último estadio larval de Gelechioidea Stainton, 1854; Tortricoidea Stephens, 1829 y Pyraloidea Leach, 1819.– *SHILAP Revista de lepidopterología,* **15**(57): 49-54.

HUERTAS-DIONISIO, M., 2005.– Estados inmaturos de Lepidoptera (XXIII). Dos especies de la familia Tineidae Latreille, 1810 en Huelva, España (Insecta: Lepidoptera).– *SHILAP Revista de lepidopterología,* **33**(130): 113-122.

HUERTAS-DIONISIO, M., 2006.– Estados inmaturos de Lepidoptera (XXVI). Quetotaxia de las patas anales de las orugas (Insecta: Lepidoptera).– *SHILAP Revista de lepidopterología,* **34**(135): 213-228.

PETERSEN, G., 1957.– Die Genitalien der paläarktischen Tineiden (Lepidoptera: Tineidae).– *Beiträge zur Entomologie,* **7**(1/2): 55-176.

PETERSEN, G., 1960.– Contribución al conocimiento de la distribución geográfica de los Tineidos de la Península Ibérica (Lep. Tineidae).– *Eos,* **36**: 205-236.

PETERSEN, G., 1964.– Zweiter Beitrag zur Kenntnis der geographischen Verbreitung der Tineiden auf der Iberischen Halbinsel (Lepidoptera: Tineidae).– *Beiträge zur Entomologie,* **14**(3/4): 395-420.

PETERSEN, G. & GAEDIKE, R., 1979.– Beitrag zur Kenntnis der Tineiden-Fauna des Mittelmeerraumes.– *Beiträge zur Entomologie,* **29**(2): 383-412.

PETERSEN, G. & GAEDIKE, R., 1992.– Artenbestand und geographische Verbreitung der Tineiden der Iberischen Halbinsel (Lepidoptera: Tineidae).– *SHILAP Revista de lepidopterologia,* **20**(80): 325-353.

ROBINSON, G. S., 1976.– The preparation of slides of Lepidoptera genitalia with special reference to the Microlepidoptera.– *Entomologist's Gazette,* **27**: 127-132.

STEHR, F. W., 1987.– *Immature insects*: 754 pp. Kendall-Hunt, Iowa.

VIVES MORENO, A., 1986.– Lista actualizada de la familia Tineidae Latreille, 1810 en España y Portugal (4ª Revisión) (Insecta: Lepidoptera).– *SHILAP Revista de lepidopterología,* **14**(54): 47-59.

VIVES MORENO, A., 2014.– *Catálogo sistemático y sinonímico de los Lepidoptera de la Península Ibérica, de Ceuta, de Melilla y de las islas Azores, Baleares, Canarias, Madeira y Salvajes (Insecta: Lepidoptera)*: 1184 pp. Suplemento de SHILAP Revista de lepidopterología, Improitalia, Madrid.

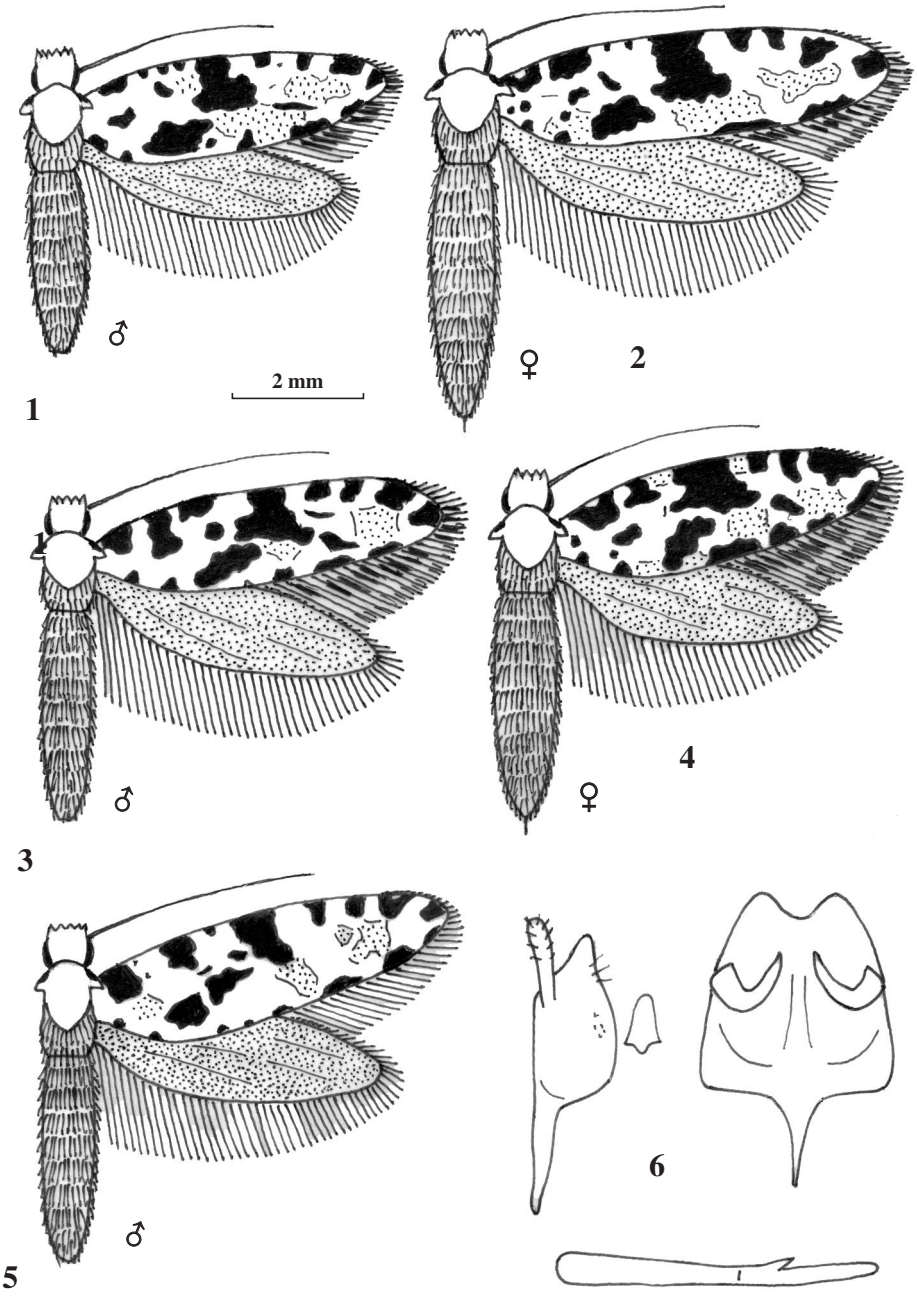
*M. H. D.
Apartado de correos, 47
E-21080 Huelva
ESPAÑA / *SPAIN*
E-mail: huertasdionisio@gmail.com
https://orcid.org/0000-0002-6758-1984

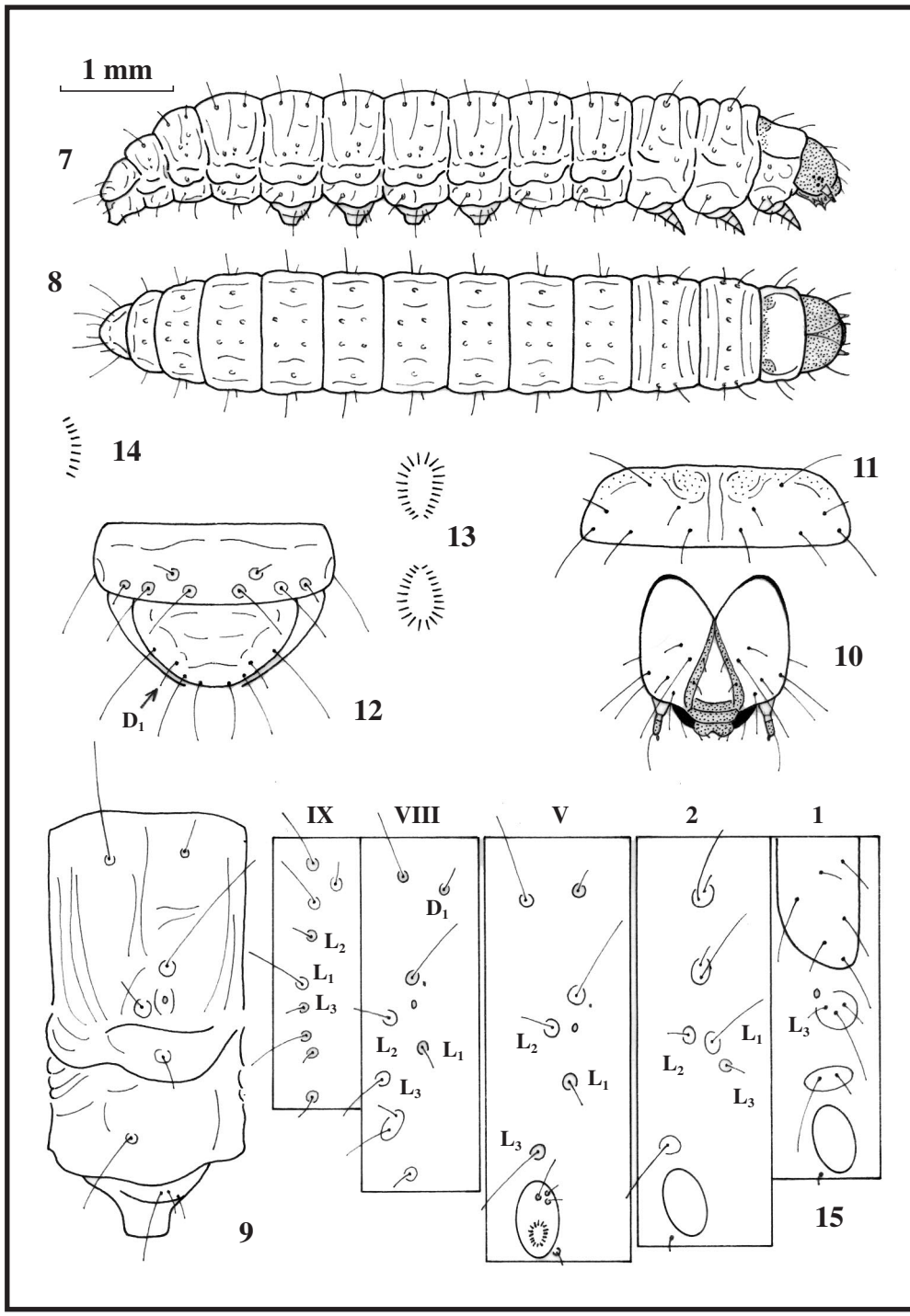
P. M. B. R.
Plaza de La Morana, 1-1º-B
E-21004 Huelva
ESPAÑA / *SPAIN*
E-mail: pedromiguel.bernabe@gmail.com
https://orcid.org/0000-0001-6325-2318

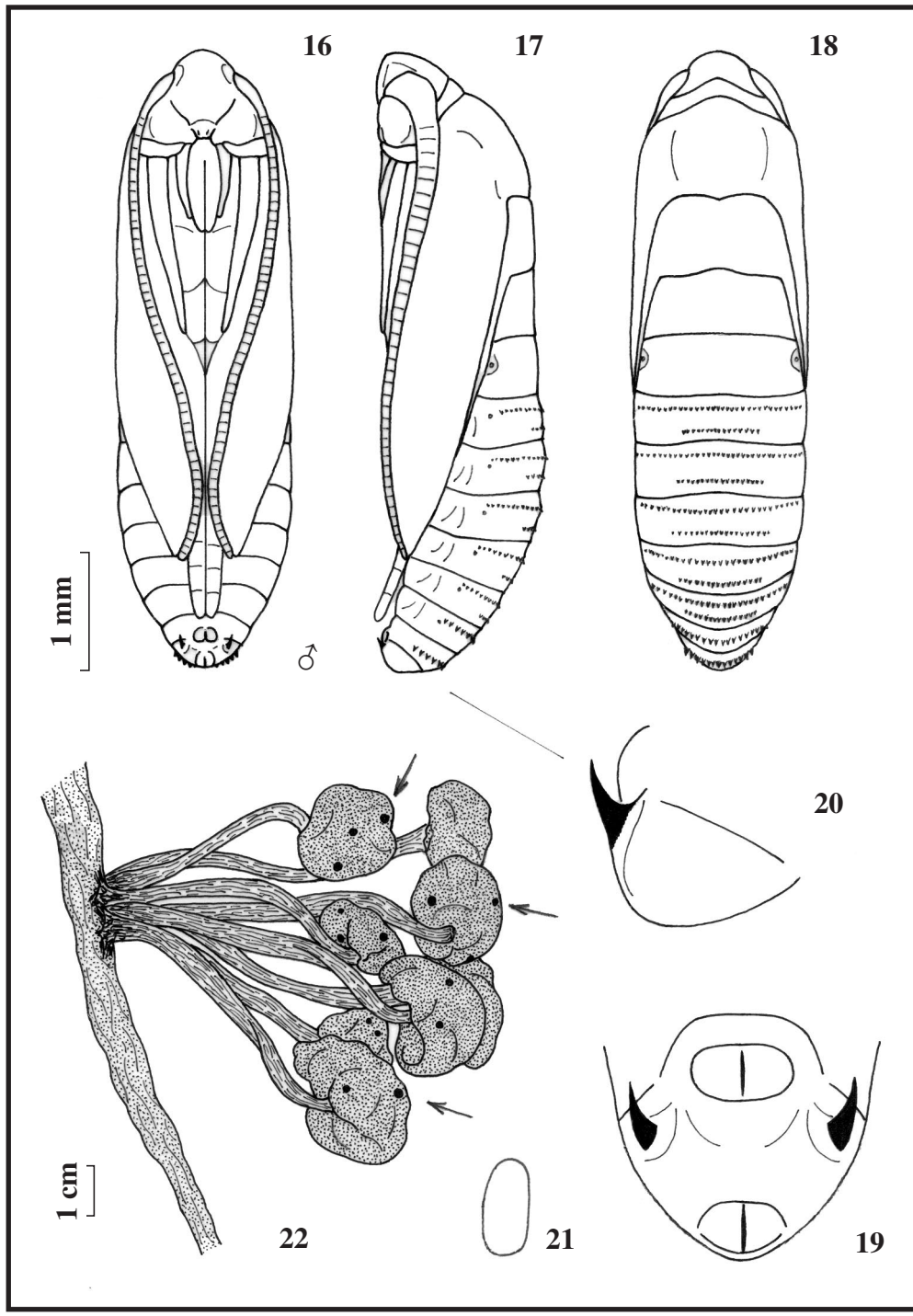
*Autor para la correspondencia / *Corresponding author*

(Recibido para publicación / *Received for publication* 27-XI-2019)
(Revisado y aceptado / *Revised and accepted* 20-XII-2019)
(Publicado / *Published* 30-VI-2020)

Nemapogon nevadella




1 mm
7
8
14
13
11
10
12
D1
9
IX
VIII
V
2
1
L2
L1
L3
D1
15


16
17
18
1 mm
♂
20
1 cm
22
21
19

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*

Solicitud de autorización para recoger lepidópteros con fines científicos en España

Las solicitudes cumplirán las siguientes condiciones:

1.– Estar al día en el pago de la cuota anual de la Sociedad, antes de solicitar los permisos.

2.– Enviar un correo electrónico al Secretario General de SHILAP con todos los datos personales, incluyendo nombre, apellidos, dirección, DNI o número de pasaporte, número de teléfono (con código del país y prefijo) y correo electrónico. Estos datos serán enviados al Secretario General con un mínimo de 45 días de antelación al período de captura previsto.

3.– Se detallará el área donde se desea capturar el material (provincia y/o región), el período de tiempo (días, meses o todo el año); método de captura que se desea emplear (manga entomológica, grupo electrógeno, etc.), material que se desea recoger (especies, géneros, familias, y/o superfamilias) y cualquier otro dato que se desee añadir.

4.– Todos los socios de SHILAP que soliciten estos permisos para recoger Lepidoptera en España con fines científicos, serán incluidos en el Proyecto de Investigación Científica creado por la Sociedad y denominado: *"Faúnula Lepidopterológica Ibérica, Baleárica y región Macaronésica"*.

5.– Con el fin de contribuir con este Proyecto Científico, se ruega remitan a SHILAP, **o una copia por correo electrónico (e-mail), con el listado del material recogido en EXCEL,** sólo en este formato, indicando la Familia, Subfamilia, Tribu, nombre de la especie (género, especie, autor y año), localidad, coordenadas UTM (1 X 1) o GPS, provincia, fecha de captura, colector y número de machos y hembras capturados (**sólo 5 ejemplares por taxón y localidad, máximo**). Por favor, utilice sólo el *"Catálogo sistemático y sinonímico de los Lepidoptera de la Península Ibérica, de Ceuta, de Melilla y de las islas Azores, Baleares, Canarias, Madeira y Salvajes (Insecta: Lepidoptera)*" (A. VIVES MORENO, 2014)". Esta lista es necesaria para este Proyecto Científico de SHILAP y para nuevas autorizaciones.

6.– Es obligatorio publicar en *SHILAP Revista de lepidopterología,* las nuevas especies o subespecies que se descubran y remitir a SHILAP **una parte del material TIPO**, para su posterior incorporación a la colección de Lepidoptera del Museo Nacional de Ciencias Naturales en Madrid, España.

7.– Se recuerda a todos los socios de la obligación de estar autorizados para recoger Lepidoptera, con fines científicos, en España y que está prohibida todo tipo de actividad comercial, con el material capturado.

8.– Conocer los fines científicos de SHILAP y comprometerse a pagar los gastos de participación en este Proyecto Científico, que la Junta Directiva considere en cada momento.

Application for permits to collect Lepidoptera in Spain for scientific purposes

Applications must abide by the following conditions:

1.– The Society's annual fee must be paid before applying for the permits.

2.– To send an electronic mail the General Secretary of SHILAP, with all the personal data, including name, surname, address, ID card number or Passport number, telephone number (with country code and prefix) and electronic mail address. These data must reach the General Secretary at least 45 days in advance of the foreseen collecting activity.

3.– The collecting area to be visited by the applicant should also be detailed (province and/or region), expected dates (days, months, or the whole year), collecting method (entomological net, generator, etc.), taxonomical groups of interest to be collected (species, genera, families and/or superfamilies); any other data the applicant wishes to add.

4.– All members of SHILAP who apply for these permits to collect Lepidoptera in Spain with scientific purposes, will be included in the Scientific Investigation Project created by the Society and called: *"Lepidopterological Fauna of the Iberian Peninsula, Balearic Islands and Macaronesian region"*.

5.– In order to contribute to this Scientific Project, it is requested to send to SHILAP, **either a copy by electronic mail (e-mail), with the listing of materials collected in EXCEL** (- only in this format, please), indicating the Family, Subfamily, Tribe, name of the species (genera, species, author's name and year), town, UTM (1 X 1) or GPS coordinates, province, dates of capture, collector and numbers of males and females captured (**only 5 specimens per taxon and locality, maximum**). Please, use only the *"Catálogo sistemático y sinonímico de los Lepidoptera de la Península Ibérica, de Ceuta, de Melilla y de las islas Azores, Baleares, Canarias, Madeira y Salvajes (Insecta: Lepidoptera)* (A. VIVES MORENO, 2014)". This list is necessary for this Scientific Project of SHILAP and for new authorizations.

6.– It's obligatory to publish in *SHILAP Revista de lepidopterología*, the new species or subspecies that are discovered and to remit to SHILAP **a part of the TYPE material**, for later incorporation into the Lepidoptera Collection of the National Museum Natural Sciences, Madrid, Spain.

7.– All members are kindly reminded of the obligation to be duly authorized for collecting Lepidoptera, with scientific purposes, in Spain and that it is forbidden all type of commercial activity, with the captured material.

8.– To know about the scientific aims of SHILAP and to commit to pay the expenses of participation in this Scientific Project, that the Board of Directors considers at any given moment.

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 307-324 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.396

Contribución al conocimiento de los Lepidoptera de España con la descripción de cuatro nuevas especies para nuestra fauna y otras citas de interés (Insecta: Lepidoptera)

J. Gastón & A. Vives Moreno

Resumen

Se describen cuatro nuevas especies descubiertas en España: *Paraswammerdamia kitamurae* Gastón & Vives, sp. n., *Agnoea emarella* Gastón & Vives, sp. n., *Agnoea lvovskyi* Gastón & Vives, sp. n. y *Monochroa felixi* Gastón & Vives, sp. n. También se citan por primera vez para España el género *Metalampra* Toll, 1956 y las especies *Metalampra italica* Baldizzone, 1977, *Elachista atricomella* Stainton, 1849, *Coleophora lusciniapennella* (Treitschke, 1833, *in* Ochsenheimer), *Stomopteryx hungaricella* Gozmány, 1957, *Oxypteryx parahelotella* (Nel, 1995) y *Caryocolum mazeli* Huemer & Nel, 2005. Se cita como nueva para la Península Ibérica a *Coleophora texanella* Chambers, 1878, lo que supone el segundo registro de este Coleophoridae para España, al haber sido citado anteriormente de Menorca en las Islas Baleares. Por primera vez, se describe la hembra de *Taleporia improvisella* (Staudinger, 1859). Se proporcionan fotografías de los adultos y su genitalia.
PALABRAS CLAVE: Insecta, Lepidoptera, nuevas especies, nuevas citas, España.

Contribution to the knowledge of the Lepidoptera of Spain with the description of four new species for our fauna and other interesting records.
(Insecta: Lepidoptera)

Abstract

Four new species discovered in Spain are described: *Paraswammerdamia kitamurae* Gastón & Vives, sp. n., *Agnoea emarella* Gastón & Vives, sp. n., *Agnoea lvovskyi* Gastón & Vives, sp. n., and *Monochroa felixi* Gastón & Vives, sp. n. The genus *Metalampra* Toll, 1956 and the species *Metalampra italica* Baldizzone, 1977, *Elachista atricomella* Stainton, 1849, *Coleophora lusciniapennella* (Treitschke, 1833, *in* Ochsenheimer), *Stomopteryx hungaricella* Gozmány, 1957, *Oxypteryx parahelotella* (Nel, 1995), and *Caryocolum mazeli* Huemer & Nel, 2005 are mentioned for the first time for Spain. *Coleophora texanella* Chambers, 1878, is cited as new for the Iberian Peninsula which is the second record of this Coleophoridae for Spain, having previously been cited from Menorca in the Balearic Islands. The female of *Taleporia improvisella* (Staudinger, 1859) is described for the first time. Photographs of the adults and genitalia are present.
KEY WORDS: Insecta, Lepidoptera, new species, new mentions, Spain.

Introducción

La fauna de la Península Ibérica en general y de España en particular, no deja de sorprendernos con nuevas aportaciones a su destacada biodiversidad, demostrando ser una de las regiones europeas de

mayor riqueza. Es evidente que los muestreos realizados son aún insuficientes, quedando todavía mucho trabajo por realizar, sobre todo localizando nuevos biotopos, pero los resultados poco a poco arrojan mayores conocimientos y nuevas especies por descubrir. Este es el caso del presente artículo, en el que se han analizado colecciones particulares y revisados los fondos de Instituciones científicas, lo que nos ha permitido detectar la presencia en nuestro país de diez nuevas especies, de las que cuatro son nuevas para la Ciencia. Por su interés, se aporta también la primera cita para la Península Ibérica de *Coleophora texanella* Chambers, 1878, especie ya citada anteriormente de la isla de Menorca, en las islas Baleares (VALLHONRAT *et al*., 2010), por lo que constituye la segunda cita para España. Así mismo se describe de la provincia de Cádiz, la hembra de *Taleporia improvisella* (Staudinger, 1859), especie endémica de España, de la que únicamente se conocía, hasta la fecha, el macho.

Material y métodos

El material utilizado para el estudio se ha obtenido mediante muestreos nocturnos con trampas de luz actínica distribuidas en los biotopos apropiados y disponiendo de las autorizaciones de las diferentes regiones afectadas. Para su identificación nos hemos basado en el examen comparativo de los caracteres morfológicos externos y, sobre todo, en el análisis de la estructura genital de los ejemplares. La preparación de los órganos genitales se ha efectuado siguiendo a ROBINSON (1976), con modificaciones. Se han utilizado los microscopios Leica DMLB, Leica MZAPO, NIKON Eclipse E400 y las cámaras digital Leica DFC550, NIKON D3100 y SONY α100 DSLR-A100K con objetivo AF 100 MACRO 1:2,8 (32), e igualmente para el retoque fotográfico, el programa de Adobe Photoshop ©.

Abreviaturas

E.	España
JG	Javier Gastón
MNCN	Museo Nacional de Ciencias Naturales, Madrid, España
P.	Portugal
prep. gen.	Preparación de genitalia

Resultados

PSYCHIDAE

Taleporia improvisella (Staudinger, 1859) (Figs. 1, 22)
Talaeporia improvisella Staudinger, 1859. *Stettin. ent. Ztg*., **20**(7-9): 234
LT: Granada, ESPAÑA

Material estudiado: 1 ♀, ESPAÑA, CÁDIZ, Benalup, dehesa "Las Cruces", a 90 m, 14-IX-2015, J. Gastón leg. y coll., prep. genit. 7936JG,

Descripción de la hembra (fig. 1): Envergadura, 19 mm, (n = 1). Cabeza bien desarrollada con pelos escamiformes de color ocre. Palpos labiales de mediano tamaño, rectos, ligeramente inclinados hacia arriba en su primer segmento que se presenta densamente poblado de largos pelos de color ocre-amarillento con sus extremos algo más oscuros. Antenas filiformes recubiertas de pequeñas cerdas de color ocre oscuro con artejos muy cortos. Tórax con escamas de color ocre claro con ligera alternancia de escamas algo más oscuras. Tégulas recubiertas de las mismas escamas. Abdomen recubierto de las mismas escamas que el tórax. Alas anteriores sensiblemente rectangulares, bien desarrolladas con el ápice levemente redondeado. Margen costal (externo) levemente cóncavo. Termen con una fuerte inclinación del ápice al ángulo dorsal. El color de fondo de las alas delanteras es ocre oscuro, uniforme. Presenta una característica mancha circular y oscura en los interespacios V_4-V_5 de la zona postdiscal, justo al borde de la celda. También presenta tres manchas menos marcadas en el borde costal, junto al

ápice, en los interespacios V_{10}, V_{11} y V_{12}. Entre los interespacios V_1 y V_2, justo debajo de la celda, se observan varias máculas oscuras que forman un cordón interrumpido de escamas marrón oscuro. Finalmente se observa una línea de escamas oscuras en la zona marginal de ambas alas delanteras. Las fimbrias, bien desarrolladas, son de color ocre claro. Las alas posteriores son elípticas y apuntadas fuertemente hacia el ápice, sin ángulo anal. Son de color ocre uniforme, ligeramente más claro que las delanteras, sin manchas. Las fimbrias, de gran longitud, son también de color ocre claro uniforme.

Genitalia de la hembra (fig. 22): Con el 8º y 9º segmentos prácticamente soldados entre sí, sin espacio entre ellos, predominando el 8º segmento, de gran tamaño, fuertemente esclerotizado y con gran desarrollo hasta el punto que invade el espacio del 9º segmento en su parte posterior, quedando el 9º segmento incluido en su interior, donde se aprecian unas papilas anales bien desarrolladas. Apófisis posteriores largas, y anteriores cortas, pero debido a la estructura del 8º segmento, ya comentado, sus longitudes coinciden. En el 8º segmento, la placa postvaginalis presenta sendos lobulos cubierto de pequeñas microespinas. El ostium es circular, muy esclerotizado en sus bordes. Ductus bursae membranoso, cilíndrico y delgado, de corto recorrido. Bursa esférica y membranosa, sin signum, de gran volumen, aunque no supera la longitud de las apófisis.

Biología: Desconocida.

Distribución: Esta especie es endémica de España.

Detalles: Sólo se conocen dos machos procedentes de la provincia de Granada (ARNSCHEID & WEIDLICH, 2017) y ahora ampliamos su distribución hasta la provincia de Cádiz, lo que nos indica que la especie podría distribuirse por el sur de España.

YPONOMEUTIDAE

Paraswammerdamia kitamurae Gastón & Vives, sp. n.

Material estudiado: Holotipo, 1 ♀, ESPAÑA, Almería, Sierra de Gádor, a 2.020 m, 31-VII-2019, J. Gastón leg., prep. genit. 7914JG, depositado en el Museo Nacional de Ciencias Naturales, en Madrid (MNCN). Paratipo, 1 ♀, Almería, Sierra de Gádor, a 2.020 m, 31-VII-2019, J. Gastón leg. y coll., prep. genit. 7921JG.

Descripción del macho: Desconocido.

Descripción de la hembra (fig. 2): Envergadura, 13,5 mm, (n = 2). Cabeza bien desarrollada con pelos escamiformes blancos. Palpos labiales cortos y rectos. Antenas filiformes recubiertas de pequeñas cerdas de color gris oscuro rematadas en blanco. Tórax con escamas de color gris ocráceo claro uniforme y tégulas recubiertas de las mismas escamas. Abdomen recubierto de las mismas escamas que el tórax. Alas anteriores estrechas y alargadas con el termen redondeado y algo puntiagudo, lo que hace inapreciable el ápice. Margen costal (externo) levemente cóncavo. El color de fondo de las alas delanteras es gris claro salpicado de multitud de pequeñas escamas negras que lo oscurecen a primera vista. Presenta una apreciable, aunque difusa, mancha de escamas negras en el extremo exterior de la celda, lo mismo que otra, menos apreciable junto al margen interno (dorsal). En la zona postdiscal presenta una serie de tres manchitas oscuras en forma triangular, dos de ellas situadas en los márgenes costal y dorsal, y la tercera junto al termen, casi en la zona marginal. Esta se remata en su extremo con una fina línea de escamas oscuras en la base de las fimbrias, que son de color gris claro rematadas en negro. Las alas posteriores son estrechas y apuntadas fuertemente hacia el ápice, sin ángulo anal. Son de color gris claro uniforme, sin manchas. Las fimbrias, de gran longitud son también de color gris claro uniforme.

Genitalia de la hembra (fig. 23): 8º y 9º segmentos de gran tamaño en comparación con el resto de la estructura. Papilas anales bien desarrolladas con apófisis posteriores largos superando ligeramente el borde anterior del 8º segmento. Este presenta una geometría característica del género en la lamella postvaginalis, muy esclerotizada, con sendos lóbulos anchos y cortos de extremo redondeado recubiertos de pelos bien visibles. El borde anterior del 8º segmento presenta una apreciable y profunda entrada dirigida hacia la parte posterior, altamente esclerotizada que rodea al ostium. Las apófisis

anteriores son de menor tamaño que las posteriores, presentado en su raíz una clara bifurcación; por un lado su conexión con los lóbulos de la placa postvaginalis, y por el otro un remate esclerotizado que llega hasta la parte superior del segmento. El ductus bursae es cilíndrico y membranoso. La bursa, ovoidal, es también membranosa y no presenta signum.

Biología: No se conocen los estados inmaduros ni las plantas nutricias de las orugas. Los imagos se capturaron en la parte superior de la ladera sur de la Sierra de Gádor, en el piso bioclimático mesomediterráneo (RIVAS-MARTÍNEZ, 1987) y a una altitud aproximada de 2.020 metros sobre el nivel del mar. Por los datos de que disponemos hasta la fecha, la especie vuela únicamente en una generación durante el mes de julio.

Distribución: Únicamente se conoce la especie de la localidad típica, Sierra de Gádor (Almería).

Detalles: Siguiendo a VIVES MORENO (2014), debería colocarse detrás de *Paraswammerdamia albicapitella* (Scharfenberg, 1805, *in* Beschtein & Scharfenberg).

Etimología: Dedicamos esta nueva especie a Makiko Kitamura, nuera del primer autor.

OECOPHORIDAE

Metalampra Toll, 1956
Annls. zool. Warsz., **16**(13): 178
Especie tipo: *Oecophora cinnamomea* Zeller, 1839. *Isis von Oken,* **1839**(3): 192

Detalles: Este género, junto con la especie, resultan **nuevos para la fauna de España** y siguiendo a VIVES MORENO (2014), habría que colocarlos detrás del género *Decantha* Busck, 1908 (*Proc. U. S. Nat. Mus*., **35**: 202).

Metalampra italica Baldizzone, 1977 (Figs. 3, 24)
Metalampra (Borkhausenia) italica Baldizzone, 1977. *Entomologica,* **13**: 37, figs. 1, 3, 5, 7, 9, 13
LT: Asti, Boschi di Valmanera, ITALIA

Material estudiado: 1 ♀, ESPAÑA, Lérida, Valle de Arán, Lés, a 625 m, 2-VIII-2018, J. Gastón leg. y coll., prep. genit. 7941JG.

Biología: Según nuestros datos, la larva se alimenta de los hongos *Lenzites betulinus* (L.) Fr. (Polyporaceae) y *Stereum hirsutum* (L.) Fr., (Steraceae), que se encuentran sobre diferentes de Betulaceae, Corylaceae Fagaceae.

Distribución: Según nuestros datos la especie se distribuye por Alemania (GAEDIKE, 2010), Austria (HUEMER, 2013), Bélgica (DE PRINS & DE PRINS, 2014), Croacia, Países Bajos, Suiza (SELIGER & SCHREURS, 2013), Dinamarca (BUHL *et al*., 2015), Italia (BALDIZZONE, 1977), por lo tanto, la especie resulta **nueva para España**.

LYPUSIDAE

Para el estatus actual de la familia Lypusidae Herrich-Schäffer, 1857 (*KorrespBl. zool.-min. Ver. Regensburg*, **11**: 58), se ha seguido a HEIKKILÄ & KAILA (2019) y dentro de la misma, hemos considerado dos subfamilias Lypusinae y Chimabachinae Heinemann, 1870 (*Schmett. Dtl. Schweitz* (2)**2**(1): 130).

Hemos estudiado el género *Agnoea* Walsingham, 1907 (*Proc. U. S. Nat. Mus*., **33**(1567): 200. Especie tipo *Blastobasis evanescens* Walsingham, 1901), que tiene una distribución Paleártica y, actualmente, está dividido en dos subgéneros *Agnoea,* con diecisiete especies y *Tubuliferodes* Toll, 1956 (*Ann. Zool. Warsawa*, **16**: 185), con tres especies (SINEV & LVOVSKY, 2014).

El género *Agnoea* fue originalmente incluido en los Blastobasidae (WALSINGHAM, 1907), después transferido a los Oecophoridae (FLETCHER, 1929 lo pasa a sinonimia del género *Borkhausenia* Hübner, [1825] 1816) y últimamente a los Lypusidae (SINEV, 2014), que es lo que seguimos.

Las especies que actualmente se incluyen en el género *Agnoea*, han sido situadas en otros géneros

a lo largo del tiempo y que han pasado a considerarse sinonimias del mismo, a saber: *Pseudatemelia* Rebel, 1910 (*Verh. zool.-bot. Ges. Wien*, **60**: 29, especie tipo *Pseudatemelia aeneella* Rebel, 1910, por monotipia); *Tubulifera* Spuler, 1910 (*Schmett. Eur*., **2**: 345, especie tipo *Tinea flavifrontella* [Denis & Schiffermüller], 1775, por monotipia, es una homonimia de *Tubulifera* Zopf, 1885 *in* Schenk, (Protozooa), *Handb. Botanik*, **3**(2): 173); *Tubuliferola* Strand, 1917 (*Int. ent. Z*., **10**: 137, especie tipo *Tinea flavifrontella* [Denis & Schiffermüller], 1775, por monotipia, nombre de reemplazo para *Tubulifera* Spuler, 1910) y *Tubuliferodes* Toll, 1956 (*Annls zool., Warsz*., **16**: 185, especie tipo *Tubuliferola josephinae* Toll, 1956, por monotipia) que consideramos como un subgénero válido ([DENIS & SCHIFFERMÜLLER], 1775; DOUBLEDAY, 1859; STAUDINGER, 1859; REBEL, 1900; TOLL, 1956; JÄCKH, 1959, 1972; VIVES MORENO, 1986; CORLEY, 2014).

El género *Agnoea*, está ampliamente representado en la Península Ibérica (VIVES MORENO, 2014, con modificaciones) y actualmente con once especies presentes en España (E.) (*Agnoea (Agnoea) nonscriptella* Corley, 2014, se ha citado por primera vez para España (LAŠTŮVKA & LAŠTŮVKA, 2020) y cinco en Portugal (P.), a saber:

(E.) *Agnoea (Agnoea) flavifrontella* ([Denis & Schiffermüller], 1775). *Ank. syst. Wienergegend*: 143
(E.) *Agnoea (Agnoea) subochrella* (Doubleday, (1859). *Syn. List Brit. Butterflies & Moths*: 31
(E.P.) *Agnoea (Agnoea) nonscriptella* Corley, 2014. *Entomologist's Rec. J. Var.*, **126**: 242
(E.P.) *Agnoea (Agnoea) filiella* (Staudinger, 1859). *Stett. ent. Ztg*., **20**: 247
(E.) *Agnoea (Agnoea) detrimentella* (Staudinger, 1859). *Stett. ent. Ztg*., **20**: 247
(E.P.) *Agnoea (Agnoea) amparoella* (Vives, 1986). *SHILAP Revta. lepid*., **13**(52): 254-255
(E.P.) *Agnoea (Agnoea) xanthosoma* (Rebel, 1900). *Dt. ent. Ztschr. Iris*, **13**: 174
(E.) ***Agnoea (Agnoea) emarella* Gastón & Vives, sp. n.**
(E.) ***Agnoea (Agnoea) lvovskyi* Gastón & Vives, sp. n.**
(E.) *Agnoea (Tubeliferodes) josephinae* (Toll, 1956). *Annls zool., Warsz*., **16**(13): 185

En este trabajo descubrimos dos nuevas especies para la fauna de España, lo que representa un aumento del 25,00% y llegado a este punto, podríamos considerar que la Península Ibérica podría ser el punto de origen de este género, ya que posee el 50,00% de todas las especies conocidas, incluyendo las nuevas descritas a continuación.

Agnoea (Agnoea) emarella Gastón & Vives, sp. n.

Material estudiado: Holotipo, 1 ♂, ESPAÑA, Teruel, Torrecilla del Rebollar, a 1.200 m, 25-VI-1999, J. Gastón leg., prep. genit. 7772JG, depositado en el Museo Nacional de Ciencias Naturales, en Madrid (MNCN). Paratipos (4 ♂♂, 7 ♀♀); Burgos, Cebrecos, a 980 m, 1 ♀, 18-VI-2018, Tx. Revilla leg. y coll., prep. genit. 7907JG; Guadalajara, Embid, a 1.050 m, 1 ♂, 31-V-2019, J. Gastón leg. y coll., prep. genit. 7767JG; Idem, 3 ♂♂, Tx. Revilla leg. y coll., prep. genit. 7902JG, 7903JG y 7904JG; Teruel: Torrecilla del Rebollar, a 1.200 m, 1 ♀, 25-VI-1999, J. Gastón leg. y coll.; Idem, prep. genit. 7785JG; Zaragoza: Torralba de los Frailes, a 1.050 m, 1 ♀, 14-VI-1997, J. Gastón leg. y coll., prep. genit. 7787JG; Idem, 11-VI-1999, J. Gastón leg. y coll., prep. genit. 7788JG; Aguarón, a 750 m, 1♀, 13-VI-1998, J. Gastón leg. y coll., prep. genit. 7768JG; Idem, prep. genit. 7784JG.

Descripción del macho (fig. 4): Envergadura, 20 mm, (n = 5). Cabeza bien desarrollada y con pelos escamiformes grises claros y compactos en la frente y amarillos pajizos y más desordenados en la zona alta del epicráneo en forma de penacho. Palpos labiales cortos, ligeramente curvados en su extremo hacia arriba y recubiertos de pelos escamiformes de color gris oscuro. Antenas filiformes recubiertas de pequeñas cerdas de color ocre oscuro, con escapo corto. Tórax recubierto de escamas de color gris oscuro uniforme con tégulas recubiertas de las mismas escamas salteadas de alguna de color gris claro. Abdomen recubierto de las mismas escamas que el tórax. Alas anteriores con una geometría típica del género, con la costa ligeramente convexa, sobre todo en su parte basal junto al tórax y también junto al ápice que es fuertemente apuntado. Margen externo muy angulado, tanto que se

confunde con el margen interno. El margen interno también presenta una ligera curvatura, en este caso cóncava. El color de fondo de las alas delanteras es gris muy oscuro y uniforme, presentando un leve oscurecimiento algo mayor en la zona basal y posdiscal. Es tan oscuro el color gris de las escamas de las alas delanteras que apenas se perciben tres manchas negras conspicuas situadas al tresbolillo, dos en la zona discal y una en la zona posdiscal. Las fimbrias son de color gris claro con una leve franja de color algo más claro en su parte central. Las alas posteriores son de color gris claro, sin manchas. Las fimbrias son iguales a las de las alas anteriores.

