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Contribución al conocimiento de los Lepidoptera de un gradiente altitudinal en la cuenca del río Cachirí, Santander, Colombia (Lepidoptera: Papilionoidea)

A. Villalobos-Moreno, J. A. Salazar & I. J. Gómez-Murillo

Resumen

Se realizaron capturas de los Lepidoptera diurnas dentro del proyecto de “Caracterización de la Entomofauna silvestre de la cuenca de río Cachirí, jurisdicción de la CDMB”, la cual se ubica en el departamento de Santander, al nororiente de los Andes colombianos, en bosques secundarios en un gradiente altitudinal entre los 400 y 3.250 msnm, con el propósito de establecer una línea base sobre la diversidad entomológica, y eventualmente detectar elementos faunísticos para la conservación de zonas boscosas dentro de la cuenca. Se colectaron 331 ejemplares de 112 especies pertenecientes a las familias Hesperidae, Papilionidae, Pieridae, Lycaenidae, Riodinidae y Nymphalidae. La familia Nymphalidae fue la mayor abundancia (191) y riqueza de especies (66). Santa Rosa (1.220 msnm) fue el sitio con mayor abundancia (91) y mayor riqueza de especies (47). El análisis de la calidad del inventario indicó una riqueza potencial de especies de 224,35, una proporción de especies observadas del 49,92% y un esfuerzo de muestreo del 99,78%. Santa Rosa fue la localidad con los mayores valores de diversidad: abundancia (91), riqueza observada (47), riqueza potencial (115,17), diversidad de orden 1 (38,84) y diversidad de orden 2 (31,73). La comparación de los inventarios de los sitios de muestreo permitió determinar que no existe similitud entre estas localidades, lo cual se puede explicar por las distancias altitudinales y geográficas entre ellas.

PALABRAS CLAVE: Lepidoptera, Papilionoidea, abundancia, Andes colombianos, diversidad, riqueza de especies, Colombia.

Contribution to the knowledge of Lepidoptera of an altitudinal gradient in Cachiri river basin, Santander, Colombia (Lepidoptera: Papilionoidea)

Abstract

The sampling of Lepidoptera was carried during the “Characterization of wild Entomofauna of the Cachiri river basin, jurisdiction of CDMB”, department of Santander, northeast of Colombian Andes, in secondary forests in an altitudinal gradient from 400 to 3,280 masl with the purpose of establishing a baseline of entomological diversity, and eventually detect faunal elements for the conservation of forested areas within the basin. We collected 331 specimens of 112 species belonging to the families Hesperidae, Papilionidae, Pieridae, Lycaenidae, Riodinidae and Nymphalidae. The family Nymphalidae was the most abundance (191) and richness of species (66). The analysis of inventory quality indicated a potential richness of species of 224.35, a proportion of observed species of 49.92% and a sampling effort of 99.78%. Santa Rosa was the locality with highest values of diversity: abundance (91), observed richness (47), potential richness (115.17), diversity of order 1 (38.84) and diversity of order 2 (31.73). The comparison of inventories of each sampling sites allowed determining that there is not similarity between these localities, which can be explained by the altitude and geographic distances between them.

KEY WORDS: Lepidoptera, Papilionoidea, abundance, Colombian Andes, diversity, richness of species, Colombia.

Introducción

Colombia tiene una posición geográfica, una complejidad vegetal y una diversidad de ecosistemas que lo convierten en un país verdaderamente privilegiado en biodiversidad, lo que le ha permitido ocupar primeros lugares a nivel mundial en varios grupos, como el tercero en diversidad de mariposas diurnas con más de 3.780 especies, distribuidas en las familias Hesperidae, Papilionidae, Pieridae, Nymphalidae, Riodinidae y Lycaenidae (FORBES *et al.*, 2018; HUERTAS & ARIAS 2007; LAMAS, 2004). En el departamento de Santander su estudio se ha limitado a capturas en el marco de proyectos de caracterización de flora y fauna silvestre, salidas y prácticas docentes, trabajos de grado y consultorías ambientales, lo cual ha suministrado abundantes datos sobre la fauna local, aunque todavía quedan zonas del nororiente colombiano por ser estudiadas, y que indudablemente tiene mucho por decir en términos biológicos y medioambientales (CASAS *et al.*, 2017; HUERTAS & ARIAS, 2007; PARDO-LOCARNO & VILLALOBOS-MORENO, 2016; VILLALOBOS-MORENO, 2013, 2020; VILLALOBOS-MORENO & GÓMEZ, 2015, 2020; VILLALOBOS-MORENO & SALAZAR-ESCOBAR, 2020a, 2020b, 2020c; VILLALOBOS-MORENO *et al.*, 2012, 2020a, 2020b, 2020c).

La preferencia por el estudio de los Lepidoptera se basa en su gran atractivo, por su abundancia y facilidad de encuentro, así como por la sensibilidad ecológica, endemismos, facilidad de manejo en campo y laboratorio, estabilidad taxonómica y espaciotemporal, y su importancia como bioindicadores, debido a la sensibilidad a cambios en sus hábitats, convirtiéndose en una excelente herramienta para la evaluación del grado de conservación o alteración del medio natural (BROWN, 1991, 1997; EHRlich, 1984; KREMEN, 1992, 1994; KREMEN *et al.*, 1993, 1994; LLORENTE & MARTÍNEZ, 1998). En este sentido, la degradación de las áreas silvestres contribuye con la extinción de especies de Lepidoptera, lo cual es crítico en las zonas Andinas debido a la ampliación de la frontera agrícola y urbana (PALACIOS & CONSTANTINO, 2006).

En la presente investigación, se estudió la estructura y composición de la comunidad de mariposas diurnas en un rango altitudinal comprendido entre los 400 y 3.280 msnm dentro de la cuenca del río Cachirí en los Andes nororientales de Colombia, y se aportaron datos sobre la composición, abundancia y distribución, información básica que permite comprender mejor la entomofauna regional y nacional. Así mismo, la presente investigación sería un punto de partida para trabajos de profundización en el tema y un importante insumo para establecer posibles programas de conservación en la zona de estudio.

Materiales y métodos

ÁREA DE ESTUDIO

El río Cachirí forma parte de la cuenca superior del río Lebrija en el departamento de Santander, Colombia. La cuenca de río Cachirí está en el área de jurisdicción del municipio de Suratá, y se localizada a unos 30 km al norte de la ciudad de Bucaramanga, Santander, en el nororiente de los Andes colombianos (Figura 1). Las localidades establecidas en la zona de estudio se ubican desde los 400 hasta los 3.250 msnm, en un gradiente que va desde selvas neotropicales inferiores hasta zonas de páramo (CUATRECASAS, 1989). A continuación, una breve descripción de las localidades muestreadas:

Balsas, Vereda Mesallana: Corresponde a una selva neotropical inferior con alto grado de fragmentación debido a procesos antropogénicos por labores agrícolas y piscícolas. Se ubica a orillas del río Cachirí a unos 300 metros del sitio de confluencia con el río Playonero. 7°26'57,57"N, 73°12'36,35"O, 400 msnm.

Santa Rosa, Vereda Santa Rosa: Corresponde a una selva neotropical subandina con presencia de algunas zonas de fragmentación de bosques debido a labores agrícolas y ganaderas. Se ubica sobre la vía Playón-Suratá a unos 100 m del río Cachirí y a un poco más de 3 km al suroeste del corregimiento de Turbay. 7°29'19,10"N, 73°03'47,42"O, 1.220 msnm.

San Isidro, Vereda San Isidro: Corresponde a una selva neotropical subandina con amplios

procesos de fragmentación del bosque debido a labores agrícolas y ganaderas. Se ubica a 2,5 km del río Romeritos, afluente del río Cachirí, y a unos 700 m al norte del corregimiento de Turbay. 7°31'11,35"N, 73°02'40,28"O, 2.180 msnm.