Genitalia del macho (fig. 14): Uncus piramidal apuntado con el extremo redondeado. Gnathos característico del género provisto de una estructura que une el extremo de ambos brazos compuesta por infinidad de celdillas y pelos interpuestos lo que le confieren una textura y una imagen semejante a una esponja semicircular de casi el ancho del tegumen. Las valvas, cortas y anchas son casi rectangulares, presentando un cucullus vertical que se confunde en su extremo inferior con el sacculus. Es destacable reseñar la existencia de una estructura situada en el interior del vinculum que enlaza la transtilla superior y la juxta inferior. Tiene la forma de dos letras C invertidas con sendos lóbulos en su parte superior rematados con infinidad de pequeños pelos. El aedeagus es muy corto y voluminoso con el extremo apuntado.

Descripción de la hembra (fig. 5): Envergadura, 18,33 mm, (n = 6). La morfología de las hembras no difiere esencialmente de la de los machos. Las principales estriban en los palpos, que en el caso de las hembras se encuentran tapizados de pelos escamiformes de color ocre claro y no de color gris oscuro. En la cabeza también presentan diferencias, con la frente recubierta de escamas de color ocre claro y no grises. Las alas son morfológicamente similares a las de los machos, aunque por lo general presentan un tono de gris más claro que en los machos, lo que hace más visibles las tres manchas descritas para estos últimos.

Genitalia de la hembra (fig. 25): Papilas anales de tamaño medio, poco esclerotizadas. Apófisis posteriores bien desarrolladas alcanzando el borde inferior esclerotizado del 8º segmento. Este, es alargado y membranoso en su parte superior y bien esclerotizado en su tercio inferior, presentando en el esternito una placa más esclerotizada que el resto con base horizontal, desde donde surgen las apófisis anteriores, que son de pequeño tamaño. El ostium es membranoso, lo mismo que el antrum hasta el colliculum, algo más voluminoso que el ductus que nace de su parte inferior, que también es membranoso y alargado hasta su entronque con la bursa. La bursa es membranosa con forma de maza, (similar a la cabeza del extremo de un palo de golf). Dispone en uno de sus extremos de un signum muy esclerotizado de tamaño medio de forma sensiblemente rectangular con sus extremos horizontales ligeramente apuntados y cubierto parcialmente de gruesas espinas.

Biología: No se conocen los estados inmaduros ni las plantas que sustentan a las orugas. Por los datos de que disponemos, hemos comprobado que vuela únicamente en una generación que se extiende desde finales de mayo y durante todo el mes de junio.

Distribución: La especie se ha localizado hasta la fecha en la encrucijada de las provincias de Zaragoza (Sierra de Vícor), Teruel (Sierra de Cucalón) y Guadalajara (Paramera de Molina), en el Sistema Ibérico turolense dentro del piso bioclimático supramediterráneo (RIVAS-MARTÍNEZ, 1987).

Detalles: Siguiendo a VIVES MORENO (2014), debería colocarse detrás de *Agnoea (Agnoea) xanthosoma* (Rebel, 1900)

Etimología: Dedicamos esta nueva especie a Ema Gastón Kitamura, tercera nieta del primer autor.

Agnoea (Agnoea) lvovskyi Gastón & Vives, sp. n.

Material estudiado: Holotipo, 1 ♂, ESPAÑA, Almería, Rambla de Cueva Negra, Mojácar, a 55 m, 18-IV-2018, J. Gastón leg. prep. genit. 7766JG, depositado en el Museo Nacional de Ciencias Naturales, en Madrid (MNCN). Paratipos (3 ♂♂); Almería, Rambla de Cueva Negra, Mojácar, a 55 m, 1 ♂, 18-IV-2018, J. Gastón leg. y coll., prep. genit. 7766JG; Idem, 2 ♂♂, Tx. Revilla leg. y coll., prep. genit. 7900JG y 7901JG.

Descripción del macho (fig. 6): Envergadura, 17,5 mm, (n = 4). Cabeza bien desarrollada y con

pelos escamiformes ocre claros y compactos en la frente y ocre amarillento y más desordenados en la zona alta del epicráneo en forma de penacho. Palpos labiales cortos, ligeramente curvados en su extremo hacia arriba y recubiertos de pelos escamiformes de color ocre. Antenas filiformes recubiertas de pequeñas cerdas de color ocre en la base y grises en el extremo. Escapo pequeño. Tórax recubierto de escamas de color gris oscuro uniforme lo mismo que las tégulas. Abdomen recubierto de las mismas escamas que el tórax. Alas anteriores con una geometría típica del género, con la costa ligeramente convexa, sobre todo en su parte basal junto al tórax y también junto al ápice que es fuertemente apuntado. Margen externo muy angulado, tanto que se confunde con el margen interno. El margen interno también presenta una ligera curvatura, en este caso cóncava. El color de fondo de las alas delanteras es gris muy oscuro y uniforme. En los ejemplares mejor conservados se aprecia con dificultad una leve mancha negra en la zona discal, que se hace imperceptible en los ejemplares algo volados. Las fimbrias son de color gris oscuro con una leve franja de color algo más claro en su base. Las alas posteriores son de color gris claro, sin manchas.

Genitalia del macho (fig. 15): Uncus piramidal apuntado, con el extremo redondeado. Gnathos como el resto del género, con los brazos poco acusados y provisto en su extremo de una estructura compuesta por infinidad de celdillas y pelos interpuestos lo que le confieren (como el resto de las especies del género) una textura y una imagen semejante a una esponja de geometría ovoidal y de un tamaño igual a la mitad de la anchura del tegumen. Las valvas, cortas y muy anchas en su base son triangulares, presentando un ápex apuntado y redondeado. En su base se aprecian sendas estructuras con forma de V muy abierta y algo más esclerotizadas que el resto de la valva. El sacculus, ligeramente esclerotizado, presenta un pequeño quiebro en su parte media, detalle más acusado en unos ejemplares que en otros, pero siempre presente. Saccus sumamente corto y redondeado. El aedeagus es muy corto y voluminoso con el extremo ligeramente apuntado.

Descripción de la hembra: Desconocida.

Biología: No se conocen los estados inmaduros ni las plantas que sustentan a las orugas. Los imagos se capturaron al sur de Mojácar, en la Rambla de Cueva Negra, en el piso bioclimático termomediterráneo (RIVAS-MARTÍNEZ, 1987), y a una altitud aproximada de 55 m sobre el nivel del mar. Por los datos de que disponemos hasta la fecha, hemos comprobado que vuela únicamente en una generación durante el mes de mayo.

Distribución: Únicamente se conoce la especie de la localidad típica, Mojácar en la provincia de Almería.

Detalles: Siguiendo a VIVES MORENO (2014), debería colocarse detrás de *Agnoea (Agnoea) emarella* Gastón & Vives, sp. n.

Etimología: Dedicamos esta nueva especie a nuestro estimado colega el Dr. Alexander L. Lvovsky, que siempre ha estado en disposición de ayudarnos en cuantas consultas tuvimos que realizarle, tanto personalmente (durante la visita del segundo autor al Instituto de Zoología, de la Academia Rusa de Ciencias en San Petersburgo, Rusia), como epistolarmente.

ELACHISTIDAE

Elachista atricomella Stainton, 1849 (Figs. 7, 16)
Elachista atricomella Stainton, 1849. *Syst. Cat. Br. Tineidae & Pterophoridae*: 25
LT: [GRAN BRETAÑA]
?*Microsetia obsoletella* Stephens, 1834. *Ill. Br. Ent. (Haust.)*, **4**: 264
LT: Ripley, GRAN BRETAÑA
Microsetia exiguella sensu Stephens, 1834. *Ill. Br. Ent. (Haust.)*, **4**: 264
Elachista alienella Stainton, 1851. *Suppl. Cat. Br. Tineidae & Pterophoridae,* App. A: 9
LT: Lewishan [Londres], GRAN BRETAÑA
Elachista extensella Stainton, 1851. *Suppl. Cat. Br. Tineidae & Pterophoridae,* App. A: 26
LT: [GRAN BRETAÑA]
Elachista zetterstedtii Wallengren, 1852. *Ofvers. K. VetenskAkad. Förh*., **9**: 219

LT: Trolle-Ljungby, SUECIA
Elachista holdenella Stainton, 1854. *Ins. Br. Lepid.*: 252
LT: Londres, GRAN BRETAÑA
Elachista helvetica Frey, 1856. *Die Tineen und Pterophoren der Schweiz*: 289
LT: Zürichs [Zurich], SUIZA
Elachista longipennis Frey, 1885. *Stettin. ent. Ztg*., **46**(2-13): 102
LT: Wallis [Valais], SUIZA

Material estudiado: 1 ♂, ESPAÑA, Lérida, Valle de Arán, Aiguamoix, a 1.700 m, 5-VII-2019, J. Gastón leg. y coll., prep. genit. 7948JG.

Biología: Según nuestros datos, la larva se alimenta de diferentes especies de *Carex sp*. (Cyperaceae), *Milium sp.* y *Melica sp*. (Poaceae), los adultos vuelan de mayo a septiembre en una sola generación (TRAUGOTT-OLSEN & SCHMIDT-NIELSEN, 1977; EMMET, 1996).

Distribución: Según nuestra información, se distribuye por casi toda Europa, incluido el Reino Unido; esta especie ya era conocida de Portugal, concretamente de Beira Litoral (CORLEY *et al*., 2007), por lo que resulta la **primera cita para España peninsular**.

COLEOPHORIDAE

Coleophora texanella Chambers, 1878 (Figs. 8, 26)
Coleophora texanella Chambers, 1878. *U. S. Geol. Surv. Bull*., **4**: 93
LT: Belfrage, Texas, EE.UU.
(= *Coleophora vagans* Walsingham, 1907. *Proc. U. S. nat. Mus*., **33**: 217
LT: New York, EE.UU.
(= *Coleophora coxi* Baldizzone & van der Wolf, 2007. *SHILAP Revta. lepid*., **35**(137): 91, figs. 1-9
LT: Catania Fondachello, Sicilia, ITALIA

Material estudiado: 2 ♀♀, ESPAÑA, Granada, La Bernardilla, a 100 m, 1-X-2018, J. Gastón leg. y coll., prep. genit. 7920JG.

Biología: Según nuestros datos, la larva se alimenta de *Portulaca oleracea* L. (Portulacaceae) y los adultos vuelan en dos generaciones, la primera de mayo a junio y la segunda de septiembre a octubre (BALDIZZONE, 2019).

Distribución: Según nuestra información, se distribuye por EE.UU., España (Baleares), Francia, Grecia, Italia, Sicilia, Cerdeña, Croacia, Macedonia, Bulgaria y Creta. La especie ya estaba citada de la isla de Menorca (Baleares) (WALLHONRAT *et al*., 2010), por lo que resulta la **primera cita para España peninsular**.

Detalles: Las sinonimias fueron establecidas por LANDRY *et al*. (2013).

Coleophora lusciniaepennella (Treitschke, 1833, *in* Ochsenheimer) (Figs. 9, 17)
Ornix lusciniaepennella Treitschke, 1833, *in* Ochsenheimer. *Europ. Schmett*., **9**(2): 213
LT: Wollmaise, ALEMANIA
(= *Coleophora viminetella* Zeller, 1849. *Linn. ent.*, **4**: 394
LT: Glogau [Glogów], POLONIA
(= *Coleophora orbitella* sensu Herrich-Schäffer, 1853: *Samml. eur. Schmett*., **5**: pl. 87, fig. 670
(= *Coleophora draghiaella* Căpuşe, 1971. *Alexanor*, **7**(3): 140, pl. 7, figs A-D, pl. 8, figs A-C
LT: Scheitnig, [Wroclaw], POLONIA

Material estudiado: 1 ♂, ESPAÑA, Vizcaya, Gallartu (Orozko), a 300 m, 4-VI-2011, J. Gastón leg. y coll., prep. genit. 7917JG.

Biología: Siguiendo a EMMET (1996), la especie es univoltina encontrándose entre los meses de mayo hasta julio. La oruga se alimenta de diferentes especies de *Salix* sp. (Salicaceae) y ocasionalmente de *Betula* sp. (Betulaceae)

Distribución: Por los datos que disponemos, esta especie tiene una distribución Paleártica, casi por toda Europa, ocasional en el sur, llegando por Turquía hasta el Cáucaso y los Urales.

Detalles: Esta especie ya era conocida de Portugal, concretamente de Duoro Litoral (CORLEY *et al*., 2006), por lo que resulta **nueva para España**.

GELECHIIDAE

Stomopteryx hungaricella Gozmány, 1957 (Figs. 10, 18)
Stomopteryx hungaricella Gozmány, 1957. *Acta zool. hung.,* **3**: 111, fig. E
LT: Budakeszi, Hársbokorhegy, HUNGRÍA

Material estudiado: 1 ♂, ESPAÑA, Ávila, Arcones, Sierra de Arcones, a 1.212 m, 10-VII-2018, J. Gastón leg. y coll. 1 ♂, Idem, prep. genit. 7861JG

Biología: Se desconoce, pero siguiendo a GOZMÁNY (1957), la especie se encontró en un bosque con la asociación botánica *Quercetum pubescentis*, volando entre los meses de junio y agosto.

Distribución: Por los datos que disponemos, esta especie se distribuye por el centro sur y oeste de Europa, llegado hasta el Asia Menor (ELSNER *et al*., 1999).

Detalles: Siguiendo a VIVES MORENO (2014), habría que colocarla delante de *Stomopteryx lusitaniella* Corley & Karsholt, 2014, *in* Corley.

Monochroa felixi Gastón & Vives, sp. n.

Material estudiado: Holotipo, 1 ♂, ESPAÑA, Almería, Sierra de Gádor, a 2.020 m, 31-VII-2019, J. Gastón leg., prep. genit. 7844JG, depositado en el Museo Nacional de Ciencias Naturales, en Madrid (MNCN).

Descripción del macho (fig. 11): Envergadura, 9 mm, (n = 1). Cabeza pequeña con pelos escamiformes gris-plateados tanto en la frente como en la zona alta del epicráneo. Palpos labiales de mediado tamaño, ligeramente curvados hacia arriba y recubiertos de pelos gris claro. Antenas filiformes recubiertas de pequeñas cerdas de color gris claro. Escapo de mediado tamaño. Tórax y tégulas recubiertos de escamas de color uniforme gris plateado. Abdomen recubierto de escamas de color ocre oscuro. Alas anteriores extremadamente apuntadas en su ápice, de color uniforme ocre oscuro sin manchas apreciables. Alas posteriores de color uniforme ocre algo más claro que las anteriores, rectangulares (margen anal paralelo al margen interno), con el ápice sumamente puntiagudo.

Genitalia del macho (fig. 20): Uncus piramidal de extremo redondeado. Gnathos, ausente. Valva altamente esclerotizada, triangular, de base ancha y apuntada hacia su extremo con su margen externo ligeramente convexo, sobre todo en su extremo distal. Sacculus ancho, muy poco esclerotizado, manteniendo esa anchura en toda su longitud hasta el extremo, donde se redondea. El margen externo del sacculus es cóncavo y el interno convexo. Vinculum muy esclerotizado con cresta manifiesta en su parte inferior. Saccus bien desarrollado, potente, ancho y redondeado en su extremo inferior. Aedeagus de gran tamaño, cilíndrico y recto, ligeramente cónico en su parte distal donde se aprecia una zona más esclerotizada que el resto; vesica con la superficie granulada y compuesta con un grupo importante de micro-cornuti débilmente esclerotizadas.

Descripción de la hembra: Desconocida.

Biología: No se conocen los estados inmaduros ni las plantas que sustentan a las orugas. Los imagos se capturaron en la ladera sur de la Sierra de Gádor, en el piso bioclimático mesomediterráneo (RIVAS-MARTÍNEZ, 1987), y a una altitud aproximada de 2.020 m sobre el nivel del mar. Por los datos de que disponemos hasta la fecha, la especie vuela únicamente en una generación durante el mes de julio.

Distribución: Únicamente se conoce la especie de la localidad típica, Sierra de Gádor en la provincia de Almería (España).

Detalles: Siguiendo a VIVES MORENO (2014), debería colocarse detrás de *Monochroa nomadella* (Zeller, 1868).

Etimología: Dedicamos esta nueva especie al Dr. Félix Rodríguez de la Fuente, en el

cuadragésimo aniversario de su trágico fallecimiento, como homenaje a su trayectoria de naturalista y gran divulgador científico.

Oxypteryx parahelotella (Nel, 1995) (Figs. 12, 21)
Eulamprotes parahelotella Nel, 1995. *Alexanor*, **19**(1): 38-42, figs. 6-7, 10, 17
LT: Combe du Grand Barbeirol, Mont Ventoux, FRANCIA
(= *Epithectis levisella* Chrétien, 1930) ♀, *in partim*. *Et. Lép. Comp*., **19**(1): 354
LT: Mrassine, MARRUECOS

Material estudiado: 2 ♂♂, ESPAÑA, Burgos, La Vid, a 950 m, 29-IX-2019, J. Gastón leg. y coll., prep. genit. 7814JG y 7828JG; Briongos de Cervera, a 1.100 m, 1 ♂, 4-X-2019, J. Gastón leg. y coll., prep. genit. 7833JG

Biología: Se desconoce.

Distribución: Por los datos que disponemos, esta especie se encuentra en Francia, Marruecos y ahora también es **nueva para España**.

Detalles: Según HUEMER & KARSHOLT (2020), esta especie hay que incluirla en el género *Oxypteryx* Rebel, 1911, pasando a sinonimia del mismo, el género *Eulamprotes* Bradley, 1971. Siguiendo a VIVES MORENO (2014), habría que colocarla detrás de *Oxypteryx helotella* (Staudinger, 1859).

Caryocolum mazeli Huemer & Nel, 2005 (Figs. 13, 19)
Caryocolum mazeli Huemer & Nel, 2005. *Bull. Soc. Ent. Fr*., **110**: 125, figs. 1a-b, 3, 5a-b
LT: Eyne, Pyrénées-Orientales, FRANCIA

Material estudiado: 1 ♂, ESPAÑA, Lérida, Valle de Aiguamoix, a 1.500 m, Valle de Arán, 21-VIII-1992, J. Gastón leg. y coll., prep. genit. 7870JG

Biología: Se desconoce, pero es posible que las orugas se alimenten de Caryophyllaceae de algunas especies del género *Dianthus* L. sp. y/o *Petrorhagia* (Ser.) Link., los adultos vuelan entre los meses de julio y agosto.

Distribución: Por los datos que disponemos, esta especie se encuentra localizada en Andorra, Francia y ahora en España.

Detalles: La especie ya era conocida de Andorra (VIVES MORENO, 2014), por lo que resulta **nueva para la fauna de España**.

Agradecimientos

No podemos terminar este trabajo sin agradecer la colaboración y la ayuda prestada por las siguientes personas e Instituciones: Dr. Giorgio Baldizzone (Asti, Italia), Dr. Alexander L. Lvovsky (San Petersburgo, Rusia), Francisco Javier Conde de Saro (Madrid, España), Txema Revilla (Vizcaya, España); Dra. Amparo Blay, Conservadora de Entomología, en el Museo Nacional de Ciencias Naturales (Madrid, España), que siempre ha estado dispuesta a ayudarnos en cuantas consultas la hemos solicitado y a las Direcciones Generales de Medio Ambiente por las autorizaciones concedidas allí donde se han desarrollado los muestreos.

BIBLIOGRAFÍA

ARNSCHEID, W. R. & WEIDLICH, M., 2017.– Psychidae.– *In* O. KARSHOLT & M. NUSS (ed.). *Microlepidoptera of Europe*, **8**: XIII + 223 pp. Brill, Leiden - Boston

BALDIZZONE, G., 1977.– *Metalampra (Borkhausenia) italica* n. sp. (Lepidoptera, Oecophoridae).– *Entomologica*, **13**: 37-46.

BALDIZZONE, G., 2019.– Lepidoptera Coleophoridae.– *Fauna de Italia*, **53**: XVII + 907 pp. Edizioni Agricole di New Business Media Srl, Milano.

BALDIZZONE, G. & VAN DER WOLF, H. W., 2007.– *Coleophora coxi* Baldizzone & van der Wolf, sp. n.: a new

species from the Mediterranean region (Lepidoptera: Coleophoridae).– *SHILAP Revista de lepidopterología*, **35**(137): 91-95.

BECHSTEIN, J. M. & SCHAFENBERG, G. L., 1804-1805.– *Vollständige Naturgeschichte der schädlichen Forstinsekten; ein Handbuch für Forstmänner, Cameralisten und Dekonomen*, **1**(1804): VIII + 1-292, pls. 1-3; **2**(1805): 293-602, pls. 4-9, **3**(1805): 603-1046 pp., pls. 10-13. Richter, Leipzig.

BOLT, D., HUEMER, P. & SCHMID, J., 2018.– *Agnoea langohri* (Palm, 1990) - eine neue Kleinschmetterlingsart für die Schweiz (Lepidoptera; Lypusidae).– *Entomo Helvetica,* **11**: 171-175.

BUHL, O., FALCK, P., KARSHOLT, O., LARSEN, K. & VILHALMSEN, F., 2015.– Fund af småsommerfugle fra Danmark i 2014 (Lepidoptera).– *Entomologiske Meddelelser*, **83**(2): 88-109.

BRADLEY, J. D., 1971.– Some changes in the Nomenclature of British Lepidoptera.– *Entomologist's Gazette*, **22**(1): 23-28.

BUSCK, A., 1908.– A generic revision of American moths of the family Oecophoridae, with descriptions of new species.– *Proceeding of the United States National Museum*, **35**(1644): 187-207.

CĂPUŞE, I., 1971.– Contribution à l'étude de la famille des Coleophoridae (VI). Sur le vrai *C. prunifoliae* Doets et sur quelques nouvelles espèces de *Coleophora* Hb.– *Alexanor*, **7**(3): 135-143, 161-168.

CHAMBERS, V. T., 1878.– Descriptions of New Tineina from Texas, and other from more Northern localities.– *Bulletin of the United States Geological and Geographical Survey of the Territory*, **4**: 79-106.

CHRÉTIEN, P., 1922.– Les Lépidoptères du Maroc: 354.– *In* CH. OBERTHÜR. *Études de Lépidoptérologie Comparée*, **19**(1): 1-402.

CORLEY, M. F. V., 2014.– Five new species of microlepidoptera from Portugal.– *Entomologist's Record and Journal of Variation*, **126**: 229-243.

CORLEY, M. F. V., MARABUTO, E. & PIRES, P., 2007.– New Lepidoptera for the fauna of Portugal (Insecta: Lepidoptera).– *SHILAP Revista de lepidopterología*, **35**(139): 321-334.

CORLEY, M. F. V., MARAVALHAS, E. & PASSOS DE CALVALHO, J., 2006.– Miscellaneous additions to the Lepidoptera of Portugal (Insecta: Lepidoptera).– *SHILAP Revista de lepidopterología*, **34**(136): 407-427.

[DENIS, M. & SCHIFFERMÜLLER, I.], 1775.– *Ankündung eines systematisches Werkes von den Schmetterlingen der Wienergegend*: 323 pp., 2 pls. Vienna.

DE PRINS, W. & DE PRINS, J., 2014.– *Metalampra italica* (Lepidoptera: Oecophoridae), also in Belgium.– *Phegea*, **42**(2): 26-28.

DOUBLEDAY, H., 1859.– *The Zoologist's Synonymic List of British Butterflies and Moths*: 40 pp. London.

ELSNER, G., HUEMER, P. & TÓKAR, Z., 1999.– *Die Palpenmotten (Lepidoptera, Gelechiidae) Mitteleuropas. Bestimmung - Verbreitung - Flugstandort Lebensweise der Raupen*: 208 pp. František Slamka, Bratislava.

EMMET, A. M., 1996.– *The Moths and Butterflies of Great Britain and Ireland. Yponomeutidae - Elachistidae*, **3**: 452 pp. Harley Books, Colchester.

FLETCHER, T. B., 1929.– A list of the generic names used for Microlepidoptera.– *Memoirs of the Department of Agriculture in India (Ent. Ser.)*, 11: i-ix + 1-244.

FREY, H., 1856.– *Die Tineen und Pterophoren der Schweiz:* XII + 430 pp. Zürich.

FREY, H., 1885.– Zur Kenntniss des Tineen-Genus *Elachista*.– *Stettiner Entomologische Zeitung,* **46**(1-3): 97-108.

GAEDIKE, R., 2010.– Nachtrag 2009 zum Verzeichnis der Schmetterlinge Deutschlands (Microlepidoptera). Mit Beiträgen von H. BLACKSTEIN, U. BÜCHNER, D. HAUSENBLAS, L. LINDNER, D. NOWAK, M. NUSS, B. PIEPGRAS, W. SCHMITZ & S. WAUER.– *Entomologische Nachrichten und Berichte*, **54**(2): 109-122.

GOZMÁNY, L., 1957a.– Notes on the Generic Group *Stomopteryx* Hein. and the Descriptions of some new Microlepidoptera.– *Acta Zoologica Academiae Scientiarum Hungaricae,* **3**(1-2). 107-135.

HEIKKILA, M. & KAILA, L., 2010.– Reassessment of the enigmatic Lepidopteran family Lypusidae (Lepidoptera: Tineoidea; Gelechioidea).– *Systematic Entomology*, **35**: 71-89.

HEINEMANN, H., 1870.– *Die Schmetterlinge Deutschlands und der Schweiz, 2, Kleinschmetterlinge. Die Motten und Federmotten*, **2**(1): 388 pp. Schwetschke und Sohn Braunschweig.

HERRICH-SCÄFFER, G. A. W., 1843-1856.– *Systematische Bearbeitung der Schmetterlinge von Europa, zugleich als Text, Revision und Supplement zu Jakob Hübner's Sammlung europäischer Schmetterlinge. Die Tagfalter,* **1** (1843-(1855)): 164 + 24, 134 + 7 pls.; *Die Schwärmer, Spinner und Eulen*, **2** ((1843)-1845-(1855)): 450 + 64 pp., 1 + 1 + 2 + 16 + 10 + 4 + 22 + 124 + 1 pls.; *Die Spanner*, **3** ((1843)-1847-(1856)): 184 + 34 pp., 91 pls.; *Die Zünsler und Wickler*, **4** ((1847)-1849-(1855)): 288 + 48 pp., 23 + 59 pls.; *Die Schaben und Federmotten*, **5** ((1847)-1853-1855): 394 + 52 pp., 124 + 7 + 1 pls.; *Sechster und letzter Band*, **6** (1843-1856): IV + XVIII + VIII + 178 + 72 + 48 pp., 22 + 14 pls. Regensburg.

HERRICH-SCHÄFFER, G. A. W., 1857.– Kritischer Anzeiger des zoologisch-mineralogischen Vereines in

Regensburg.– *Korrespondenz-Blatt des Zoologisch-Mineralogischen Vereines in Regensburg*, **11**(3, 4, 5): 33-72.

HÜBNER, J., 1816-[1825].– *Verzeichniss bekannter Schmettlinge* (sic): 431 pp. Augsburg.

HUEMER, P., 2013.– Die Schmetterlinge Österreichs (Lepidoptera). Systematische und faunistische Checkliste.– *Studiohefte*, **12**: 1-304.

HUEMER, P. & NEL, J., 2005.– *Caryocolum mazeli* sp. n., a new species from southern France (Lepidoptera, Gelechiidae).– *Bulletin de la Société entomologique de France*, **110**(2): 125-127.

HUEMER, P. & KARSHOLT, O., 2020.– Commented checklist of European Gelechiidae (Lepidoptera).– *ZooKeys*, **921**: 65-140.

JÄCKH, E., 1959.– Beitrag zur Kenntnis der Oecophoridae die Gattung *Tubuliferola* Strand, 1917.– *Deutsche Entomologische Zeitschrift, N. F.,* **6**(1-3): 174-184.

JÄCKH, E., 1972.– Die Gattung *Pseudatemelia* Rebel, 1910 (Lepidoptera, Oecophoridae).– *Entomologica, Bari,* **8**: 133-140.

LANDRY, J.-F., NAZARI, V., DEWAARD, J. R., MUTANEN, M., LOPEZ-VAAMONDE, C., HUEMER, P. & HEBERT, P. D. N., 2013.– Shared but overlooked: 30 species of Holarctic Microlepidoptera revealed by DNA barcodes and morphology.– *Zootaxa*, **3749**(1): 001-093.

LAŠTŮVKA, A. & LAŠTŮVKA, Z., 2020.– New faunistic records of moths from the Iberian Peninsula (Insecta: Lepidoptera).– *SHILAP Revista de lepidopterología*, **48**(189): 47-58.

NEL, J., 1995.– Sur quelques espèces nouvelles ou peu connues de Gelechiidae observées au Mont Ventoux (Vaucluse) et en Basse-Provence. Quatrième contribution à la connaissance des Gelechiidae du sud de la France (Lepidoptera).– *Alexanor*, **19**(1): 37-43.

REBEL, H., 1900.– Neue palaearctische Tineen.– *Deutsche entomologische Zeitschrift Iris*, **13**: 161-188.

REBEL, H., 1911.– Bericht der Sektion für Lepidopterologie. Beitrag zur Lepidopterenfauna von Syrien bekannt.– *Verhandlungen der der kaiserlich-königlichen zoologisch-botanischen Gesellschaft in Wien*, **61**(5-6): (141)-(141), (7-8): (145)-(158).

RIVAS-MARTÍNEZ, S., 1987.– *Memoria del mapa de series de vegetación de España 1: 400.000*: 268 pp. ICONA, Madrid.

ROBINSON, G. S., 1976.– The preparation of slides of Lepidoptera genitalia with special reference to the Microlepidoptera.– *Entomologist's Gazette*, **27**: 127-132.

SELIGER, R. & SCHREURS, A., 2013.– Neue Erkenntnisse zur Verbreitung von Metalampra italica Baldizzone, 1977 mit Nachweisen aus unserem Arbeitsgebiet (Lep., Oecophoridae).– *Melanargia*, **25**(2): 92-100.

SINEV, S. Yu. & LVOVSKY, A. L., 2014.– Taxonomical status and species composition of the little known genus *Agnoea* Walsingham, 1907 (Lepidoptera: Gelechioidea: Lupysinae).– *Zoosystematica Rossica*, **23**(1): 137-144.

SINEV S. Yu., 2014.– *World catalogue of blastobasid moths (Lepidoptera, Blastobasidae)*: 108 pp. ZIN RAS, St Ptersburg.

STAINTON, H. T., 1849.– *An attempt at a Systematic Catalogue of the British Tineidae & Pterophoridae*: IV + 32 pp. London.

STAINTON, H. T., 1851.– *A Supplementary Catalogue of the British Tineidae & Pterophoridae*: IV + 28 pp. London.

STAINTON, H. T., 1854.– *Insecta Britannica. Lepidoptera: Tineina*, **3**: VIII + 313 pp., 8 pls. London.

STAUDINGER, O., 1859.– Diagnosen nebst kurzen Beschreibungen neuer andalusischer Lepidopteren.– *Entomologische Zeitung von dem entomologischen Vereine zu Stettin*, **20**(7-9): 211-259.

STEPHENS, J. F., 1831-1835.– *Illustrations of British Entomology; or, a Synopsis of Indigenous Insects: containing their generic and specific distinctions; with an account of their metamorphoses, times of appearance, localities, food, and economy, as far as practicable. Haustellata*, **4**(1): pl. 33-40 (1831), (2): 1-352 (1834), (3): 353-433 (1835).

TOLL, S., 1956.– Versuch einer natürlichen Gruppierung der europäischen Oecophoridae auf Grund des Baues der Genitalapparate, samt Beschreibungen von zwei neunen Arten.– *Annales Zoologici. Instytut Zoologiczny, Polska Akademia Nauk, Warsawa*, **16**(13): 171-193, pls. 21-28.

TRAUGOTT-OLSEN, E. & SCHMIDT-NIELSEN, E., 1977.– The Elachistidae (Lepidoptera) of Fennoscandia and Denmark.– *Fauna Entomologica Scandinavica*, **6**: 1-299, 108 pls.

TREITSCHKE, G. F., 1833, *in* F. OCHSENHEIMER.– *Die Schmetterlinge von Europe*, **9**(2): 294 pp. Ernst Fleischer, Leipzig.

VALLHONRAT, F., PÉREZ DE-GREGORIO, J. J. & REQUENA, E., 2010.– Heteròcers nous o interessants per a la

fauna de les illes Balears de Fomentera i Menorca (Lepidoptera).– *Butlleti de la Societat Catalana de Lepidopterologia*, **101**: 45-50.

VIVES MORENO, A., 1986.– Lista sistemática y sinonímica de la familia Oecophoridae Bruand, [1851], de España y Portugal, con la descripción de nuevos géneros y especies.– *SHILAP Revista de lepidopterología*, **13**(52): 251-270.

VIVES MORENO, A., 2014.– *Catálogo sistemático y sinonímico de los Lepidoptera de la Península Ibérica, de Ceuta, de Melilla y de las islas Azores, Baleares, Canarias, Madeira y Salvajes (Insecta: Lepidoptera):* 1184 pp. Suplemento de SHILAP Revista de lepidopterología, Improitalia, Madrid.

WALLENGREN, H. D. J., 1852.– Nya Svenska Lepidoptera.– *Öfversigt af Kongliga Vetenskaps-Akademiens förhandlonger,* **9**(3): 80-82, (9-10): 214-220.

WALSINGHAM, L., 1901.– New Corsican and French Micro-Lepidoptera.– *The Entomologist's Monthly Magazine*, **37**: 177-184.

WALSINGHAM, L., 1907.– Descriptions of new North American tineid moths, with a generic table of the family Blastobasidae.– *Proceeding of the United States National Museum*, **33**: 197-228.

WALSINGHAM, L., 1908.– Spanish and Moorish Microlepidoptera.– *Entomologist's Monthly Magazine*, **44**: 52-55.

ZELLER, P. C., 1839.– Versuch einer naturgemässen Einteilung der Schaben.– *Isis von Oken,* **1839**(3): 167-220.

ZELLER, P. C., 1849.– Beitrag zur Kenntnis der Coleophoren.– *Linnaea Entomologica*, **4**: 191-416.

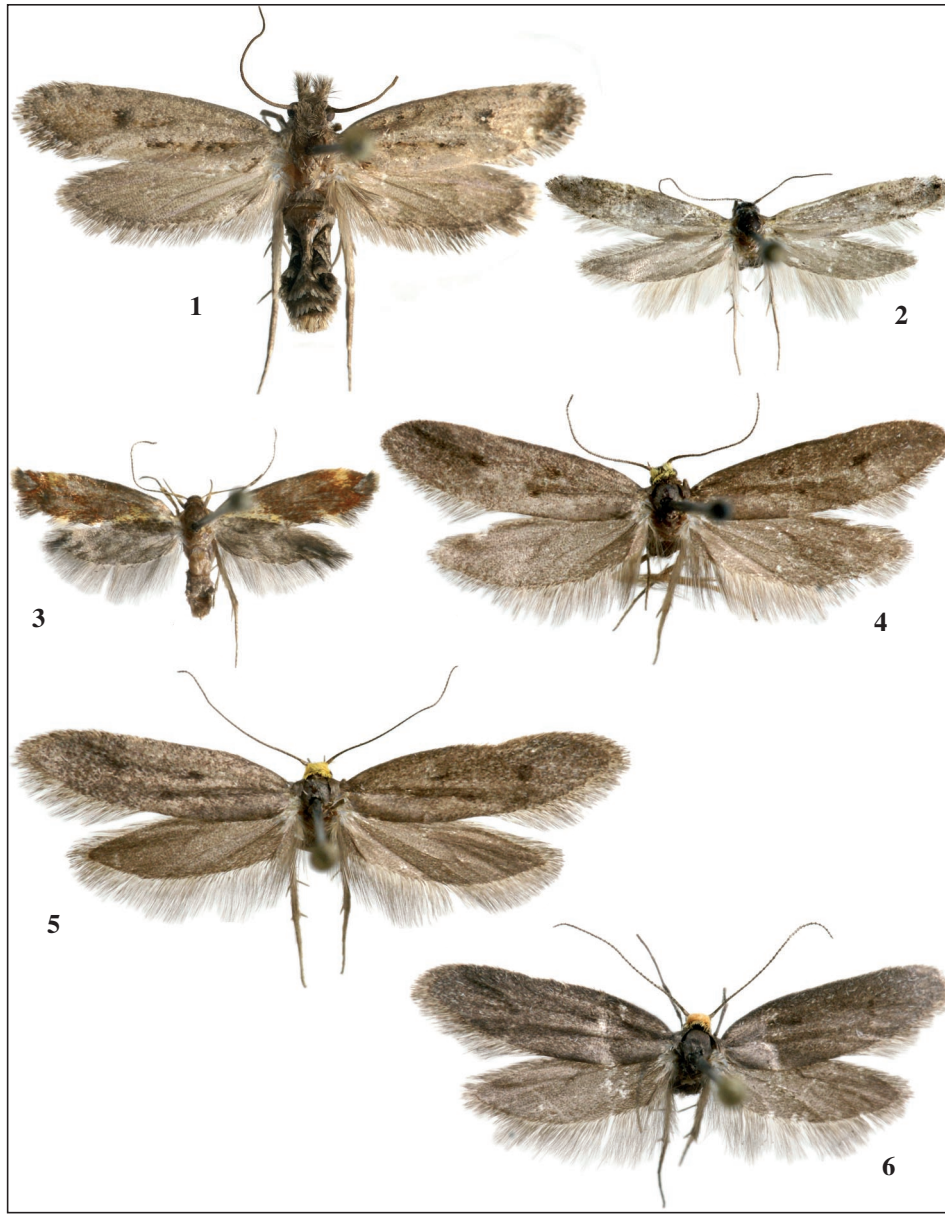
ZELLER, P., 1868.– Beitrag zur Kenntniss der Lepidoptern-Fauna der Umgegend von Raibl in Oberkärnthen und Preth im angrenzenden Küstengebiet.– *Verhandlungen der kaiserlich-königlichen zoologisch-botanische Gesellschaft in Wien*, **18**: 563-628.

*J. G.
Amboto, 7-4ª-Dcha.
E-48993 Getxo (Vizcaya)
ESPAÑA / *SPAIN*
E-mail: fjgaston@yahoo.es
https://orcid.org/0000-0003-3382-3874

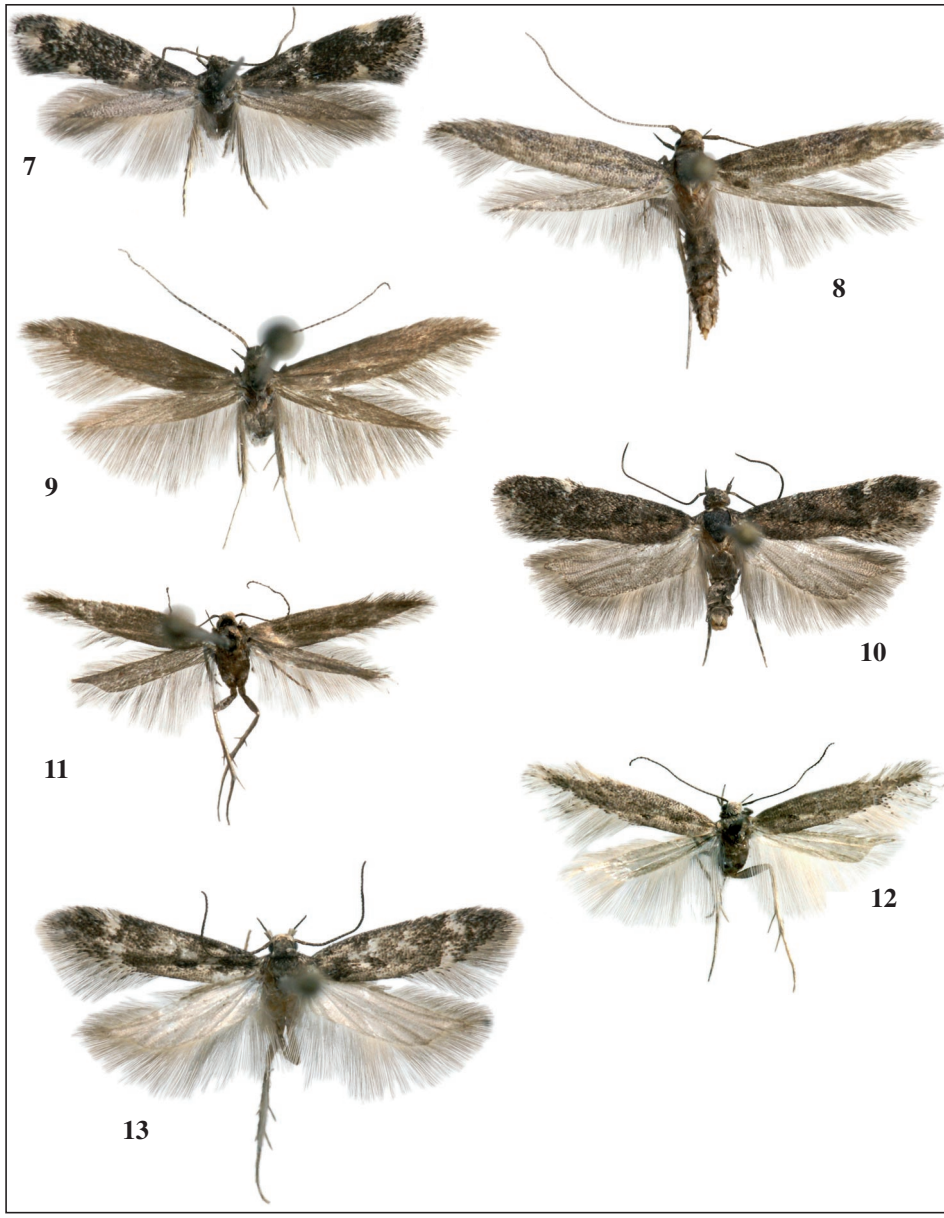
A. V. M
Cátedra de Entomología Agraria
E.T.S. de Ingeniería Agronómica, Alimentación y Biosistemas
Universidad Politécnica de Madrid
Avenida Puerta de Hierro, 2
E-28040 Madrid
ESPAÑA / *SPAIN*
E-mail: avives1954@outlook.es
https://orcid.org/0000-0003-3772-2747

*Autor para la correspondencia / *Corresponding author*

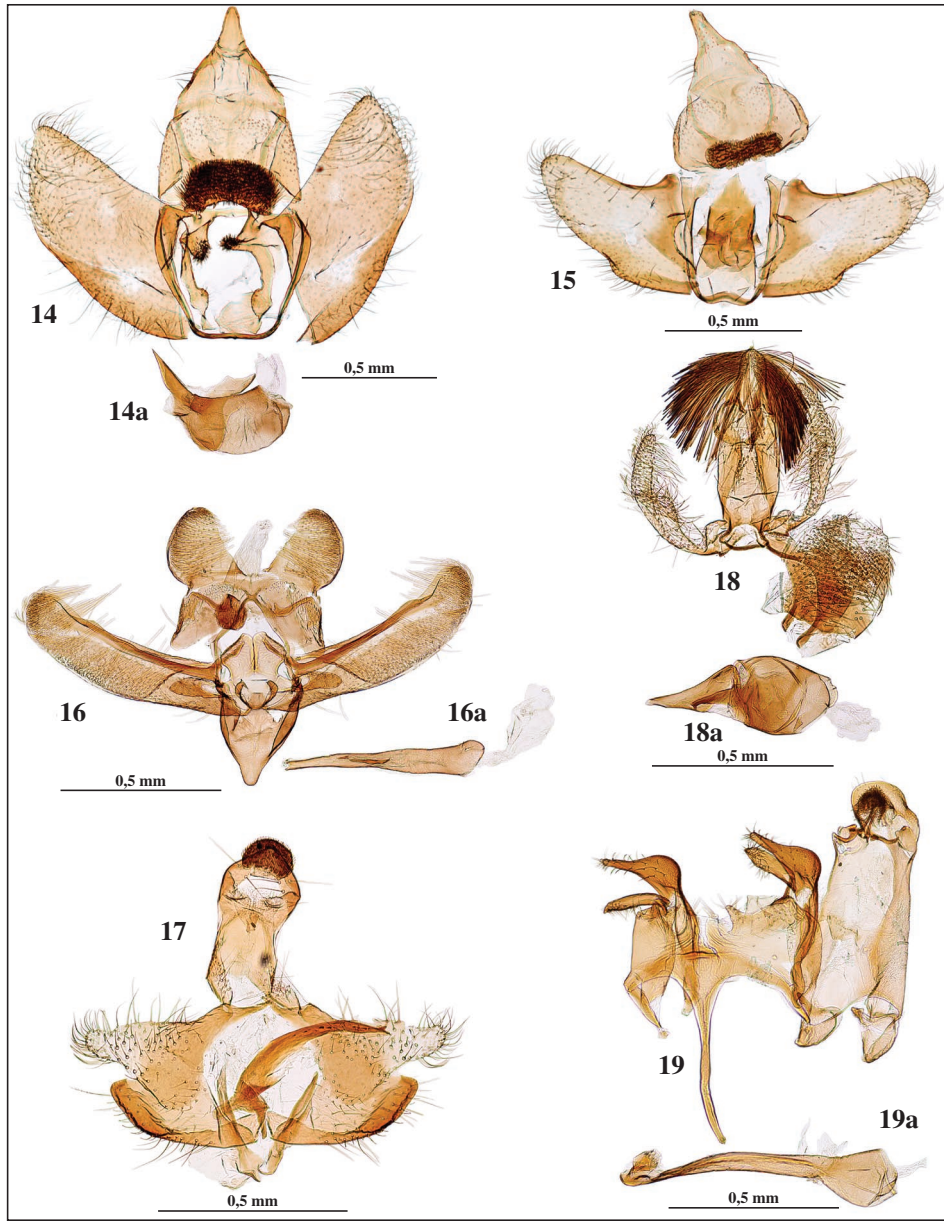
(Recibido para publicación / *Received for publication* 1-II-2020)
(Revisado y aceptado / *Revised and accepted* 10-III-2020)
(Publicado / *Published* 30-VI-2020)



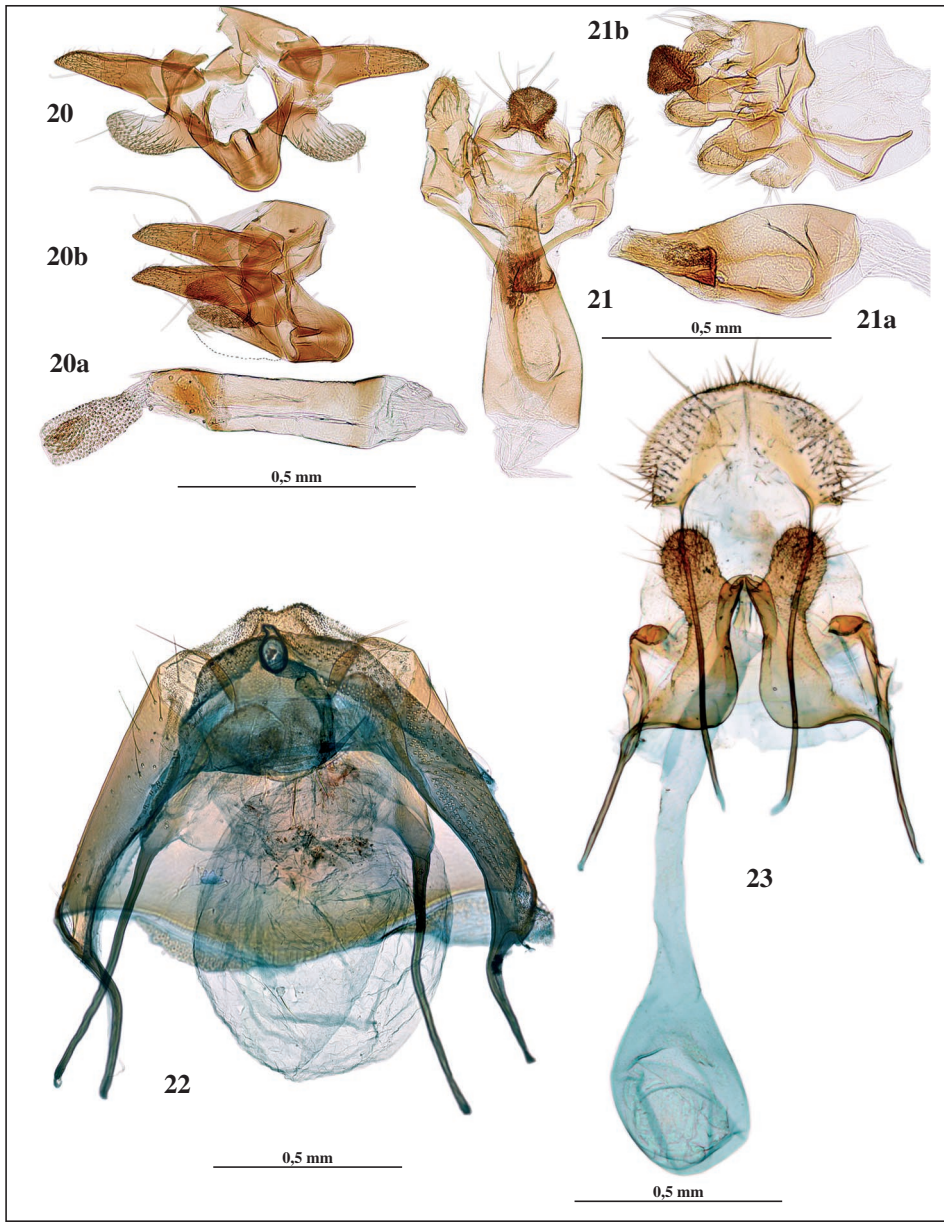
Figs. 1-6. Adultos. 1.– *Taleporia improvisella* (Stgr.), ♀, prep. gen. 7936JG. **2.** *Paraswammerdamia kitamurae* Gastón & Vives, sp. n., ♀, holotipo, prep. gen. 7914JG. **3.** *Metalampra italica* Bldz. ♀, prep. gen. 7941JG. **4.–** *Agnoea emarella* Gastón & Vives, sp. n., ♂, holotipo, prep. gen. 7772JG. **5.** *Agnoea emarella* Gastón & Vives, sp. n., ♀, paratipo, prep. gen. 7785JG. **6.** *Agnoea lvovskyi* Gastón & Vives, sp. n., ♂, holotipo, prep. gen. 7766JG.



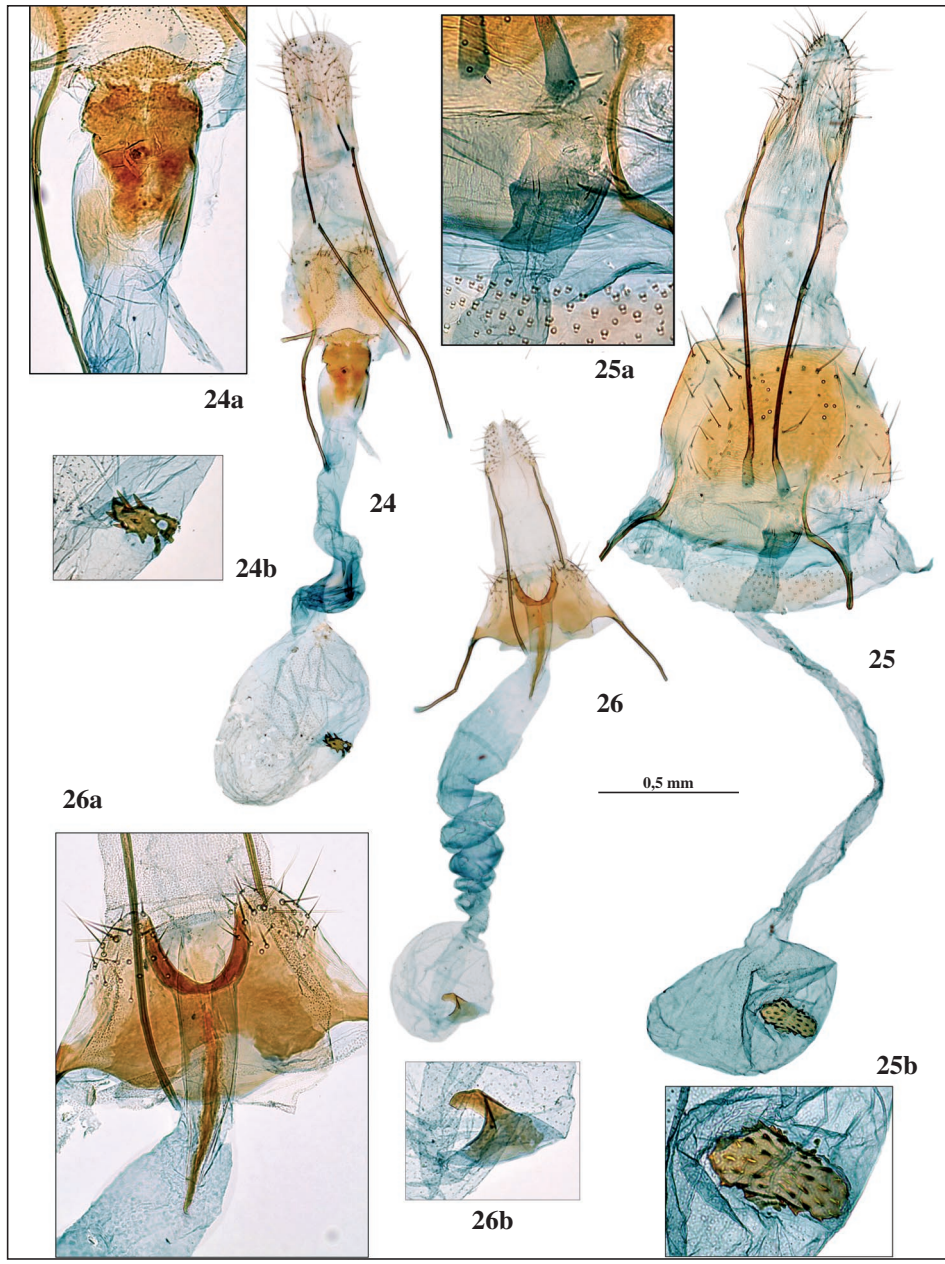
Figs. 7-13.– Adultos. 7. *Elachista atricomella* Stt., ♂, prep. gen. 7948JG. **8.** *Coleophora texanella* Cham., ♀, prep. gen. 7920JG. **9.** *Coleophora lusciniaepennella* (Tr.), ♂, prep. gen. 7917JG. **10.** *Stomopteryx hungaricella* Gozm., ♂, prep. gen. 7861JG. **11.** *Monochroa felixi* Gastón & Vives, sp. n., ♂, holotipo, prep. gen. 7844JG. **12.** *Oxypteryx parahelotella* (Nl.), ♂, prep. gen. 7833JG. **13.** *Caryocolum mazeli* Huem. & Nl., ♂, prep. gen. 7870JG.



Figs. 14-19.– Genitalia del macho. 14. *Agnoea emarella* Gastón & Vives, sp. n., holotipo, prep. gen. 7772JG. **14a.** Ditto, aedeagus. **15.** *Agnoea lvovskyi* Gastón & Vives, sp. n., holotipo, prep. gen. 7766JG. **16.** *Elachista atricomella* Stt., prep. gen. 7948JG. **16a**. Ditto, aedeagus. **17.** *Coleophora lusciniaepennella* (Tr.), prep. gen. 7917JG. **18.** *Stomopteryx hungaricella* Gozm., prep. gen. 7861JG. **18a.** Ditto, aedeagus. **19.** *Caryocolum mazeli* Huem. & Nl., prep. gen. 7870JG. **19a.** Ditto, aedeagus.



Figs. 20-23.– Genitalia del macho y de la hembra. 20. *Monochroa felixi* Gastón & Vives, sp. n., holotipo, prep. gen. 7844JG., vista frontal. **20a.** Ditto, aedeagus. **20b.** Ditto, vista lateral. **21.** *Oxypteryx parahelotella* (Nl.), vista frontal, prep. gen. 7828JG. **21a.** Ditto, aedeagus. **21b.** *Oxypteryx parahelotella* (Nl., 1995), vista lateral, prep. gen. 7833JG. **22.** *Taleporia improvisella* (Stgr.), prep. gen. 7936JG. **23.** *Paraswammerdamia kitamurae* Gastón & Vives, sp. n., holotipo, prep. gen. 7914JG.



Figs. 24-26.– Genitalia de la hembra. 24. *Metalampra italica* Bldz., prep. gen. 7941JG. **24a.** Ditto, detalle ostium. **24b.** Ditto, detalle signum. **25.** *Agnoea emarella* Gastón & Vives, sp. n., paratipo, prep. gen. 7788JG. **25a.** Ditto, detalle ostium. **25b.** Ditto, detalle signum bursae. **26.** *Coleophora texanella* Cham., prep. gen. 7920JG. **26a.** Ditto, detalle ostium. **26b.** Ditto, detalle signum bursae.

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 325-332 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.382

Discovery of the Tribe Polyorthini Obraztsov, 1966 in the Canary Islands. Description of the genus *Canaria* Larsen, gen. n. and the species *C. palmariana* Larsen, sp. n. and *C. gomeriana* Larsen, sp. n. (Lepidoptera: Tortricidae, Chlidanotinae, Polyorthini)

K. Larsen

Abstract

A new genus of the tribe Polyorthini *Canaria* Larsen, gen. n. and two new species *Canaria palmariana* Larsen, sp. n. and *Canaria gomeriana* Larsen, sp. n. are described from the Canary Islands respectively from La Palma and La Gomera. The genus *Canaria* differs from the closest related genus *Lopharcha* Diakonoff, 1941 by external characters and by both male and female genitalia. The two new species differs in external characters and structure of labial palpi, abdomen, legs and wings plus in DNA. Photographs of adults, palpi, genitalia and type localities are provided.
KEY WORDS: Lepidoptera, Tortricidae, Polyorthini, *Canaria*, *Canaria palmariana, Canaria gomeriana*, Canary Islands, Spain.

Descubrimiento de la tribu Polyorthini Obraztsov, 1966 en las Islas Canarias. Descripción del género *Canaria* Larsen, gen. n. y las especies *C. palmariana* Larsen, sp. n. y *C. gomeriana* Larsen, sp. n. (Lepidoptera: Tortricidae, Chlidanotinae, Polyorthini)

Resumen

Se describe de las Islas Canarias un nuevo género de la tribu Polyorthini *Canaria* Larsen, gen. n. y dos nuevas especies *Canaria palmariana* Larsen, sp. n. and *Canaria gomeriana* Larsen, sp. n. respectivamente de La Palma y La Gomera. El género *Canaria* difiere del relativamente del género próximo *Lopharcha* Diakonoff, 1941, por los caracteres externos y por la genitalia de ambos macho y hembra. Las dos nuevas especies difieren en los caracteres externos y la estructura del palpo labial, abdomen, patas y venas más en ADN. Se proporcionan fotografías de los adultos, palpos, genitalia y localidades tipo.
PALABRAS CLAVE: Lepidoptera, Tortricidae, Polyorthini, *Canaria*, *Canaria palmariana, Canaria gomeriana*, Islas Canarias, España.

Introduction

The subtribe Polyorthini is mainly distributed in South America, South East Asia and Australia. A few genera are known from the old world. (GILLIGAN *et al*., 2014). It was a big surprise to discover a new genus and two new species of Polyorthini from La Gomera and La Palma in the Canary Islands (Spain). The nearest relatives to the new genus are found in Nepal and Vietnam. (NEDOSHIVINA, 2013; RAZOWSKI, 1992). There are only two genera of Polyorthini in Europe *Isotrias* Meyrick, 1885 (nine

species) and *Olindia* Guenée, 1845 (one species); likewise in Africa: *Ebodina* Diakonoff, 1968 (two species) and *Xenoboda* Razowski & Tuck, 2000 (three species). (RAZOWSKI, 2002, 2017). None of the European and African genera are close relatives to the new genus.

The general appearance of many species in this group are rather similar to *Acleris* (subfamily Tortricinae, tribe Tortricini), and they were treated like this by Meyrick (CLARKE, 1958), but transferred to Polyorthini by DIAKONOFF (1974).

Imagines of the two new species are easy to recognize by appearance and they are separated from all other species in Polyorthini by special structures in the wings and in the genitalia. The possible long term isolation of the genus in the Canary Islands may also have affected the separation of the genus from any other genus in the subfamily.

Material and methods

The specimens were collected during a joint Danish expedition in August 2018 to Tenerife, La Palma, El Hierro and La Gomera. The specimens were found in La Palma and La Gomera using light traps with eight watt super actinic tubes and 125 watt mercury vapur bulbs.

The genitalia slides are made according to standard procedure mounted in euparal. The photographs of genitalia are taken by a Toup Tek camera mounted on a Toup Tek binocular microscope.

The holotypes are deposited in the collection A. Vives / Museo Nacional de Ciencias Naturales, Madrid, Spain.

The nomenclature for imagines and genitalia follow HORAK (1991) and RAZOWSKI (2008).

Canaria Larsen, gen. n.

Type species: *Canaria palmariana* Larsen, 2020.

Diagnosis: *Canaria* is characterized by the rather narrow, elongate and pointed forewing. There is a transverse band one third from the base including some blotches of raised scale tufts. The biggest is close to dorsum. On the underside, basally and close to dorsum, there is a blotch of stronger scales. Hindwings are also pointed with concave termen. At the base there is a tuft of long very fine hairy scales bend towards the dorsum, a cubital pecten.

These diagnostic characters are present in both species and both genders.

The female genitalia are characterized by a very long and fragile ductus bursa. Bursa itself has a pattern of small straight spines filling the complete corpus bursa. There is a very large bulla seminalis.

The male is not known.

The genus *Canaria* is closely related to *Lopharcha* Diakonoff, 1941. In *Lopharcha* al species except one have one or two signa in bursa. None of the species have a cubital pecten on the hind wing and none are described with the blotch of stronger scales on the base of the underside of the forewing (DIAKONOFF, 1974; RAZOWSKI, 1976, 2017).

Differences in the male genitalia will be discussed under the description of *Canaria gomeriana* Larsen, sp. n.

The genus *Lopharcha* consists of 23 species distributed from Nepal, Vietnam, Indonesia, Papua New Guinea over Australia to New Caledonia and with one representative in Japan. (GILLEGAN *et al*., 2014). The distance to the nearest known *Lopharcha* Diakonoff, 1941 population in Nepal from the Canary Islands is nearly 10.000 km.

Etymology: The name *Canaria* is chosen because of the geographically isolated presence in the Canary Islands, Spain.

Canaria palmariana Larsen, sp. n. (Figs 1-2)

Material examined: Holotype ♀, SPAIN: Canary Islands, La Palma, Barranco de la Madera, 500 m, 14-15-VIII-2018, K. Larsen leg., gen. prep. 3506 ♀ K. Larsen.

Description: Male. Unknown.

Female (Fig. 1): Wingspan: 14 mm. Frons upper part light creamy lower part grey. Vertex is light creamy. Ocellus posterior. Antenna less than half the length of the forewing, white ringed the complete length. Labial palpus (Fig. 2) moderate triangular shaped, terminal segment rather short, black ringed. Colour of labial palpus divided, upper part grey, lower part creamy whitish widening posteriorly. Thorax and tegulae dark brown. Abdomen blackish brown except the second last segment which is greyish white interrupted in the middle by a dark brown line. Legs creamy light yellow with long spurs.

Forewing lanceolate curved, apex pointed. Termen very moderate indented and oblique. Ground colour is blackish brown with lighter ochreous parts forming an oblique median fascia. Two thirds from costa there is a bigger scale tuft, which is light grey and placed in a round indented part of the wing. Cilia dark brown with a light dividing line. Hindwing light grey, gradually darker and browner towards pointed apex; termen strongly concave. Venation darker scaled. Cilia longer than cilia at the forewing, and with the same colour as wing and with light basal line. Dorsal part unto the termen with scattered black scales. Base of wing with large cubital pecten consisting of long hairy scales curved upright.

Underside of forewings grey with light costal strigula. At base a small indented part with short whitish, raised scalesh. Underside of hindwing peculiar, divided in three light grey areas stretching from base of the wing to the termen separated with three brown lines following the venation. The same darker lines visible on the upper side.

Female genitalia (Fig. 6): Sterigma cup-shaped with strongly curved lateral lobes. Antrum broader than ductus bursa which is very long, narrow, but widening a bit one third of the length. Ductus bursa fragile and weekly sclerotized, widening again just before corpus bursa, covered by a large amount of small spines spread over bursa in an equal pattern. Bulla seminalis very large.

It is to be noticed that the apophyses in the left side of the preparation is somewhat distorted. The specimen was born with this deformation.

Preparate of abdomen is shown in figure 7. The segments are characterized by the strong sclerotized framing.

Biology: Not known except the collecting date and the locality (Fig. 8). The type locality is Barranco de la Madera. This barranco is very narrow and steep. The vegetation is partly dry *Pinus* forest and partly Laurisilva forest, which continues to the northern part of La Palma.

Etymology: The species name *palmariana* refers to the finding in La Palma.

Canaria gomeriana **Larsen, sp. n.** (Figs 3-4)

Material examined: Holotype ♂, SPAIN: Canary Islands, La Gomera, El Cedro, 870 m, 17-20-VIII-2018, K. Larsen leg., gen. prep. 3507 ♂ K. Larsen.

Description: Male (Fig. 3). Wingspan: 11 mm. Frons and vertex deep chocolate brown all over. Ocellus posterior. Antenna one third of the length of the forewing very weakly ciliate. Last two thirds of the antenna weakly whitish ringed. Labial palpus (Fig. 4) short with a short terminal segment. Colour dark brown, laterally a little lighter. Thorax, tegulae and abdomen dark brown. Legs dark brown.

Forewing lanceolate curved with pointed apex. Termen moderate indented and oblique. Ground dark chocolate brown. The oblique median fascia marked with black lines inwardly as a double line melting together just before dorsum. Space between the lines filled out with dark ochreous scales looking like a stretched drop on the wing. On the last third of the wing some very inconspicuous reddish brown cross lines. In the centre of the wing the scales have a weak bluish tinge and there is a very tiny patch of raised scales. Cilia of the same colour as the wing.

Hindwing with pointed apex; termen oblique and strongly concave. Colour dark brown. Cilia a little lighter than the colour of the wing. Base of wing with a large cubital pecten consisting of long hairy scales curved upright.

Underside of the forewings dark brown with a lighter patch along the last half of costa and at apex. At the base there is a little patch of raised scales of the same colour as the wing. Underside of the hindwings of same colour as the forewings. The venation is weakly marked with scales slightly darker than the dark ground colour.

Male genitalia (Fig. 5): According to DIAKONOFF (1974) the male genitalia are very delicate to mount. Tegumen and the sinuous vinculum are on top of each other and also combined with the strong sclerotized eight segment of abdomen. Valva are thin-walled membranous in more layers and thus not with a specific clear form when mounted. In the present case the tegumen with uncus has been bent downwards under the preparation process not to cover the other structures.
Tegumen slender, pedunculus broad, uncus strongly bent, long and rather thin but a little thickened in the middle. Socius broad, oval covered with small spines. Gnathos is long and slender, strongly sclerotized (can be seen in between the two large socius). Phallus long with minor folds at the tip and placed straight upright in the middle of the structure. Vesica large. Valva membranous with at least two layers depending on where the layers are counted. Thus they cannot be spread out, but even then it is easy to see the general structure covered with many smaller and longer hairs especially at costa, dorsum and apex. Valva pointed and somewhat inconspicuously eggshaped. The strong curved structure of the eigth segment is also seen. Female is not known.

Biology: Not known except the collecting date and the locality (Fig. 9). The type locality is a terraced fruit garden at the edge of the large Laurisilva forest in the centre of La Gomera.

Etymology: The species name *gomeriana* refers to the finding on La Gomera.

Diagnosis: *C. gomeriana* is related to *C. palmariana* differing by strong external characters both on abdomen, frons and wings. *C. gomeriana* is much smaller, fewer drawings on the wing and frons and labial palpi are unicoloruos dark brown. Both the color of the hindwing and the drawings on the underside of the hindwing are different, as *C. palmariana* has three large whitish areas separated by darker veins. The tuft at the base of the underside of the forewing is light brown in opposition to a large whitish tuft with much longer scales than at the other species. The terminal part of labial palps is smaller in *C. gomeriana.* Legs are brown not light yellowish and have shorter tibia spurs. The large tuft with raised scales is replaced with a small hardly visible tuft, plain with the surface of the wing in *C. gomeriana*. The complete structure of *C. gomeriana* demonstrates in all parts that the two specimens belong to two different species in the same genus.

Results from the DNA analysis from Guelph, Canada in BOLD systems shows a difference on 4.4 % between the two species. Distance model: kimura 2 parameter. Marker: COI-5P. Results at a high quality level.

The male genitalia of *C. gomeriana* differs from the type of the genus *Lopharcha* Diakonoff, 1941 by the strongly sclerotized and curved vinculum, the very large phallus without cornuti and the lack of a large coremata tuft on the eight sternite and the lack of the large anellus plate found in the type species of *Lopharcha* Diakonoff, 1941.

Overall the female genitalia in Polyorthini are much less subject to polymorphy and variation than those of the males (DIAKONOFF, 1974).

Discussion

In 2013 I described a new genus *Willibaldiana* Larsen, 2013 (LARSEN, 2013) consisting of two new species found at the same locality in Jandia, Fuerteventura. This genus was placed in Eucosmini, but with uncertain position because of the very unusual structure of the genitalia. A recent DNA analysis shows less difference in the DNA than concerns the two present species. This is a very valid argument for the understanding of the character of the two specimens male and female found in La Gomera and La Palma as different species, although they belong to different gender. Besides there are very large dissimilarities in the imagines as described above. The finding of the new genus on two Islands demonstrates that it presumably cannot be an accidental introduction of species from a distant country. Like the two new species from Fuerteventura, it is to

be believed that these species are difficult to find and probably can be very local as many Tortricidae species can be. It is to be remarked that the nearest relative is to be found in Nepal about 10.000 km. away.

Polyorthini is the oldest subtribe of Tortricidae going back to the late cretaceous period, an estimated 70 million years ago (FAGUA *et al*., 2016), but the age of La Palma is estimated 1.7 ma old and La Gomera 11 ma (BOGAARD, 2013). A tentative idea could be, that the new genus has survived the different ice ages which also is the case of several genera of plants because of the southern isolated position of the islands. After the drying out of North Africa creating the Sahara, the Laurisilva forest ecosystem has been isolated for thousands of years. (BRAMWELL & BRAMWELL, 2001) The new genus could be a very old relict connected with the occurrence of the Laurisilva forest.

Further investigation on these species will be carried out and published together with new information on the genus *Willibaldiana*.

Acknowledgements

A special thanks is given to Dr. P. Buchner, Austria who has been very helpful with the performance of the DNA analysis and the understanding of the results. I also thank Mr. P. R. Orlien, Hørsholm, Denmark for the photos of the labial palpus. The author is likewise grateful to Dr. A. Vives, Spain for translating the abstract into Spanish and also thankful for serving and support for help with permissions to collect on the Islands under the joint Danish Island expedition in 2018 into the Scientific Project of SHILAP in 2018 and to the referee for linquistic advice.

BIBLIOGRAPHY

BOGAARD, P., 2013.– The origin of the Canary Island Seamount Province - New ages of old seamounts.– *Scientific Reports*, **3**(2107): 1-7. Available from http:// www.nature.com/articles/srep02107.

BRAMWELL, D. & BRAMWELL, Z. 2001.– *Wild Flowers of the Canary Islands*: × + 261 pp. Madrid.

CLARKE, J. F. G., 1958.– *Catalogue of the Type Specimens of Microlepidoptera in the British Museum (Natural History) described by Edward Meyrick*, **3**: 600 pp., 298 pls. London.

DIAKONOFF, A., 1974.– The South Asiatic Polyorthini with notes on species of *Polyortha* Dogning (Lepidoptera, Tortricidae).– *Zoologische Verhanddelingen*, **131**: 1-86.

FAGUA, G., CONDAMINE, F. L., HORAK, M., ZWICK, A. & SPERLING, F. A. H., 2016.– Diversification shifts in leafroller moths linked to continental colonization and the rise of angiosperms.– *Cladistics*, 0: 1-18. Doi 10.1111/cla.12185. 1-18.

GILLIGAN, T. M., BAIXERAS, J., BROWN, J. W. & TUCK, K. R., 2014.– *T@RTS. Online World Catalogue of the Tortricidae (Ver. 3.0)*. Available from http://www.tortricid.net/catalogue.asp (accessed 11 November 2019).

HORAK, M., 1991.– Morphology, Phylogeny and Systematics: 1-22.– *In* L. P. S. VAN DER GEEST & H. H. EVENHUIS (Ed.). *World Crop Pests. Tortricid Pests. Their Biology, Natural Enemies and Control*, **5**: XVIII + 808 pp. Elsevier, Amsterdam.

LARSEN, K., 2013.– A new genus and two new species of Tortricidae (Lepidoptera) from the Canary Islands.– *Phegea*, **41**(3): 50-54.

NEDOSHIVINA, S., 2013.– *Tortricidae of Vietnam*: 240 pp., 18 pls. Taipeh. (In Russian).

RAZOWSKI, J., 1976.– Phylogeny and System of Tortricidae (Lepidoptera).– *Acta Zoologica Cracoviensia*, **21**(5): 73-118.

RAZOWSKI, J., 1992.– Tortricidae (Lepidoptera) from Vietnam. Contribution I.– *SHILAP Revista de lepidopterología*, **20**(78): 107-119.

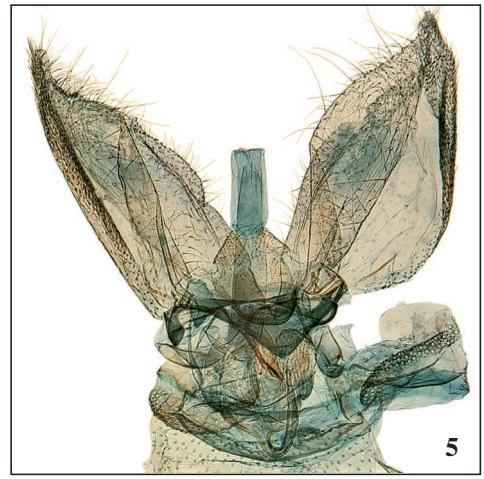
RAZOWSKI, J., 2002.– *Tortricidae (Lepidoptera) of Europe. Tortricinae and Chlidanotinae*, **1**: 247 pp. 71 + 16 pls. František Slamka, Bratislava.

RAZOWSKI, J., 2008.– *Tortricidae (Lepidoptera) of the Palaearctic Region. General part and Tortricini*, **1**: 152 pp. 8 + 27 pls. František Slamka, Bratislava.

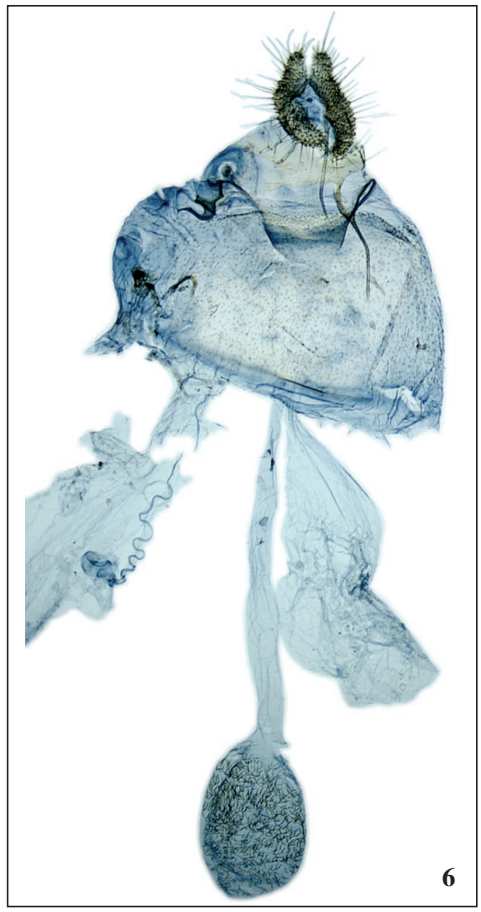
Razowski, J., 2017.– Diagnoses and remarks on the genera of Tortricidae (Lepidoptera). Part 5. Chlidanotinae.– *Acta Zoologica Cracoviensia*, **60**(1): 1-15.

K. L.
Røntoftevej, 33
DK-2870 Dyssegaard
DINAMARCA / *DENMARK*
E-mail: knud.torts@gmail.com
https://orcid.org/0000-0001-5556-3503

(Recibido para publicación / *Received for publication* 14-XI-2019)
(Revisado y aceptado / *Revised and accepted* 15-I-2020)
(Publicado / *Published* 30-VI-2020)



Figures 1-5.– 1. *Canaria palmariana* Larsen, sp. n. Holotype ♀. **2.** Labial palpus. **3.** *Canaria gomeriana* Larsen, sp. n. Holotype ♂. **4.** Labial palpus. **5.** *C. gomeriana* Larsen, sp. n. male genitalia Holotype. Gen. prep. 3507 ♂ K. Larsen.



Figures 6-9.– 6. *C. palmariana* Larsen, sp. n. female genitalia Holotype. Gen. prep. 3506 ♀ K. Larsen. **7.** *C. palmariana* Larsen, sp. n. abdomen prep. 3506 ♀ K. Larsen. **8.** La Palma, Barranco de la Madera. Type locality for *C. palmariana* Larsen, sp. n. **9.** La Gomera, El Cedro. Type locality for *C. gomeriana* Larsen, sp. n.

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 333-349 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.398

Notes on the biology and natural enemies of *Polyphagozerra coffeae* (Nietner, 1861) infesting *Eucalyptus pellita* F. Muell. (Myrtaceae) trees in Riau, Indonesia (Lepidoptera: Cossidae, Zeuzerinae)

W. de S. Tavares, S. K. Kkadan, A. M. Hendrik, M. Tarigan, R. Asfa, R. V. Yakovlev, T. Tachi, A. Duran, C. Y. Wong & M. Sharma

Abstract

Polyphagozerra coffeae (Nietner, 1861) (Lepidoptera: Cossidae) is one of the most destructive borers in the world. The objective of this study was to identify and evaluate some biological parameters of *P. coffeae* in laboratory. Natural enemy species and the damage caused on *Eucalyptus* (Myrtaceae) trees by this pest were also identified in Riau, Sumatra, Indonesia. Lepidoptera were identified as *P. coffeae* after external morphology and aedeagus (male genitalia) analysis. The 1.66 ± 0.28 day old females were able to lay an average of 591.80 ± 126.33 eggs per individual. Caterpillars stayed in the tree stem for a period longer than 60 days. Natural enemies from five groups were recovered from *P. coffeae*. They were *Brachymeria* sp. (Hymenoptera: Chalcididae) as a hyperparasitoid of *Cossidophaga coffeae* Tachi & Shima, 2020 (Diptera: Tachinidae) parasitizing the caterpillar, *Metarhizium* sp. (Hypocreales: Clavicipitaceae), an Eulophidae, Tetraschinae (pupal endoparasitoid), a Nematoda species (pupal parasite), and *C. coffeae* (larval parasitoid). Hanging and fallen tree tops, galleries and pupation chambers were damages caused by *P. coffeae* larvae on *Eucalyptus* trees. Sixty nine plant species belonging to 30 families are recorded as hosts of *P. coffeae* from the examined literature. The current study includes *Eucalyptus pellita* F. Muell. and *E. pellita* × *Eucalyptus grandis* W. Hill ex Maiden as hosts of this pest.
KEY WORDS: Lepidoptera, Cossidae, Zeuzerinae, *Cossidophaga coffeae*, damage, *Eucalyptus grandis*, parasitoid, *Zeuzera coffeae*, Sumatra, Indonesia.