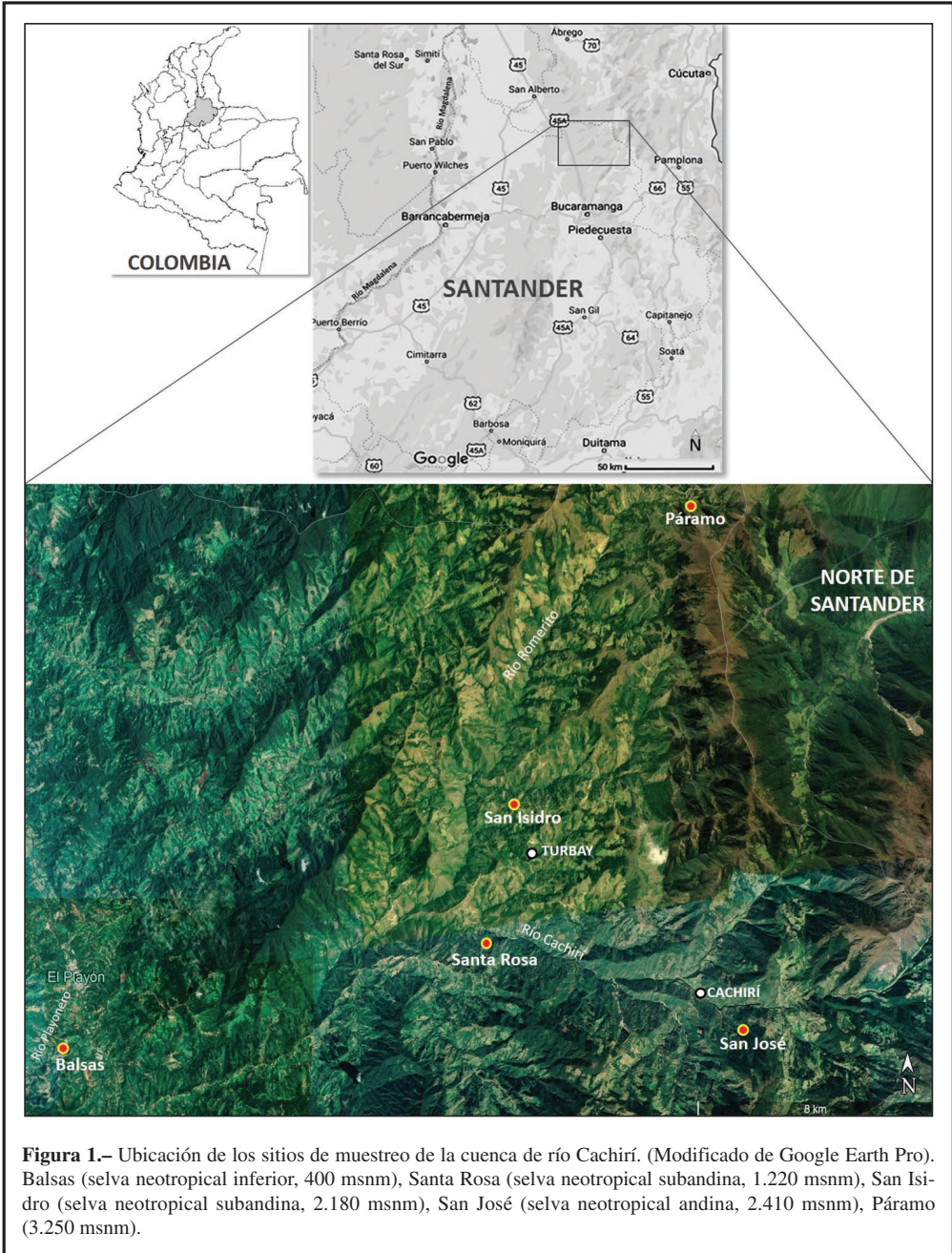


Figura 1.– Ubicación de los sitios de muestreo de la cuenca de río Cachirí. (Modificado de Google Earth Pro). Balsas (selva neotropical inferior, 400 msnm), Santa Rosa (selva neotropical subandina, 1.220 msnm), San Isidro (selva neotropical subandina, 2.180 msnm), San José (selva neotropical andina, 2.410 msnm), Páramo (3.250 msnm).

San José, Vereda Marcela: Corresponde a una selva neotropical andina relativamente conservada, con cierto grado de fragmentación del bosque debido a labores agrícolas y ganaderas. Se ubica en la parte alta de la cuenca del río Cachirí, en la microcuenca de la quebrada San José, a 2 km al sureste del casco urbano de Cachirí, y un poco más de 500 m del río del mismo nombre. 7°27'34,50"N, 72°58'24,17"O, 2.410 msnm.

Páramo, Vereda Mohán: Corresponde a una zona de páramo que se encuentra relativamente bien conservada por la escasez de procesos productivos y por la dificultad de acceso debido al mal estado de las vías. Se observan matorrales bajos y pastizales, con elementos arbóreos dispersos; presenta temperaturas muy bajas, vientos fuertes, lluvias frecuentes y escasa radiación solar. Pertenece al territorio del Páramo de Santurbán, que se ubica en la parte más alta de la cuenca del río Romerito, afluente del río Cachirí. 7°36'56,18"N, 72°59'15,17"O, 3.250 msnm.

FASE DE CAMPO

Captura y preservación del material: Se realizaron colectas de Lepidoptera diurnas como parte integral del Proyecto de "Caracterización de la Entomofauna Silvestre de la cuenca del río Cachirí, área de jurisdicción de la Corporación Autónoma Regional para la Defensa de la Meseta de Bucaramanga - CDMB", en las localidades llamadas: Balsas, Santa Rosa, San José, San Isidro y Páramo de Santurbán. Los muestreos se hicieron durante 4 días en cada una de las localidades, durante la segunda temporada de lluvias del año y el inicio de la temporada seca (octubre-diciembre). Con respecto al muestreo pasivo, en cada una de las localidades se instalaron seis trampas Van Someren-Rydon cebadas con plátano en descomposición y revisadas cada 12 horas, con un esfuerzo de muestreo de 96 horas/trampa/localidad, y un esfuerzo total de 576 horas/localidad. Los muestreos activos se realizaron por dos personas, desde las 8:00 am a las 6:00 pm, en recorridos libres de longitud no definida, haciendo capturas con red entomológica de 45 cm de diámetro y mango de madera, para un esfuerzo de muestreo total de 80 horas/localidad. Básicamente se siguieron las recomendaciones de los muestreos rápidos (RAPs) propuestos por el Instituto Von Humboldt (VILLARREAL *et al.*, 2004), aunque no se dedicó la totalidad del esfuerzo de muestreo solo a mariposas, debido a los términos de referencia del proyecto desarrollado.

Los ejemplares colectados se sacrificaron y guardaron en sobres de papel milano para ser llevados al laboratorio de la CDMB y ser montados siguiendo normas internacionales (ANDRADE *et al.*, 2013; MÁRQUEZ, 2005; TRIPLEHORN & JOHNSON, 2004). La determinación taxonómica se realizó siguiendo las claves e ilustraciones de LE CROM *et al.* (2002, 2004) y NEILD (1996, 2008), así como por comparación en la Colección Entomológica del Instituto de Ciencias Naturales de la Universidad Nacional de Colombia y la Colección Entomológica de la CDMB. Se utilizó la organización sistemática propuesta por LAMAS (2004). Todos los muestreos se realizaron en el interior bosques secundarios bien conservados, orillas de camino y bordes de quebradas (Figura 2).

CALIDAD DEL INVENTARIO

Se realizó un análisis de esfuerzo de muestreo para examinar el grado de conocimiento alcanzado acerca del inventario de especies y predecir la riqueza potencial de la zona de estudio. Se consideró cada unidad de esfuerzo de muestreo (UEM) como el sumatorio de los datos procedentes de los diferentes días de trabajo reportados para la cuenca de río Cachirí, por lo tanto, se tuvieron en cuenta 20 UEM. Mediante el programa EstimateS (COLWELL, 2000), se aleatorizó la entrada de datos (1.000 iteraciones) para evitar sesgos en la predicción de la riqueza potencial. Para predecir la riqueza potencial, se utilizó el estadístico no paramétrico Chao1 (basado en abundancias), por tratarse de un estimador robusto de la riqueza mínima que suele ofrecer mejores resultados que otros estimadores (GOTELLI & COLWELL, 2001; WALTHER & MOORE, 2005), y posteriormente, con el programa CurveExpert (HYAMS, 2009), se ajustaron las estimaciones obtenidas de Chao1 a una curva asintótica Clench, para poder realizar el cálculo de diferentes parámetros de la curva; este método es ampliamente utilizado y ha demostrado un buen ajuste en diversas situaciones y diferentes grupos taxonómicos, corresponde a una versión adaptada de la ecuación de Michaelis-Menten (JIMÉNEZ-VALVERDE &

HORTAL, 2003). Adicionalmente, permite el cálculo fácil y rápido de una serie de parámetros, como asíntota y pendiente, y con ellas, establecer la calidad del inventario y el grado del esfuerzo realizado. Los parámetros básicos que se calculan con este procedimiento son: la asíntota (a/b), que corresponde al número máximo de especies predichas para el lugar de muestreo; pendiente de la curva $[a/(1+b \cdot n)^2]$, donde n corresponde al número de unidades de esfuerzo de muestreo; proporción de especies registradas $[Sobs/(a/b)]$, este valor es el porcentaje de las especies observadas al realizar el muestreo con respecto a las predichas (asíntota).