Notas sobre la biología y enemigos naturales de *Polyphagozerra coffeae* (Nietner, 1861) infestando el árboles *Eucalyptus pellita* F. Muell. (Myrtaceae) en Riau, Indonesia (Lepidoptera: Cossidae, Zeuzerinae)

Resumen

Polyphagozerra coffeae (Nietner, 1861) (Lepidoptera: Cossidae) es uno de los más destructivos taladradores en el mundo. El objetivo de este estudio fue identiticar y evaluar algunos parámetros biológicos de *P. coffeae* en laboratorio. También fueron identificadas las especies como enemigos naturales y los daños causados sobre *Eucalyptus* (Myrtaceae) por esta plaga en Riau, Sumatra, Indonesia. Los Lepidoptera fueron identificados como *P. coffeae* después de analizar la morfología externa y el aedeagus (genitalia del macho). El 1.66 ± 0.28 día de las viejas hembras eran capaces de producir un promedio 591.80 ± 126.33 huevos por individuo. Las orugas se quedaron en el tallo de árbol por un período superior a los 60 días. Fueron recobrados los enemigos naturales de

cinco grupos de *P. coffeae*. Fueron *Brachymeria* sp. (Hymenoptera: Chalcididae) como un hyperparasitoide de *Cossidophaga coffeae* Tachi & Shima, 2020 (Diptera: Tachinidae) parasitando la oruga, *Metarhizium* sp. (Hypocreales: Clavicipitaceae), un Eulophidae, Tetrastichinae (endoparásito pupal), un Nematoda (parásito pupal) y *C. coffeae* (parásito larval). Los daños causados por las larvas de *P. coffeae* sobre los árboles de *Eucalyptus* son las galerías y las cámaras de pupación. Desde la bibliografía examinada, se han registrado sesenta y nueve especies de plantas pertenecientes a 30 familias, como plantas huesped de *P. coffeae*. El corriente estudio incluye *Eucalyptus pellita* F. Muell. y *E. pellita* × *Eucalyptus grandis* W. Hill ex Maiden como planta huesped de esta plaga.
PALABRAS CLAVE: Lepidoptera, Cossidae, Zeuzerinae, *Cossidophaga coffeae*, daños, *Eucalyptus grandis*, parasitoides, *Zeuzera coffeae*, Sumatra, Indonesia.

Introduction

The red maghogany, *Eucalyptus pellita* F. Muell. (Myrtaceae) is endemic to north-eastern Queensland in Australia (HII *et al.,* 2017; PRASETYO *et al.,* 2017; YUNIARTI *et al.,* 2017). This species was formally described in 1864 based on plant material collected near Rockingham Bay in Far North Queensland, Australia (KEMP *et al.,* 2007). Populations in New South Wales (a state on the east coast of Australia) formerly included in this species are currently referred to the large-fruited red mahogany, *Eucalyptus scias* L. A. S. Johnson & K. D. Hill (LE *et al.,* 2009).

Riau in central eastern coast of Sumatra island is one of the richest provinces in Indonesia. It is rich in natural resources particularly natural gas, African oil palm *Elaeis guineensis* Jacq. (Arecaceae), petroleum, rubber tree *Hevea brasiliensis* Müll. Arg. (Euphorbiaceae), and fiber plantations including *Eucalyptus* (PALLAS *et al.,* 2013; GAFUR *et al.,* 2015; HARDIE *et al.,* 2018). *Eucalyptus pellita* was introduced into Riau to concede rusticity and raise the wood yield of the flooded gum, *Eucalyptus grandis* W. Hill ex Maiden (a species naturally found from Newcastle in New South Wales northwards to west of Daintree in Queensland) (AGUSTINI *et al.,* 2014; YUSKIANTI *et al.,* 2014; GILL *et al.,* 2016) such as due to its resistance to insect pests as reported for the blue gum chalcid wasp, *Leptocybe invasa* Fisher & La Salle, 2004 (Hymenoptera: Eulophidae) in India (GOUD *et al.,* 2010). Little is known about insect pests and their potential to cause damage on *E. pellita* and genotypes from crosses *E. grandis* × *E. pellita* around the world.

The red coffee borer, *Polyphagozerra coffeae* (Nietner, 1861) (Lepidoptera: Cossidae) is also called carpenter moth (YAKOVLEV, 2015), carpenter worm, cocoa pod borer, coffee leopard moth, red twig borer, tea stem borer (CAB INTERNATIONAL, 2018), coffee borer (BEESON, 1941; ARORA, 1976), coffee carpenter (YAKOVLEV, 2011), goat moth (VOS, 2017), leopard moth (CAB INTERNATIONAL, 2014), red borer (BEESON, 1941; ARORA, 1976; ABRAHAM & SKARIA, 1995; SAMIKSKA, 2017), red branch borer (KALSHOVEN, 1940; WALLER *et al.,* 2007), red stem borer (SUNDARARAJ *et al.,* 2019), stem borer (SATHIAMMA & BHAT, 1974; CAB INTERNATIONAL, 2014), and walnut borer (GUL & WALI-UR-REHMAN, 1999; AHMAD, 2017). *Polyphagozerra coffeae* is reported for 15 Asian countries [Bangladesh, Brunei, China, India, Indonesia (East Nusa Tenggara, Java, Sumatra, and Western New Guinea), Japan, Laos, Malaysia, Myanmar, Pakistan, Philippines, Sri Lanka, Taiwan, Thailand, and Vietnam] and two Oceanian countries (Papua New Guinea and Solomom Islands). There are also vague records of this pest for two African countries (São Tomé and Príncipe and South Africa) (TAMS, 1927; YAKOVLEV, 2005; SMETACEK, 2008; MISHRA *et al.,* 2016; CAB INTERNATIONAL, 2018) (Fig. 1).

Three synonyms of the red coffee borer are reported: *Zeuzera oblita* Swinhoe, 1890 from Rangoon, Myanmar; *Zeuzera coffeae virens* Toxopeus, 1948 from Bogor, West Java, Indonesia; and *Zeuzera coffeae angulata* Arora, 1976 from West Bengal, India. *Polyphagozerra coffeae* was referred as *Zeuzera coffeae* Nietner, 1861 from individuals collected in Ceylon (Sri Lanka). However, it was combined to *Polyphagozerra* species-group proposed in 2011 by YAKOVLEV (2011). Illustrations of aedeagus (ARORA, 1976: 110, plate 61; YAKOVLEV, 2011) and male and female (YAKOVLEV, 2011: 124, plates 1 and 2) red coffee borer are provided.

The biological parameters of the red coffee borer on *E. pellita* as a plant host are unknown. The

species identity of the red coffee borer and its natural enemies from commercial plantations of *E. pellita* in Riau are also unknown. The objectives of the current study were: First, to study some biological parameters of the red coffee borer starting from larval and pupal stages collected from *E. pellita* trees. Second, to identify and study the natural enemies of *P. coffeae* from commercial plantations of *E. pellita* in Riau. Third, to characterize the damage caused by the red coffee borer on the commercial plantations of *E. pellita* trees in Riau. Fourth, to list all plant species reported as hosts of the red coffee borer from the examined literature.

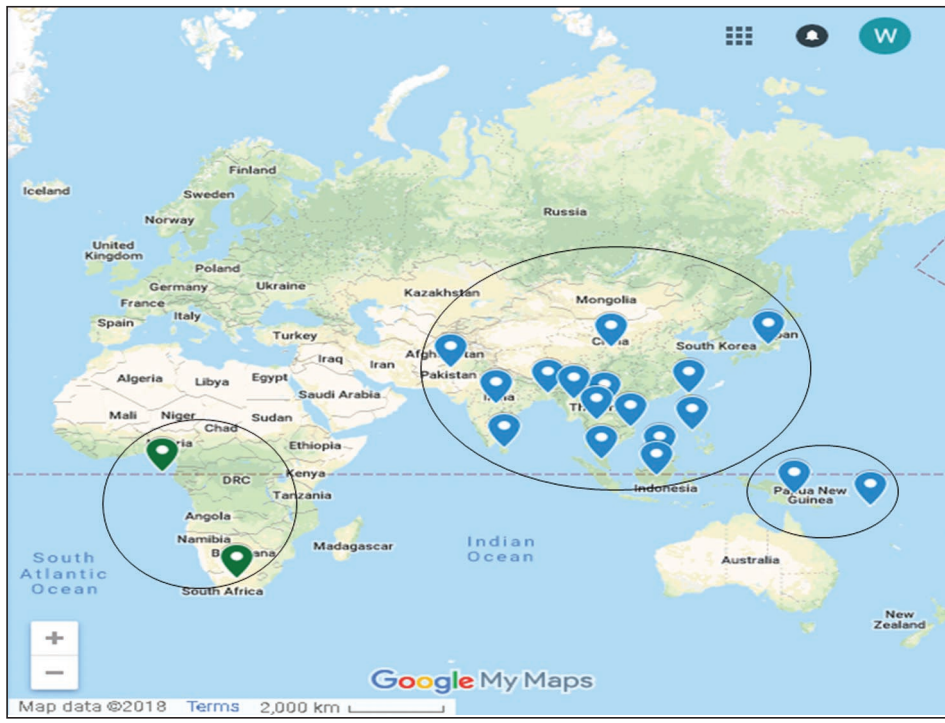


Fig. 1.– Distribution of the red coffee borer, *Polyphagozerra coffeae* (Nietner, 1861) (Lepidoptera: Cossidae) around the world: Africa (medium size circle - countries highlighted in green color), Asia (large size circle - countries highlighted in blue color) and Oceania (small size circle - countries highlighted in blue color). Map prepared using Google Maps (Google LLC®; California, United States of America) in December 2018.

Material and methods

Identification of the red coffee borer

The red coffee borer caterpillars were collected from a commercial stand of *E. pellita* in June 2017 in Baserah sector (Pangkalan Kerinci sub-district, Pelalawan regency, Riau, Sumatra, Indonesia) at 0º 26' S × 101º 44' E and 100 m above sea level. Under the Köppen climate classification, Riau features a tropical rainforest climate (Af) with no real dry season (LEE & BAE, 2015). May is the hottest month in Riau with an average temperature of 27.6ºC, while January is the coolest with an average temperature of 26.4ºC (SIAGIAN & SIMARMATA, 2018). November is the rainiest month with 312 mm, while the least rainfall is July with 123 mm (SUSANTI *et al.,* 2018).

Damage of *E. pellita* trees by the red coffee borer caterpillars is caused mainly by stem feeding and, as a consequence, presence of galleries and pupation chambers. The damages anteriorly mentioned lead to stem weakness and prone to top breaks during windy periods. *Eucalyptus pellita* trees damaged by the red coffee borer were seen with tops hanging and fallen (Fig. 2A). The presence of the red coffee borer caterpillars in the *E. pellita* hanging and fallen tops and remaining stems was detected by observing entrance holes with and without fresh frass from actively feeding caterpillars (Fig. 2B). Trees suspected as harboring caterpillars were aleatory selected within the stand and felled using a chainsaw (Husqvarna®; Jakarta, Indonesia). Stem logs (around 15 cm long) containing caterpillars and/or pupae inside were made from hanging and fallen tops besides remaining stems. Then, stem logs were split vertically into two similar-sized parts using a machete to observe the caterpillars and/or the pupae inside. The two obtained stem log pieces were returned to the original position after observation of the red coffee borer stages and fixed using elastic.

Fifty-four stem logs, each with a red coffee borer caterpillar of undetermined age and instar, were obtained during the survey. Stem logs containing red coffee borer stages were placed into 2.5-L plastic containers closed with aerated lids and brought to the Entomology Laboratory of the PT. Riau Andalan Pulp and Paper (APRIL) in Pangkalan Kerinci where they were kept at 26 ± 2ºC, 75 ± 15% RH and 14:10 (L:D) h photoperiod for 24 h. Then, the logs were opened and the caterpillars removed from them and individualized into 500 g plastic containers closed with aerated lids. The caterpillars were fed at pleasure on a ripe apple fruit, *Malus pumila* Miller (Rosaceae) until they turned into pupa. Consumed apple fruits were replaced by a new ripe apple fruit when necessary. The biology of the red coffee borer was studied using apple as a food source because a high survival of the caterpillars on this fruit was obtained as a result from a preliminary trial in laboratory. Red coffee borer pupae obtained from the logs or caterpillars reared in the laboratory were transferred to new 1-Kg plastic containers closed with aerated lids. A pupa individual was placed per plastic container until moth or parasitoid emerged.

Red coffee borer moths obtained from the pupae were reared until their death in same plastic containers as they turned into pupa. A 10-mL acrylic container filled with a 50:50% honey:distilled water solution was introduced per plastic container as humidity and energy source to the moths. This acrylic container lid had a hole which a cotton piece was inserted through connecting the solution to the external environment. Three day old moths were killed and pinned, and 10 males shipped to the Altai State University (ASU) in Barnaul, Russia, where the insect was identified at species level. Another 10 males, obtained from Mandau sector, Riau, Sumatra, Indonesia (0º46' N × 101º46' E, 70 m above sea level), from a previous survey carried out in 2016, were also shipped by air-mail to this Institution for species identification. Genitalia of the 20 males were exposed and analyzed using a technique described by YAKOVLEV & ALIPANAH (2017). Red coffee borer male moths were identified by the Dr. R. V. Yakovlev after comparing their aedeagus with the keys and taxonomic descriptions provided by YAKOVLEV & WITT (2017a, b) as well as with the insects previously deposited at the ASU collection, respectively.

Biology

Fifty-four caterpillars of red coffee borer being the same individuals used for the insect identification study were utilized to evaluate some biological parameters. The caterpillars that were placed into 500 g plastic containers and pupae into 1-Kg plastic containers closed with aerated lids were assessed daily until moth death.

The biological parameters evaluated were: larval, pupal and adult stage period (days); caterpillar mortality from the collection date (%); pupa mortality from the collection date as caterpillar or pupa (%); number of males and females; female proportion [number of females × (number of females + number of males)] × 100; eggs laid per female; parasitism (exerted by parasitoid) (%); infection (exerted by fungi) (%); female age (days) at egg deposition date; entrance hole diameter (cm), and caterpillar length (from the head to abdomen extremity, cm) at collection date. Data of some parameters were presented as mean ± SE. The number of eggs laid per female was counted from eggs deposited on plastic container inner surface. The entrance hole diameter and caterpillar length were measured using a ruler.

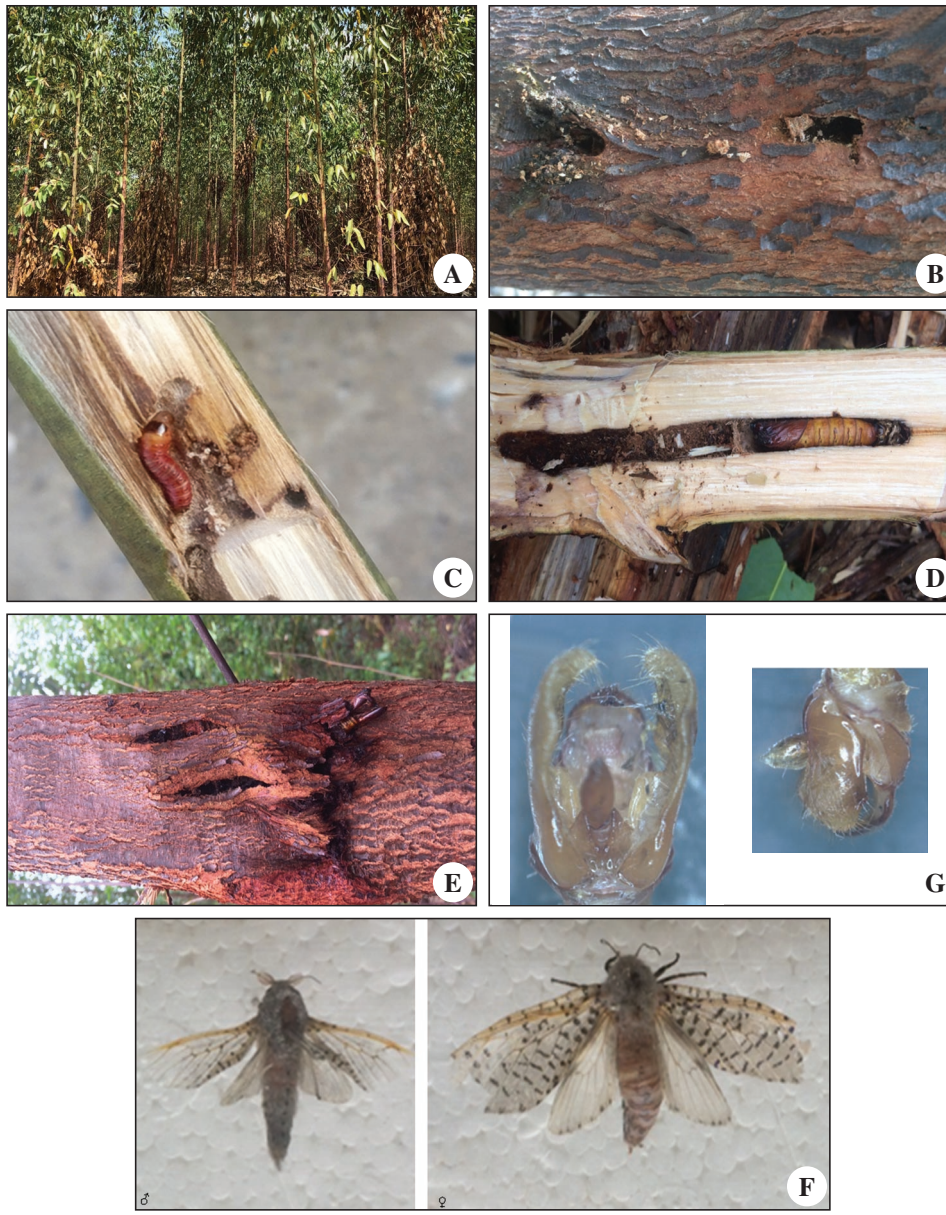


Fig. 2.– Hanging and fallen tops in a commercial stand of *Eucalyptus pellita* (Myrtaceae) trees damaged by the red coffee borer, *Polyphagozerra coffeae* (Nietner, 1861) (Lepidoptera: Cossidae) (**A**), two entrance holes with fresh frass (**B**), a middle-age caterpillar (**C**) and a mature pupa (**D**) in galleries, a pupation chamber with tree bark scratched by caterpillars before pupation (**E**), a male and a female moth - dorsal view (**F**), and male genitalia (frontal - top and lateral - down views) (**G**). Baserah sector, Riau, Sumatra, Indonesia.

Natural enemies

Parasitoids that have emerged from the red coffee borer caterpillars and pupae reared in laboratory were recovered and preserved in plastic vials (Eppendorf®; Hamburg, Germany) with ethanol at 70% in distilled water. Fifteen hymenopteran (of a same species) and five dipteran (of a same species) parasitoid individuals were shipped by air-mail to respective specialists for identification. Hymenopteran parasitoids were identified by the Dr. Christer Hansson (Lund University, Department of Biology in Lund, Sweden) and dipteran parasitoids by the Dr. T. Tachi. All remaining parasitoid individuals were deposited at the RAPP insects, mites and spiders depository.

A hymenopteran hyperparasitoid (one individual) emerged from a puparium of the dipteran parasitoid mentioned anteriorly. The puparium was observed after dissection of the parasitized red coffee borer caterpillar. The dipteran parasitoid and the hymenopteran hyperparasitoid were obtained from the anteriorly mentioned survey of the red coffee borer caterpillars and pupae carried out in Mandau sector in 2016. The red coffee borer pupa abdominal segments, which the hymenopteran parasitoids came out through, were evaluated as well as the number of parasitoid individuals emerged per host pupa. The number of dipteran parasitoid individuals emerged per red coffee borer caterpillar was also evaluated.

Host plants

The present study was conducted by surveying the red coffee borer on two *Eucalyptus* host groups, *E. pellita* and *E. grandis* × *E. pellita* in Riau. Additionally, a search was carried out on the literature available from Google Scholar (Google LLC®; California, United States of America) up to the submission date of this manuscript for all scientific reports recording the host plants of this pest.

Damage

The damage of *E. pellita* trees by the red coffee borer caterpillars while they feed and build galleries and pupation chambers was characterized. Around 50 field visits (morning and afternoon periods) were made between February 2016 and November 2019 to study the damage characteristics and other related-evaluations.

A middle-age caterpillar (Fig. 2C) and a mature pupa (Fig. 2D) found in galleries made by this insect were photographed. A pupation chamber showing scratches on the stem bark made by caterpillars on a one year and eight month old *E. pellita* tree was also photographed (Fig. 2E). A male and a female red coffee borer (Fig. 2F) were also photographed. The red coffee borer caterpillar, pupa, pupation chamber, and moths were photographed using an 8 megapixels camera iSight (Apple Inc.; Vancouver, BC, Canada).

A male red coffee borer obtained from a colony of this insect from the Entomology Laboratory in November 2019 was dissected using a surgical forceps and its genitalia was photographed (Fig. 2G) using a camera HDMI Indomicro attached to a Nikon SMZ1270 stereomicroscope (Yurakucho, Tokyo, Japan).

Results

Identification of the red coffee borer

The red coffee borer was identified as *Polyphagozerra coffeae* (Nietner, 1861) based on external morphology and aedeagus (male genitalia) analysis from 10 individuals collected in Baserah sector and another 10 in Mandau sector.

Biology

The duration of the pupal stage was 3.22 times longer than the adult stage. The mortality of pupa was 1.36 times higher than of caterpillar. Males were more numerous with 15 individuals. The less and more fertile female produced 175 and 1,198 eggs, respectively. Up to two day old females are able to lay eggs. The diameter of the entrance hole was 0.50 ± 0.02 cm. These holes are made by the young caterpillars to bore into the stem. The caterpillar body length was 2.21 ± 0.12 cm. The larval stage period in the stem is longer than 60 days (Table 1, Figs 3 and 4). Part of the larval and the fully pupal stage take place in the stem. The red coffee borer caterpillars showed color patterns varying according to its age: light brown to reddish for the young and mature caterpillars, respectively.

Table 1.– Biological parameters of the red coffee borer, *Polyphagozerra coffeae* (Nietner, 1861) (Lepidoptera: Cossidae) initially on *Eucalyptus pellita* (Myrtaceae) trees in the field and, from 24 h after collected, with caterpillars transferred to ripe apple fruits, *Malus pumila* (Rosaceae) as food source in laboratory.

Parameters	**Mean ± SE**	**N**	**Range**
Pupa stage duration (days)	18.96 ± 1.44	25	10–33
Adult stage duration (days)	05.88 ± 0.54	25	1–11
Larva mortality from the collection date (%)	29.62	54	–
Pupa mortality from the collection date as larva or pupa (%)	40.47	42	–
Number of males and females	15 and 11, respectively	26	–
Female proportion (%)*	42.30	26	–
Eggs laid per female	591.80 ± 126.33	10	175–1,198
Parasitism (exerted by parasitoid) (%)	4.00	25	–
Infection (exerted by fungus) (%)	5.26	38	–
Female age (days) at egg deposition date	1.66 ± 0.28	9	1–3
Entrance hole diameter (cm) at collection date	0.50 ± 0.02	19	0.30–0.70
Larva length (cm) at collection date	2.21 ± 0.12	44	1.0–4.0

* Female proportion (%)= number of females × (number of females + number of males) × 100.

Natural enemies

Individuals from a single species of hymenopteran parasitoid emerged from a red coffee borer pupa and they were identified as eulophid (Tetrastichinae), and two caterpillars were found colonized by *Metarhizium* sp. (Hypocreales: Clavicipitaceae). The hymenopteran parasitoid is a gregarious emerged from a red coffee borer pupa collected in Baserah sector in July 2017. The total number of parasitoid specimens emerged was > 500. The parasitoids came out through two exit holes: one made on the third and another made on the fourth abdominal segments of the red coffee borer pupa. *Metarhizium* sp. was identified by the M.Sc. A. M. Hendrik based on the analysis of the conidium morphology.

Three parasitoid species were recovered from a previous survey carried out in Mandau sector in 2016. First, 16 individuals of the recently described *Cossidophaga coffeae* Tachi & Shima, 2020 (Diptera: Tachinidae), being a gregarious endoparasitoid, emerged from a red coffee borer caterpillar (TACHI *et al.,* 2020). The mated females of this fly parasitize the red coffee borer caterpillar with the final instar of its offspring coming out from the host body for pupation. The pupation took place on the bottom of the plastic container used to rear the caterpillar host in the laboratory. Second, an individual of a hyperparasitoid species identified as *Brachymeria* sp. (Hymenoptera: Chalcididae, Chalcidinae) emerged from a *C. coffeae* puparia. This puparia was observed after dissection of the red coffee borer caterpillar host using a surgical forceps. Third, hundreds of individuals of an entomopatogenic nematode species identified as Nematoda emerged from a red coffee borer pupa.

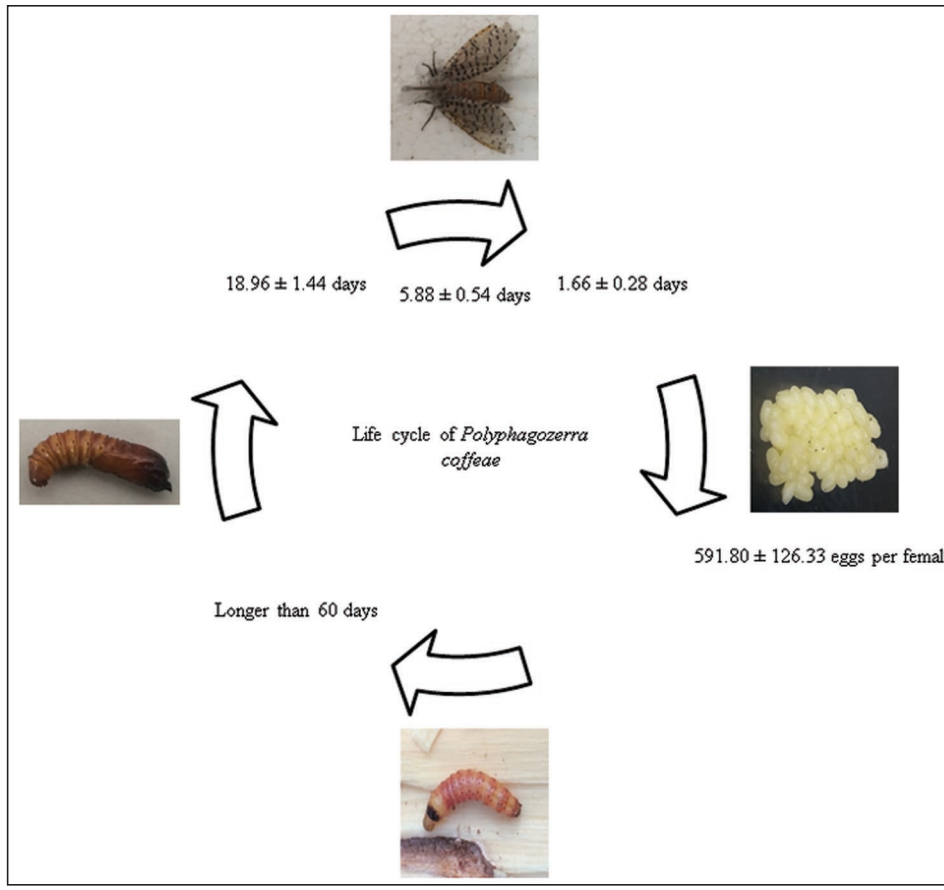


Fig. 3.– *Polyphagozerra coffeae* (Nietner, 1861) (Lepidoptera: Cossidae) life cycle. Riau, Sumatra, Indonesia.

HOST PLANTS

The current study reports, for the first time, *E. pellita* and *E. grandis* × *E. pellita* as plant hosts of the red coffee borer in the world. A list of all known plant hosts of *P. coffeae*, reported from the examined literature, is provided. Sixty nine plant species belonging to 30 families are recorded as host of *P. coffeae* from the examined literature (Table 2). The richest family in host plant species of red coffee borer was Fabaceae with 12, flowed by Meliaceae with seven and Lauraceae and Malvaceae each with five (Fig. 5).

DAMAGE

Caterpillars at young age start to borer into the tree stem. Initially, they feed on the wood just behind the bark and then penetrate deeply into the stem according to caterpillar age increases. Large caterpillars are found feeding on the heartwood and pith. Caterpillars make galleries upwards on *Eucalyptus* trees. These galleries and the pupation chambers create weakly spots on the stem. The damaged stem breaks in most cases due to wind generally when a weak spot is present just below the

crown (Fig. 2A). Young, active entrance holes in the stem can be detected by observing caterpillar frass. Caterpillars feed on the stem making galleries and pupation chambers which cause its morphological deformation (Fig. 2E). Caterpillars scratch the stem bark before its pupation. The pupation takes place in a pupation chamber made by the caterpillar just behind the stem bark. Later, the emerged moth comes out from the stem through the scratches.

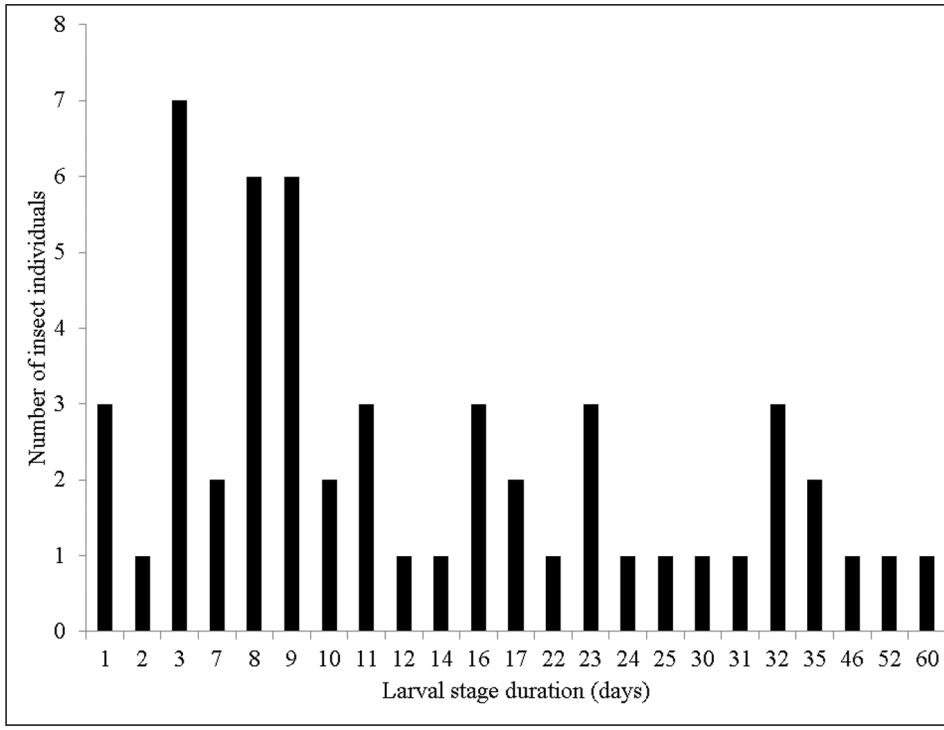


Fig. 4.– Larval stage duration (days) of the red coffee borer, *Polyphagozerra coffeae* (Nietner, 1861) (Lepidoptera: Cossidae) from the collection date until insect death by unknown reasons or turned into pupa. Number of individuals evaluated= 53. Riau, Sumatra, Indonesia.

Table 2.– Order, family and scientific name (authority) of all known host plants of the red coffee borer, *Polyphagozerra coffeae* (Nietner, 1861) (Lepidoptera: Cossidae) reported from the examined literature published from February 2016 to November 2019.

Order	Family	Scientific names (authority)
Ericales	Theaceae	*Camellia sinensis* (L.) Kuntze (= *Thea sinensis* L.)
Fabales	Fabaceae	*Acacia auriculiformis* A. Cunn. ex Benth.; *Acacia mangium* Willd.; *Amherstia nobilis* Wall.; *Bauhinia malabarica* Roxb.; *Cassia auriculata* L.; *Cassia fistula* L.; *Cassia grandis* L.f.; *Cassia siamea* (Lam.) Irwin et Barneby; *Leucaena leucocephala* (Lam.) de Wit; *Pericopsis* Thwaites; *Robinia pseudoacacia* L.; *Xylia dolabriformis* Benth.
Fagales	Casuarinaceae	*Casuarina equisetifolia* L.
	Fagaceae	*Castanea* Mill.
	Juglandaceae	*Carya* Nutt.; *Juglans regia* L.

Gentianales	Rubiaceae	*Coffea robusta* L. Linden
Lamiales	Lamiaceae Oleaceae Verbenaceae	*Clerodendrum infortunatum* L.; *Tectona grandis* L.f.; *Vitex pubescens* Vahl *Jasminum* L. *Lantana* L.
Laurales	Lauraceae	*Cinnamomum verum* J. Presl; *Cinnamomum zeylanicum* Blume; *Persea americana* Mill.; *Persea gratissima* Gaertner f.; *Phoebe* Nees
Magnoliales	Annonaceae	*Annona squamosa* L.; *Annona* spp.
Malpighiales	Achariaceae Erythroxylaceae Euphorbiaceae Phyllanthaceae Salicaceae	*Hydnocarpus wightiana* Blume; *Taraktogenus kurzii* King *Erythroxylum* P. Browne *Acalypha* L.; *Manihot esculenta* Crantz *Phyllanthus emblica* L. *Dovyalis* E. Mey. ex Arn.; *Populus* L.
Malvales	Malvaceae	*Abelmoschus esculentus* (L.) Moench; *Ceiba pentandra* (L.) Gaertn.; *Gossypium* L.; *Hibiscus rosa-sinensis* L.; *Theobroma cacao* L.
Myrtales	Combretaceae Lythraceae Myrtaceae	*Terminalia belerica* (Gaertn.) Roxb. *Lagerstroemia speciosa* (L.) Pers. *Pimenta dioica* (L.) Merr.; *Psidium guava* Griseb.
Pinales	Cupressaceae	*Cryptomeria* D. Don
Proteales	Proteaceae	*Grevillea robusta* A. Cunn. ex R. Br.
Rosales	Moraceae Rosaceae	*Artocarpus* J. R. Forster & G. Forster *Crataegus* Tourn. ex L.; *Eriobotrya japonica* (Thunb.) Lindl.; *Malus domestica* Borkh.
Santalales	Santalaceae	*Santalum album* L.
Sapindales	Meliaceae	*Cedrela febrifuga* Blume; *Cedrela sinensis* Juss.; *Cedrela toona* Roxb. ex Rottler; *Chukrasia tabularis* A. Juss.; *Melia azedarach* L.; *Swietenia macrophylla* King; *Swietenia mahagoni* (L.) Jacq.
	Rutaceae	*Citrus* L. (several species); *Clausena lansium* (Lour.) Skeels
	Sapindaceae	*Filicium* Thwaites ex Benth. & Hook.f.; *Nephelium litchi* Cambess.; *Schleichera trijuga* Willd.
Solanales	Solanaceae	*Cestrum nocturnum* L.
Vitales	Vitaceae	*Vitis vinifera* L.

Sources: LADELL (1927), BEESON (1941), GARDNER (1945), TOXOPEUS (1948), ARORA (1976), GUL & WALI-UR-REHMAN (1999), SRIDHAR *et al.* (2002), YAKOVLEV (2012), and PKB (2017).

Discussion

Identification of the red coffee borer

Ten individuals of the red coffee borer obtained from Baserah sector and another ten from Mandau sector, identified based on the male genitalia analysis, confirm the fact of male moth as the gender used in cossid identification (YAKOVLEV, 2014). Male genitalia of Zeuzerinae are characterized by the presence of gnathos free (if present) or completely absent. The shape and structure of claspers are variable, but help in the determination of species. On the other hand, female genitalia of zeuzerine vary considerably. However, it is helpful in determining the species only within the genus (ARORA, 1976).

The different color patterns of the red coffee borer caterpillar body follows the wood color which they fed on and insect age. Wood color of the hosts *E. pellita* and *E. grandis* × *E. pellita* is naturally light brown and originate lighter caterpillars while those borers feeding on a darker wood (usually due to the natural color of the wood host or a light wood colonized by microorganisms causing discoloration on plant tissue) originate darker caterpillars. Red coffee borer caterpillars having purple-brown color with a brown head were reported on coffee *Coffea* sp. (Rubiaceae), sandalwood *Santalum*

sp. (Santalaceae) and tea *Camellia sinensis* (L.) Kuntze (Theaceae) in India (SAMIKSHA, 2017). The age of the caterpillars was not mentioned in the latter study; however, it is may reporting about mature caterpillars.

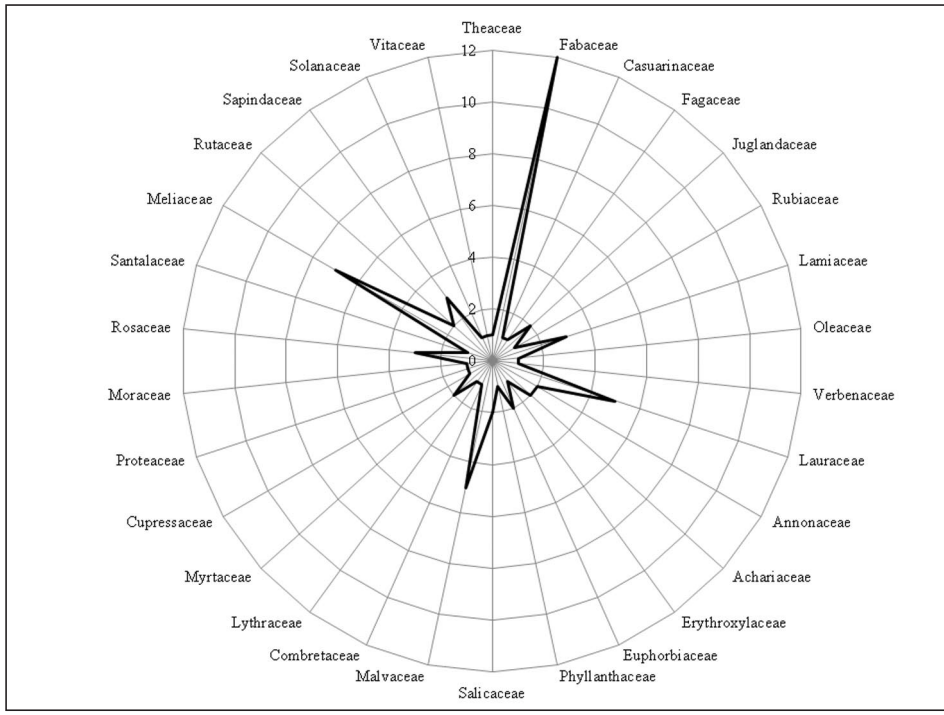


Fig. 5.– Number of plant species per family recorded as host of the *Polyphagozerra coffeae* (Nietner, 1861) (Lepidoptera: Cossidae) around the world.

The collection of *P. coffeae* in Indonesia, in addition to the patters of the geographical distribution of carpenter moths (YAKOVLEV, 2015) and the endemism of *E. pellita* to north-eastern Queensland (HII *et al.,* 2017), suggest Australia as the likely endemic spot of this pest.

BIOECOLOGY OF THE RED COFFEE BORER

The pupal stage duration of the red coffee borer from Riau was shorter than reported of being three weeks to a month on coffee, sandalwood and tea in India (BEESON, 1941) and 19 to 36 days on grapevine, *Vitis* sp. (Vitaceae) in Taiwan (CHANG, 1984), longer than reported of being nine to 13 days on cacao tree, *Theobroma cacao* L. (Malvaceae) in India (SATHIAMMA & BHAT, 1974) and similar of being 17 to 21 days on common walnut trees in Pakistan (AHMAD, 2017). Similarly to the current study, the pupation took place in the gallery formed by the caterpillar in the stem of coffee and tea in India (SAMIKSHA, 2017). At the end of the pupal stage, the pupa wriggles towards the exit hole pushing out the door-flap and extending its body about half way through the hole. The moth emerges, leaving the exuviae protruding from the hole in the bark. It takes about 20 min. for the wings to expand and dry (BEESON, 1941; WALLER *et al.,* 2007).

The adult stage duration of the red coffee borer from Riau is within the range reported of two to

six days on grapevine in Taiwan (CHANG, 1984) and common walnut in Pakistan (AHMAD, 2017), and shorter than reported of six to seven days on cacao tree in India (SATHIAMMA & BHAT, 1974).

The red coffee borer larval mortality in this study agrees with reports of high mortality of the first instars of this pest on coffee, sandalwood and tea in India (BEESON, 1941) and on this first crop in Indonesia, Papua New Guinea and South East Asia (CAB INTERNATIONAL, 2014).

The eggs were obtained from the laboratory rearing in this study. In the field, they are laid in sticky strings or in groups in cracks of the bark of small stems (BEESON, 1941) or branches (WALLER *et al.,* 2007). It was also reported that the eggs are arranged in several rows on the branches (SAMIKSKA, 2017). Caterpillars hatch in about 10 days (BEESON, 1941; SAMIKSKA, 2017) or nine to 30 days (CHANG, 1984), and they at first feed in a group under a silk web (BEESON, 1941; WALLER *et al.,* 2007). Later, they launch themselves on threads of silk and are widely dispersed by the wind. They bore into after land on a suitable host, often entering at a junction between a leaf-stalk or twig and the main stem (BEESON, 1941). The cylindrical galleries of older caterpillars are more irregular and, oppositely from observed in the current study, those of small caterpillars run down the center of the branch. The reddish frass is ejected through holes opened to the exterior at intervals (WALLER *et al.,* 2007).