Figura 2.– Vista general de las localidades muestreadas en la cuenca de río Cachiří. Balsas (selva neotropical inferior, 400 msnm), Santa Rosa (selva neotropical subandina, 1.220 msnm), San Isidro (selva neotropical subandina, 2.180 msnm), San José (selva neotropical andina, 2.410 msnm), Páramo (3.250 msnm).

ESTRUCTURA Y COMPOSICIÓN DE LAS LOCALIDADES DE MUESTREO

Utilizando los valores de abundancias y riquezas observadas, se establecieron para cada una de las localidades de muestreo, la serie de números de Diversidad de Hill: N_0 = riqueza potencial, N_1 = diversidad de orden 1 (exponencial del Índice de Shannon-Wiener: eH') y N_2 = diversidad de orden 2 (inverso del Índice de Simpson: $1/D_{st}$) (MORENO *et al.*, 2011; NÚÑEZ & BARRO, 2003; VILLALOBOS-MORENO *et al.*, 2016). Para obtener la riqueza potencial (N_0) se llevó a cabo un procedimiento similar al del análisis de esfuerzo de muestreo, coincidiendo ésta, con la asíntota de la curva Clench ajustada; para este proceso se utilizó el programa EstimateS (COLWELL, 2000) para la aleatorización de la entrada de datos y uso de estimadores no paramétricos y el programa CurveExpert (HYAMS, 2009) para ajustar la curva a la asíntota Clench. Para el cálculo de N_1 y N_2 se utilizó el programa Spade (CHAO & SHEN, 2009), que ofrece el valor junto con su desviación estándar. Los números de diversidad de Hill, que tienen como unidad los números de especies miden el número efectivo de especies presentes y son una medida del grado de distribución de las abundancias relativas entre las especies de una muestra; N_0 corresponde al número de total de especies, N_1 es el número de especies abundantes y N_2 es el número de las especies muy abundantes ($N_0 > N_1 > N_2$) (JOST, 2010).

COMPARACIÓN ENTRE SITIOS DE MUESTREO

Con el propósito de establecer posibles similitudes entre los sitios de muestreo de la presente investigación dentro de la cuenca de río Cachirí, se comparó el inventario de taxones reportados para cada una de las localidades de muestreo. Mediante el programa PAST 3 (HAMMER *et al.*, 2001) y usando el índice de Bray-Curtis, que se basa en abundancias, se construyó el respectivo dendrograma mediante una estrategia de "single linkage" (LUDWIG & REYNOLDS, 1988; MAGURRAN, 1988). Es importante mencionar que Bray-Curtis es un índice de disimilitud, sin embargo, el programa PAST calcula el inverso del índice, de tal manera que en el dendrograma generado, se grafica el grado de similitud entre las localidades, con la ventaja adicional de tener una escala numérica que va de cero a uno, y de este modo, el grado de similitud se pueden equiparar a un porcentaje.

Resultados y discusión

Se colectaron 331 ejemplares pertenecientes a 112 especies, agrupados en las familias Hesperiiidae, Papilionidae, Pieridae, Lycaenidae, Riodinidae y Nymphalidae (Anexo 1). Siendo la familia Nymphalidae la mejor representada en todos los sitios de muestreo y la de mayor abundancia y riqueza de especies, con 191 especímenes y 66 especies, seguido por Pieridae con 72 individuos y 20 especies, y Hesperiiidae con 38 especímenes y 12 especies (Figuras 3A y 3B). Además, la familia Nymphalidae presentó el mayor número de subfamilias con 8 (Anexo 1). Lo anterior se puede explicar porque la familia Nymphalidae es un grupo con amplia distribución geográfica, presenta hábitos generalistas, tiene una gran proporción de especies y, en términos generales, se adapta fácilmente a medioambientes alterados (DEVRIES, 1987).

Con respecto a las localidades muestreadas, Santa Rosa fue el sitio con mayor abundancia con 91 individuos colectados y con la mayor riqueza de especies (47), seguido por Balsas con una abundancia de 84 y una riqueza de especies de 41, ambos sitios se ubican en las altitudes más bajas dentro del gradiente establecido.

En el Anexo 1 se presenta el listado de especies de la zona de estudio, con la abundancia por localidad y su clasificación en las categorías: abundante con más de 10 registros, común entre 6 y 10 registros, escasa entre 2 y 5 registros y rara con un solo registro, siguiendo la metodología propuesta por FAGUA (1996), HENAO (2006), HENAO & STILES (2018). Se observó que una sola especie se consideró abundante, 15 fueron comunes (13,39%), 52 fueron escasas (46,43%) y 44 especies se consideraron raras (39,29%).

Las especies con mayores abundancias en los muestreos de la cuenca de río Cachirí fueron

Altopedaliodes kruegeri Pycrz, 1995 (23), *Eurema philae columbia* (C. & R. Felder, 1861) (10), *Oressinoma typhla* Doubleday, [1849] (10) y *Colias dimera* Doubleday, 1847 (9). Por otra parte, 44 especies estuvieron representadas por un solo ejemplar y considerada en la categoría de raras, dentro de las cuales se encuentran algunas especies que son poco comunes y/o difíciles de capturar como *Chionides catillus* (Cramer, 1779), *Phocides polybius* (Fabricius, 1793), *Poanes azin* (Godman, 1900), *Synapte malitiosa* (Herrich-Schäffer, 1865), *Catasticta tricolor* Butler, 1897, *Hesperocharis marchalii* (Guérin-Méneville, 1844), *Pieriballia viardi* (Boisduval, 1836), *Tatochila xanthodice* (Lucas, 1852), *Ocaria aholiva* (Hewitson, 1867), *Parcela amarynthina* (C. & R. Felder, 1865), *Adelpha seriphia aquillia* Fruhstorfer, 1915, *Consul panariste* (Hewitson, 1856), *Dircenna jemina* (Geyer, [1837]), *Marpesia zerynthia* (Hübner, [1823]), *Mestra hersilia hypermestra* (Hübner, [1825]) y *Pyrrhogyra nearea kheili* Fruhstorfer, 1908.

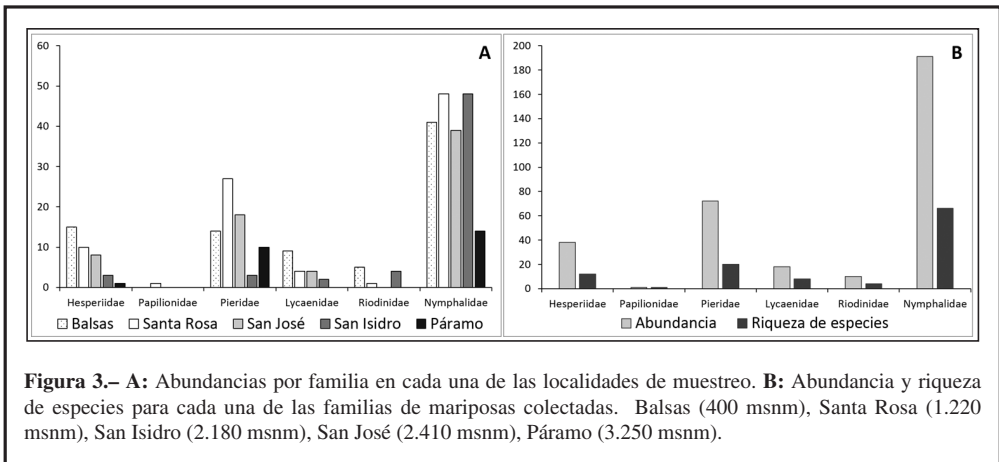


Figura 3.- A: Abundancias por familia en cada una de las localidades de muestreo. **B:** Abundancia y riqueza de especies para cada una de las familias de mariposas colectadas. Balsas (400 msnm), Santa Rosa (1.220 msnm), San Isidro (2.180 msnm), San José (2.410 msnm), Páramo (3.250 msnm).

Ninguna especie fue registrada en todos los sitios de muestreo, ni siquiera en cuatro de las cinco localidades estudiadas; lo cual puede ser explicado por la variabilidad de los ecosistemas a lo largo del gradiente, así como las distancias altitudinales y geográficas, aunque también puede ser explicado por la época de muestreo, la fenología de las especies y el esfuerzo de muestreo.

CALIDAD DEL INVENTARIO

La riqueza potencial estimada según el ajuste a la curva Clench alcanzó un total de 224,35 especies (asíntota de la función; ver Figura 4). El valor de la pendiente de la curva fue de 2,46, que puede ser explicado por el alto número de especies únicas, y la proporción de especies observadas fue del 49,92%, que corresponde a un esfuerzo de muestreo estimado del 99,78%. Con estos valores calculados, se estima que es evidente que existen un número importante de especies por reportarse en la cuenca de río Cachirí, para lo cual se recomienda realizar muestreos adicionales en estas y otras localidades, así como en todas las épocas del año. El análisis de la calidad del inventario en cada uno de los sitios de muestreo sustenta la afirmación anterior sobre la necesidad de mayores colectas para establecer una lista más completa de especies para la zona, y que represente la riqueza real de la cuenca del río Cachirí (Tabla I).