The number of eggs deposited per female obtained in the current study agrees with reports that they are laid in large numbers (WALLER *et al.,* 2007), and ranging 348 to 966 eggs deposited by four females reared in cages (KALSHOVEN, 1940), 500 to 1,000 eggs deposited during a one to two weeks-period (BEESON, 1941), about 510 eggs per female (SATHIAMMA & BHAT, 1974), and 190 to 1,134 eggs (CHANG, 1984).

The fact that the younger than two day old females are able to lay eggs suggests that mating occurs soon after they turn into adult. This finding agrees with report that the red coffee borer moths copulate soon after their emergence (SAMIKSHA, 2017).

The caterpillar body length at collection date in this study was 1.59 cm lower than that of the fully grown caterpillars which can reach about 3.80 cm (SAMIKSHA, 2017).

The larval stage duration of the red coffee borer, longer than 60 days in Riau, is within the range for the complete duration of this stage from four to five months on coffee and tea in India (SAMIKSHA, 2017), 73 to 205 days on grapevine in Taiwan (CHANG, 1984) and 150 days on common walnut in Pakistan (AHMAD, 2017). The development cycle of the red coffee borer lasted four to five months on coffee, sandalwood and tea in southern Indian regions and at low elevations; however, it probably extends to a year at high elevations and in the north of India (BEESON, 1941). It is suggested that there are two generations a year on coffee, sandalwood and tea in India (BEESON, 1941) and on grapevine in Taiwan (CHANG, 1984). The moths are capable of breeding continuously all the year round and may be found in almost every stage of development in each month; there is, therefore, no marked season sequence of generations (BEESON, 1941).

Natural enemies

All parasitoids recovered from the red coffee borer in the present study represent the first record as natural enemies of this pest. However, different parasitoids were reported from the red coffee borer: caterpillars are parasitized by the hymenopteran braconid wasps such as *Amyosoma chinense* (Szepligeti, 1902) in unknown locality (CAB INTERNATIONAL, 2003) and the ectoparasitoid *Amyosoma leuzerae* Rohwer, 1918 in India and Indonesia (GOPINATH, 1962; WALLER *et al.,* 2007). The latter species often appears under the specific epithet *zeuzerae*. *Bracon zeuzerae* Fahringer, 1934 (Hymenoptera: Braconidae) is considered a subspecies of *A. leuzerae* since publication by WALLER *et al.* (2007), and the similarity of the names has caused some confusion. In Java, Indonesia, the red coffee borer caterpillars are parasitized by *B. zeuzerae*. Additionally, two species of tachinid fly attack the caterpillars in Indonesia: *Carcelia kockiana* Townsend, 1927 and *Isosturmia chatterjeeana* (Baranov, 1934) (WALLER *et al.,* 2007). A sphecid wasp species (Hymenoptera) being parasitoid of caterpillars, and a fly of the genus *Anthrax* Scopoli, 1763 (Diptera: Bombyliidae) being a pupal

parasitoid, were collected from the galleries of the red coffee borer on common walnut, *Juglans regia* L. (Juglandaceae) trees in Pakistan (AHMAD, 2017).

The gregarious ectoparasitoid *Myosoma chinensis* Quicke & Wharton, 1989 (Hymenoptera: Braconidae) and *Senometopia kockiana* (Townsend, 1927) (Diptera: Tachinidae) are also reported as associated with the red coffee borer (CAB INTERNATIONAL, 2018). The first species was described after its emergence from caterpillars of the spotted stalk borer, *Chilo partellus* (Swinhoe, 1885) (Lepidoptera: Pyralidae) in Kenya (QUICKE & WHARTON, 1989).

Cossidophaga coffeae, recovered from a red coffee borer caterpillar in this study, represents the second report of a parasitoid belonging to this genus with known species of the caterpillar host: *Duomitus ceramicus* (Walker, 1865) is reported to be parasitized by *Cossidophaga atkinsoni* (Aubertin, 1932) in Thailand (YAKOVLEV, 2011).

Other organisms are reported as natural enemies of the red coffee borer. Living caterpillars are less likely to be found in trees foraged by the predatory ants, but the introduction of ants into plantations such as cacao tree orchards is difficult (CAB INTERNATIONAL, 2014). In addition to predatory ants, the red coffee borer caterpillars are suppressed by the predators and entomopathogens such as woodpeckers (Piciformes: Picidae) which frequently peck out borers (CAB INTERNATIONAL, 2014) and *Beauveria bassiana* (Bals.-Criv.) Vuill. (1912) (Hypocreales: Clavicipitaceae) (WALLER *et al.,* 2007; CAB INTERNATIONAL, 2014) and *Gibberella fujikuroi* (Sawada) Wollenw., (1931) (Hypocreales: Nectriaceae) (CAB INTERNATIONAL, 2018), respectively.

Host plants

Eucalyptus pellita and *E. grandis* × *E. pellita* are added as host plants of the red coffee borer. Trophic relations of 59 cossid species representing 8% of the Old World fauna of carpenter moths, with 178 genera of 69 plant families were presented by YAKOVLEV (2012). The trophic spectrum ranges from monophagy to polyphagy, and the caterpillars can be divided into three groups: monophagous, oligophagous and polyphagous. *Polyphagozerra coffeae* is recorded as the most polyphagous species, being associated with plants of 34 families by YAKOVLEV (2012) and 30 families in this study, which make it one of the most destructive lepidopteran borers in the world.

The finding of red coffee borer feeding on *E. pellita* and *E. grandis* × *E. pellita* trees increases its host range. This pest is recorded on more than 50 plant species belonging to more than 40 families, including economic crops (LADELL, 1927; GARDNER, 1945; TOXOPEUS, 1948; ARORA, 1976; GUL & WALI-UR-REHMAN, 1999; SRIDHAR *et al.,* 2002; YAKOVLEV, 2012). However, hosts such as *Acacia auriculiformis* A. Cunn. ex Benth., *Acacia mangium* Willd. and other *Acacia* species (Fabaceae) are largely planted in the same region where the red coffee borer was recorded as a pest of *E. pellita* and *E. grandis* × *E. pellita* in Riau; however, no attack of *Acacia* trees by the red coffee borer was seen, suggesting preference of this pest to *Eucalyptus*.

Sectors with *E. pellita* and *E. grandis* × *E. pellita* plantations, near to Baserah sector and Mandau sector, were also reported as presenting severe damage by the red coffee borer, such as Langgam, Logas South, Logas North, Teso East, Teso West, Nagodang, and Ukui (Riau, Sumatra, Indonesia).

Damage

The damage on commercial materials is more pronounced on the pure *E. pellita* compared to the crosses *E. grandis* × *E. pellita* in Riau. Damaged trees of *Eucalyptus* were firstly observed in Riau by mid-2012, and hanging and fallen tops was the first symptom warned. This date is near to that of the beginning of large planting of *Eucalyptus* in Riau. An increase of the damage rate has been observed annually. *Eucalyptus* trees bearing four months to three year old are observed being attacked by this pest in the field. Notably, the peak of damage normally occurs at one year.

The damage caused by the red coffee borer on *Eucalyptus* in the current study agrees with reports that caterpillars of this species bore into the stem of the host plant and form galleries in the main stem

and/or lateral branches (SAMIKSHA, 2017). In the Thrissur district of Kerala, India, allspice *Pimenta dioica* (L.) Merr. (Myrtaceae) crops are damaged by the red coffee borer with caterpillars making galleries reaching the collar region, and the branches show withering and wilting (ABRAHAM & SKARIA, 1995). The presence of caterpillars can be detected by the pallets of frass on the ground below the infested branches (ARORA, 1976). The galleries of young caterpillars in small branches or stems are cylindrical and run more or less straight up and down the center, but those of older caterpillars are widened out into irregular cavities at intervals. The gallery may be eaten away right into the cambium; so, that only a thin shell of bark is left. Sometimes, the cavities are ring-shaped and completely girdle the shoot which dies back at once; the side branches of older trees break off at the girdle. A well developed gallery reaches an overall length of between 30 and 60 cm and may extend down to the root of a small plant; exceptionally a gallery in a teak, *Tectona grandis* (L.f.) Lam. (Lamiaceae) sapling may extend for 120 cm. At various distances in its course circular holes are cut to the outer surface through which the borer ejects its frass and excrement, which is in the form of yellowish or reddish rounded pellets, usually gummy and adhering in small lumps to the bark or collecting in a heap on the ground below (BEESON, 1941). In *T. cacao* trees, the caterpillars tunnel up to 30 cm along the center of a branch and finally makes a cross tunnel before pupation. The pupa sticks out of the entrance of the cross tunnel before emergence (CAB INTERNATIONAL, 2014). The attacked plants die back to the point at which they are girdled by the gallery of the borer, or are killed outright if small (BEESON, 1941). The damage was characterized by holes with frass, brittleness of the twigs and branches and withering; serious damage could result in death of the vine of grapevine in Taiwan (CHANG, 1984). Woody seedlings are also subject to attack (BEESON, 1941). Our current study disagrees with report that galleries are made downwards with larva reaching up the roots of the host plant, which is stated to occur usually in young plants (SAMIKSHA, 2017).

In conclusion, *P. coffeae* was identified and recorded as an important pest of the pure *E. pelitta* as well as crosses *E. grandis* × *E. pellita* in Riau, Sumatra, Indonesia. The 1.66 ± 0.28 day old females were able to lay an average of 591.80 ± 126.33 eggs per individual. Caterpillars stayed in the tree stem for a period longer than 60 days. Five groups of natural enemies were recovered from larvae and pupae: *Brachymeria* sp. (hyperparasitoid of *C. coffeae* parasitizing the red coffee borer caterpillar), *Metarhizium* sp., an eulophid tetrastichine wasp (pupal endoparasitoid), a nematode species (pupal parasite), and *C. coffeae* (larval parasitoid). The most common natural enemies were eulophid tetrastichine wasp and *C. coffeae*; however, preliminary trials showed that they are difficult to be reared for a possible biological control program. The damage caused by the red coffee borer on *Eucalyptus* trees was characterized; so, it could be used to identify the attacks by this pest in the field. Four months to three year old *Eucalyptus* trees were observed being attacked by this pest. However, the peak of damage normally occurs at one year.

Acknowledgments

Thanks are going to field and laboratory staff of APRIL and RAPP for helping in the collection and rearing of the *P. coffeae*.

BIBLIOGRAPHY

ABRAHAM, C. C. & SKARIA, B. P., 1995.– New record of the red borer *Zeuzera coffeae* Nietner (Cossidae: Lepidoptera) as a pest of allspice, *Pimenta dioica* (Linn.) Merril.– *Insect Environment*, **1**(1): 1-6.

AGUSTINI, L., FRANCIS, A., GLEN, M., INDRAYADI, H. & MOHAMMED, C. L., 2014.– Signs and identification of fungal root-rot pathogens in tropical *Eucalyptus pellita* plantations.– *Forest Pathology*, **44**(6): 486-495.

AHMAD, I., 2017.– Integrated pest management of *Zeuzera coffeae* Nietner: an efficient approach to reduce the infestation of walnut trees.– *Pakistan Journal of Zoology*, **49**(2): 693-698.

ARORA, G. S., 1976.– A taxonomic revision of the Indian species of the family Cossidae (Lepidoptera).– *Records of the Zoological Survey of India*, **69**(1): 1-160.

BEESON, C. F. C., 1941.– *The ecology and control of the forest insects of India and the neighbouring countries*: 1007 pp. Vasant press, Dehra Dun.

CAB INTERNATIONAL, 2003.– *Crop Protection Compendium 2003*. CABI, Wallingford.

CAB INTERNATIONAL, 2014.– Stem borer. Crop Protection Compendium. Available from http://www.cocoasafe.org/Resources%5CDatasheets%5CStemBorer.pdf (Accessed on 06 June 2018).

CAB INTERNATIONAL, 2018.– *Zeuzera coffeae* (coffee carpenter). Invasive Species Compendium. Available from https://www.cabi.org/isc/datasheet/57492 (Accessed on 19 June 2018).

GAFUR, A., NASUTION, A., YULIARTO, M., YONG, W. C. & SHARMA, M., 2015.– A new screening method for *Ganoderma philippii* tolerance in tropical *Acacia* species.– *Southern Forests*, **77**(1): 75-81.

CHANG, C. P., 1984.– The morphology and life history of the coffee borer (*Zeuzera coffeae* Nietner) on grapevine in Taiwan.– *Plant Protection Bulletin*, **26**(2): 145-153.

GARDNER, J. C. M., 1945.– Immature stages of Indian Lepidoptera (Cossidae, Indarbelidae).– *Journal of the Bombay Natural History Society*, **45**(1): 390-395.

GILL, W., EYLES, A., GLEN, M. & MOHAMEED, C., 2016.– Structural host responses of *Acacia mangium* and *Eucalyptus pellita* to artificial infection with the root rot pathogen, *Ganoderma philippii*.– *Forest Pathology*, **46**(4): 369-375.

GOPINATH, K., 1962.– Studies on the braconid, *Amyosoma zeuzerae* Rohwer an ectoparasite of the coffee red borer, *Zeuzera coffeae* Nietner.– *Current Science*, **31**(1): 5-6.

GOUD, K. B., KUMARI, N. K., VASTRAD, A. S., BHADRAGOUDAR, M. & KULKARNI, H., 2010.– Screening of eucalyptus genotypes against gall wasp, *Leptocybe invasa* Fisher and La Salle (Hymenoptera: Eulophidae).– *Karnataka Journal of Agricultural Sciences*, **23**(1): 213-214.

GUL, H. & WALI-UR-REHMAN, 1999.– A note on walnut borer, *Zeuzera coffeae* (Cossidae: Lepidoptera) on walnut trees (*Juglans regia*) in district Dir.– *Pakistan Journal of Forestry*, **49**(1/4): 117-120.

HARDIE, M., MENDHAM, D., CORKREY, R., HARDIYANTO, E., MAYDRA, A., SIREGAR, S., MAROLOP, R. & WIBOWO, A., 2018.– Effects of *Eucalypt* and *Acacia* plantations on soil water in Sumatra.– *New Forests*, **49**(1): 87-104.

HII, S. Y., HA, K. S., NGUI, M. L., AK PENGUANG JNR, S., DUJU, A., TENG, X. Y. & MEDER, R., 2017.– Assessment of plantation-grown *Eucalyptus pellita* in Borneo, Malaysia for solid wood utilisation.– *Australian Forestry*, **80**(1): 26-33.

KALSHOVEN, L. G. E., 1940.– Observations on the red branch borer, *Zeuzera coffeae* Nietn. (Lep. Coss.).– *Entomologische Mededeelingen van Nederlandanasch-Indie*, **6**(1): 50-56.

KEMP, J. E., LOVATT, R. J., BAHR, J. C., KAHLER, C. P. & APPELMAN, C. N., 2007.– Pre-clearing vegetation of the coastal lowlands of the Wet Tropics Bioregion, North Queensland.– *Cunninghamia*, **10**(2): 285-329.

LADELL, W. R. S., 1927.– Some injurious insects in Siam.– *Journal of the Siam Society Natural History Supplement*, **7**(1): 101-105.

LE, S., NOCK, C., HENSON, M. & SHEPHERD, M., 2009.– Genetic differentiation among and within three red mahoganies (series Annulares), *Eucalyptus pellita*, *E. resinifera* and *E. scias* (Myrtaceae).– *Australian Systematic Botany*, **22**(5): 332-343.

LEE, M. H. & BAE, D. H., 2015.– Climate change impact assessment on green and blue water over Asian monsoon region.– *Water Resources Management*, **29**(7): 2407-2427.

MISHRA, S. B., KENCHARADDI, R. N., DEVAGIRI, G. M. & KHAPLE, A. K., 2016.– Moths diversity of Kodagu District in Central Western Ghats of Karnataka, India.– *Indian Journal of Ecology*, **43**(2): 713-718.

PALLAS, B., MIALET-SERRA, I., ROUAN, L., CLÉMENT-VIDAL, A., CALIMAN, J. P. & DINGKUHN, M., 2013.– Effect of source/sink ratios on yield components, growth dynamics and structural characteristics of oil palm (*Elaeis guineensis*) bunches.– *Tree Physiology*, **33**(4): 409-424.

PKB, 2017.– Coffee carpenter (*Zeuzera coffeae*). Plantwise Knowledge Bank. Available from http://www.plantwise.org/KnowledgeBank/Datasheet.aspx?dsid=57492 (Accessed on 22 June 2018).

PRASETYO, A., AISO, H., ISHIGURI, F., WAHYUDI, I., WIJAYA, I. P. G., OHSHIMA, J. & YOKOTA, S., 2017.– Variations on growth characteristics and wood properties of three *Eucalyptus* species planted for pulpwood in Indonesia.– *Tropics*, **26**(2): 59-69.

QUICKE, D. L. J. & WHARTON, R. A., 1989.– *Myosoma nyanzaensis* sp. n. (Hymenoptera: Braconidae) parasitic on the stem-borer pest *Chilo partellus* (Swinhoe) (Lepidoptera: Pyralidae) in Kenya.– *Bulletin of Entomological Research*, **79**(1): 1-6.

SAMIKSKA, S., 2017.– Red borer (*Zeuzera coffeae*): Distribution, life cycle and control. YourArticleLibrary.com. Available from http://www.yourarticlelibrary.com/zoology/red-borer-zeuzera-coffeae-distribution-life-cycle-and-control/24052/ (Accessed on 22 June 2018).

SRIDHAR, V., SINGH, H. S. & PANDEY, V., 2002.– Record of *Zeuzera coffeae* Nietner (Lepidoptera: Cossidae) as a pest of custard apples (*Annona* spp.) from the coastal area of Orissa.– *Progressive Horticulture*, **34**(1): 128-129.

SATHIAMMA, B. & BHAT, K. S., 1974.– Record of a stem borer on cacao from India.– *Journal of Plantation Crops*, **2**(2): 34-35.

SIAGIAN, M. & SIMARMATA, A. H., 2018.– Trophic status of the lacustrine zone around the dam site of Koto Panjang Reservoir, Riau Province, Indonesia.– *AACL Bioflux*, **11**(1): 1-9.

SMETACEK, P., 2008.– Moths recorded from different elevations in Nainital District, Kumaon Himalaya, India.– *Bionotes*, **10**(1): 5-15.

SUNDARARAJ, R., WILSON, J. J. & VIMALA, D., 2019.– Stem borers of Indian sandalwood (*Santalum album* Linn.) in Karnataka, India.– *Journal of the Indian Academy of Wood Science*, **16**(1): 31-35.

SUSANTI, W., ADNAN, A., YENDRA, R. & MUHAIJIR, M. N., 2018.– The analysis of extreme rainfall events in Pekanbaru city using three-parameter generalized extreme value and generalized Pareto distribution.– *Applied Mathematical Sciences*, **12**(2): 69-80.

TACHI, T., SHIMA, H., TAVARES, W. DE S. & TARIGAN, M., 2020.– A new species of *Cossidophaga* Baranov from Indonesia (Diptera: Tachinidae), a parasitoid of the carpenter moth, *Polyphagozerra coffeae* (Nietner) (Lepidoptera: Cossidae).– *Oriental Insects*, DOI: 10.1080/00305316.2019.1697386.

TAMS, W. H. T., 1927.– List of the moths collected in Siam by E. J. Godfrey, B. Sc., F. E. S. with description of new species.– *Journal of Natural History Society of Siam*, **6**(1): 229-289.

TOXOPEUS, L. J., 1948.– On the borer moths *Zeuzera coffeae* Nietn, and *Z. roricyanea* Wlk. (*neuropunctata* Gaede) (Lep., Cossidae, Zeuzerinae).– *Treubia*, **19**(1): 167-175.

VOS, R., 2017.– The goat moths (Lepidoptera: Cossidae) of Papua Indonesia. Available from http://www.papua-insects.nl/insect%20orders/Lepidoptera/Cossidae/Zeuzera/Zeuzera%20coffeae.htm (Accessed on 22 June 2018).

WALLER, J. M., BIGGER, M. & HILLOCKS, R. A., 2007.– Coffee pests, diseases and their management. 1-400. Available from https://books.google.co.id/books?id=RpcoIgUBOLoC&pg=PA61&redir_esc=y#v=onepage&q&f=false (Accessed on 22 June 2018).

YAKOVLEV, R. V., 2005.– Cossidae (Lepidoptera) of Andaman Islands (India).– *Tinea*, **18**(1): 257-260.

YAKOVLEV, R. V., 2011.– Catalogue of the family Cossidae of the Old World.– *Neue Entomologische Nachrichten*, **66**(1): 1-129.

YAKOVLEV, R. V., 2012.– Trophic relations of Old World carpenter-moths (Lepidoptera, Cossidae).– *Euroasian Entomological Journal*, **11**(1): 189-194.

YAKOVLEV, R. V., 2014.– Descriptions of three new species of Cossidae (Lepidoptera) from Vietnam, with an updated annotated checklist.– *Zootaxa*, **3802**(1): 240-256.

YAKOVLEV, R. V., 2015.– Patterns of geographical distribution of carpenter moths (Lepidoptera: Cossidae) in the Old Word.– *Contemporary Problems of Ecology*, **8**(1): 36-50.

YAKOVLEV, R. V. & ALIPANAH, H., 2017.– Description of the male genitalia of *Dyspessa wiltshirei* Daniel, 1938 (Lepidoptera, Cossidae) based on the type specimens.– *Ukrainian Journal of Ecology*, **7**(1): 108-110.

YAKOVLEV, R. V. & WITT, T. J., 2017a.– Redescription of the genus *Paralophonotus* Schoorl, 1990 based on the morphology of male genitalia (Lepidoptera: Cossidae).– *SHILAP Revista de lepidopterología*, **45**(180): 665-668.

YAKOVLEV, R. V. & WITT, T. J., 2017b.– Three new species and one new subspecies of *Deserticossus* Yakovlev, 2006 (Lepidoptera: Cossidae) from Kazakhstan, Kyrgyzstan and Russia, with world catalogue of the genus.– *Zootaxa*, **4269**(3): 379-395.

YUNIARTI, N., MEGAWATI, M. & LEKSONO, B., 2017.– The effect of method and germination paper substrate on viability of *Eucalyptus pellita* F. Mull seed.– *Jurnal Penelitian Kehutanan Wallacea*, **6**(1): 13-19.

YUSKIANTI, V., GLEN, M., PUSPITASARI, D., FRANCIS, A., RIMBAWANTO, A., GAFUR, A., INDRAYADI, H. & MOHAMMED, C. L., 2014.– Species-specific PCR for rapid identification of *Ganoderma philippii* and *Ganoderma mastoporum* from *Acacia mangium* and *Eucalyptus pellita* plantations in Indonesia.– *Forest Pathology*, **44**(6): 477-485.

*W. S. T., S. K. K., A. M. H., M. T., R. A., A. D., C. Y. W., M. S.
Asia Pacific Resources International Holdings Ltd. (APRIL)
PT. Riau Andalan Pulp and Paper (RAPP)
28300, Pangkalan Kerinci, Riau, Sumatra
INDONESIA / *INDONESIA*
*E-mail: Wagner_Tavares@aprilasia.com
https://orcid.org/0000-0002-8394-6808

E-mail: Srikumar@aprilasia.com
https://orcid.org/0000-0002-1875-6899

E-mail: ademeizon9@gmail.com
https://orcid.org/0000-0002-9561-6806

E-mail: Marthin_Tarigan@aprilasia.com
https://orcid.org/0000-0002-9128-2650

E-mail: rianza1982@gmail.com
https://orcid.org/0000-0002-5650-0552

E-mail: Alvaro_Duran@aprilasia.com
https://orcid.org/0000-0002-3035-9087

E-mail: Wong_Ching_Yong@aprilasia.com
https://orcid.org/0000-0001-8250-826X

E-mail: Mukesh_Sharma@aprilasia.com
https://orcid.org/0000-0002-9409-1200

R. V. Y.
Department of Ecology
Altai State University
656049, Barnaul
RUSIA / *RUSSIA*
E-mail: cossus_cossus@mail.ru
E-mail: yakovlev_asu@mail.ru
https://orcid.org/0000-0001-9512-8709

T. T.
Biosystematics Laboratory
Department of Environmental Changes
Faculty of Social and Cultural Studies
Kyushu University
819-0395, Fukuoka City
JAPÓN / *JAPAN*
E-mail: tachi@scs.kyushu-u.ac.jp
https://orcid.org/0000-0003-0013-9638

* Autor para la correspondencia / *Corresponding author*

(Recibido para publicación / *Received for publication* 4-XII-2019)
(Revisado y aceptado / *Revised and accepted* 10-II-2020)
(Publicado / *Published* 30-VI-2020)

Normas para los autores que deseen publicar en ©*SHILAP Revista de lepidopterología*

1. SHILAP Revista de lepidopterología es una revista internacional publicada desde 1973 por la Sociedad Hispano-Luso-Americana de Lepidopterología y utiliza el identificador digital persistente de ORCID® (https://orcid.org) como una manera de asegurar la normalización de la autoría correcta. Incluye artículos de investigación empírica y teórica en todas las áreas de la Lepidopterología (sistemática, taxonomía, filogenia, morfología, bionomía, ecología, faunística y zoogeografía, también trabajos bibliográficos o sobre la historia de la Lepidopterología, así como revisiones de libros sobre estos temas) procedentes de todas las regiones del mundo, con especial interés en los estudios que de una u otra manera tengan relevancia en la biología de la conservación. Cada volumen consta de cuatro fascículos anuales (un volumen por año) en marzo, junio, septiembre y diciembre.

2. Se permite emplear como idiomas el español, inglés, francés, alemán, italiano y portugués, lenguas oficiales de la revista.

3. El manuscrito versa sobre investigaciones originales no publicadas anteriormente y que se somete en exclusiva a **SHILAP Revista de lepidopterología**, de no ser así deberá comunicarlo urgentemente. El manuscrito se enviará preferentemente en formato electrónico. Se prefiere el archivo en Formato de Texto Enriquecido (RTF). Se requiere una resolución mínima para los archivos: las ilustraciones en color en formato RGB de 24 bits, 300 ppp (puntos por pulgada) en el tamaño de la letra; en la escala de grises de 8 bits, 300 ppp en el tamaño de la letra; el texto en blanco y negro de 1 bits, 1.200 ppp en el tamaño de la letra.

4. El Director representa la opinión del Consejo de Redacción y hará saber a los autores su fallo sobre la aceptación o no de sus trabajos. Todos los manuscritos serán revisados por el Director y al menos dos revisores independientes en orden de garantizar la calidad de los trabajos. El proceso de revisión es rápido. Basándose en su informe, el Director decide si un manuscrito será aceptado para su publicación. La publicación de los trabajos aceptados se realiza con la mayor rapidez posible, normalmente dentro de los 12 meses siguientes a la recepción de los mismos. Una vez aceptado, el trabajo pasará a ser propiedad de la revista, ésta se reserva los derechos de autor y ninguna parte del trabajo podrá ser reproducida sin citar su procedencia.

5. Todos los artículos deberán llevar un resumen de su contenido en español y otro en cualquiera de los idiomas oficiales de la revista, preferentemente en inglés (Abstract). Para autores que no conocen el español, la traducción del Abstract del inglés al español se realizará por el Director, si el trabajo es aceptado. El resumen será conciso y condensará las conclusiones del trabajo, no incluirá puntos y aparte. Cada uno de los resúmenes deberá ir seguido de un máximo de 10 palabras clave (Key words) en el mismo idioma, separadas por comas. El resumen en idioma diferente al del texto, deberá ir precedido de una traducción del título en inglés.

6. El orden de presentación de los trabajos será: título, autor, resúmenes, texto y bibliografía. En caso de duda, por favor consulten números anteriores de la revista. **Los trabajos que no se ajusten a estas normas serán devueltos a los autores.**

7. DE LOS AUTORES: Presentarán su nombre completo, dirección de contacto, correo electrónico e incluirán en su firma sus identificadores ID (ORCID®). Los nombres de pila de los autores se expresarán mediante las iniciales. Se aconseja a los autores de expresión española que usen los dos apellidos, que los unan mediante un guión.

8. DEL TEXTO: Se recomienda utilizar poco las llamadas infrapaginales, que dificulten la comprensión del trabajo.

Las fechas se escribirán como sigue: 15-VII-1985 (o sea, días y años en números arábigos y meses en romanos).

Las menciones de los autores de la bibliografía en el texto, se darán en mayúsculas y con la fecha: LINNAEUS (1758), (LINNAEUS, 1758) o bien HARRY (*in* MOORE, 1980), si hubiese más de dos autores se indicará el primero y, a continuación, *et al*. Si se quieren indicar las páginas, éstas se pospondrán al año separándolas con dos puntos (1968: 65).

Las citas del material capturado deberán hacerse del siguiente modo: País (cuando necesario), provincia, localidad, altitud, sexo de los especímenes, fecha y colector. El símbolo de macho y hembra tiene que ser codificado como (&&) y (&) respectivamente con paréntesis. Los caracteres diacríticos normalmente no incluidos en las fuentes europeas del oeste (por ejemplo: lenguas eslavas, rumano, polaco, turco, etc.) deberán también codificarse; los códigos usados se presentarán en hoja aparte, con una versión impresa del manuscrito.

9. DE LAS ESPECIES Y OTRAS CATEGORÍAS TAXONÓMICAS: Todos los nombres de taxones mencionados en el texto, tanto de los ya establecidos como de los nuevos que se describan, deberán ajustarse a las recientes normas del *Código Internacional de Nomenclatura Zoológica*. Las abreviaturas **gen. n.**, **sp. n.**, **syn. n.**, **comb. n.**, o similar, deberán de usarse explícitamente para todas las innovaciones taxonómicas. En la descripción de un nuevo género, la especie tipo nominal, debe de ser designada en la combinación original y con referencia a la descripción original e inmediatamente después del nuevo nombre. Si en el artículo se describen nuevos taxones, es imprescindible que los tipos estén depositados en alguna institución científica.

Todos los taxones se mencionarán seguidos de su descriptor (con el nombre completo) y la fecha de descripción por lo menos una vez. Las abreviaturas de los autores que son reconocidas internacionalmente pueden utilizarse. Ejemplos: L. (Linnaeus); H.-S. (Herrich-Schäffer); Stgr. (Staudinger), etc.

10. DE LAS ILUSTRACIONES: Los dibujos serán realizados en tinta china, sobre cartulina blanca o papel vegetal DIN A4. Podrán presentarse fotografías que tengan buen contraste. También se pueden publicar láminas en color. **El coste de las láminas en color irá a cargo del autor**.

11. DE LA BIBLIOGRAFÍA: Todos los trabajos irán acompañados de una bibliografía que incluirá únicamente las publicaciones citadas en el texto. Las citas bibliográficas deben hacerse del siguiente modo: autor, año de publicación del trabajo o libro a que se hace referencia, titulo del trabajo o libro y título de la revista completo, indicándose el volumen, número (entre paréntesis) y páginas. Ejemplos:

Artículos en revista:

SARTO I MONTEYS, V., 1985.- Confirmación de la presencia en la Península Ibérica de *Earias vernana* (Hübner, 1790).- *SHILAP Revista de lepidopterología*, **13**(49): 39-40.

Artículo en volumen colectivo:

REBEL, H., 1901.- Famil. Pyralidae-Micropterygidae. 2 Theil.- *In* O. STAUDINGER & H. REBEL. *Catalog der Lepidopteren des palaeartischen Faunengebietes*: 368 pp. R. Friedlander & Sohn, Berlin.

Libro:

HIGGINS, L. G., 1975.- *The Classification of European Butterflies*: 320 pp. Collins, London.

Internet:

DE PRINS, J. & DE PRINS, W., 2011.- *Global taxonomic database of Gracillariidae (Lepidoptera).* Disponible en http://www.gracillariidae.net (accedido el 14 de diciembre de 2011).

Las citas bibliográficas se relacionarán siguiendo el orden alfabético de los autores. Cuando se haga referencia a más de un trabajo de un mismo autor, las citas bibliográficas correspondientes se relacionarán en orden de antigüedad de los trabajos.

12. DE LAS TABLAS: Llevarán su propia numeración correlativa en cifras romanas, en hojas independientes sin paginar.

13. DE LAS NOTAS Y RESEÑAS BIBLIOGRÁFICAS: De extensión no superior a dos páginas, sin ilustraciones, deben seguir las mismas normas que los artículos.

14. DE LAS PRUEBAS DE IMPRENTA: Los autores recibirán pruebas para corregir cuidadosamente los errores de imprenta. Sólo se permitirán las correcciones de errores tipográficos, el coste de las correcciones de estilo o de texto será cargado a aquellos. Las pruebas deberán ser devueltas dentro del plazo de 15 días a partir de la fecha de recepción. Transcurrido este tiempo, el Consejo de Redacción decidirá entre retrasar su publicación o realizar las correcciones, declinando toda responsabilidad sobre la persistencia de posibles errores. El Consejo de Redacción se reserva el derecho a realizar las modificaciones oportunas para mantener la uniformidad de la revista.

15. DE LAS SEPARATAS: Los autores recibirán un **PDF gratis de su trabajo**. Si necesita separatas adicionales de su trabajo, debería de comunicárselo con antelación al Secretario General y el gasto correrá a cargo del autor/s. Se permite el autoarchivo de los artículos publicados en el momento de su publicación en la versión impresa.

16. DE LA CORRESPONDENCIA: Sólo se mantendrá correspondencia con el primer autor firmante, si el autor corresponsal no fuese éste, deberá indicarse por escrito al Secretario General. Caso de incluir fotografías o láminas en color, se requerirá que el autor manifieste por escrito la aceptación de los gastos que éstas generen.

17. DE LOS TRABAJOS: Se remitirán a:

SHILAP
Apartado de Correos, 331
E-28080 Madrid
ESPAÑA / *SPAIN*
E-mail: avives1954@outlook.es / avives1954@gmail.com / avives1954@outlook.com

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 351-361 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.388

On the biology, ecology and conservation of *Jordanita* (*Gregorita*) *hispanica* (Alberti, 1937) (Lepidoptera: Zygaenidae, Procridinae)

K. A. Efetov & G. M. Tarmann

Abstract

Hitherto, the early stages of *Jordanita* (*Gregorita*) *hispanica* (Alberti, 1937) have only been briefly described (EFETOV & TARMANN, 2003). In the present paper a more extended description is given, new data on the biology and ecology are presented and the early stages figured. Moreover, for accurate identification the male and female genitalia and the DNA-barcode are provided. The holotype of this species is figured.
KEY WORDS: Lepidoptera, Zygaenidae, Procridinae, *Jordanita hispanica*, early stages, biology, DNA-barcode, holotype, Spain, Portugal, France.

Sobre la biología, ecología y conservación de *Jordanita* (*Gregorita*) *hispanica* (Alberti, 1937) (Lepidoptera: Zygaenidae, Procridinae)

Resumen

Hasta ahora, los primeros estadios de *Jordanita (Gregorita) hispanica* (Alberti, 1937) solamente han sido descritos brevemente (EFETOV & TARMANN, 2003). En el presente trabajo se da una descripción más extensa, se presentan nuevos datos sobre la biología y la ecología y se dan los primeros estadios. Además, para la identificación exacta, se suministra la genitalia del macho y de la hembra y el ADN-código de barras.
PALABRAS CLAVE: Lepidoptera, Zygaenidae, Procridinae, *Jordanita hispanica*, primeros estadios, biología, AND-código de barras, holotipo, España, Portugal, Francia.

Introduction

The family Zygaenidae is an important model for ecological, environmental, zoogeographic, karyological, biochemical and taxonomical investigations (EFETOV *et al*., 2004, 2010, 2014b, 2014c, 2015, 2016, 2018; EFETOV & KNYAZEV, 2014; EFETOV & SAVCHUK, 2009; EFETOV & TARMANN, 2017a; KNYAZEV *et al*., 2015; CAN CENGIZ *et al*., 2018; CAN *et al*., 2019; TARMANN, 2019) in Lepidoptera. Its systematics is well established. According to the contemporary classification the family Zygaenidae consists of five subfamilies: Inouelinae Efetov & Tarmann, 2017; Procridinae Boisduval, 1828; Chalcosiinae Walker, 1865; Callizygaeninae Alberti, 1954; and Zygaeninae Latreille, 1809 (EFETOV, 1999, 2001a, 2001b, 2004; EFETOV *et al*., 2014a; EFETOV & TARMANN, 2017a; TARMANN, 1994). Many species have been recently described (see e. g. EFETOV, 1997a, 1997b, 1998, 2006, 2010; EFETOV & TARMANN, 2013a, 2013b, 2014a, 2014b, 2016a, 2016b, 2017b; MOLLET, 2018; MOLLET & TARMANN, 2018; TARMANN & COCK, 2019; TARMANN & DROUET, 2015). However, even in Western Europe the biology and early stages of some species are poorly

studied or even unknown. A good example is *Jordanita* (*Gregorita*) *hispanica* (Alberti, 1937), a species known from Spain, Portugal and France.

The Iberian Peninsula is one of the richest European regions for endemism in the Zygaenidae. Five forester moths (Procridinae), viz. *Rhagades* (*Wiegelia*) *predotae* (Naufock, 1930), *Adscita* (*Adscita*) *jordani* (Naufock, 1921), *A.* (*A.*) *schmidti* (Naufock, 1933), *A.* (*Tarmannita*) *bolivari* (Agenjo, 1937), and *Jordanita* (*Jordanita*) *vartianae* (Malicky, 1961), and one burnet moth (Zygaeninae), viz. *Zygaena* (*Agrumenia*) *ignifera* Korb, 1897, are endemic and one more Procridinae, viz. *Jordanita* (*Gregorita*) *hispanica* (Alberti, 1937) and two Zygaeninae, viz. *Zygaena* (*Mesembrynus*) *contaminei* Boisduval, 1834, and *Z.* (*Zygaena*) *anthyllidis* Boisduval, 1828, are subendemic to the Iberian Peninsula. This high endemism is based on the exceptional environmental situation here with long isolation and independent development of wildlife during the last glacial periods. Today, the extreme changes of the environment in Spain because of the climatic changes in the last decades – and from other causes – require careful documentation of these highly endangered endemic species. To protect them and to prevent their extinction, intensive field work and monitoring of these environmental changes are required. A profound knowledge of the biology and ecology of endemic species is crucial for this purpose. The authors have repeatedly studied these endemisms. One species, viz. *Jordanita hispanica*, is discussed in this paper.

Materials and methods

The first field studies on *J. hispanica* go back to the year 1978 when a colony was discovered by G. M. T. in the south-western Alps on Mont Ventoux in the Department Vaucluse in southern France. Females were observed ovipositing on *Centaurea paniculata* L. (Asteraceae) (TARMANN, 1992; NAUMANN *et al*., 1999; EFETOV & TARMANN, 1999). A few larvae were reared from these eggs until L3 on *Centaurea jacea* L. and *C. scabiosa* L. in captivity, but then died. In Spain the observations of G. M. T. started in 1979 in the Provinces Cuenca and Madrid. However, it was not before both authors of this study undertook a joint field trip to Spain in 2002 that a female was found, eggs were obtained and the species could be reared from egg to imago for the first time.

Description of the life history of *Jordanita hispanica*

Habitats

1. France, Vaucluse, Mont Ventoux south side, Forêt de la Perache, 1180 m: rocky calcareous plateau (Cretaceous limestone) with Mediterranean steppe vegetation in open *Quercus pubescens* forest.
2. Spain, Segovia, east of San Rafael, El Espinar, 1260 m: dry, rocky slope beside open pine forest (Fig. 1).

Oviposition

The first oviposition was observed in nature on 24 July 1978 by G. M. T. at noon (around 12 o'clock, summer time) on the stems below and on the calyx of flowering *Centaurea paniculata* L. (Asteraceae) plants at Forêt de la Perache. A second oviposition was observed on 15 June 2002 by K. A. E. & G. M. T. at El Espinar, again at noon (exactly at 12 o'clock, summer time) on *Centaurea* cf. *ornata* Wild., again singly and on the calyx of the flower heads. When ovipositing the female bends its abdomen downwards and attaches the eggs singly or in a short row (the eggs not touching each other) on the surface of the plant.

EGG (Fig. 2)

The egg is ovoid, length 0.7 mm, breadth 0.4 mm, height 0.3 mm, and of whitish yellow (EFETOV & TARMANN, 2003) or yellowish green colour (NAUMANN *et al*., 1999).

LARVA (Figs 3-5)

First instar (L1). Final length before moulting 0.9-1.0 mm, breadth 0.3 mm. Body whitish yellow, head and anal comb brown. The setal formula of the first abdominal segment is: D: 1*d*, 1*l*; SD: 0*d*, 1*l*; L: 0*d*, 2*l* (the terminology of the setae follows EFETOV *et al*. (2006) and EFETOV & HAYASHI (2008): D = dorsal setae, SD = subdorsal setae, L = lateral setae, *l* = light, hair-like setae, *d* = dark, stronger sclerotized setae). This setal combination is typical for the subgenera *Gregorita* Povolný & Šmelhaus, 1951, *Tremewania* Efetov & Tarmann, 1999, and *Jordanita* Verity, 1946, of the genus *Jordanita* (EFETOV, 2001c; EFETOV & TARMANN, 2003). Duration of L1: 7 days.