ESTRUCTURA Y COMPOSICIÓN DE LAS LOCALIDADES DE MUESTREO

De las comunidades en las localidades estudiadas, Santa Rosa fue la que presentó los mayores valores de abundancia, riqueza de especies (observada y potencial), dominancia y equidad,

resaltándose que la comunidad de mariposas recolectadas en Santa Rosa presenta la abundancia más equitativamente distribuida que las otras localidades (Tabla II). En contraposición, la localidad Páramo presenta los valores más bajos en todos los parámetros de diversidad, con una comunidad de mariposas que presentan una baja abundancia con una distribución muy poco equitativa, debido a que pocas especies son abundantes y la gran mayoría están representadas por solo uno o dos especímenes, lo que se puede explicar por las condiciones extremas en esta localidad, que mantiene bajas las poblaciones en zonas de páramo, e incluso hace difícil su observación y recolección (VILLALOBOS-MORENO, 2020).

Tabla I.– Resumen de los análisis de la calidad del inventario para cada localidad de muestreo.

SITIOS	Riqueza Observada	Riqueza Potencial	% Especies Observada	% Esfuerzo Muestreo	Coefficiente Correlación
Balsas	41	79,29	51,71	99,33	0,990
Santa Rosa	47	115,17	40,81	99,30	0,993
San José	32	82,17	40,16	99,26	0,961
San Isidro	28	59,50	47,06	98,51	0,962
Páramo	10	20,60	48,54	97,38	0,918

La comparación con sitios de altitudes similares (Tabla II), permite observar que los parámetros de diversidad son muy parecidos en los puntos más bajos en el gradiente altitudinal: Balsas y La Negrena, con excepción de la riqueza potencial que para este último punto es mayor. Algo similar se aprecia al comparar estos parámetros de diversidad en los dos puntos más altos en el gradiente altitudinal: Páramo y La Nevera, observándose gran similitud entre todos los valores, excepto por una leve reducción del valor de riqueza potencial de especies y la diversidad de orden 1 (N1), esto último indica que la abundancia de Páramo está mejor distribuida que la abundancia de La Nevera.

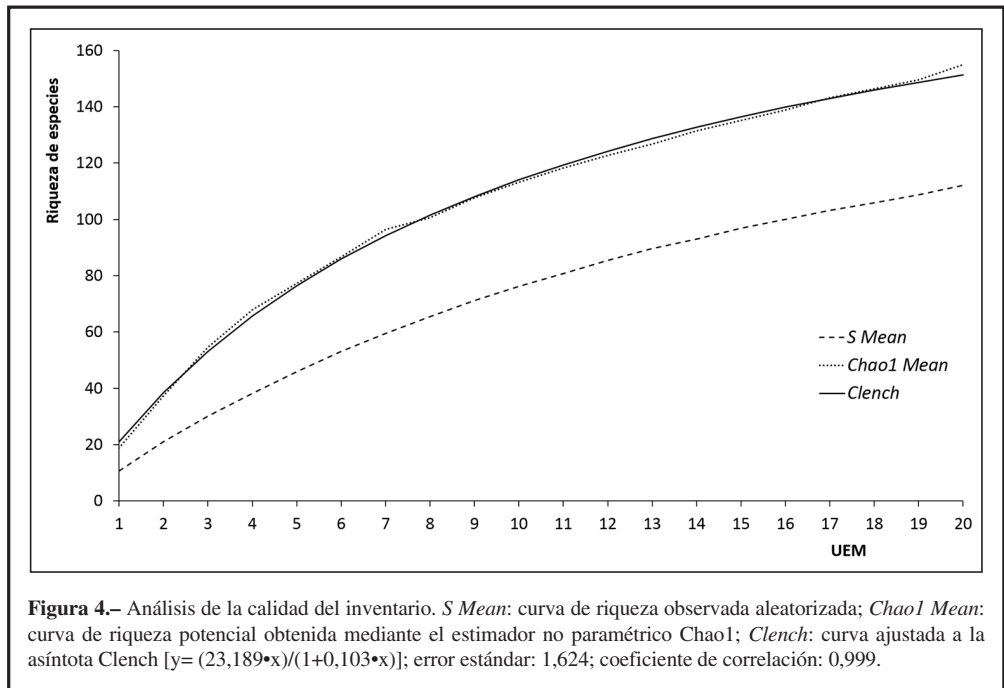


Tabla II.– Parámetros de diversidad de las localidades muestreadas en la cuenca del río Cachirí, Santander, Colombia, comparados con localidades en altitudes similares. Ab: abundancia; Ro: riqueza observada de especies; N0: riqueza potencial de especies; N1: número de especies abundantes; N2: número de las especies muy abundantes.

Localidad	Altitud msnm	Parámetros de diversidad				
		Ab	Ro	N0	N1	N2
Balsas	400	84	41	79,29	35,86 (±1,96)	32,07 (±0,08)
Santa Rosa	1.220	91	47	115,17	38,84 (±2,60)	31,73 (±0,11)
San Isidro	2.180	61	28	59,50	19,59 (±2,18)	13,94 (±0,19)
San José	2.410	70	32	82,17	25,15 (±2,32)	18,70 (±0,18)
Páramo	3.250	25	10	20,60	8,19 (±0,98)	7,03 (±0,18)
La Negraña*	650	92	41	109,19	32,83 (±2,14)	27,30 (±0,11)
La Purnia**	1.237	52	38	78,55	34,51 (±2,22)	30,73 (±0,13)
La Mariana***	2.226	109	32	47,68	24,99 (±1,69)	20,31 (±0,11)
La Nevera***	2.850	24	10	16,22	2,11 (±0,13)	6,86 (±0,16)

* VILLALOBOS-MORENO *et al.*, 2020a. **VILLALOBOS-MORENO & SALAZAR, 2020c, ***2020a.

COMPARACIÓN ENTRE LOS SITIOS DE MUESTREO

La comparación entre los inventarios de taxones de los sitios de muestreo en la zona de estudio permitió observar que no existe ninguna relación entre las localidades establecidas (Figura 5). Esto puede ser explicado por la distancia geográfica y altitudinal entre los sitios muestreados, y las diferencias entre las zonas de vida en las que se ubica cada una de ellas. Sin embargo, temas de fenología e intensidad del muestreo no pueden ser descartados, por lo cual se recomienda realizar más muestreos en estas y otras localidades dentro de la cuenca, así como en todas las épocas del año.

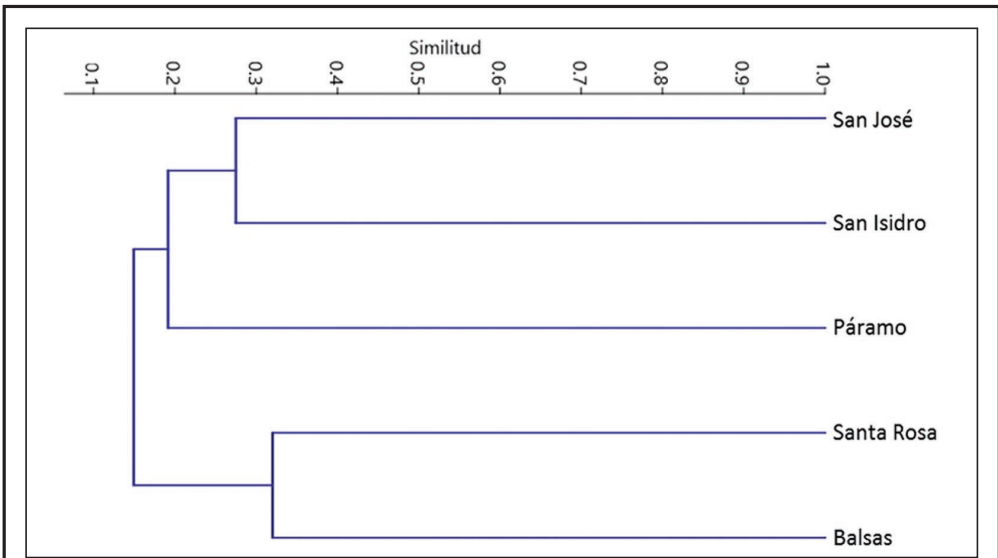


Figura 5.– Análisis de Similitud entre los sitios de muestreo en la cuenca de río Cachirí, Santander, Colombia. Coeficiente de correlación: 0,8836. Balsas (400 msnm), Santa Rosa (1.220 msnm), San Isidro (2.180 msnm), San José (2.410 msnm), Páramo (3.250 msnm).

Conclusiones

Si bien las colectas no se realizaron en un proyecto específico de lepidopterología, sino en colectas generales de flora y fauna silvestre de la zona de estudio, el presente documento hace un importante aporte al conocimiento de las mariposas del nororiente colombiano, siendo evidente en el análisis de la calidad del inventario que aún falta un cierto número de especie por ser reportadas. Lo anterior permite proponer, que para lograr una lista más precisa de especies de mariposas para la zona de estudio, es necesario realizar nuevos muestreos para las localidades estudiadas y otras que se puedan definir, así como durante todas las épocas del año. No obstante, los datos suministrados en la presente investigación, con respecto a la lista preliminar, así como a la estructura y composición de la comunidad de mariposas diurnas en el rango altitudinal comprendido entre los 400 y 3.250 msnm dentro de la cuenca del río Cachirí en los Andes nororientales de Colombia, son importantes como punto de partida para realizar trabajos de profundización en el tema y como insumo para establecer posibles programas de conservación en la zona de estudio.

Se resalta la presencia de algunas especies de mariposas indicadoras de la buena calidad del bosque, debido a que se relacionan con zonas umbrófilas y bosques con aceptable estado de conservación, como: *Consul panariste* (Hewitson, 1856), *Ithomia terra* Hewitson, [1853], *Mechanitis menapis occasiva* Fox, 1967, *Oleria amalda* (Hewitson, [1857]), *Oleria padilla* (Hewitson, 1863) y *Oleria victorine* (Guérin-Méneville, [1844]). Sin embargo, la mayoría de las especies registradas dentro del gradiente estudiado pertenecen a géneros propios de zonas abiertas o perturbadas (HAMER *et al.*, 2006; PALACIOS & CONSTANTINO, 2006; VALENCIA *et al.*, 2005), dentro de éstas podemos mencionar: *Anartia amathea* (Linnaeus, 1758), *Anartia jatrophae* (Linnaeus, 1763), *Eurema albula* (Cramer, 1775), *Eurema elathea* (Cramer, [777]), *Heliconius charitonia* (Linnaeus, 1767), *Heliconius clysonymus* Latreille, [1817], *Heliconius erato* (Linnaeus, 1758), *Heliconius sara* (Fabricius, 1793), *Junonia evareta* (Cramer, 1779), *Oressinoma typhla* Doubleday, [1849], *Phoebis senna* (Linnaeus, 1758), *Urbanus dorantes* (Stoll, [1790]), *Urbanus simplicius* (Stoll, [1790]) y *Urbanus teleus* (Hübner, 1821); el registro de estas especies propias de zonas abiertas sugiere la presencia de procesos de fragmentación del bosque, algo cada vez más extendido en todas las franjas Andinas colombianas (DUQUE *et al.*, 2013; ECHEVERRY & RODRÍGUEZ, 2006).

Es importante resaltar que el número limitado de localidades y los pocos días de campo, se relacionan con la metodología y los objetivos planteados por la CDMB en el Proyecto de Caracterización de la Entomofauna silvestre de su área de jurisdicción. Esta autoridad ambiental estableció como base metodológica, los muestreos rápidos (RAPs) propuestos por el Instituto Alexander von Humboldt (VILLARREAL *et al.*, 2004), pero fueron modificados por la CDMB para no limitarlos a los grupos indicadores, sino que además, las colectas se extendían a todos los órdenes de insectos que se encontraran en las localidades, motivo por el cual, se redujo el tiempo de muestreo de mariposas, lo que se hizo evidente en los diferentes análisis de los datos que se llevaron a cabo en el presente manuscrito. Sin embargo, es posible que algunas especies escasas o raras no fuesen recolectadas debido a temas de su historia natural como su fenología, horarios de actividad, gran movilidad, baja densidad, entre otras (VILLALOBOS-MORENO, 2017).

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BIBLIOGRAFÍA

- ANDRADE, M. G., HENAO-BAÑOL, E. R. & TRIVIÑO, P., 2013.– Técnicas y procesamiento para la recolección, preservación y montaje de mariposas en estudios de biodiversidad y conservación. (Lepidoptera: Hesperioidea-Papilionoidea).– *Revista Academia Colombiana de Ciencias*, **37**(144): 311-325.
- BROWN, K. S., 1991.– Conservation of Neotropical environments: Insects as indicators.– In N. M. COLLINS & J. A. THOMAS. *Conservation of Insects and their Habitats*: 349-404. Academic Press, London.
- BROWN, K. S., 1997.– Diversity, disturbance, and sustainable use of Neotropical forests: insects as indicators for conservation monitoring.– *Journal of Insect Conservation*, **1**: 25-42.
- CASAS-PINILLA, L. C., MAHECHA, O., DUMAR, J. C. & RÍOS-MÁLAVAR, I. C., 2017.– Diversidad de mariposas en un paisaje de bosque seco tropical, en la Mesa de los Santos, Santander, Colombia (Lepidoptera: Papilionoidea).– *SHILAP Revista de lepidopterología*, **45**(177): 83-108.
- CHAO, A. & SHEN, T. J., 2009.– *Program SPADE* (Species prediction and diversity estimation). Disponible en <http://chao.stat.nthu.edu.tw> (Accedido el 15 de diciembre de 2020).
- COLWELL, R. K., 2000.– *EstimateS v. 6.0b1*. Disponible en <http://vicroy.eeb.uconn.edu/EstimateS> (Accedido el 15 de diciembre de 2020).
- DUQUE, A., ÁLVAREZ, E., RODRÍGUEZ, W. & LEMA, A., 2013.– Impacto de la fragmentación en la diversidad de plantas vasculares en bosques andinos del nororiente de Colombia.– *Colombia Forestal*, **16**(2): 115-137.
- ECHEVERRY, M. & RODRÍGUEZ, J., 2006.– Análisis de un paisaje fragmentado como herramienta para la conservación de la biodiversidad en áreas de bosque seco y subhúmedo tropical en el municipio de Pereira, Risaralda Colombia.– *Scientia et Technica*, **12**(30): 405-410.
- EHRlich, P. R., 1984.– The structure and dynamics of butterfly populations.– In: R. I. VANE-WRIGHT & D. R. ACKERY. *The biology of butterflies*: 25-40. Academic Press, London.
- FAGUA, G., 1996.– Comunidad de mariposas y arthropofauna asociada con el suelo de tres tipos de vegetación de la Serranía de Taraira (Vaupés, Colombia). Una prueba del uso de mariposas como bioindicadores.– *Revista Colombiana de Entomología*, **22**(3): 143-151.
- FORBES, A. A., BAGLEY, R. K., BEER, M. A., HIPPEE, A. C. & WIDMAYER, H. A., 2018.– Quantifying the unquantifiable: why Hymenoptera, not Coleoptera, is the most speciose animal order.– *BMC Ecology*, **18**(21): 1-11.
- GOTELLI, N. & COLWELL, R. K., 2001.– Quantifying biodiversity: Procedures and pitfalls in the measurement and comparison of species richness.– *Ecology Letters*, **4**: 379-391.
- HAMER, K. C., HILL, J. K., BENEDICK, S., MUSTAFFA, N., CHEY, V. K. & MARYATI, M., 2006.– Diversity and ecology of carrion and fruit-feeding butterflies in Bornean rain forest.– *Journal of Tropical Ecology*, **22**: 25-35.
- HAMMER, O., HARPER, D. & RYAN, P. D., 2001.– *PAST - Palaeontological Statistics*. Disponible en <https://palaeo-electronica.org/> (Accedido el 15 de diciembre de 2020).
- HENAO, E., 2006.– Aproximación a la distribución de mariposas del departamento de Antioquia (Papilionidae, Pieridae y Nymphalidae: Lepidoptera) con base en zonas de vida.– *Boletín Científico Museo Historia Natural Universidad de Caldas*, **10**: 279-312.
- HENAO, E. & STILES, F., 2018.– Un inventario de las mariposas diurnas (Lepidoptera: Hesperioidea-Papilionoidea) de dos reservas altoandinas de la Cordillera Oriental de Colombia.– *Revista de la Facultad de Ciencias*, **7**(1): 71-87.
- HYAMS, D., 2009.– *CurveExpert v1.40*. Disponible en <http://www.curveexpert.net/> (Accedido el 15 de diciembre de 2020).
- HUERTAS, B. & ARIAS, J. J., 2007.– A new butterfly species from the Colombian Andes and a review of the taxonomy of the genera *Idioneurula* Strand, 1932 and *Tamania* Pycrz, 1995 (Lepidoptera: Nymphalidae: Satyrinae).– *Zootaxa*, **1652**: 27-40.
- JIMÉNEZ-VALVERDE, A. & HORTAL, J., 2003.– Las curvas de acumulación de especies y la necesidad de evaluar la calidad de los inventarios biológicos.– *Revista Ibérica de Aracnología*, **8**: 151-161.
- JOST, L., 2010.– The relation between Evenness and Diversity.– *Diversity*, **2**: 207-232.
- KREMEN, C., 1992.– Assessing the indicator properties of assemblages for natural areas monitoring.– *Ecological Applications*, **2**(2): 203-217.
- KREMEN, C., 1994.– Biological inventory using target taxa: a case study of the butterflies of Madagascar.– *Ecological Applications*, **4**: 407-22.
- KREMEN, C., COLWELL, R. K., ERWIN, T. L., MURPHY, D. D., NOSS, R. F. & SANJAYAN, M. A., 1993.– Terrestrial arthropod assemblages: their use in conservation planning.– *Conservation Biology*, **7**(4): 796-808.