Second instar (L2). Colour and pattern like first instar. Final length before moulting 2.2 mm, breadth 0.7 mm. Duration of L2: 12 days.

Third instar (L3) (Fig. 3). Final length before moulting 3.3 mm. Dorsolateral area differentiates into stripes and the pattern of the adult larva is already visible. Duration of L3: 15-16 days.

Fourth instar (L4). Final length before moulting 3.5 mm. Mediodorsal line interrupted, forming a row of oval, dark brown spots that are embedded into a broad grey dorsal band; space between mediodorsal and lateral area (except dorsal verrucae) greyish yellow; lateral and basal lines absent, lateral area greyish brown dorsally, whitish brown ventrally; ventrolateral area light brown; dorsal verrucae light reddish brown, subdorsal, lateral and subventral verrucae brown; ventral part of larva crimson. Thoracic legs dark brown, abdominal prolegs crimson. Head dark brown; prothoracic plate dark brown with white mediodorsal line. Duration of L4 before hibernation: 22-26 days.

Hibernation in L4.

Fifth and sixth instars (L5, L6). Pattern like L4.

Seventh and eighth instars (L7, L8) (Figs 4-5). Final length before moulting of L8 12.5 mm. Mediodorsal line interrupted, forming a row of hammer-shaped (T-shaped), dark brown spots that are embedded into a broad grey dorsal band; a visible dorsolateral line is absent; space between mediodorsal and lateral area (except dorsal verrucae) whitish yellow; lateral and basal lines absent; lateral area greyish brown dorsally, whitish brown ventrally; ventrolateral area light brown; dorsal verrucae light reddish brown, subdorsal, lateral and subventral verrucae reddish brown; ventral part of larva light red. Thoracic legs dark brown, abdominal prolegs light red. Periteme of spiracles blackish brown. Head blackish brown; prothoracic plate dark brown with white mediodorsal line. Anal comb dark brown, with 12 setae. Except for the verrucae, body covered with sclerotized dark brown multispined macrotubercles. Dorsal verruca of first abdominal segment with 6 long, light setae and 24 short, dark setae. Duration of L8: 10 days.

PUPA (Fig. 6)

Length 7.5 mm. Head, thorax, wings and abdomen smooth, shiny, light brown; proboscis long but not extending beyond the end of the abdomen. Duration of pupal stage: 16 days.

COCOON

Length 12.0 mm, breadth 5.0 mm, spindle-shaped, white, constructed of loosely spun silk.

ADULTS (Figs 7-8)

The imagines emerge in the morning. Activity starts shortly after the sun arrives at the habitat when males and females are looking for flowers to obtain nectar. Copula takes place in early evening and lasts until next morning. The females oviposit during the hottest hours at midday.

The males of this species are found during day and night and are frequently attracted by UV light (DROUET, 2016).

It is also important to mention that during our observations in 2002 *J. hispanica* was frequently occurring sympatrically, syntopically and synchronously with *Jordanita* (*Tremewania*) *notata* (Zeller, 1847). Both species externally are extremely similar and cannot be distinguished in nature even by a specialist. Moreover, *J. notata* is more common than *J. hispanica* in central Spain.

Discussion

J. hispanica is the type-species of the subgenus *Gregorita* Povolný & Šmelhaus, 1951 (by original designation). This subgenus is represented by 8 species of which 7 occur in North Africa. In Europe only *J. hispanica* is present, distributed in Portugal, Spain and France (Fig. 10) (EFETOV & TARMANN, 1999; FERNÁNDEZ-RUBIO, 2005; DROUET, 2016). In the male genitalia in all species of this subgenus the valva is without process and the phallus is characterised by an aedeagus that is broader distally, with a single cornutus on the vesica seminalis (Fig. 11). In the female genitalia of many species of Procridinae a special structure exists named 'praebursa'. The praebursa is the strongly dilated distal part of the ductus bursae between the antrum and the corpus bursae (ALBERTI, 1954; EFETOV, 1996; EFETOV & TARMANN, 2014a, 2014b, 2016a). In the subgenus *Gregorita* this structure is present only in some North African species. In *J. hispanica* the female genitalia lack a praebursa (Fig. 12), the proximal part of the ductus bursae is funnel-shaped, smooth, with a slightly grooved structure distally (TARMANN & TREMEWAN, 1995).

The larvae of *Gregorita* are characterised by an inverted T-shaped sclerite (prothoracic plate) on the prothoracic segment, dorsal verrucae that are almost contiguous mediodorsally or mediodorsally fused to form a large, horizontal dorsal 'spot' on each segment and the pattern on the 10th abdominal segment forms a characteristic 'five-spot cluster' (TARMANN & TREMEWAN, 1995; MOLLET, 2003).

As far as it is known, the females of all *Gregorita* species lay their eggs singly or in short rows and attach them either on the calyx on the flower head, the distal part of the stem or on the leaves of the larval host-plant. The larvae are either leaf-mining until pupation or feed freely after hibernation in the later instars depending of the larval host-plants (TARMANN & TREMEWAN, 1995; MOLLET, 2003).

Identification and additional information

For the conservation of a species it is essential that it can safely be identified. Only then it is possible to observe changes in its population density and to realise a decrease in the number of specimens and populations. Unfortunately, no stage of *J. hispanica* can be identified with certainty by habitus in nature. The early stages as well as the adults have to be collected. In the first case the larvae have to be reared to imago (by entomologists with some experience in Procridinae rearing) and the genitalia of the imagines have to be studied after dissection of the abdomen and the structures compared with the known literature. Therefore, we provide the necessary information below and include also two DNA-barcodes (EFETOV *et al*., 2019) for the genetic identification of early stages, adult specimens and parts of specimens of *J. hispanica*.

The holotype of this species (Figs 8-9) is deposited in Zoologische Sammlungen des Bayerischen Staates (ZSBS), Munich, Germany (EFETOV & TARMANN, 1999).

For the identification of the adults we provide the drawings of male and female genitalia of *J. hispanica* (Figs 11-12) and another Spanish species, viz. *J.* (*Tremewania*) *notata* (Zeller, 1847) (Figs 13-14), which is usually flying together with *J. hispanica*, has similar habitus and the same larval host-plant.

DNA barcodes (COI gene sequences) (EFETOV *et al*., 2019) of two male specimens of *J. hispanica* (SPAIN, Segovia, 1 km SE Navafría, 1300 m, 11-VI-2002, K. A. Efetov & G. M. Tarmann leg.) are listed below.

Genbank number HM386570:

AACACTTTATTTTATTTTTGGTGTTTGATCAGGAATAGTTGGTACATTATTAAGTGTTTT
AATTCGTACAGAATTAGGAGCTCCAGGATCTTTAATTGGTGATGATCAAATTTATAATA
CTATTGTTACCGCTCATGCTTTTATTATAATTTTTTTTATAGTTATACCTATTATAATTGGT
GGATTTGGAAATTGATTAGTTCCTTTAATATTAGGGGCTCCAGATATAGCTTTCCCACG
AATAAATAATATAAGATTTTGACTTCTCCCCCCTTCATTAACTCTTTTAATTTCAAGAAG
AATTGTAGAAACAGGAGCTGGAACAGGATGAACCGTTTACCCCCCTCTTTCATCTAAC
ATTACTCATAGAGGAGGTTCTGTAGATTTAGCAATTTTTTCTTTACATTTAGCAGGTATT
TCTTCAATTTTAGGAGCAGTAAATTTTATCACAACTATTATTAATATACGACCTGATGGA
ATATCATTTGATCAAATACCTTTATTCGTTTGAGCAGTGGGAATTACTGCTTTATTATTAT
TGCTTTCTTTACCTGTATTAGCTGGAGCAATTACTATACTTTTAACTGATCGAAATCTTA
ATACATCATTTTTTGATCCTGCAGGTGGGGGGAGATCCAATTCTTTATCAACATTTATTT

Genbank number HM386571:

AACACTTTATTTTATTTTTGGTGTTTGATCAGGAATAGTTGGTACATTATTAAGTGTTTT
AATTCGTACAGAATTAGGAGCTCCAGGCTCTTTAATTGGTGATGATCAAATTTATAATA
CTATTGTTACCGCTCATGCTTTTATTATAATTTTTTTTATAGTTATACCTATTATAATTGGT
GGATTTGGAAATTGATTAGTTCCTTTAATATTAGGAGCTCCAGATATAGCTTTTCCACG
AATAAATAATATAAGATTTTGACTTCTCCCCCCTTCATTAACTCTTTTAATTTCAAGAAG
AATTGTAGAAACAGGAGCTGGAACAGGATGAACTGTTTACCCCCCTCTTTCATCTAAC
ATTGCTCATAGAGGAGGTTCTGTAGATTTAGCAATTTTTTCTTTACATTTAGCAGGTATT
TCTTCAATTTTAGGAGCAGTAAATTTTATTACAACTATTATTAATATACGACCTAATGGA
ATATCATTTGATCAAATACCTTTATTCGTTTGAGCAGTAGGAATTACTGCTTTATTATTAT
TGCTTTCTTTACCTGTATTAGCTGGAGCAATTACTATACTTTTAACTGATCGAAATCTTA
ATACATCATTTTTTGATCCTGCAGGTGGGGGGGATCCAATTCTTTATCAACATTTATTT

Habitat preference and conservation

The preferred habitats of *J. hispanica* are unfertilised, dry, sometimes rocky, meadows with a diverse flora that contain good numbers of the respective larval host-plant. Like many Procridinae this species is also dependent on a steady succession in the vegetation, created by natural conditions (e. g. by rock falls, moving scree, heavy winds etc.) or human activities (e. g. by wood cutting, continuous grazing etc.).

In the last years *J. hispanica* has become endangered on the Iberian Peninsula especially due to the dramatic climatic changes and the transformation of former suitable habitats into semideserts. In France several of the former habitats are now overgrown by dense forest (e. g. Forêt de la Perache, Mt. Ventoux).

In general *J. hispanica* should be able to survive these changes by shifting around through suitable habitats as it obviously did in history. However, continuous observations on its changing

status could help to obtain a better overview of potential threats and population changes. For this, continuous field work is necessary. The Scientific Project of SHILAP on the Iberian Peninsula and the work of GIRAZ in France where experts monitor the population changes of Lepidoptera (including Zygaenidae) are good bases for preserving this rare species.

Acknowledgments

We thank Dr Antonio Vives (Spain) for his continuous help in obtaining the relevant collecting permits for our field work in Spain within the Scientific Project of SHILAP. We are indebted to Dr Axel Hausmann (Germany) for loan of the type material from ZSBS, to Dr V. L. Saenko (Russia) for help in the preparation of genitalia drawings and to Mrs E. E. Kucherenko (Russia) for technical support. We also thank Dr A. Spalding (Great Britain) for editing the English text.

BIBLIOGRAPHY

ALBERTI, B., 1954.– Über die stammesgeschichtliche Gliederung der Zygaenidae nebst Revision einiger Gruppen (Insecta, Lepidoptera).– *Mitteilungen aus dem Zoologischen Museum der Humboldt-Universität Berlin*, **30**: 115-480.

CAN, F., EFETOV, K. A., BURMANN, J., KAYA, K., KUCHERENKO, E. E., ULAŞLİ, B. & TARMANN, G. M., 2019.– A study of the Zygaenidae (Lepidoptera) fauna of Central Anatolia, Turkey.– *Turkish Journal of Entomology (Türkiye Entomoloji Dergisi)*, **43**(2): P. 189-199.

CAN CENGIZ, F., EFETOV, K. A., KAYA, K., KUCHERENKO, E. E., OKYAR, Z. & TARMANN, G. M., 2018.– Zygaenidae (Lepidoptera) of Thrace Region of Turkey.– *Nota lepidopterologica*, **41**(1): 23-36.

DROUET, E., 2016.– *Les Procris de France, French Forester Moths (Lepidoptera, Zygaenidae, Procridinae & Chalcosiinae)*: 128 pp. Roland Robineau édition, Thoury-Férottes.

EFETOV, K. A., 1996.– The description of the female of *Illiberis* (*Alterasvenia*) *yuennanensis* Alberti, 1951 (Lepidoptera: Zygaenidae, Procridinae).– *Entomologist's Gazette*, **47**(2): 111-113.

EFETOV, K. A., 1997a.– Two new species of the genus *Artona* Walker, 1854 (Lepidoptera: Zygaenidae, Procridinae).– *Entomologist's Gazette*, **48**(3): 165-177.

EFETOV, K. A., 1997b.– Three new species of the genus *Illiberis* Walker, 1854, from Taiwan and Vietnam (Lepidoptera: Zygaenidae, Procridinae).– *Entomologist's Gazette*, **48**(4): 231-244.

EFETOV, K. A., 1998.– A revision of the genus *Goe* Hampson, [1893] (Lepidoptera: Zygaenidae, Procridinae), with descriptions of two new species.– *Entomologist's Gazette*, **49**(1): 49-62.

EFETOV, K. A., 1999.– *Inouela* gen. n. from Japan and Taiwan (Lepidoptera: Zygaenidae, Chalcosiinae).– *Entomologist's Gazette*, **50**(2): 91-95.

EFETOV, K. A., 2001a.– On the systematic position of *Zygaenoprocris* Hampson, 1900 (Lepidoptera: Zygaenidae, Procridinae) and the erection of two new subgenera.– *Entomologist's Gazette*, **52**(1): 41-48.

EFETOV, K. A., 2001b.– An annotated check-list of Forester moths (Lepidoptera: Zygaenidae, Procridinae).– *Entomologist's Gazette*, **52**(3): 153-162.

EFETOV, K. A., 2001c.– *A Review of the Western Palaearctic Procridinae (Lepidoptera: Zygaenindae)*: 328 pp. CSMU Press, Simferopol.

EFETOV, K. A., 2004.– *Forester and Burnet Moths (Lepidoptera: Zygaenidae). The genera Theresimima Strand, 1917, Rhagades Wallengren, 1863, Zygaenoprocris Hampson, 1900, Adscita Retzius, 1783, Jordanita Verity, 1946 (Procridinae), and Zygaena Fabricius, 1775 (Zygaeninae)*: 272 pp. CSMU Press, Simferopol.

EFETOV, K. A., 2006.– Nine new species of the genus *Chrysartona* Swinhoe, 1892 (Lepidoptera: Zygaenidae, Procridinae).– *Entomologist's Gazette*, **57**(1): 23-50.

EFETOV, K. A., 2010.– *Illiberis* (*Hedina*) *louisi* sp. nov. (Lepidoptera: Zygaenidae, Procridinae) from China.– *Entomologist's Gazette*, **61**(4): 235-241.

EFETOV, K. A., CAN, F., TOSHOVA, T. B. & SUBCHEV, M., 2010.– New sex attractant for *Jordanita anatolica* (Naufock) (Lepidoptera: Zygaenidae: Procridinae).– *Acta Zoologica Bulgarica*, **62**(2): 315-319.

EFETOV, K. A. & HAYASHI, E., 2008.– On the chaetotaxy of the first instar larva of *Artona martini* Efetov, 1997 (Lepidoptera: Zygaenidae, Procridinae, Artonini).– *Entomologist's Gazette*, **59**(2): 101-104.

EFETOV, K. A., HOFMANN, A. & TARMANN, G. M., 2014b.– Application of two molecular approaches (use of sex attractants and DNA barcoding) allowed to rediscover *Zygaenoprocris eberti* (Alberti, 1968) (Lepidoptera, Zygaenidae, Procridinae), hitherto known only from the female holotype.– *Nota lepidopterologica*, **37**(2): 151-160.

EFETOV, K. A., HOFMANN, A., TARMANN, G. M. & TREMEWAN, W. G., 2014a.– Taxonomic comments on the treatment of the Zygaenidae (Lepidoptera) in volume 3 of Moths of Europe, Zygaenids, Pyralids 1 and Brachodids (2012).– *Nota lepidopterologica*, **37**(2): 123-133.

EFETOV, K. A., KIRSANOVA, A. V., LAZAREVA, Z. S., PARSHKOVA, E. V., TARMANN, G. M., ROUGERIE, R. & HEBERT, P. D. N., 2019.– DNA barcoding of Zygaenidae (Lepidoptera): results and perspectives.– *Nota lepidopterologica*, **42**(2): 137-150.

EFETOV, K. A. & KNYAZEV, S. A., 2014.– New records of *Jordanita* (*Roccia*) *volgensis* (Möschler, 1862) (Lepidoptera: Zygaenidae, Procridinae) from Siberia (Russia) and Ukraine.– *Entomologist's Gazette*, **65**(3): 175-178.

EFETOV, K. A., KOSHIO, C. & KUCHERENKO, E. E., 2018.– A new synthetic sex attractant for males of *Illiberis* (*Primilliberis*) *pruni* Dyar, 1905 (Lepidoptera: Zygaenidae, Procridinae).– *SHILAP Revista de lepidopterología*, **46**(182): 263-270.

EFETOV, K. A., KUCHERENKO, E. E., PARSHKOVA, E. V. & TARMANN, G. M., 2016.– 2-butyl 2-dodecenoate, a new sex attractant for *Jordanita* (*Tremewania*) *notata* (Zeller, 1847) and some other Procridinae species (Lepidoptera: Zygaenidae).– *SHILAP Revista de lepidopterología*, **44**(175): 519-527.

EFETOV, K. A., PARSHKOVA, E. V., BAEVSKY, M. Y. & PODDUBOV, A. I., 2014c.– Sec-butyl ester of dodecenoate: synthesis and attractive properties.– *Ukrainian Biochemical Journal*, **86**(6): 175-182.

EFETOV, K. A., PARSHKOVA, E. V. & KOSHIO, C., 2004.– The karyotype of *Illiberis* (*Primilliberis*) *rotundata* Jordan, [1907] (Lepidoptera: Zygaenidae, Procridinae).– *Entomologist's Gazette*, **55**(3): 167-170.

EFETOV, K. A., PARSHKOVA, E. V., TARASOVA, L. G. & TARMANN, G. M., 2015.– The karyotypes of Procridinae (Lepidoptera: Zygaenidae), with the first record of the karyotype of *Pollanisus commoni* Tarmann, 2004, a representative of the tribe Artonini.– *Entomologist's Gazette*, **66**(2): 121-125.

EFETOV, K. A. & SAVCHUK, V. V., 2009.– The first record of *Jordanita* (*Roccia*) *volgensis* (Möschler, 1862) (Lepidoptera: Zygaenidae, Procridinae) from the Crimea.– *Entomologist's Gazette*, **60**(3): 155-158.

EFETOV, K. A. & TARMANN, G. M., 1999.– *Forester Moths*: 192 pp. Apollo Books, Stenstrup.

EFETOV, K. A. & TARMANN, G. M., 2003.– New data on the biology of *Jordanita* (*Gregorita*) *hispanica* (Alberti, 1937) (Lepidoptera: Zygaenidae, Procridinae), pp. 20-21.– *In* T. KEIL (ed.). *Abstracts of the VIII Symposium on Zygaenidae (Dresden, 10-14 September 2003)*: 54 pp. Dresden.

EFETOV, K. A. & TARMANN, G. M., 2013a.– *Illiberis* (*Alterasvenia*) *cernyi* sp. nov. (Lepidoptera: Zygaenidae, Procridinae) from northern Thailand.– *Entomologist's Gazette*, **64**(1): 33-39.

EFETOV, K. A. & TARMANN, G. M., 2013b.– *Chrysartona* (*Chrystarmanna*) *mineti* sp. nov. (Lepidoptera: Zygaenidae, Procridinae) from northern Vietnam.– *Entomologist's Gazette*, **64**(3): 197-206.

EFETOV, K. A. & TARMANN, G. M., 2014a.– *Illiberis* (*Alterasvenia*) *banmauka* sp. nov. (Lepidoptera: Zygaenidae, Procridinae) from China and Myanmar.– *Entomologist's Gazette,* **65**(1): 62-70.

EFETOV, K. A. & TARMANN, G. M., 2014b.– A new European species, *Adscita dujardini* sp. nov. (Lepidoptera: Zygaenidae, Procridinae) confirmed by DNA analysis.– *Entomologist's Gazette*, **65**(3): 179-200.

EFETOV, K. A. & TARMANN, G. M., 2016a.– *Pseudophacusa multidentata* Efetov & Tarmann, a new genus and species of Procridini from Myanmar, China and Laos (Lepidoptera: Zygaenidae, Procridinae).– *SHILAP Revista de lepidopterología*, **44**(173): 81-89.

EFETOV, K. A. & TARMANN, G. M., 2016b.– A new *Illiberis* species: *I.* (*Alterasvenia*) *kislovskyi* (Lepidoptera: Zygaenidae, Procridinae) from Myanmar.– *Entomologist's Gazette*, **67**(2): 137-142.

EFETOV, K. A. & TARMANN, G. M., 2017a.– The hypothetical ground plan of the Zygaenidae, with a review of the possible autapomorphies of the Procridinae and the description of the Inouelinae subfam. nov.– *Journal of the Lepidopterists' Society*, **71**(1): 20-49.

EFETOV, K. A. & TARMANN, G. M., 2017b.– *Thibetana keili* Efetov & Tarmann, a new species of the genus *Thibetana* Efetov & Tarmann, 1995, from Tibet (Lepidoptera: Zygaenidae, Procridinae, Artonini).– *SHILAP Revista de lepidopterología*, **45**(180): 581-587.

EFETOV, K. A., TARMANN, G. M., HAYASHI, E. & PARSHKOVA, E. V., 2006.– New data on the chaetotaxy of the first instar larvae of Procridini and Artonini (Lepidoptera: Zygaenidae, Procridinae).– *Entomologist's Gazette*, **57**(4): 229-233.

FERNÁNDEZ-RUBIO, F., 2005.– Lepidoptera Zygaenidae.– *Fauna Iberica*, **26**: 292 pp. Museo Nacional de Ciencias Naturales, CSIC, Madrid.

KNYAZEV, S. A., EFETOV, K. A. & PONOMARYOV, K. B., 2015.– Zygaenidae (Lepidoptera) from Omsk Region.– *Zoologicheskii Zhurnal*, **94**(11): 1297-1302.

MOLLET, B., 2003.– Notes on the biology and ecology of the *Jordanita* species of North Africa (Lepidoptera: Zygaenidae, Procridinae).– *Entomologist's Gazette*, **54**: 171-178.

MOLLET, B., 2018.– Two new species and new data of the genus *Chrysartona* from Southern Vietnam and Laos (Lepidoptera Zygaenidae Procridinae Artonini).– *Antenor*, **5**(1): 79-83.

MOLLET, B. & TARMANN, G. M., 2018.– A new genus and a new species of Chalcosiinae from Southern Vietnam, with biological data on the subfamily (Lepidoptera Zygaenidae Chalcosiinae).– *Antenor*, **5**(2): 165-170.

NAUMANN, C. M., TARMANN, G. M. & TREMEWAN, W. G., 1999.– *The Western Palaearctic Zygaenidae (Lepidoptera)*: 304 pp. Apollo Books, Stenstrup.

TARMANN, G. M., 1992.– Foodplants of the Zygaenidae subfamilies Procridinae and Chalcosiinae with notes on the biology and ecology of these two groups.– *Proc. 4th Symposium on Zygaenides, Nantes 1987*: 144-161.

TARMANN, G. M., 1994.– A preliminary review of the classification of the zygaenid subfamily Procridinae (Lepidoptera).– *Nota lepidopterologica. Suppl.*, **5**: 115-123.

TARMANN, G. M., 2019.– Vergleich der historischen und aktuellen Verbreitung von *Chazara briseis* (Nymphalidae) und Zygaenidae (Lepidoptera) im oberen Vinschgau (Südtirol, Italien) zeigt ein komplettes Verschwinden der Zygaenidae in talnahen Gebieten.– *Gredleriana* **19**: 109-184.

TARMANN, G. M., & COCK, M. J. W., 2019.– Zygaenidae from Trinidad, West Indies.– *Journal of the Lepidopterists' Society*, **73**(3): 153-161.

TARMANN, G. M. & DROUET, E., 2015.– Zygaenidae from French Guiana, with a key to the narrow-winged Zygaenidae genera of the New World.– *Journal of the Lepidopterists' Society*, **69**(3): 209-235.

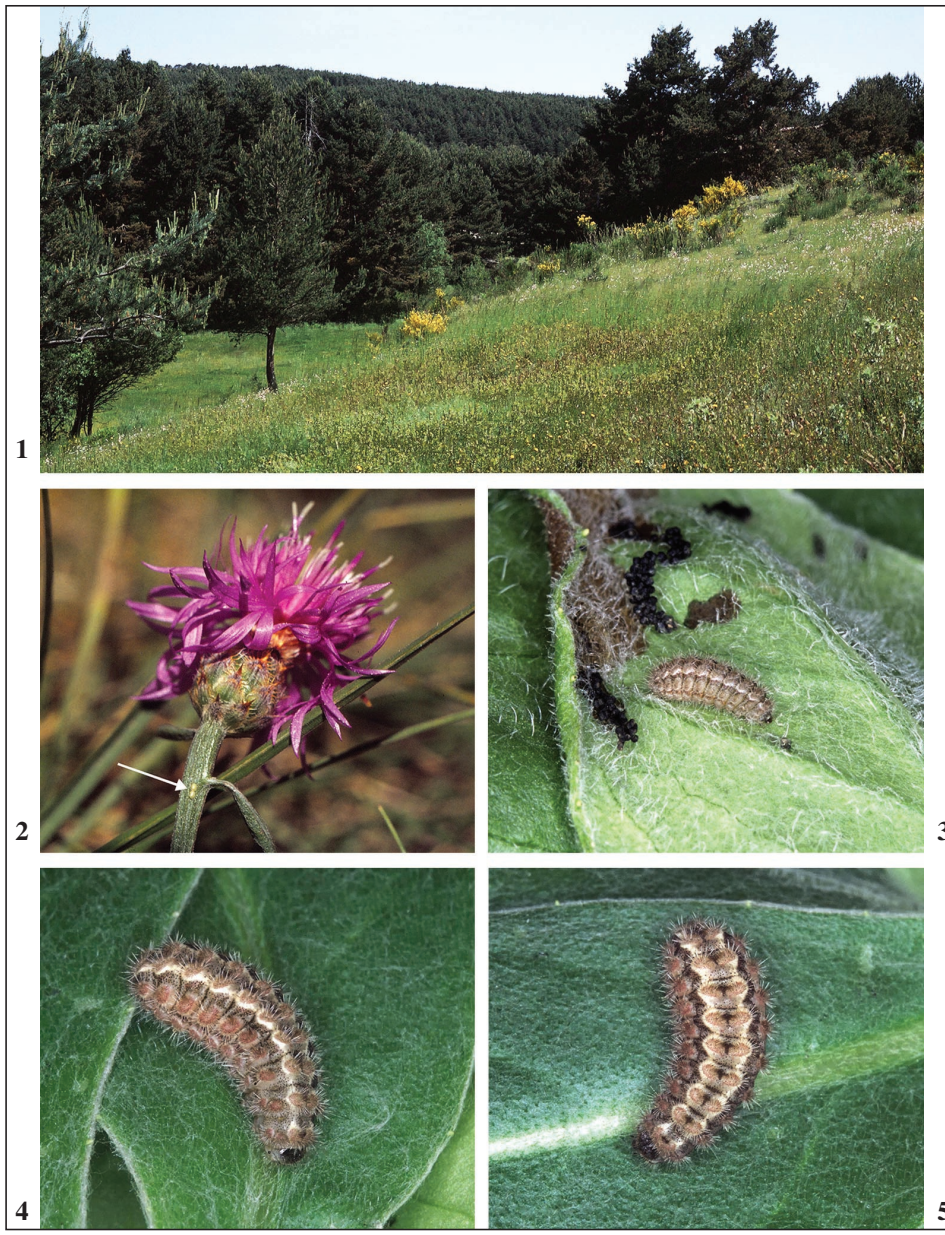
TARMANN, G. M. & TREMEWAN, W. G., 1995.– A revision of the North African *Jordanita* Verity, 1946, and *Adscita* Retzius, 1783: their taxonomy, biology and ecology (Lepidoptera: Zygaenidae, Procridinae).– *Entomologist's Gazette*, **46**(1): 3-56.

*K. A. E.
V. I. Vernadsky Crimean Federal University
RU-295051 Simferopol (Crimea)
RUSIA / *RUSSIA*
E-mail: efetov.konst@gmail.com
E-mail: shysh1981@mail.ru
https://orcid.org/0000-0003-1468-7264

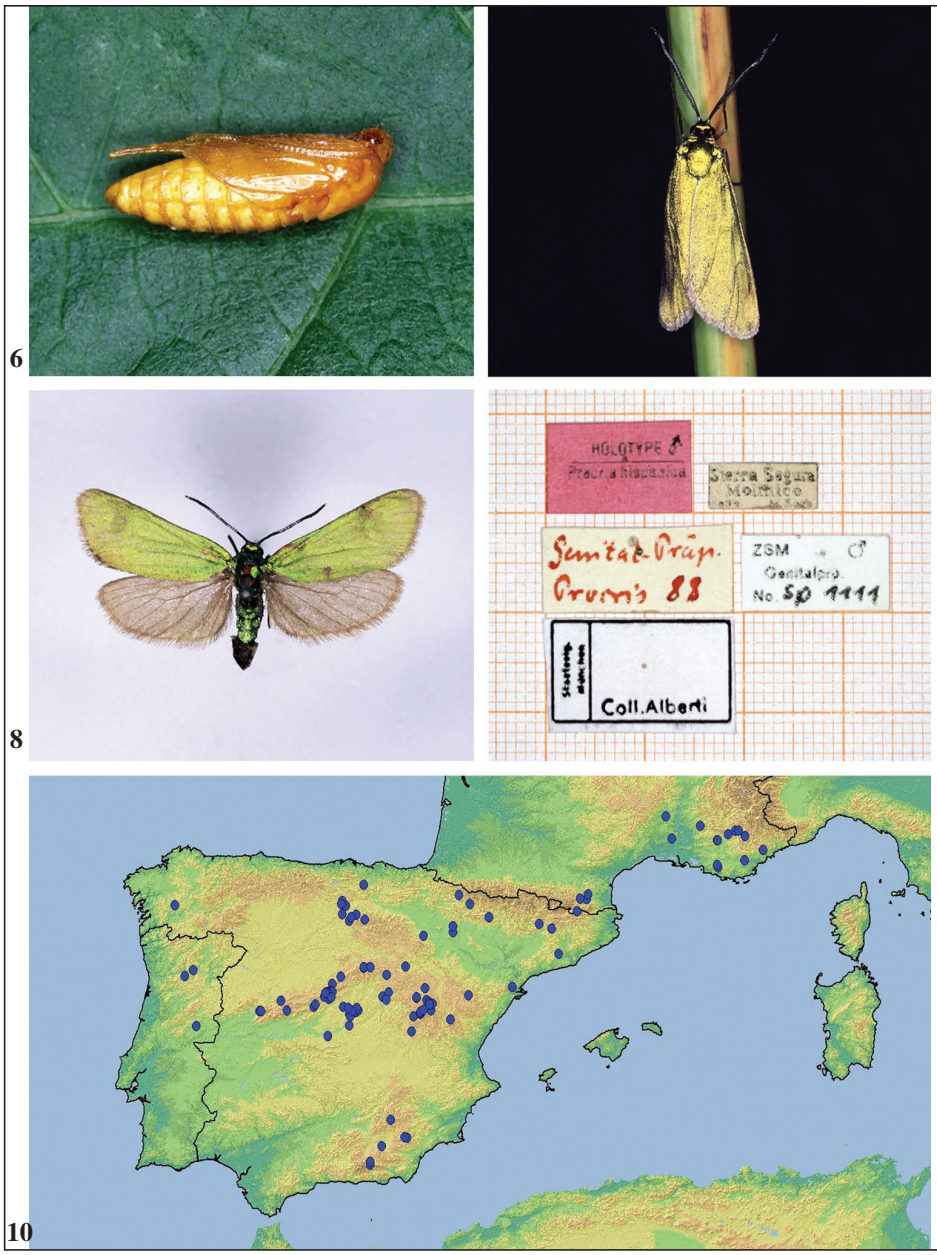
G. M. T.
Sammlungs und Forschungszentrum der Tiroler Landesmuseen
Krajnc-Straße, 1
A-6060 Hall
AUSTRIA / *AUSTRIA*
E-mail: g.tarmann@tiroler-landesmuseen.at
https://orcid.org/0000-0002-7360-5698

*Autor para la correspondencia / *Corresponding author*

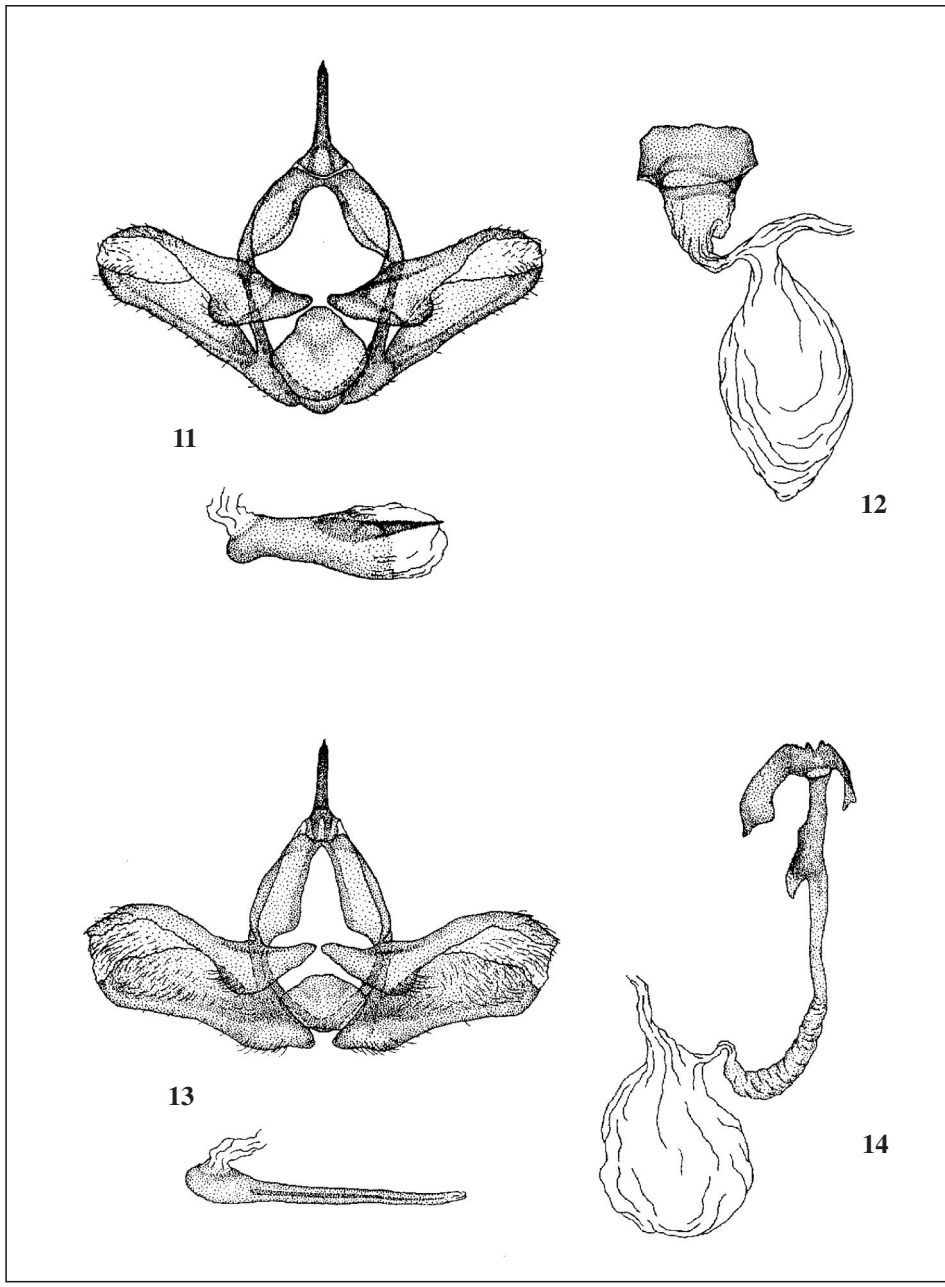
(Recibido para publicación / *Received for publication* 4-II-2020)
(Revisado y aceptado / *Revised and accepted* 8-III-2020)
(Publicado / *Published* 30-VI-2020)



Figures 1-5.– 1. Habitat of *J. hispanica* at Spain, Segovia, east of San Rafael, El Espinar. **2.** Eggs (shown by arrow) on the stem below the flower of *Centaurea paniculata* L. at France, Mt. Ventoux, Forêt de la Perache. **3.** Third instar larva of *J. hispanica* on the leaf of *Centaurea montana* L. (in captivity). **4.** Adult (L8) larva of *J. hispanica* on *Centaurea montana* leaf (in captivity) (dorsolateral view). **5.** Adult (L8) larva of *J. hispanica* on *Centaurea montana* leaf (in captivity) (dorsal view).



Figures 6-10.– 6. Pupa of *J. hispanica* (lateral view). **7.** Freshly emerged male of *J. hispanica*, reared from egg from San Rafael, El Espinar, Spain. **8.** Holotype male of *Procris hispanica* (ZSBS, Munich). **9.** Pin-labels of holotype male of *Procris hispanica*. **10.** Distribution map of *J. hispanica*. BioOffice database of Tiroler Landesmuseen, Ferdinandeum, Innsbruck, Austria.



Figures 11-14.– 11-12. *Jordanita* (*Gregorita*) *hispanica* (Alberti, 1937). **11.** Male genitalia, **12.** Female genitalia. **13-14.** *Jordanita* (*Tremewania*) *notata* (Zeller, 1847). **13.** Male genitalia, **14.** Female genitalia. (Ex EFETOV, 2001c).

Instructions to authors wishing to publish in ©*SHILAP Revista de lepidopterología*

1. **SHILAP Revista de lepidopterología** is an international journal which has been published by the Sociedad Hispano-Luso-Americana de Lepidopterología since 1973 and uses the persistent digital identifier by ORCID® (https://orcid.org) as a way to ensure proper authorship normalization. It includes empirical and theoretical research on all aspects of Lepidopterology (Systematics, Taxonomy, Phylogeny, Morphology, Bionomics, Ecology, Faunistics and Zoogeography, as well as bibliographical papers, those on the history of Lepidopterology, or book reviews on the topics mentioned) from all over the world with special emphasis on the study of Conservation Biology. Each volume consists of four issues a year (one volume per annum) in March, June, September and December.
2. Contributions may be written in Spanish, English, French, German, Italian or Portuguese, the official languages of the journal.
3. Manuscripts report on original research not published elsewhere and are submitted exclusively for consideration by **SHILAP Revista de lepidopterología.** If this is not the case, please tell us as soon as possible. Electronic submission of papers is encouraged. The preferred format is a document in Rich Text Format (RTF). Required mode and minimum resolution for bitmap graphic file: Colour in 24-bit RGB mode, 300 dpi at print size; halftones in 8-bit greyscale mode, 300 dpi at print size; line art in 1-bit black and white mode, 1200 dpi at print size.
4. The Editor represents the opinion of the Editorial Board; he will inform the authors about the acceptance or rejection of their contributions. All manuscripts will be reviewed by the Editor and two independent reviewers in order to guarantee the quality of the papers. Based on their reports the Editor decides whether a manuscript shall be accepted for publication. The process of review is rapid. Once accepted, papers are published as soon as practicable, usually within 12 months the initial submission. Upon acceptance, manuscripts become the property of the journal, which reserves copyright no published material may be reproduced without quoting its origin.
5. Manuscripts should include a summary in Spanish and another in any other official languages of the Journal, preferably in English (Abstract). For authors who do not know Spanish, translation of the English abstract into Spanish is provided by the Editor, if the paper has been accepted. Abstracts shall be brief and condense the conclusions of the paper, without full stops. Each summary shall be followed by a maximum of 10 key words (Palabras clave) in the same language, separated by comas. The summary in a language different to that of the text will be preceded by a translation of the title into English.
6. Contributions should be presented as follows: title, author, summaries, text and bibliography. In case there are any doubts, please check previous issues of the journal. **Works which do not comply with these rules shall be returned to authors**.
7. **AUTHORS:** Should give their full name, address, e-mail and will include in their dignature their badges ID (ORCID®). The author's first names must be referred to by their initials.
8. **TEXT:** It is requested not to use footnotes, if possible, they sometimes make understanding of papers difficult.

   Dates must be given as 15-VII-1985 (days and years in Arabic and months in Roman numbers).

   References given in the text should be done like: LINNAEUS (1758), (LINNAEUS, 1758) or HARRY (*in* MOORE, 1980) that is names of authors in capitals and date of the indicated work. If there are two or more authors, the first one followed by et al. will be given. If pages are to be quoted, they will follow the year separated by a colon (1968:65).

   Mentions of captures should be made in this way: Country (when pertinent), province (or equivalent administrative unit), locality, altitude, sex of the specimens, date and collector. Male and female symbols have to be coded as (&&) and (&) respectively, with parenthesis. Special characters with diacritic marks usually not included in West European fonts (e. g. Slavic languages, Romanian, Polish, Turkish, etc.) should also be coded; the codes used must be presented on a separate sheet with a printed version of the manuscript.
9. **SPECIES AND OTHER TAXONOMIC CATEGORIES:** All the names of taxa mentioned in the text, both well established and new ones, must conform to the current norms of the *International Code of Zoological Nomenclature*. The abbreviations **gen. n., sp. n., syn. n., comb. n.,** or similar should be used to explicitly indicate all taxonomic innovations. In describing new genus level taxa, the nominal type-species must be designated in its original combination and with reference to the original description immediately after the new name. If the article describes new taxa, type material must be deposited in a scientific institution.

Names of taxa should be followed by the names of their describers (complete surnames) and by the date of description at least once. The internationally accepted abbreviations may be used. Examples: L. (Linnaeus); H.-S. (Herrich-Schäffer); Stgr. (Staudinger), etc.

10. **ILLUSTRATIONS:** Drawings should be made with Indian ink on white card or drawing paper DIN A4. Authors may send high contrast photographs. Colour plates may also be published. Publication cost for colour plates will be borne by the author.
11. **BIBLIOGRAPHY:** All manuscripts must include a bibliography of those publications cited in the text. Bibliographic references should be made as follows: author, publication year, title of the paper or book and the title of the journal should be cited full, indicating volume, number (within parenthesis) and pages. Examples:

    Article in journal:

    SARTO I MONTEYS, V., 1985.- Confirmación de la presencia en la Península Ibérica de *Earias vernana* (Hübner, 1790).- *SHILAP Revista de lepidopterología*, **13**(49): 39-40.

    Article to collective volume:

    REBEL, H., 1901.- Famil. Pyralidae-Micropterygidae. 2 Theil.- *In* O. STAUDINGER & H. REBEL. *Catalog der Lepidopteren des palaearctischen Faunengebietes*: 368 pp. R. Friedlander & Sohn, Berlin.

    Book:

    HIGGINS, L. O., 1975.- *The Classification of European Butterflies*: 320 pp. Collins, London.

    Internet:

    DE PRINS, J. & DE PRINS, W., 2011.- *Global taxonomic database of Gracillariidae (Lepidoptera).* Available from http://www.gracillariidae.net (accessed 14th December 2011).

    Bibliographic references should be given following the alphabetical order of the author's name. If there is more than one reference to the same author they should be ordered from older to more recent dates.
12. **TABLES:** They must be identified with correlative Roman numerals, on unnumbered sheets.
13. **NOTES AND BOOK REVIEWS:** No more than two pages without figures, instructions as for articles.
14. **PROOFS:** Authors will be provided with galleys for careful checking of misprints. Only misprint corrections will be allowed, text or style corrections will be charged to author. Corrected galleys should be returned within 15 days after reception date. If delayed, the Editorial Board will decide whether to delay publication of the article or to do corrections, declining responsibility for persisting errors. The Editorial Board reserves the right to do appropriate modifications in order to keep the uniformity of the journal.
15. **REPRINTS:** Authors shall receive a **PDF of your paper free of charge**. If you need additional reprints of their paper, should be ordered beforehand from the General Secretary, at extra cost to be paid by the author/s. The auto-archive of the article is allowed, as at the moment of their publication in the printed version.
16. **CORRESPONDENCE:** The first author is responsible for correspondence unless stated otherwise when submitting the typescript to the General Secretary. If photographs or colour figures are included, authors are requested to accept charges in writing when submitting the typescript.
17. **MANUSCRIPTS:** Should be sent to:

SHILAP
Apartado de Correos, 331
E-28080 Madrid
ESPAÑA / *SPAIN*
E-mail: avives1954@outlook.es / avives1954@gmail.com / avives1954@outlook.com

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 363-374 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.397

Re-evaluation of some problematic taxa of Palaearctic Scythrididae, with two new synonyms and descriptions of three new species (Lepidoptera: Scythrididae)

K. Nupponen

Abstract

Some problematic taxa of Palaearctic Scythrididae were re-evaluated using a combination of morphological and genetical methods for determination. Three new species are described: *Apostibes ustyurtensis* Nupponen, sp. n. and *Scythris praecox* Nupponen, sp. n. from Kazakhstan, and *S. kuldchuktaui* Nupponen, sp. n. from Uzbekistan. *Scythris rotundella* Nupponen, 2010 is synonymized with *S. cretacella* Nupponen & Nupponen, 2000, syn. n., and *S. parenthesella* Bengtsson, 2002 with *S. aciella* Bengtsson, 1997, syn. n.
KEY WORDS: Lepidoptera, Scythrididae, new species, new synonyms, Palaearctic region.

Reevaluación de algunas taxa problemáticas de Scythrididae paleárticos con dos nueva sinonimias y descripción de tres nuevas especies (Lepidoptera: Scythrididae)

Resumen

Fueron reevaluadas algunas taxa problemáticas de Scythrididae paleárticos usando métodos morfológicos y genéticos para la determinación. Se describen tres nuevas especies: *Apostibes ustyurtensis* Nupponen, sp. n. y *Scythris praecox* Nupponen, sp. n. de Kazajstán y *S. kuldchuktaui* Nupponen, sp. n. de Uzbekistán. *Scythris rotundella* Nupponen, 2010 se sinonimiza con *S. cretacella* Nupponen & Nupponen, 2000, syn. n. y *S. parenthesella* Bengtsson, 2002 con *S. aciella* Bengtsson, 1997, syn. n.
PALABRAS CLAVE: Lepidoptera, Scythrididae, nuevas especies, nuevas sinonimias, región Paleártica.

Introduction

The Central Asian and Turanian fauna of Scythrididae has studied intensively by the author since 2008. The majority of the results of these investigations have been published earlier in several separate articles. However, records of species comprising various kinds of hitherto unresolved taxonomical problems have remained unpublished, mainly due to insufficient materials, but also a few misinterpreted specimens or material determined tentatively. Recent studies on the new material with morphological and genetical methods revealed interesting results, including discovery of three undescribed species and new synonyms of two species. The results of re-evaluations are summarized in the present paper.

Material and methods

The new materials originate mainly from intensive collecting by the author from different parts of

Kazakhstan during the last ten years. Some misidentified specimens from Uzbekistan were re-evaluated. Additionally, a few important specimens from Oman were donated to me by Aidas Saldaitis and Alessandro Floriani.

Tissue samples (dried legs) of several specimens were shipped to the Canadian Centre for DNA Barcoding in Guelph for DNA sequence analysis. The barcodes are preserved in the Barcode of Life Data Systems (BOLD; see http://v4.boldsystems.org), and were used to calculate genetic distances reported below. The holotypes of new species were chosen from specimens with the 621–658 bp long fragment of the mitochondrial DNA barcode region (COI), on the other hand to support the morphological differences presented, but also to allow genetical determinations and comparisons in the future. The material is deposited in the research collection of Kari and Timo Nupponen (Espoo, Finland). The types are available for loan via the Finnish Museum of Natural History, University of Helsinki, Finland, or directly from the author.

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

***Apostibes ustyurtensis* Nupponen, sp. n.**

Type material: Holotype ♂, SW KAZAKHSTAN, 42º 36’ 25-35” N 54º 08’ 35-59” E, 0-47 m, Ustyurt Nature Reserve, Onere spring, 16-V-2011, K. Nupponen leg. Genitalia slide: K. Nupponen prep. no. 1/28-XII-2019. DNA sample (Lepid. Phyl., green label): KN00463. In coll. NUPP (FMNH). Paratypes (31 ♂♂): Ibidem, 16-V-2011, 19 ♂♂, 17-V-2011, 11 ♂♂, K. Nupponen leg.; 16-V-2008, 1 ♂, P. Gorbunov leg. Genitalia slide: K. Nupponen prep. no. 1/06-II-2010. DNA samples (Lepid. Phyl., green labels): KN00461, KN00462, KN00671, KN00672. In coll. NUPP.

Diagnosis *A. ustyurtensis* Nupponen, sp. n. is the largest known species of the genus, and characteristic by the chalk white forewings with very indistinct streaks. Fresh specimens may possible to determine only by external characters (see Remarks). The male genitalia of *A. ustyurtensis* differ from those of the other *Apostibes* by combination of details: the spatulate valva is broad (similar to that of *A. dhahrani*), the phallus a little longer than valva (much shorter than in *A. afghana* and *A. inota*; longer than in *A. dhahrani*), the uncus is broad and quadrangular without ventral sclerotizations and pegs, the gnathos arm is long and distally distinctly upcurved with three apical horn-like extensions. The aforesaid morphological differences are well supported by the DNA barcodes, which reveal distinct K2P divergences between the four taxa of *Apostibes* with barcodes available: *A. ustyurtensis* - *A. griseolineata* 3.45 %, *A. ustyurtensis* - *A. dhahrani* 4.91 %, and *A. ustyurtensis* - *A.halmyrodes* 4.75 %. The five DNA barcodes of *A. ustyurtensis* are identical to each other.

Description (Fig. 1): Wingspan 15-18.5 mm (most specimens 17-18 mm). Head, haustellum, neck tuft, collar, tegula, thorax and scape chalk white shallowly suffused with pale fuscous. Scape dorsally chalk fuscous, ventrally chalk white; pecten at ventral surface chalk white, longer than diameter of scape. Flagellum 0.7 x length of forewing, pale fuscous; in male ciliate, sensillae as long as diameter of flagellum. Labial palp chalk white, lower surfaces of segments II and III suffused with pale fuscous. Legs chalk white, upper surfaces more or less mixed with pale fuscous. Abdomen dorsally pale fuscous, ventrally chalk white. Forewing chalk white, on veins sparsely pale grey scales forming very indistinct streaks (visible only in fresh specimens). Hindwing fuscous white, a little darker than forewing.

Male genitalia (Figs. 2-3): Uncus quadrangular, laterally sparsely setose. Basal plate of gnathos hood-shaped, posteriorly heavily sclerotized and about 0.7 x width of uncus; gnathos arm long and narrow, ventrally a membrane attached to tegumen; distal 0.2 of arm upcurved 45º, tip with three bent

horn-like processes, two directed upstairs and one downstairs. Phallus 1.1 x length of valva, slender, bent at middle third. Juxta 0.4 x length of valva. Valvae symmetrical and straight, more than twice longer than tegumen, distal half broadly spatulate. Sternum VIII triangular, anterior margin concave; sub-anteriorly a narrow transverse sclerotized reinforcement, anterolaterally a pair of converging processes. Tergum VIII subtrapezoid, three times wider than high, with rounded posterior corners and reinforced anterior margin.

Female genitalia: Unknown.

Bionomy: The moth is nocturnal. The flight period is in May, and probably extends to June. The habitat is a xerotermic gypsum desert. The type locality is illustrated in KAILA *et al.* (2019; Fig. 12 b).

Distribution: SW Kazakhstan. Only known from the type locality.

Etymology: The name of the species refers to its geographical origin.

Remarks: The genus *Apostibes* Walsingham, 1907 comprise eight described species in the Old World: *A. afghana* Passerin d'Entrèves & Roggero, 2003, *A. deckerti* Bengtsson, 2014, *A. dhahrani* Passerin d'Entrèves & Roggero, 2003, *A. griseolineata* Walsingham, 1907, *A. halmyrodes* (Meyrick, 1921), *A. inota* (Meyrick, 1924), *A. raguae* Bengtsson, 1997 and *A. samburensis* Bengtsson, 2014. According to the original description *A. dhahrani*, its longitudinal striae of forewings are imperceptible. However, based on new material: UAE, Abu Dhabi, Sameih, 1 ♂, I-2013, 2 ♀♀, 31-V-2013, R. Breithaupt leg.; Genitalia slide: Wf. 11.889 ♂; DNA sample (Lepid. Phyl., green labels): KN00638; (coll. NUPP), the striae are distinct, and the moths are easily separable from *A. ustyurtensis.* The new taxon was tentatively reported as *A. griseolineata* Walsingham, 1907 (NUPPONEN, 2010, 2012). However, all specimens collected in Ustyurt Nature Reserve belong to *A. ustyurtensis*.

Scythris kuldchuktaui Nupponen, sp. n.

Type material: Holotype ♂, UZBEKISTAN, Buchara district, 40º 44' 59.6" N 63º 47' 07.5" E, 404 m a.s.l., Kuldchuktau Mts., Churuk village 7 km N, 02-V-2008, K. Nupponen & R. Haverinen leg. Genitalia slide: K. Nupponen prep. no. 1/12-XII-2008. DNA sample (Lepid. Phyl., green label): KN00557. In coll. NUPP (FMNH).

Diagnosis: Externally *S. kuldchuktaui* Nupponen, sp. n. is quite easily separated from other taxa of the *caroxylella* species complex by its large size, and broad unicolor pale cream white forewings. The male genitalia of *S. kuldchuktaui* are superficially similar to those of the *caroxylella* species complex, but readily separated from those by peculiar broad and apically cut off gnathos with extensions upwards and downwards, as well as by straight and broad valvae. The aforesaid morphological differences are well supported by the DNA barcodes, which reveal distinct K2P divergences between the five taxa of barcodes available: *kuldchuktaui-cretacella* 3.50 %; *kuldchuktaui-praecox* 3.86 %; *kuldchuktaui-caroxylella* 4.40 %; *kuldchuktaui-cramella* 4.57 %; *kuldchuktaui-fluxilis* 4.92 %.

Description (Fig. 4): Wingspan 17.5 mm. Head, haustellum, labial palp, neck tuft, collar, tegula, thorax and legs unicolor, pale cream white (same colour as forewing). Scape pale cream white, pecten longer than diameter of scape. Flagellum 0.55 x length of forewing, pale fuscous; in male ciliate, length of sensillae about 1.1 x diameter of flagellum. Abdomen dorsally pale cream fuscous, ventrally cream white. Forewing pale cream white, unicolor without pattern, moderately broad. Hindwing cream white, a little paler than and as broad as forewing.

Male genitalia (Fig. 5): Uncus stout, Y-shaped, posterior branches rather short, circular. Gnathos broad, subbasally large semicircular extension upwards, and another shallow extension subapically upwards; apex cut off with extensions directed upwards and downwards, of which latter one longer. Tegumen wide, semicircular, dorsal V-shaped depression 0.65 x length of tegumen. Phallus 0.85 x length of valva, curved 90º at basal half; distal half evenly tapered, straight, tip pointed. Valva spatulate, broad, more or less straight, apex with nine short and thick thorns. Vinculum labiate, 0.6 x length of valva. Sternum VIII triangular; posteriorly blunt, anterior margin medially concave. Tergum VIII subpentagonal, about 2.5 times wider than high, posterior margin medially shallowly concave, anterior margin widely incurved.

Female genitalia: Unknown.

Bionomy: The moth is nocturnal. The habitat is a stony desert with sparse vegetation. The habitat is illustrated in NUPPONEN (2009: Fig. 1).

Distribution: Uzbekistan.

Etymology: The species name refers to the type locality, the Kuldchuktau Mts., a low mountain range located at middle of the Kyzylkum desert.

Remarks: The present specimen was originally misidentified and reported as *S. pallidella* Passerin d'Entrèves & Roggero, 2006 (NUPPONEN, 2009). The mistake was later detected while barcoding Turanian Scythrididae. The barcode gap between *S. kuldchuktaui* and *S. pallidella* is 6.02 %, and the two species are readily separated by both externally and details in the genitalia. The *caroxylella* species complex comprising six species: *S. caroxylella* Falkovitsh, 1969, *S. fluxilis* Falkovitsh, 1986, *S. cretacella* K. Nupponen & T. Nupponen, 2000 (= *S. rotundella* K. Nupponen, 2010 [see below]), *S. cramella* K. Nupponen, 2010, *S. kuldchuktaui* K. Nupponen, sp. n. and *S. praecox* K. Nupponen, sp. n. [see below]. In addition, *S. parafluxilis* Passerin d'Entréves & Roggero, 2007 may belongs to the same complex, but it cannot be confirmed until a male of the species is found. Male genitalia of the six species are superficially of each other, but readily separated by details, particularly shape of the gnathos, and characterized by spatulate valvae with short thick apical thorns. The *caroxylella* complex is tentatively placed to the heterogeneous *pascuella* species-group.

Scythris praecox Nupponen, sp. n.

Type material: Holotype ♂, KAZAKHSTAN, 43º 46' 43" N 79º 55' 16" E, 515 m a.s.l., desert near Rakhat Kuduk by Ketmen Mts., 04-VI-2014, K. Nupponen & R. Haverinen leg. Genitalia slide: K. Nupponen prep. no. 1/20-XII-2019. DNA sample (Lepid. Phyl., green label): KN00501. In coll. NUPP (FMNH). Paratypes (19 ♂♂, 17 ♀♀): Idem, 10 ♂♂, 2 ♀♀; KAZAKHSTAN, 43º 47' 03" N 68º 03' 15" E, 540 m a.s.l., Karatau Mts., Turkestan town 50 km N, 1 ♂, 8-V-2010, K. Nupponen leg.; KAZAKHSTAN, 47º 12' 02" N 55º 29' 13" E, 45 m a.s.l., Emba River, Besbai village 2 km E, 1 ♂, 11-V-2011, K. Nupponen leg.; Kazakhstan, 43º 32' 52" N 67º 30' 09" E, 170 m a.s.l., Syr-Darya River, tugai forest, Talap station 13 km SW, 1 ♂, 19-IV-2014, K. Nupponen leg.; KAZAKHSTAN, 47º 26' 23" N 60º 49' 04" E, 150 m a.s.l., Malye Barsuki sands, Karachokat village 5 km NW, 1 ♂, 30-IV-2014, K. Nupponen leg.; KAZAKHSTAN, 43º 59' 37" N 79º 34' 20" E, 495 m a.s.l., Ili River valley, Aidarly sands, Aidarly village 6 km SE, 1 ♂, 6 ♀♀, 02-VI-2017, K. Nupponen & R. Haverinen leg.; KAZAKHSTAN, 44º 07' 50" N 79º 23' 44" E, 792 m a.s.l., foothills of Katutau Mts., Konyrolen River, 2 ♂♂, 1 ♀, 04-VI-2017, K. Nupponen & R. Haverinen leg.; Kazakhstan, 44º 00' 04" N 79º 31' 00" E, 515 m a.s.l., sand dunes by Ili River, Aidarly village 3 km S, 1 ♀, 03-VI-2017, K. Nupponen & R. Haverinen leg.; KAZAKHSTAN, 43º 46' 08" N 80º 03' 51" E, 518 m a.s.l., Rakhat Kuduk, desert & sand dunes, 2 ♂♂, 7 ♀♀, 05-VI-2017, K. Nupponen & R. Haverinen leg. Genitalia slides: K. Nupponen prep. no. 8/30-XI-2010 ♂, 2/24-VIII-2014 ♀, 1/23-XII-2019 ♀. Four genitalia preparations preserved in glycerol. DNA samples (Lepid. Phyl., green labels): KN00500, KN00502. In coll. NUPP.

Diagnosis: Externally *S. praecox* Nupponen, sp. n. is separable from other taxa of the *caroxylella* species complex by its narrow and elongate pale grey forewings with characteristic darker patches along dorsum, and medium size (*S. kuldchuktaui*, *S. fluxilis* and *S. parafluxilis* are distinctly larger, and *S. cretacella*, *S. caroxylella* and *S. cramella* smaller). The male genitalia of *S. praecox* are superficially similar to those of the *caroxylella* species complex, but readily separated by a peculiar gnathos with a large subbasal extension and apical processes, as well as a short phallus. The female genitalia of *S. praecox* resemble those of *S. cramellla*, but differ by narrower sterigma with a larger ostium. In *S. praecox*, the ostium is opening near anterior margin of the sterigma, while in *S. fluxilis* and *S. parafluxilis* the sterigma is anteriorly widely open and the ostium is situated at anterior incisure. In *S. praecox*, medioposterior incision of the sternum VII is narrower than that of *S. parafluxilis*, but much deeper than in *S. fluxilis*. The aforesaid morphological differences are well supported by the DNA barcodes, which reveal distinct K2P divergences between the five taxa of barcodes available: *praecox*-

cretacella 2.24 %; *praecox-kuldchuktaui* 3.86 %; *praecox-fluxilis* 4.54 %; *praecox-caroxylella* 4.93 %; *praecox-cramella* 5.99 %.

Description (Fig. 6): Wingspan 11.5-14 mm. Head, collar, neck tuft, haustellum and thorax pale grey mixed with fuscous. Scape fuscous; pecten dirty white, about 1.5 x longer than diameter of scape. Flagellum 0.55 x length of forewing, fuscous; in male ciliate, sensillae as long as diameter of flagellum. Labial palp dirty white, posterior half of segment II and segment III with a few dark fuscous scales at lower surface. Legs pale grey, forelegs a little darker than mid- and hindlegs. Abdomen dorsally fuscous, ventrally dirty white. Forewing narrow and elongate, pale grey, irregularly suffused with dark fuscous over the wing; fuscous scales form indistinct patches between fold and dorsum at 0.2, 0.4, 0.6, and apically near cilia line. Hindwing pale fuscous.

Male genitalia (Fig. 7; see also NUPPONEN, 2011: Figs. 28-29): Uncus stout, Y-shaped, posterior branches elongated and distally rounded. Gnathos broad, subbasally large sub-semicircular extension upwards; distal part thick, apex strongly elongated upwards with tip shortly bifurcate; downwards directed extension short. Tegumen wide, semicircular, dorsal V-shaped depression 0.7 x length of tegumen. Phallus 0.6 x length of valva, curved 90º at basal quarter; distal 0.75 about of equal width, straight, tip more or less blunt. Valva spatulate; distal third bent inwards, apex with 5-6 short and thick thorns. Vinculum broad, triangular, 0.6 x length of valva. Sternum VIII triangular, elongated (length somewhat variable); posteriorly blunt, anterior margin somewhat variable (straight or medially incurved). Tergum VIII subpentagonal, about 1,75 x wider than high, posterior margin more or less shallowly concave, anterior margin widely incurved.

Female genitalia (Figs. 8-9): Sterigma a rectangular plate, 1.8 x higher than wide, posteriorly slightly narrowed; ostium large, sub-circular, situated near anterior margin of sterigma at middle. Sternum VII quadrangular, posterior margin with deep (0.4 x height of sternum VII) V-shaped medial incision; anterior margin medially slightly concave. Apophyses posteriores 1.3 x length of apophyses anteriores.

Bionomy: The moth is nocturnal. Flight period is early, starting already from mid-April, and ending in first half of June. The habitats are various kinds of deserts. The type locality is illustrated in NUPPONEN *et al.* (2016: Fig. 13).

Distribution: Kazakhstan. Widely distributed in the desert zone of southern Kazakhstan, from the Ili River valley in Central Asia westwards to the Emba River in western part of the country.

Etymology: Latin *praecox* = very early. The species name alludes to early onset of flight period of the moth.

Remarks: *S. praecox* Nupponen, sp. n. belongs to the *caroxylella* species complex (see Remarks of *S. kuldchuktaui* above). The taxon is earlier regarded with some doubt as *S. parafluxilis* Passerin d'Entrèves & Roggero, 2007 (NUPPONEN, 2011; NUPPONEN *et al.,* 2016). The new material including females allow to confirm that *S. praecox* Nupponen, sp. n. is not conspecific with *S. parafluxilis*. The exact status of the Mongolian *S. parafluxilis* in the *caroxylella* species complex still remains a little doubtful, due to scarce material with unknown male and a moderately rough original description (PASSERIN D'ENTRÈVES & ROGGERO, 2007).

Taxonomic accounts

Scythris aciella Bengtsson, 1997

Scythris parenthesella Bengtsson, 2002, **syn. n.**

Type material studied only from original descriptions.

Other material (5 ♂♂, 2 ♀♀): Tunisia, 33º 51-53' N 7º 47-49' E, Nefta village 6 km W, Sahara semidesert, 20-30 m a.s.l., 29-IV-2000, 2 ♂♂, K. Nupponen leg., one genitalia preparation preserved in glycerol, In coll. NUPP; Tunisia, 33º 51-53' N 7º 47 49' E, Tozeur 30 km W, Nefta env., 20-30 m a.s.l., 15-XI-2009, 2 ♂♂, 1 ♀, T. Nupponen leg., Genitalia slides: K. Nupponen prep. no. 1/23-I-2010 (♂), 5/23-I-2010 (♀), DNA samples (Lepid. Phyl., green labels): KN00547 ♀, KN00548 ♂. In coll. NUPP; N Oman, 20º 57.926' N 58º 47.610' E, coast line, 0-5 m a.s.l., 1 ♂, 1 ♀, 13-III-2016, A. Floriani & A.

Saldaitis leg., Genitalia slides: K. Nupponen prep. no. 1/13-V-2017 ♂, 1/04-XII-2017 ♀, DNA samples (Lepid. Phyl., green labels): KN01028 ♂, KN01029 ♀. In coll. NUPP.

Distribution: Egypt, Lebanon, Oman, Tunisia, Yemen.

Remarks: *Scythris aciella* was described on the basis of two males from Egypt and Lebanon (BENGTSSON, 1997). The description of *S. parenthesella* is based on a single female from Yemen (BENGTSSON, 2002). The two taxa were expected to be conspecific (NUPPONEN, 2013), but available material was not sufficient to make final conclusions. Examination of new material from Oman allow to study not only morphological features of *S. parenthesella*, but also compare the two taxa by the DNA barcodes. The female genitalia of the Oman specimen are identical to those of the holotype of *S. parenthesella*. The genitalia of both male and female of the Omanian specimens are identical to those of *S. aciella* from Tunisia, and the male genitalia also perfectly coincide with drawing of those of holotype of *S. aciella* (BENGTSSON, 1997). The morphological uniformity by the genitalia of the taxa is well supported by the DNA barcodes. The barcodes (K2P) of the Omanian male and female are identical with each other, and exhibit only a minor intraspecific difference with those of Tunisian male and female, which are identical by the DNA barcodes. Thus, *S. parenthesella* is a junior synonym of *S. aciella*, syn. n. Genitalia of the taxa are illustrated as follows: *S. aciella* (BENGTSSON 1997: holotype, male, Fig. 47 drawing; sternum VIII and tergum VIII are mixed up); NUPPONEN, 2013: female, Figs. 13-14); *S. parenthesella* (BENGTSSON, 2002: holotype, female, Figs. 89-90). Genitalia of the barcoded Omanian male and female are illustrated in the present paper (Fig. 10 ♂, Fig. 11 ♀). *S. aciella* is externally a variable species, and can be safety determined only by dissection. The DNA barcodes reveal distinct K2P divergences between *S. aciella* and the allopatric two taxa (*S. curtiphallus* Nupponen, 2016, *S. digitibasella* Nupponen & Saldaitis, 2013) with similar structure of the male genitalia: *aciella* - *curtiphallus* 9.01 % and *aciella* - *digitibasella* 6.75 %.

Scythris cretacella K. Nupponen & T. Nupponen, 2000

Scythris rotundella K. Nupponen, 2010, **syn. n.**

Material studied: *Scythris cretacella* K. Nupponen & T. Nupponen, 2000.Type material: Holotype (♀: Fig. 12)*:* Russia, Southern Urals, 50º 45’ N 54º 28’ E, 170 m a.s.l., Orenburg oblast, Pokrovka village 20 km S, Schibendy valley, 6-VI-1998, T. & K. Nupponen leg.; Genitalia slide: K. Nupponen prep. no. 3/18-X-1999. In coll. NUPP.

Scythris rotundella K. Nupponen, 2010. Type material: Holotype (♀)*:* Uzbekistan, Buchara district, 40º 34’ 30.8” N 64º 07’ 03.4” E, 195 m a.s.l., Turt Kuduk village 20 km SW, 20-VII-2009, K. Nupponen leg. In coll. NUPP. Paratypes (1 ♂, 1 ♀): 1 ♀, Uzbekistan, Buchara district, 40º 34’ 30.8” N 64º 07’ 03.4” E, 195 m a.s.l., Turt Kuduk village 20 km SW, 20-VII-2009, K. Nupponen leg.; 1 ♂, Uzbekistan, Buchara district, 40º 44’ 59.6” N 63º 47’ 07.5” E, 404 m, Kuldchuktau Mts, Churuk village 7 km N, 18-VII-2009, K. Nupponen leg. Genitalia slides: K. Nupponen prep. no. 2/30-XII-2009 ♂, 4/28-XII-2009, ♀. In coll. NUPP.

Other material (50 ♂♂, 8 ♀♀): Kazakhstan, 47º 16’ 58” N 55º 35’ 50” E, 55 m a.s.l., Emba river bank, near Mijaly village, 1 ♂, 18-V-2010, K. Nupponen leg.; SW Kazakhstan, 45º 30’ 20” N 55º 17’ 07” E, 110 m a.s.l., Beineu town 18 km N, 28-V-2011, 7 ♂♂, K. Nupponen leg.; Kazakhstan, 46º 20’ 21” N 59º 41’ 49” E, 45 m a.s.l., Aral Sea, N shore, Tamshima well, 35 ♂♂, 4 ♀♀, 30-V-2011, K. Nupponen leg.; Kazakhstan, 46º 19’ 53” N 59º 41’ 36” E, 35 m a.s.l., Aral Sea, dunes at N shore, Tamshima well, 1 ♀, 31-V-2011, K. Nupponen leg.; Kazakhstan, 46º 17’ 13” N 58º 50’ 35” E, 130 m a.s.l., S Barsuki desert, near Bozoi village, 3 ♂♂, 1-VI-2011, K. Nupponen leg.; Kazakhstan, 47º 37’ 43” N 59º 31’ 14” E, 190 m a.s.l., N Barsuki desert, Chelkar settlement 25 km S, 3-VI-2011, K. Nupponen leg.; Kazakhstan, 47º 16’ 36” N 61º 01’ 07” E, 200 m a.s.l., Saxaulsky village 20 km NW, Tynshokysu hills, 1 ♀, 10-IX-2011, K. Nupponen leg.; Kazakhstan, 43º 37’ 52” N 79º 55’ 50” E, 650 m a.s.l., Rakhat Kuduk by Ketmen Mts., 1 ♂, 2 ♀♀, 2-VI-2014, K. Nupponen & R. Haverinen leg.; Genitalia slides: K. Nupponen prep. no. 1/08-I-2011 ♂, 3/29.XI.2014 ♀. Six genitalia preparations preserved in glycerol. In coll. NUPP.

Distribution: Russia (S Ural), Uzbekistan, Kazakhstan. Widely distributed in the desert zone of

southern Kazakhstan, from the Ili River valley in Central Asia westwards to the Emba River in western part of the country.

Remarks: *Scythris cretacella* was described from Southern Urals on the basis of a single female. The specimen was collected on chalk hills of the Schibendy valley, a well known locality by abnormally coloured moths reflecting chalk white colour of the soil. *S. rotundella* was described on the basis of two females and one male from Uzbekistan. The holotype (female) of *S. rotundella* is mixed with brown, giving externally quite a different impression than *S. cretacella*. However, examination of large material from different regions of Kazakhstan reveal that there exist all colour forms between the types of *S. cretacella* and *S. rotundella*. The female genitalia of *S. cretacella* and *S. rotundella* are identical, and evidently the two taxa are conspecific. Thus, *S. rotundella* is a junior synonym of *S. cretacella*, syn. n. The taxa are illustrated as follows: *S. cretacella* (NUPPONEN *et al*., 2000: holotype, adult Fig. 20, female genitalia Fig. 21); *S. rotundella* (NUPPONEN, 2010: holotype, adult Fig. 10, paratype female genitalia Fig. 30, paratype male genitalia Figs. 28-29). Further notes on determination of the taxon (as *S. rotundella*) is given in NUPPONEN (2010).

Acknowledgements

I am indebted to Pavel Gorbunov (Ekaterinburg, Russia) for his invaluable help in the field work in Kazakhstan. I also thank staff of Ustyurt Nature Reserve for their hospitality and support during our visit; Risto Haverinen (Vantaa, Finland), Stanislav Korb (Bishkek, Kyrgyzstan), Elena Nupponen (Espoo, Finland), Timo Nupponen (Espoo, Finland), Vladimir Olschwang (Ekaterinburg, Russia) and Aleksander Pototski (Tallinn, Estonia) for organizing expeditions and various kinds of help and support in the field; Aidas Saldaitis (Vilnius, Lithuania), Alessandro Floriani (Milano, Italy) and Hugo van der Wolf (Nuenen, the Netherlands) for donating the Arabian material to me for examination; Pasi Sihvonen (Kirkkonummi, Finland) and Kimmo Silvonen (Espoo, Finland) for their help in processing the imagegraphs; Marko Mutanen (Kiiminki, Finland) for help in producing the DNA samples; Faunatica Oy and Ripako Oy for various kinds of support and assistance; Suomen Perhostutkijain Seura ry for a grant to barcode the specimens.

BIBLIOGRAPHY

BENGTSSON, B. Å., 1997.– Scythrididae- *In* P. HUEMER, O. KARSHOLT & L. LYNEBORG (eds.). *Microlepidoptera of Europe,* **2**: 301 pp. Apollo Books, Stenstrup.

BENGTSSON, B. Å., 2002.– Scythridids of the Arabian Peninsula, II: Yemen (Lepidoptera, Scythrididae).– *Esperiana,* **9**: 61-127.

KAILA, L., NUPPONEN, K., GORBUNOV, P., MUTANEN, M. & HEIKKILÄ, M., 2019.– Ustyurtiidae, a new family of Urodoidea with description of a new genus and two species from Kazakhstan, and discussion on possible affinity of Urodoidea to Schreckensteinioidea (Lepidoptera).– *Insect Systematics & Evolution*: 1-28. DOI 10.1163/1876312X-00002209.

NUPPONEN, K., 2010.– Notes on Scythrididae from the Turanian region, with descriptions of six new species (Lepidoptera: Scythrididae).– *SHILAP Revista de lepidopterología*, **38**(151): 267-285.

NUPPONEN, K., 2011.– Notes on Scythrididae from the Turanian region, with one new synonym and descriptions of seven new species (Lepidoptera: Scythrididae).– *SHILAP Revista de lepidopterología*, **39**(155): 301-319.

NUPPONEN, K., 2012.– Notes on Scythrididae from southern and western Kazakhstan, with description of *Scythris aralensis* Nupponen, sp. n. (Lepidoptera: Scythrididae).– *SHILAP Revista de lepidopterología*, **40**(160): 475-488.

NUPPONEN, K., 2013.– Noteworthy records of Scythrididae from the Palaearctic region, with descriptions of two new species from Spain (Lepidoptera: Scythrididae).– *SHILAP Revista de lepidopterología*, **41**(164): 495-510.

NUPPONEN, K., BENGTSSON, B. Å., KAITILA, J.-P., NUPPONEN, T., JUNNILAINEN, J. & OLSCHWANG, V., 2000.– The scythridid fauna of the southern Ural Mountains, with description of fourteen new species (Lepidoptera: Scythrididae).– *Entomologica Fennica,* **11**: 5-34.

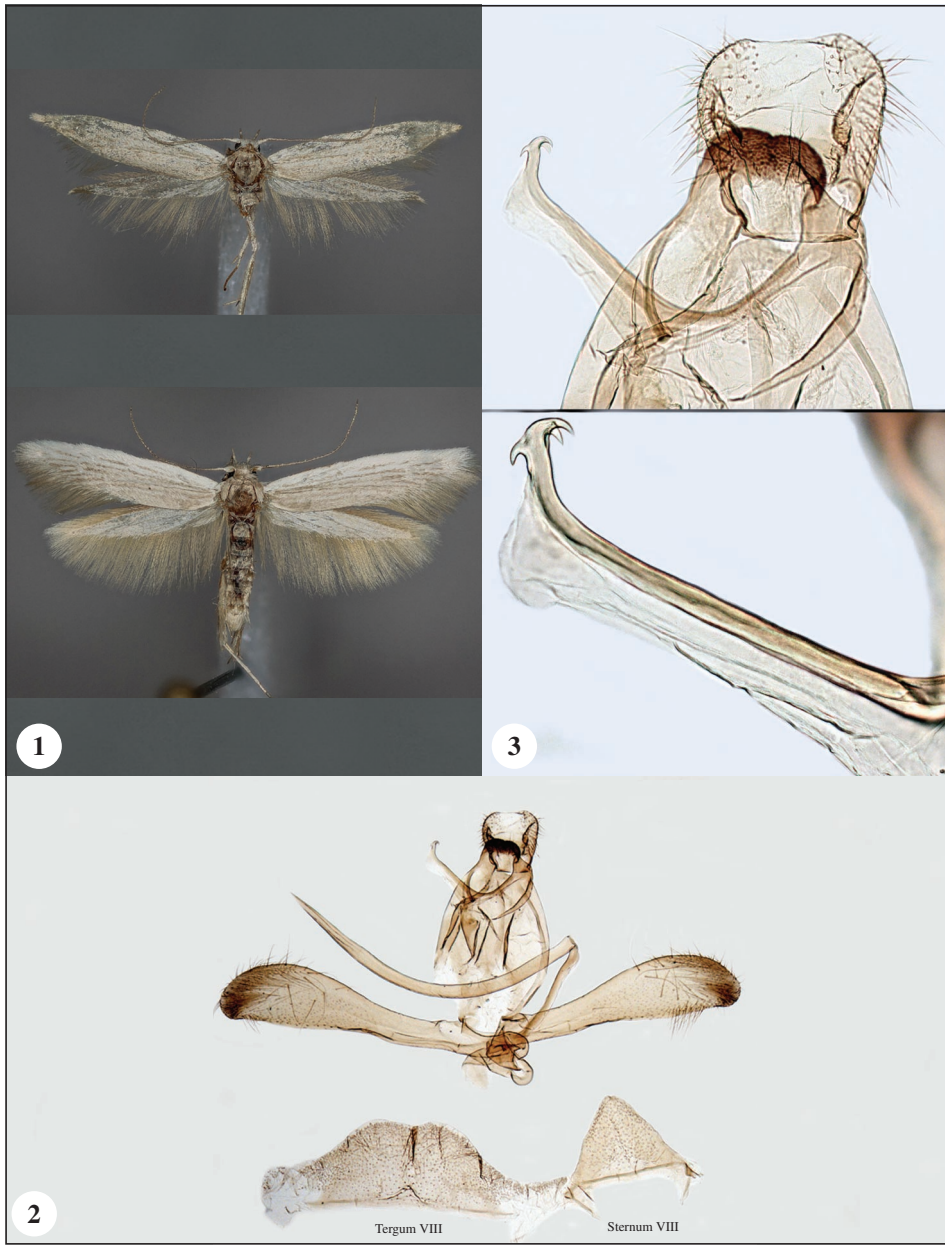
NUPPONEN, K., NUPPONEN, T., HAVERINEN, R. & POTOTSKI, A., 2016.– Notes on Scythrididae of Central Asia, with description of a new species (Lepidoptera: Scythrididae).– *Entomologica Fennica,* **27**: 118-132.

PASSERIN D'ENTRÈVES, P. & ROGGERO, A., 2003.– Description of two new species of *Apostibes* Walsingham, 1907 with some synonymic and phylogenetic accounts of the genus (Lepidoptera, Scythrididae).– *Italian Journal of Zoology,* **70**: 347-352.

PASSERIN D'ENTRÈVES, P. & ROGGERO, A., 2007.– Contribution to the knowledge of Eastern Palaearctic Scythridids (Lepidoptera, Gelechioidea, Scythrididae).– *Deutsche Entomologische Zeitschrift,* **54**(1): 115-125. DOI 10.1002/mmnd.200700011.