- KREMEN, C., MERENLENDER, A. M. & MURPHY, D. D., 1994.– Ecological monitoring: a vital need for integrated conservation and development programs in the tropics.– *Conservation Biology*, **8**: 388-97.
- LAMAS, G., 2004.– *Checklist of Neotropical Lepidoptera, Part 4A, Hesperioidea- Papilionoidea*: 439 pp. Association for Tropical Lepidoptera, Florida, Gainesville.
- LE CROM, J. F., CONSTANTINO, L. M. & SALAZAR, J. A., 2002.– *Mariposas de Colombia. Papilionidae*: 119 pp. Carlec Ltda., Bogotá.
- LE CROM, J. F., CONSTANTINO, L. M. & SALAZAR, J. A., 2004.– *Mariposas de Colombia. Pieridae*: 113 pp. Carlec Ltda., Bogotá.
- LLÓRENTE, B. J. & MARTÍNEZ, A. L., 1998.– Análisis conservacionista de las mariposas mexicanas Papilionidae (Lepidoptera, Papilionoidea).– In T. P. RAMAMOORTHY, R. BYE, A. LOT & J. FA. *Diversidad Biológica de México: orígenes y distribución*: 149-178 pp. Instituto de Biología, Universidad Nacional Autónoma de México, México D.C.
- LUDWIG, J. A. & REYNOLDS, J. F., 1988.– *Statistical ecology: a primer in methods and computing*: 368 pp. Wiley Interscience Pub., New York.
- MAGURRAN, A. E., 1988.– *Ecological diversity and its measurement*: 179 pp. Princeton University Press, New Jersey.
- MÁRQUEZ, J., 2005.– Técnicas de colecta y preservación de insectos.– *Boletín Sociedad Entomológica Aragonesa*, **37**: 385-408.
- MORENO, C. E., BARRAGÁN, F., PINEDA, E. & PAVÓN, N. P., 2011.– Reanálisis de la diversidad alfa: alternativas para interpretar y comparar información sobre comunidades ecológicas.– *Revista Mexicana de Biodiversidad*, **82**: 1249-1261.
- NEILD, A., 1996.– *The butterflies of Venezuela. Part I: Nymphalidae I (Limenitidinae, Apaturinae, Charaxinae)*: 144 pp. Meridian Publications, London.
- NEILD, A., 2008.– *The butterflies of Venezuela. Part II: Nymphalidae II (Acraeinae, Libytheinae, Nymphalinae, Ithomiinae and Morphinae)*: 144 pp. Meridian Publications, London.
- NÚÑEZ, R. & BARRO, A., 2003.– Composición y estructura de dos comunidades de mariposas (Lepidoptera: Papilionoidea) en Boca de Canasi, La Habana, Cuba.– *Revista Biología*, **17**(1): 8-17.
- PALACIOS, M. Y. & CONSTANTINO, L. M., 2006.– Diversidad de lepidópteros Rhopalocera en un gradiente altitudinal en la Reserva Natural El Pangan, Nariño, Colombia.– *Boletín Científico del Centro de Museos de la Universidad de Caldas*, **10**: 258-278.
- PARDO-LOCARNO, L. C. & VILLALOBOS-MORENO, A., 2016.– Chiasognathini colombianos: Redescripción y adiciones a la distribución de *Sphaenognathus rotundatus* Lacroix y *Sphaenognathus prionoides* Buquet (Coleoptera: Lucanidae).– *Boletín Científico del Centro de Museos de la Universidad de Caldas*, **20**(2): 217-231.
- TRIPLEHORN, C. H. & JOHNSON, N. F., 2005.– *Borror and DeLong's Introduction to the study of insects*: 864 pp. Thomson Brooks/Cole, Gainesville.
- VALENCIA, C. A., GIL, Z. N. & CONSTANTINO, L. M., 2005.– *Mariposas diurnas de la zona central cafetera de Colombia*: 244 pp. Federación Nacional de Cafeteros, Chinchiná.
- VILLALOBOS-MORENO, A., 2013.– Nueva especie de mariposa (Lepidoptera: Nymphalidae: Satyrinae) para los Andes Colombianos.– *Boletín Científico del Centro de Museos de la Universidad de Caldas*, **17**(1): 268-275.
- VILLALOBOS-MORENO, A., 2017.– *Escarabajos (Coleoptera: Melolonthidae) de un roblel asociado al Parque Natural Regional de Santurbán*: 192 pp. Tesis doctoral. Universidad Nacional de Colombia, Bogotá.
- VILLALOBOS-MORENO, A., 2020.– *Insectos de páramo en Santander*: 143 pp. Canaán Multiservicios, Bucaramanga.
- VILLALOBOS-MORENO, A. & GÓMEZ, I. J., 2015.– Contribución a la distribución de las mariposas del género *Morpho* Fabricius, 1807 (Lepidoptera: Nymphalidae: Morphinae) en el nororiente del departamento de Santander (Colombia) y estudio de su genitalia.– *Boletín Científico Museo de Historia Natural Universidad de Caldas*, **19**(2): 281-289. doi.10.17151/bccm.2015.19.2.18.
- VILLALOBOS-MORENO, A. & GÓMEZ, I. J., 2020.– Mariposas Dismorphiinae (Lepidoptera: Pieridae) en dos colecciones entomológicas del departamento de Santander, Colombia.– *Boletín de la Sociedad Entomológica Aragonesa*, **66**(1): 261-266.
- VILLALOBOS-MORENO, A. & SALAZAR, J. A., 2020a.– Contribución al conocimiento de los Lepidoptera de la cuenca de río Frío, Santander, Colombia (Lepidoptera: Papilionoidea).– *SHILAP Revista de lepidopterología*, **48**(189): 153-166.
- VILLALOBOS-MORENO, A. & SALAZAR, J. A., 2020b.– Mariposas (Lepidoptera: Papilionoidea) de un bosque Andino en la vertiente oriental de la cuenca de río Tona, Santander (Colombia).– *Anales de Biología*, **42**: 75-84.

- VILLALOBOS-MORENO, A. & SALAZAR, J. A., 2020c.– Butterflies (Lepidoptera: Papilionoidea) of La Honda basin, Mesa de Los Santos, Santander, Colombia.– *Revista Novedades Colombianas*, **15**(1): 21-45.
- VILLALOBOS-MORENO, A., CÉSPEDES, J. C. & AGUDELO, J. C., 2012.– Mariposas (Lepidoptera: Papilionidae) depositadas en las colecciones entomológicas de la CDMB y la Universidad Industrial de Santander.– *Revista Colombiana de Entomología*, **38**(1): 167-170.
- VILLALOBOS-MORENO, A., CEPEDA-OLAVE, N. E., PARDO-LOCARNO, L. C. & GÓMEZ-MURILLO, I. J., 2013.– Contribución al conocimiento de la familia Passalidae (Coleoptera: Scarabaeoidea) en Santander, Colombia.– *Revista Agricultura Tropical*, **36**(3-4): 37-45.
- VILLALOBOS-MORENO, A., AGUDELO, J. C. & SALAZAR, J. A., 2020a.– Mariposas (Lepidoptera: Papilionoidea) de un bosque tropical en la cuenca del río Playonero, Andes nororientales de Colombia.– *Folia Entomológica Mexicana (n. s.)*, **6**(3): 64-76.
- VILLALOBOS-MORENO, A., CEPEDA, N., SALAZAR, J. A. & AGUDELO, J. C., 2020b.– Butterflies of the family Pieridae (Lepidoptera: Papilionoidea) of the Frio river basin, northeastern Andes of Santander, Colombia.– *Revista Chilena de Entomología*, **46**(3): 533-543.
- VILLALOBOS-MORENO, A., SALAZAR, J. A., AGUDELO, J. C. & DÍAZ, J. J., 2020c.– Mariposas de la familia Pieridae (Lepidoptera: Papilionoidea) de un bosque seco tropical en la cuenca del río Playonero, Santander, Colombia.– *Revista Chilena de Entomología*, **46**(2): 303-312.
- VILLALOBOS-MORENO, A., PARDO-LOCARNO, L. C., CABRERO-SAÑUDO, F. J., OSPINA-TORRES, R. & GÓMEZ, I. J., 2016.– Inventario preliminar de los escarabajos de la familia Melolonthidae (Coleoptera: Scarabaeoidea) en un robledal del nororiente de los Andes colombianos.– *Boletín de la Sociedad Entomológica Aragonesa*, **58**(1): 159-167.
- VILLARREAL, H., ÁLVAREZ, S., CÓRDOBA, S., ESCOBAR, F., FAGUA, G., GAST, F., MENDOZA, H., OSPINA, M. & UMANA, A. M., 2004.– *Manual de métodos para el desarrollo de inventarios de biodiversidad*: 235 pp. Instituto Alexander von Humboldt. Bogotá.
- WALTHER, A. & MOORE, J. L., 2005.– The concepts of bias, precision and accuracy, and their use in testing the performance of species richness estimators, with a literature review of estimator performance.– *Ecography*, **28**: 815-829.