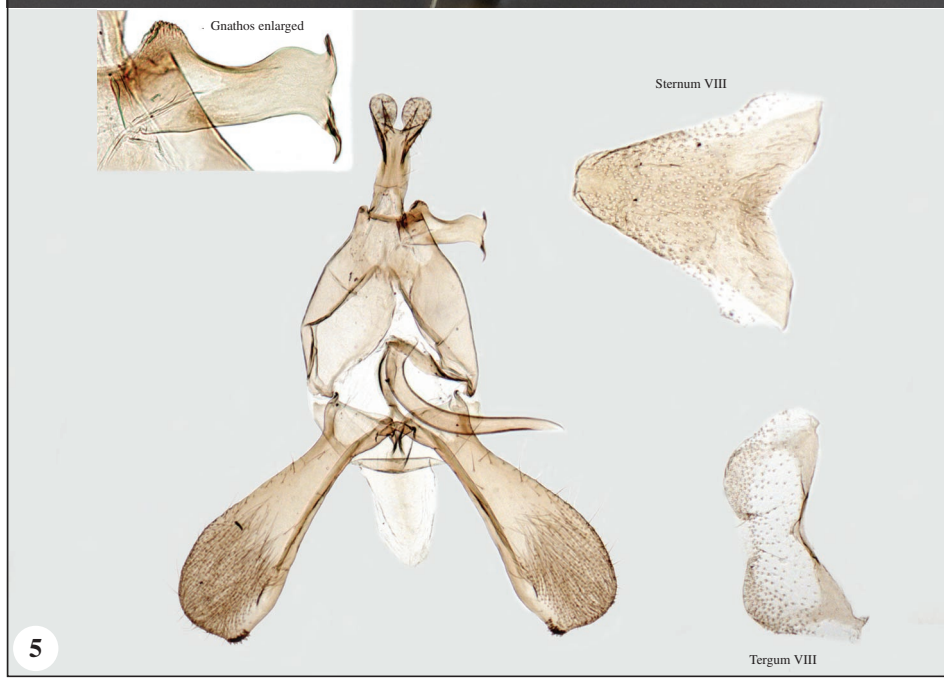
K. N.
Merenneidontie, 19 D
FI-02320 Espoo
FINLANDIA / *FINLAND*
E-mail: Kari.Nupponen@kolumbus.fi
https://orcid.org/0000-0001-8220-6966

(Recibido para publicación / *Received for publication* 6-I-2020)
(Revisado y aceptado / *Revised and accepted* 20-II-2020)
(Publicado / *Published* 30-VI-2020)



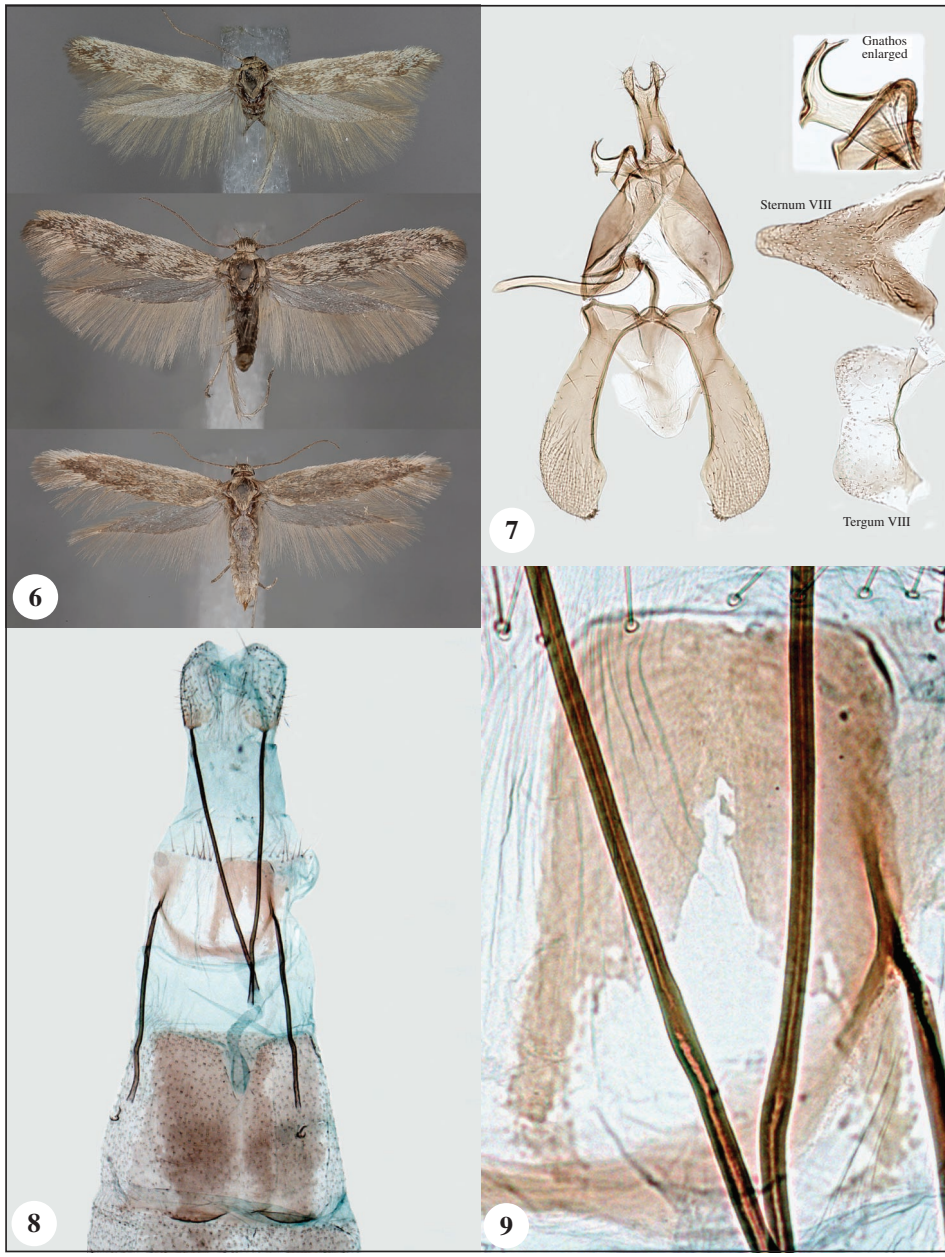
Figs 1-3.– 1. Adults of *Apostibes ustyurtensis* Nupponen, sp. n. (up: male, holotype; down: male, paratype). **2.** Male genitalia of *Apostibes ustyurtensis* Nupponen, sp. n. (holotype; GP 1/28-XII-2019 KN). **3.** Male genitalia of *Apostibes ustyurtensis* Nupponen, sp. n. (up: holotype, uncus - gnathos complex; down: paratype, gnathos arm).

4

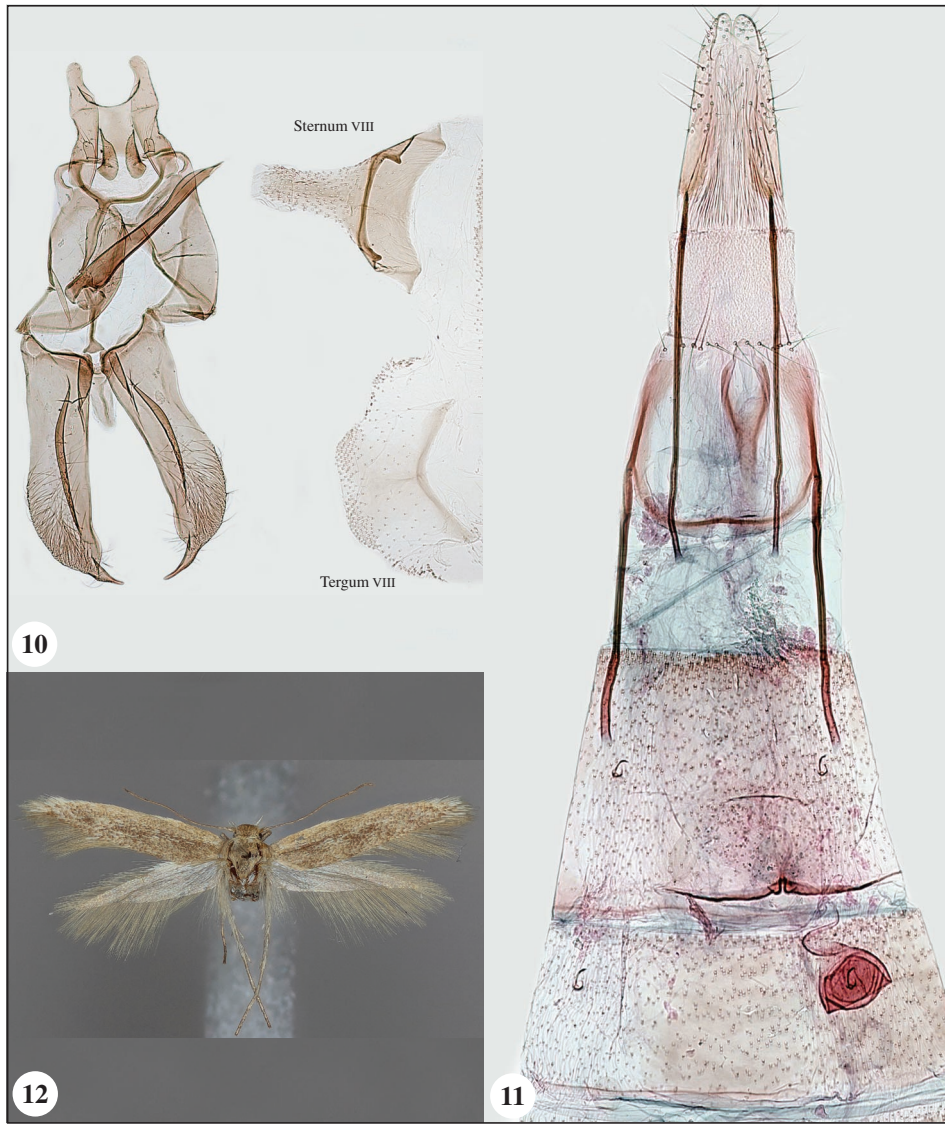


5

Figs 4-5.– 4. Adult (holotype) of *Scythris kuldchuktaui* Nupponen, sp. n. **5.** Male genitalia of *Scythris kuldchuktaui* Nupponen, sp. n. (holotype; GP 1/12-XII-2008 KN).



Figs 6-9.– 6. Adults of *Scythris praecox* Nupponen, sp. n. (up: male, holotype; middle: male paratype; down: female, paratype). **7.** Male genitalia of *Scythris praecox* Nupponen, sp. n. (holotype; GP 1/20-XII-2019 KN). **8.** Female genitalia of *Scythris praecox* Nupponen, sp. n. (paratype: GP 1/23-XII-2019 KN). **9.** Sterigma of *Scythris praecox* Nupponen, sp. n. (paratype: GP 1/23-XII-2019 KN).



Figs 10-12.– 10. Male genitalia of *Scythris aciella* Bengtsson, 1997 (Oman; GP 1/13-V-2017 KN; DNA sample KN00548). **11.** Female genitalia of *Scythris aciella* Bengtsson, 1997 (Oman; GP 1/4-XII-2017 KN; DNA sample KN00547). **12.** Adult (female, holotype) of *Scythris cretacella* K. Nupponen & T. Nupponen, 2000.

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 375-378 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.389

Coleophora antiqua Baldizzone, sp. n. a new species from Algeria. Contribution to the knowledge of the Coleophoridae CXLIV (Lepidoptera: Coleophoridae)

G. Baldizzone

Abstract

Coleophora antiqua Baldizzone, a new species from Algeria related to *C. scabrida* Toll, 1959, is described based on a male specimen found in the indeterminate Gelechioidea material preserved in the Natural History Museum, London UK. The female and bionomy are unknown.
KEY WORDS: Lepidoptera, Coleophoridae, *Coleophora*, new species, Algeria.

Coleophora antiqua **Baldizzone, sp. n. una nueva especie de Argelia. Contribución al conocimiento de los Coleophoridae CXLIV (Lepidoptera: Coleophoridae)**

Resumen

Se describe *Coleophora antiqua* Baldizzone, una nueva especie de Argelia próxima a *C. scabrida* Toll, 1959, basada sobre un macho encontrado en el material indeterminado de Gelechioidea conservado en el The Natural History Museum, London, UK. La hembra y la bionomía es desconocida.
PALABRAS CLAVE: Lepidoptera, Coleophoridae, *Coleophora*, nueva especie, Argelia.

Introduction

The Natural History Museums often have large number of specimens collected ages ago and not yet determined. During my visits to the NHMUK I found many specimens of Coleophoridae, that allowed me to describe some new species in the past. In addition to specimens collected in recent times, for example in tropical Africa, there are still numerous unidentified Lord Walsingham material collected over a century ago, all in good condition and well prepared. In March 2019 I examined many boxes full of indeterminate specimens and borrowed some interesting Coleophoridae. Among these I found a specimen collected by Walsingham in Algeria in 1906, a new species which is described here. The description of a species based on specimens collected over a century ago can bring about more research in locality of interest, or, unfortunately, represent a testimony of a biodiversity that perhaps has now disappeared.

Abbreviations:

Bldz = Giorgio Baldizzone.
GP = genitalia preparation.
NHMUK = Natural History Museum, London, U. K. (formerly British Museum of Natural History).

***Coleophora antiqua* Baldizzone, sp. n.** (Fig. 1)

Holotype ♂ (GP Bldz 16936) "Krenchela | ALGERIA | 30-IV-1906 | Wlsm."; "NHMUK 010897641 [with QR code]", coll. NHMUK.

Fig. 1.– *Coleophora antiqua* Baldizzone, sp. n., holotype.

Diagnosis: Species of medium-small size and brown overall appearance, related to *C. scabrida* Toll, 1959. In habitus *C. scabrida*, is fairly variable, but normally lighter and with evident white streaks. The male genitalia resemble those of *C. scabrida* Toll (see Toll's original description and BALDIZZONE, 2019), but with obvious differences: in *C. antiqua* Baldizzone, sp. n. the tegumen is narrower and longer, the transtilla is wider, the valvula is larger, the cucullus is not ear-shaped, but equal in width at the base and apex, slightly narrowed medially on the ventral edge, but the most evident difference is the shape of the external border of the sacculus that is much wider, not curved as in *C. scabrida*, but ending in a projection forming a right angle and jutting above the dorsal edge of the cucullus whereas this projection barely reaches the dorsal edge of the cucullus in *C. scabrida*.

Description: Wingspan 10.5 mm. Head light brown, whit thin white line above eye. Antenna ringed whitish and brown, scape light brown without erect scales. Labial palpus brown, whitish dorsally; second segment about 0.5 times longer than third. Proboscis of average length and scaling. Forewing brown, scattered with a few darker brown scales along a line under cell and along anal fold, with a narrow white costal line widening towards apex, where it terminates before fringes; costal fringes hazelnut, dorsal fringes brown. Hindwing and fringes brown. Abdomen brown.

Male genitalia (Figs 2, 4-5): Gnathos knob oval. Tegumen long, medially narrow, with pedunculus slightly dilated. Transtilla slender, ribbon-shaped. Valvula oblong, well sclerotized. Cucullus robust, of medium length, equal in width at base and at rounded apex. Sacculus well sclerotized, with straight and very wide lateral edge prolonged into long and robust projection jutting out at right above dorsal edge of cucullus, apically rounded and facing inward. Phallotheca long, slender, with two juxta rods slightly

curved, sclerotized only dorsally, with one adorned with small triangular tooth right before the apex. Two cornuti small, thorn-like, of different lengths, joined at base.

Female genitalia: Unknown.

Abdominal structures (Fig. 3): No posterior lateral struts. Transverse strut thick, slightly curved with well sclerified edges. Tergal disks (3rd tergite) about two times their width, covered by 25-30 conical spines.

Bionomy: Unknown.

Distribution: Algeria, Khenchela.

Remarks: The name "Krenchela" is written on the label of the specimen could not be found in Algeria, so I believe that the correct locality name is Khenchela.

Etymology: The name derives from Latin *antiquus* [*-a, -um*] = old, because of the collecting date of the specimen on which the description is based.

Acknowledgements

I thank Alessandro Giusti, curator of Lepidoptera at the NHMUK (London, UK) for the loan of the material and for the help during my stay at the NHMUK in March 2019. I thank also my friend Pier Giuseppe Varalda (Morano sul Po, Italy) for the photograph of the adult. Thanks to friend Bernard Landry (Geneva, Switzerland) for correcting the text. Finally, I thank Antonio Vives (Madrid, Spain) for the Spanish translation of the abstract.

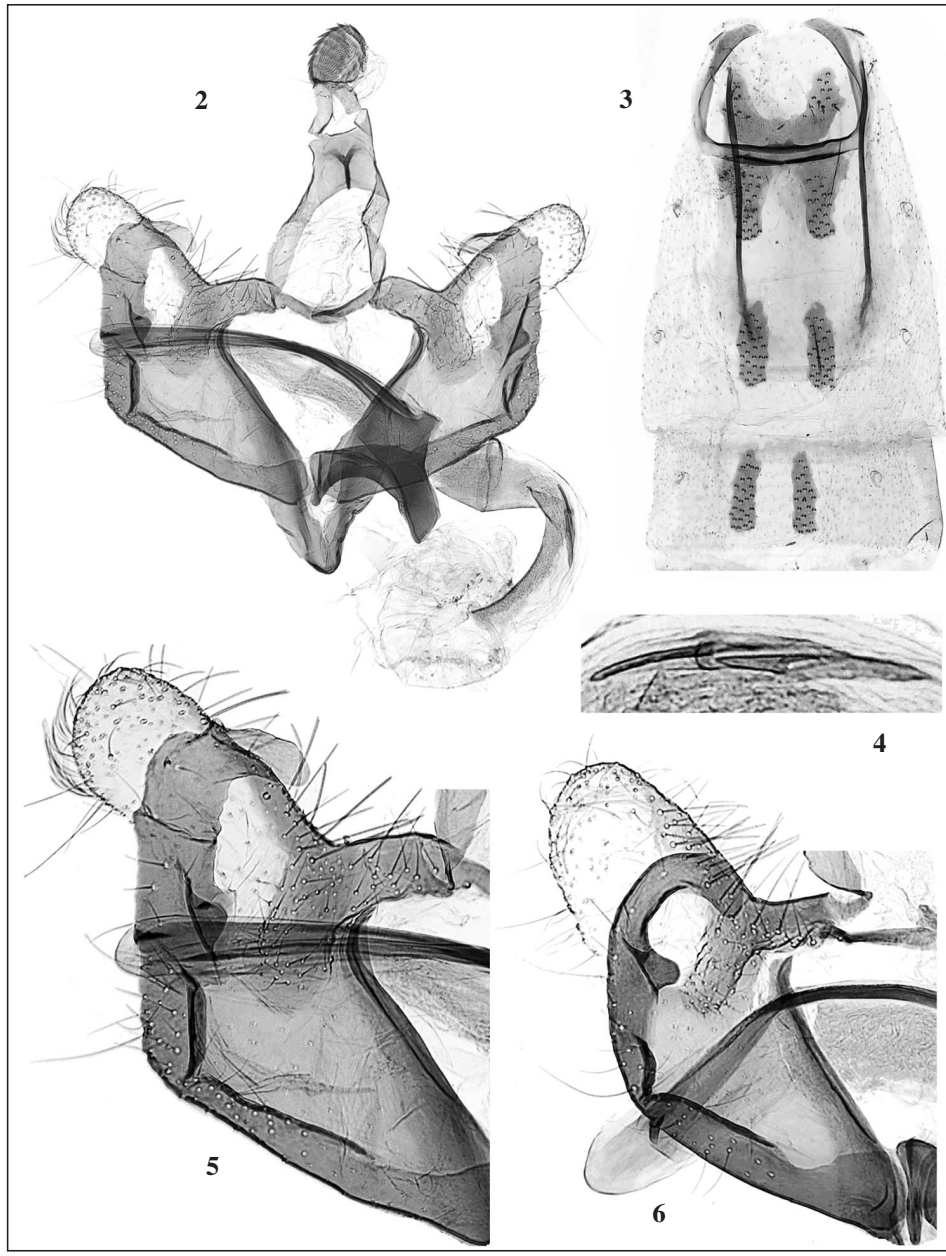
BIBLIOGRAPHY

BALDIZZONE, G., 2019.– Lepidoptera Coleophoridae.- *Fauna d'Italia*, **53**: XVII + 907 pp. . Calderini, Bologna.

TOLL, S., 1959.– Studien über die Genitalien einiger Coleophoridae XV (Lepidoptera).- *Acta Zoologica Cracoviensia,* **4**: 121-145.

G. B.
Via Manzoni, 24
I-14100 Asti (AT)
ITALIA / *ITALY*
E-mail: baldizzonegiorgio@gmail.com
https://orcid.org/0000-0001-8127-0843

(Recibido para publicación / *Received for publication* 21-III-2020)
(Revisado y aceptado / *Revised and accepted* 18-IV-2020)
(Publicado / *Published* 30-VI-2020)



Figs. 2-6.– *Coleophora* spp., male genitalia. **2.** *C. antiqua* Baldizzone, sp. n., GP Bldz 16936, holotype. **3.** Abdomen. **4**. Enlargement of cornuti. **5.** Enlargement of transtilla, cucullus, sacculus and apical part of phallotheca. **6.** *C. scabrida* Toll, same enlargement, GP Bldz 16618, Croatia, Island Krk, Punat, loc. Hrusta, 230 m, 29-V-2018, leg., coll. Bldz.

SHILAP Revista de lepidopterología, 48 (190) junio 2020: 379-384 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.393

Nuevos datos de la familia Geometridae del Parque Nacional y Parque Natural de Sierra Nevada (Almería-Granada, España) (Lepidoptera: Geometridae)

M. Garre, H. Rietz, R. M. Rubio, J. J. Guerrero & A. S. Ortiz

Resumen

Se aportan nuevos datos de veinticinco especies de la familia Geometridae en el Parque Nacional y Parque Natural de Sierra Nevada, de las que trece son nuevas para el entorno del parque, mientras que cinco lo son para la provincia de Almería y cinco para la provincia de Granada. El nuevo censo en el área de estudio contabiliza 257 especies.
PALABRAS CLAVE: Lepidoptera, Geometridae, faunística, nuevos registros, Sierra Nevada, Almería, Granada, España.

New records of the family Geometridae from the National Park and Natural Park of Sierra Nevada (Almeria-Granada, Spain) (Lepidoptera: Geometridae)

Abstract

New data are provided for twenty-five species of the Geometridae family in the Sierra Nevada National Park and Natural Park, of which thirteen are new to the park environment, while five are new to the province of Almería and five to the province of Granada. The new checklist in the study area reaches up to 257 species.
KEY WORDS: Lepidoptera, Geometridae, faunistic, new records, Sierra Nevada, Almeria, Granada, Spain.

Introducción

La familia Geometridae es un taxón bien estudiado en Sierra Nevada, ya que se conocen 244 especies desde la primera gran contribución al conocimiento de los macroheteróceros de Sierra Nevada en RIBBE (1909-1912) hasta la revisión bibliográfica realizada por ORTIZ *et al.* (2013) y la reciente aportación de 19 nuevos registros en ORTIZ *et al.* (2019).

Sierra Nevada es el macizo más importante de la Cordillera Penibética con alturas superiores a los 3.000 m, con una extensión de aproximadamente de 1.750 km^2, entre las provincias de Granada y Almería. La situación particular a nivel latitudinal y la escasa pluviosidad durante el periodo de mayo a octubre le confiere un carácter diferenciado del resto de las montañas europeas, lo que condiciona su composición faunística.

El objetivo del presente trabajo es añadir nuevos registros y confirmar la presencia de algunas especies de la familia Geometridae observadas en Sierra Nevada, así como aumentar con nuevas especies el catálogo de los geométridos de Almería y Granada.

Material y métodos

Los muestreos se realizaron en localidades situadas en las cuadrículas UTM 10x10 km 30SWG00 y 30SWF09 dentro de la provincia de Almería y en la 30SVG61 dentro de la provincia de Granada, así como en la cuadrícula 30SVG90 compartida por las dos provincias. Las localidades estudiadas se ordenan por cuadrículas UTM y provincias en la Tabla I. Todas las capturas se realizaron con trampas de luz negra y actínica de 6 y 15 vatios (tipo Heath).

Tabla I.– Relación de las localidades muestreadas.

Localidad	Municipio	Provincia	Altitud (m.s.n.m.)	U.T.M.
Fuente París	Paterna del Río	Almería	1.940	30SWG00
Fuentichaves	Paterna del Río	Almería	1.320	30SWF09
Barranco del Aguadero	Laujar de Andarax	Almería	1.000	30SWF09
Las Viñas	Laujar de Andarax	Almería	1.080	30SWF09
Encinar del Palancón	Bayárcal	Almería	1.720	30SVG90
Puerto de La Ragua	Bayárcal	Almería	2.030	30SVG90
Seminario Diocesano	Güéjar Sierra	Granada	1.550	30SVG61

El material estudiado se encuentra depositado en la colección del Laboratorio de Biología Animal del Departamento de Zoología y Antropología Física de la Universidad de Murcia y en la colección particular de H. Rietz. En la relación de especies se indica la toponimia distintiva, fecha de captura y número de ejemplares para cada taxón.

Resultados y discusión

En el presente trabajo se aportan los datos de 25 especies, donde 13 de ellas se registran como nuevas y se añaden a las 244 publicadas en el catálogo de la familia Geometridae en el Parque Nacional y el Parque Natural de Sierra Nevada (ORTIZ *et al.,* 2013) y también en la aportación posterior (ORTIZ *et al.,* 2019). Así, se amplía el censo hasta las 257 especies conocidas de la familia Geometridae en este espacio natural, de las que 5 pertenecen a la subfamilia Ennominae, dos a Sterrhinae y 6 a Larentiinae. Estos taxones representan el 42,1% del total de las 613 especies citadas en la Península Ibérica (VIVES MORENO, 2014) y, al comparar la riqueza específica con otras áreas protegidas próximas, se observa que es superior al censo conocido en la sierra de Espuña en Murcia (113 especies; CALLE *et al.,* 2007; ORTIZ *et al.,* 2008), en la sierra de María en Almería (139 especies; GARRE *et al.,* 2016a) y en la sierra del Taibilla-Las Cabras en Albacete (162 especies, GUERRERO *et al.,* 2010), mientras que es similar a otros espacios naturales peninsulares bien estudiados como la Serranía de Cuenca (207 especies; GARRE *et al.,* 2016b; GUERRERO *et al.,* 2020) y el Valle de Arán (233 especies; ORTIZ *et al.,* 2015, 2017).

La mayoría de las nuevas especies para Sierra Nevada han sido citadas varias veces en ambas o en alguna de las dos provincias como *Idaea consanguiberica*, *Cyclophora suppunctaria*, *Catarhoe basochesiata*, *Eupithecia pyreneata* y *Eupithecia ochridata.* También son nuevas, pero se citan por primera vez en la provincia de Almería, *Ennomos fuscantaria* y *Agriopis marginaria,* y nuevas para la provincia de Granada: *Selenia lunularia, Erannis defoliaria, Agriopis aurantiaria, Operophtera brumata* y *Eupithecia schiefereri*.

Estas capturas han permitido confirmar la presencia en el área de estudio de especies como *Neognopharmia stevenaria, Calamodes occitanaria, Xanthorhoe fluctuata, Pennithera ulicata* y *Chloroclysta miata* citadas por LAJONQUIÈRE (1967), *Agriopis bajaria* y *Selidosema taeniolaria* por REISSER (1927), *Idaea lusohispanica* y *Opisthograptis luteolata* por WEHRLI (1926), *Eupithecia gratiosata*

por SCHMIDT-KOEHL (1968) y *Aplocera plagiata* citada por WEHRLI (1926) y LAJONQUIÈRE (1967), e incluso la presencia de *Chloroclysta siterata*, que solamente fue reflejada en los mapas de REDONDO *et al.* (2009). De todas estas especies, *Opisthograptis luteolata*, *Chlroclysta miata* y *Aplocera plagiata* son nuevas para la provincia de Almería.

Entre los nuevos taxones que se añaden al catálogo hay que destacar los endemismos ibéricos *Idaea lusohispanica* e *I. consanguiberica.*

A continuación, se presenta la relación de especies estudiadas y ordenadas sistemáticamente, indicando la toponimia distintiva, fecha de captura y número de ejemplares. Las especies con (*) son nuevos registros en Sierra Nevada; (**) nuevos registros en Almería; (***) nuevos registros en Granada.

ENNOMINAE

Neognopharmia stevenaria (Boisduval, 1840)

Material estudiado: Las Viñas, 1 ♂, 10-IV-2016, M. Garre leg.

Cita bibliográfica: LAJONQUIERE (1967).

(*)(**) *Ennomos fuscantaria* (Haworth, 1809)

Material estudiado: Barranco del Aguadero, 1 ♂, 1 ♀, 1-IX-2018; 2 ♂♂, 7-X-2018; 1 ♂, 26-IX-2019, M. Garre leg.

(*)(***) *Selenia lunularia* (Hübner, 1788)

Material estudiado: Güejar Sierra, Seminario Diocesano, 1 ♂, 17-V-2017; 1 ♂, 27-V-2019, H. Rietz leg.

(*)(***) *Erannis defoliaria* (Clerck, 1759)

Material estudiado: Güejar Sierra, Seminario Diocesano, 10 ♂♂, 2-XII-2018, H. Rietz leg.

Agriopis bajaria ([Denis & Schiffermüller], 1775)

Material estudiado: Güejar Sierra, Seminario Diocesano, 1 ♂, 29-X-2013, H. Rietz leg.

Cita bibliográfica: REISSER (1927).

(*)(***) *Agriopis aurantiaria* (Hübner, [1799])

Material estudiado: Güejar Sierra, Seminario Diocesano, 12 ♂♂, 2-XII-2018, H. Rietz leg.

(*)(**) *Agriopis marginaria* (Fabricius, [1777])

Material estudiado: Barranco del Aguadero, 1 ♂, 4-III-2019, M. Garre leg.

Calamodes occitanaria (Duponchel, 1829)

Material estudiado: Encinar del Palancón, 1 ♂, 4-IX-2015, M. Garre leg.

Cita bibliográfica: LAJONQUIÈRE (1967).

Selidosema taeniolaria (Hübner, [1813])

Material estudiado: Fuente París, 1 ♂, 4-IX-2016, M. Garre leg.

Cita bibliográfica: REISSER (1927).

(**) *Opisthograptis luteolata* (Linnaeus, 1758)

Material estudiado: Fuente París, 1 ♂, 25-VI-2016; Puerto de la Ragua, 1 ♂, 5-VII-2015, M. Garre leg.

Cita bibliográfica: WEHRLI (1926).

STERRHINAE

Idaea lusohispanica Herbulot, 1991
Material estudiado: Fuente París, 1 ♀, 8-VII-2018; 1 ♂, 1-VII-2019, M. Garre leg.
Cita bibliográfica: WEHRLI (1926).

(*) *Idaea consanguiberica* Rezbanyai-Reser & Expósito, 1992
Material estudiado: Güejar Sierra, Seminario Diocesano, 2 ♂♂, 1 ♀, 4-VIII-2017, H. Rietz leg.

(*) *Cyclophora (Codonia) suppunctaria* (Zeller, 1847)
Material estudiado: Güejar Sierra, Seminario Diocesano, 2 ♂♂, 17-V-2017; 1 ♂, 2 ♀♀, 27-V-2019, H. Rietz leg.

LARENTIINAE

Xanthorhoe fluctuata (Linnaeus, 1758)
Material estudiado: Barranco del Aguadero, 1 ♀, 4-III-2019; 1 ♀, 7-X-2018, M. Garre leg.
Cita bibliográfica: LAJONQUIÈRE (1967).

(*) *Catarhoe basochesiata* (Duponchel, 1831)
Material estudiado: Barranco del Aguadero, 1 ♀, 1-IX-2018, M. Garre leg.

Pennithera ulicata (Rambur, 1934)
Material estudiado: Barranco del Aguadero, 3 ♀♀, 6-X-2017, M. Garre leg.
Cita bibliográfica: LAJONQUIÈRE (1967).

Chloroclysta siterata (Hufnagel, 1767)
Material estudiado: Barranco del Aguadero, 1 ♂, 26-X-2017; 3 ♂♂, 18-IV-2018; 1 ♀, 14-IV-2019, M. Garre leg.; Güejar Sierra, Seminario Diocesano, 2 ♂♂, 11-XI-2018, H. Rietz leg.

(**) *Chloroclysta miata* (Linnaeus, 1758)
Material estudiado: Barranco del Aguadero, 1 ♂, 11-XI-2018, M. Garre leg.
Cita bibliográfica: LAJONQUIÈRE (1967).

(*)(***) *Operophtera brumata* (Linnaeus, 1758)
Material estudiado: Güejar Sierra, Seminario Diocesano, 4 ♂♂, 2-XII-2018, H. Rietz leg.

(*) *Epirrita dilutata* ([Denis & Schiffermüller], 1775)
Material estudiado: Barranco del Aguadero, 1 ♀, 25-X-2018; 1 ♀, 11-XI-2018, M. Garre leg.

(*) *Eupithecia pyreneata* Mabille, 1871
Material estudiado: Güejar-Sierra, Seminario Diocesano, 1 ♂, 1 ♀, 12-IV-2015; 1 ♂, 1 ♀, 23-IV-2016, H. Rietz leg.

(*)(***) *Eupithecia schiefereri* Bohatsch, 1893
Material estudiado: Güejar Sierra, Seminario Diocesano, 2 ♂♂, 27-V-2019, H. Rietz leg.

(*) *Eupithecia ochridata* Schütze & Pinker, 1968
Material estudiado: Barranco del Aguadero, 1 ♀, 7-X-2018; 1 ♀, 12-V-2019, M. Garre leg.; Güejar Sierra, Seminario Diocesano, 1 ♀, 17-V-2017, H. Rietz leg.

Eupithecia gratiosata Herrich-Schäffer, 1861
Material estudiado: Las Viñas, 1 ♀, 22-V-2016, M. Garre leg.
Cita bibliográfica: SCHMIDT-KOEHL (1968).

(**) *Aplocera plagiata* (Linnaeus, 1758)
Material estudiado: Fuente París, 1 ♂, 24-IX-2017, M. Garre leg.
Cita bibliográfica: WEHRLI (1926), LAJONQUIÈRE (1967).

Agradecimiento

A la Dirección del Parque Nacional y Parque Natural de Sierra Nevada por las facilidades dadas para la realización de este trabajo y especialmente a Blanca Ramos por su interés. Este estudio ha sido financiado con el proyecto de la Fundación Séneca (Ref. 19908/GERM/15) de Murcia.

BIBLIOGRAFÍA

CALLE, J. A., ORTIZ, A. S., RUBIO, R. M., OCHOTORENA, F. & GUERRERO, J. J., 2007.– Los Geometridae (Lepidoptera) del Parque Regional de Sierra Espuña (Murcia, España).– *Boletín de la Sociedad Entomológica Aragonesa*, **41**: 337-343.

GARRE, M., RUBIO, R. M., GUERRERO, J. J. & ORTIZ, A. S., 2016a.– Análisis faunístico de los Geometridae Leach, 1815 del Parque Natural Sierra María-Los Vélez (Almería, España) (Lepidoptera: Geometridae).– *SHILAP Revista de lepidopterología,* **44**(174): 211-236.

GARRE, M., GUERRERO, J. J., RUBIO, R.M. & ORTIZ, A. S., 2016b.– *Los macrolepidópteros del Parque Natural de la Serranía de Cuenca. Mariposas diurnas y* nocturnas: 291 pp. Entomoibérica, Murcia.

GUERRERO, J. J., ORTIZ, A. S., RUBIO, R. M., CALLE, J. A. & GARRE, M., 2010.– Geometridae de la sierra de Taibilla y de la Reserva Natural de la sierra de las Cabras (Albacete-Murcia, España) (Lepidoptera: Geometridae).– *SHILAP Revista de lepidopterología*, **38**(151): 417-442.

GUERRERO, J. J., GARRE, M., RUBIO, R. M. & ORTIZ, A. S., 2020.– Lepidoptera invernales y nuevos datos de la fauna del Parque Natural de la Serranía de Cuenca (Cuenca, España) (Insecta: Lepidoptera).– *SHILAP Revista de lepidopterología,* **48**(189): 59-64.

LAJONQUIÈRE, E., 1967.– Le tour d'Espagne entomologique.– *Alexanor,* **5**(2): 59-66.

ORTIZ, A. S., CALLE, J. A., RUBIO, R. M., GARRE, M. & GUERRERO, J. J., 2008.– Análisis de la fauna de macrolepidópteros del Parque Regional de Sierra Espuña (Murcia, España).– *Boletín de la Asociación Española de Entomología*, **32**(1-2): 133-158.

ORTIZ, A. S., RUBIO, R. M., GARRE, M., GUERRERO, J. J., PÉREZ-LÓPEZ, F. J., 2013.– Los Geométridos (Lepidoptera: Geometridae).– *In* F. RUANO, M. TIERNO DE FIGUEROA & A. TINAUT ed. *Los Insectos de Sierra Nevada. 200 años de historia*, **1**: 232-247. Asociación Española de Entomología, Salamanca.

ORTIZ, A. S., GUERRERO, J. J., GARRE, M. & RUBIO, R. M., 2015.– *Los Macrolepidópteros del Valle de Arán*: 290 pp. Entomoibérica, Murcia.

ORTIZ, A. S., GUERRERO, J. J., GARRE, M. & RUBIO, R. M., 2017.– Actualización y correcciones al Catálogo Sistemático de los Macrolepidópteros del Valle de Arán.– *Butlletí de la Societat Catalana de Lepidopterologia*, **108**: 7-14.

ORTIZ, A. S., RUBIO, R. M., GUERRERO, J. J., GARRE, M., 2019.– Aportación al catálogo de la familia Geometridae del Parque Nacional y Parque Natural de Sierra Nevada (Almería-Granada, España) (Lepidoptera: Geometridae).– *SHILAP Revista de lepidopterología,* **47**(186): 219-225.

REDONDO, V. M., GASTÓN, F. J. & GIMENO, R., 2009.– *Geometridae Ibericae*: 361 pp. Apollo Books, Stenstrup.

REISSER, H., 1927.– Sammelergebnisse aus Andalusien mit Spezieller Berücksichtinung der Sierra Nevada.– *Verhandlungen Zoologisch-Botanischen Gesellschaft Wien*, **77**: 64-68.

RIBBE, C., 1909-1912.– Beiträge zu einer Lepidopteren-Fauna von Andalusien (Sud-Spanien). Macrolepidopteren.– *Deutsche Entomologische Zeitschrift, Iris,* **23**: 1-395.

SCHMIDT-KOEHL, W., 1968.– Neue Beiträge zur Macrolepidopteren-Fauna oberandalusien aus den Provinzen Granada, Almería und Málaga (Südspanien).– *Miscelanea Zoologica*, **2**: 101-151.

WEHRLI, E., 1926.– Ein Streifzug in die andalusischen Gebirge, Beitrag zur Geometriden-Fauna Andalusiens.– *Deutsche Entologische Zeitschrift, Iris,* **40**: 113-129.

VIVES-MORENO, A. 2014.– C*atálogo sistemático y sinonímico de los Lepidoptera de la Península Ibérica, de Ceuta, de Melilla y de las Islas Azores, Baleares, Canarias, Madeira y Salvajes (Insecta: Lepidoptera)*: 1184 pp. Suplemento de SHILAP Revista de lepidopterología, Improitalia. Madrid.

M. G.
Gran Vía Escultor Salzillo, 7
E-30004 Murcia
ESPAÑA / *SPAIN*
E-mail: manuel.garre@fripozo.com
https://orcid.org/0000-0002-5846-8621

H. R.
Radewiese 1
D-21493 Schwarzenbek
ALEMANIA / *GERMANY*
E-mail: RietzR@t-online.de
https://orcid.org/0000-0001-5597-3959

J. J. G.
Departamento de Zoología y Antropología Física
Facultad de Veterinaria
Universidad de Murcia
Campus de Espinardo
E-30071 Murcia
ESPAÑA / *SPAIN*
E-mail: juanjogf@um.es
https://orcid.org/0000-0002-9645-5266

R. M. R.
Departamento de Zoología y Antropología Física
Facultad de Veterinaria
Universidad de Murcia
Campus de Espinardo
E-30071 Murcia
ESPAÑA / *SPAIN*
E-mail: rmrubio@um.es
https://orcid.org/0000-0002-0109-7874

*A. S. O.
Departamento de Zoología y Antropología Física
Facultad de Veterinaria
Universidad de Murcia
Campus de Espinardo
E-30071 Murcia
ESPAÑA / *SPAIN*
E-mail: aortiz@um.es
https://orcid.org/0000-0002-3877-6096

*Autor para la correspondencia / *Corresponding author*

(Recibido para publicación / *Received for publication* 22-IV-2020)
(Revisado y aceptado / *Revised and accepted* 12-V-2020)
(Publicado / *Published* 30-VI-2020)