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Anexo 1.– Listado de especies y categorías de mariposas colectadas en la cuenca de río Cachirí, Santander. N: abundancia total, CT: categoría, A: abundante, C: común, E: escasa, R: rara.

TAXA	Balsas	Santa Rosa	San José	San Isidro	Páramo	N	CT
FAMILIA HESPERIIDAE							
Subfamilia Eudaminae							
<i>Chioides catillus</i> (Cramer, 1779)			1			1	R
<i>Phocides polybius</i> (Fabricius, 1793)		1				1	R
<i>Urbanus dorantes</i> (Stoll, [1790])	1	1	3			5	E
<i>Urbanus simplicius</i> (Stoll, [1790])	2	1				3	E
<i>Urbanus teleus</i> (Hübner, 1821)	2	2		4		8	C
Subfamilia Pyrginae							
<i>Achlyodes busirus</i> (Cramer, 1779)	3	1	2			6	C
<i>Heliopetes arsalte</i> (Linnaeus, 1758)	1	2				3	E
<i>Pyrgus adepta</i> Plötz, 1884	1	1	2			4	E
<i>Pyrgus oileus</i> (Linnaeus, 1767)	1	1				2	E
Subfamilia Hesperinae							
<i>Flaccilla aecae</i> (Stoll, [1781])	3					3	E
<i>Poanes azin</i> (Godman, 1900)					1	1	R
<i>Synapte malitiosa</i> (Herrich-Schäffer, 1865)	1					1	R
FAMILIA PAPILIONIDAE							
<i>Heraclides thoas nealces</i> Rothschild & Jordan, 1906		1				1	R
FAMILIA PIERIDAE							
Subfamilia Dismorphiinae							
<i>Pseudopieris nehemia</i> (Boisduval, 1836)		1				1	R
<i>Pseudopieris viridula</i> (C. & R. Felder, 1861)		1				1	R
Subfamilia Coliadinae							
<i>Colias dimera</i> Doubleday, 1847			4	1	4	9	C
<i>Eurema albula</i> (Cramer, 1775)	3	2				5	E
<i>Eurema elathea</i> (Cramer, 1777)	3	1				4	E
<i>Eurema mexicana bogotana</i> (C. & R. Felder, 1861)		7	1			8	C
<i>Eurema philae columbia</i> (C. & R. Felder, 1861)		5	5			10	C
<i>Eurema salome</i> (C. & R. Felder, 1861)		1	2			3	E
<i>Nathalis plauta</i> Doubleday, 1847			2	1	4	7	C
<i>Phoebis senna</i> (Linnaeus, 1758)	1	3				4	E
<i>Pyrisitia proterpia</i> (Fabricius, 1775)	2	2				4	E
<i>Pyrisitia venusta</i> (Boisduval, 1836)	5	2				7	C
Subfamilia Pierinae							
<i>Hesperocharis marchalii</i> (Guérin-Méneville, 1844)			1			1	R
<i>Catasticta tricolor</i> Butler, 1897					1	1	R
<i>Leodonta zenobia</i> (C. & R. Felder, 1865)			1			1	R
<i>Leptophobia aripa</i> (Boisduval, 1836)			1			1	R
<i>Leptophobia tovaria</i> (C. & R. Felder, 1861)		1		1		2	E
<i>Melete leucanthe</i> (C. & R. Felder, 1861)		1				1	R
<i>Pieriballia viardi</i> (Boisduval, 1836)			1			1	R
<i>Tatochila xanthodice</i> (Lucas, 1852)					1	1	R
FAMILIA LYCAENIDAE							
Subfamilia Teclinae							
<i>Arawacus dolyas</i> (Cramer, 1777)	2					2	E
<i>Arawacus togarna</i> (Hewitson, 1867)	3					3	E
<i>Calycopsis</i> sp.	2		1			3	E
<i>Ocaria aholiba</i> (Hewitson, 1867)			1			1	R
<i>Theritas</i> sp.			2	1		3	E

Subfamilia Popylommatinae							
<i>Hemiargus hanno</i> (Stoll, [1790])		2		1		3	E
<i>Leptotes cassius</i> (Cramer, 1775)		2				2	E
<i>Zizula cyna</i> (Edwards, 1881)	2					2	E
FAMILIA RIODINIDAE							
Subfamilia Riodininae							
<i>Charis anius</i> (Cramer, 1776)	2					2	E
<i>Juditha molpe</i> (Hübner, [1808])	3					3	E
<i>Parcela amarynthina</i> (C. & R. Felder, 1865)		1				1	R
<i>Mesosemia mevania</i> Hewitson, [1857]				4		4	E
FAMILIA NYMPHALIDAE							
Subfamilia Danainae							
<i>Danaus plexippus megalippe</i> (Hübner, [1826])		1	1			2	E
<i>Dircenna jemina</i> (Geyer, [1837])				1		1	R
<i>Episcada polita</i> Weymer, 1899				1		1	R
<i>Episcada salvinia apia</i> (C. & R. Felder, 1865)				1		1	R
<i>Greta andromica</i> (Hewitson, [1855])				2		2	E
<i>Ithomia iphianassa</i> Doubleday, 1847		2				2	E
<i>Ithomia terra</i> Hewitson, [1853]				1		1	R
<i>Mechanitis menapis occasiva</i> Fox, 1967	4	4				8	C
<i>Oleria amalda</i> (Hewitson, [1857])	1					1	R
<i>Oleria padilla</i> (Hewitson, 1863)				3		3	E
<i>Oleria victorine</i> (Guérin-Ménéville, [1844])		2				2	E
<i>Pagyris cymothoe</i> (Hewitson, [1855])		3				3	E
<i>Pteronymia latilla</i> (Hewitson, [1855])	1					1	R
Subfamilia Heliconiinae							
<i>Abananote hylonome</i> (Doubleday, 1844)			3			3	E
<i>Actinote parapheles</i> Jordan, 1913		1				1	R
<i>Altinote callianthe</i> (C. & R. Felder, 1862)			1			1	R
<i>Altinote trinacria</i> (C. & R. Felder, 1862)			1			1	R
<i>Dione glycera</i> (C. & R. Felder, 1861)			2			2	E
<i>Dione juno</i> (Cramer, 1779)		2				2	E
<i>Dryas iulia</i> (Fabricius, 1775)	1					1	R
<i>Eueides procula edias</i> Hewitson, 1861				1		1	R
<i>Euptoieta bogotana</i> Staudinger, 1885					1	1	R
<i>Heliconius charitonia</i> (Linnaeus, 1767)	1	2				3	E
<i>Heliconius clysonimus</i> Latreille, [1817]				1		1	R
<i>Heliconius erato</i> (Linnaeus, 1758)	1					1	R
<i>Heliconius sara</i> Fabricius, 1793	4					4	E
Subfamilia Lymenitidinae							
<i>Adelpha alala completa</i> Fruhstorfer, 1907			1			1	R
<i>Adelpha seriphia aquillia</i> Fruhstorfer, 1915			1			1	R
Subfamilia Biblidinae							
<i>Biblis hyperia</i> (Cramer, 1779)		3				3	E
<i>Diaethria clymena dodone</i> (Guenée, 1872)		2		1		3	E
<i>Dynamine artemisia</i> (Fabricius, 1793)		6	1			7	C
<i>Dynamine theseus</i> (C. & R. Felder, 1861)		4				4	E
<i>Mestra hersilia hypermestra</i> Hübner, [1825]		1				1	R
<i>Nica flavilla</i> (Godart, [1824])	1					1	R
<i>Pyrrhogyra neaerea kheili</i> Fruhstorfer, 1908	1					1	R
Subfamilia Cyrestinae							
<i>Marpesia zerynthia</i> Hübner, [1823]		1				1	R
Subfamilia Nymphalinae							
<i>Anartia amathea</i> (Linnaeus, 1758)	3	2				5	E

<i>Anartia jatrophae</i> (Linnaeus, 1763)	2					2	E
<i>Anthanassa drusilla</i> (C. & R. Felder, 1861)		2				2	E
<i>Colobura dirce</i> (Linnaeus, 1758)	1					1	R
<i>Eresia ithomioides anomala</i> Higgins, 1981				1		1	R
<i>Eresia polina</i> Hewitson, 1852		1				1	R
<i>Historis odius</i> (Fabricius, 1775)	1	1				2	E
<i>Hypanartia lethe</i> (Fabricius, 1793)				1		1	E
<i>Junonia evarete</i> (Cramer, 1779)	3			1		4	E
<i>Tegosa anieta</i> (Hewitson, 1852)	2	1		1		4	E
<i>Vanessa braziliensis</i> (Moore, 1883)			2	1		3	E
Subfamilia Charaxinae							
<i>Consul panariste</i> (Hewitson, 1856)		1				1	R
Subfamilia Satyrinae							
<i>Altopedaliodes kruegeri</i> Pycrz, 1995			10	10	3	23	A
<i>Cissia proba</i> (Weymer, 1911)	1					1	R
<i>Cissia terrestris</i> (Butler, 1867)	1	1		4		6	C
<i>Euptychoides griphe</i> (C. & R. Felder, 1867)			6	1		7	C
<i>Euptychoides saturnus</i> (Butler, 1867)				1		1	R
<i>Hermeuptychia hermes</i> (Fabricius, 1775)	3		1	4		8	C
<i>Idioneurula erebioides</i> (C. & R. Felder, 1867)					2	2	E
<i>Idioneurula socorro</i> Villalobos-M. & Salazar, 2013					6	6	C
<i>Idioneurula jacquelineae</i> Pycrz, 1995			3			3	E
<i>Lastiphila circe</i> C. & R. Felder, 1861					2	2	E
<i>Magneuptychia libye</i> (Linnaeus, 1767)	3					3	E
<i>Morpho helenor peleides</i> Kollar, 1850		2				2	E
<i>Mygona irmina</i> (Doubleday, [1849])				2		2	E
<i>Oressinoma typhla</i> Doubleday, [1849]			2	8		10	C
<i>Pareuptychia hesionides</i> Forster, 1964	4	3				7	C
<i>Pareuptychia ocirrhoe</i> (Fabricius, 1776)	2					2	E
<i>Pedaliodes plotina</i> (Hewitson, 1862)				2		2	E
<i>Pronophila unifasciata bogotensis</i> Jurriaanse, 1926			3			3	E
<i>Pr. unifasciata donachui</i> Adams & Bernard, 1977			1			1	R

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Materials on the Lepidoptera fauna of the Dagestan Republic (Northeastern Caucasus, Russia): autumn aspect (Insecta: Lepidoptera)

P. Ya. Ustjuzhanin, A. A. Teimurov, V. V. Anikin, A. Yu. Matov,
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Abstract

The article provides the list of Lepidoptera (the families: Cossidae, Coleophoridae, Choreutidae, Ethmiidae, Pterophoridae, Pyralidae, Crambidae, Lemoniidae, Lasiocampidae, Drepanidae, Geometridae, Sphingidae, Erebidae, Noctuidae, Lycaenidae, Nymphalidae, Pieridae), collected in four localities in the Republic of Dagestan in September 2020. In total, 207 species have been recorded. Five species are reported for the fauna of Russia for the first time: *Casignetella texanella* (Chambers, 1878) (Coleophoridae), *Agriphila cyrenaicellus* (Ragonot, 1887), *Thyridiphora furia* (Swinhoe, 1884), *Haritalodes derogata* (Fabricius, 1775) (Crambidae), and *Scopula minorata* (Boisduval, 1833) (Geometridae); 23 species - for the fauna of Eastern Caucasus: *Perygra glaucicolella* (Wood, 1892), *Ecebalia halophilella* (Zimmermann, 1926), *E. linosyris* (E. Hering, 1937), *Ionescumia clypeiferella* (O. Hofmann, 1871), *Carpochea trientella* (Christoph, 1872) (Coleophoridae), *Tebenna micalis* (Mann, 1857) (Choreutidae), *Ethmia candidella* (Alpheraky, 1908) (Ethmiidae), *Stenoptilia zophodactyla* (Duponchel, 1838), *Stenoptilodes taprobanes* (Felder & Rogenhofer, 1875), *Crombrugghia laetus* (Zeller, 1847) (Pterophoridae), *Glyptoteles leucacrinella* Zeller, 1848, *Cadra calidella* (Guenée, 1845), (Pyralidae), *Agriphila selasella* (Hübner, 1813), *Agriphila tolli* (Błeszyński, 1952), *Agriphila poliellus* (Treitschke, 1832), *Pediasia contaminella* (Hübner, 1796), *Pediasia fascelinella* (Hübner, [1813]), *Uresiphita gilvata* (Fabricius, 1794), *Antigastra catalaunalis* (Duponchel, 1833) (Crambidae), *Watsonalla binaria* (Hufnagel, 1767) (Drepanidae), *Idaea degeneraria erschoffi* (Christoph, 1872), *Scopula nigropunctata* (Hufnagel, 1767), and *Rhodometra sacraria* (Linnaeus, 1767) (Geometridae).

KEY WORDS: Insecta, Lepidoptera, biodiversity, faunistic record, species richest, Caspian basin, Dagestan State Reserve, Russia.

Materiales sobre la fauna de Lepidoptera de la República de Dagestán (noreste del Cáucaso, Rusia): aspecto otoñal (Insecta: Lepidoptera)

Resumen

El artículo proporciona la lista de Lepidoptera (las familias: Cossidae, Coleophoridae, Choreutidae, Ethmiidae, Pterophoridae, Pyralidae, Crambidae, Lemoniidae, Lasiocampidae, Drepanidae, Geometridae, Sphingidae, Erebidae, Noctuidae, Lycaenidae, Nymphalidae, Pieridae), colectadas en cuatro localidades en la República de Dagestán en septiembre de 2020. En total, 207 especies han sido registradas. Por primera vez, cinco especies son registradas para la fauna de Rusia: *Casignetella texanella* (Chambers, 1878) (Coleophoridae), *Agriphila cyrenaicellus* (Ragonot, 1887), *Thyridiphora furia* (Swinhoe, 1884), *Haritalodes derogata* (Fabricius, 1775) (Crambidae) y *Scopula minorata* (Boisduval, 1833) (Geometridae); 23 especies - para la fauna de este del Cáucaso: *Perygra glaucicolella*

(Wood, 1892), *Ecebalia halophilella* (Zimmermann, 1926), *E. linosyris* (E. Hering, 1937), *Ionescumia clypeiferella* (O. Hofmann, 1871), *Carpochena trientella* (Christoph, 1872) (Coleophoridae), *Tebenna micalis* (Mann, 1857) (Choreutidae), *Ethmia candidella* (Alpheraky, 1908) (Ethmiidae), *Stenoptilia zophodactyla* (Duponchel, 1838), *Stenoptilodes taprobanes* (Felder & Rogenhofer, 1875), *Crombrugghia laetus* (Zeller, 1847) (Pterophoridae), *Glyptoteles leucacrinella* Zeller, 1848, *Cadra calidella* (Guenée, 1845), (Pyralidae), *Agriphila selasella* (Hübner, [1813]), *Agriphila tolli* (Bleszyński, 1952), *Agriphila poliellus* (Treitschke, 1832), *Pediasia contaminella* (Hübner, 1796), *Pediasia fascelinella* (Hübner, [1813]), *Uresiphita gilvata* (Fabricius, 1794), *Antigastra catalaunalis* (Duponchel, 1833) (Crambidae), *Watsonalla binaria* (Hufnagel, 1767) (Drepanidae), *Idaea degeneraria erschoffi* (Christoph, 1872), *Scopula nigropunctata* (Hufnagel, 1767) y *Rhodometra sacraria* (Linnaeus, 1767) (Geometridae).

PALABRAS CLAVE: Insecta, Lepidoptera, biodiversidad, registros faunísticos, riqueza de especies, cuenca del Caspio, Reserva Estatal de Dagestán, Rusia.

Introduction

The Lepidoptera of the Russian part of Caucasus are studied fragmentary. With a relatively good study of the western part of the Caucasus (the Black Sea), the Central and Eastern Caucasus are very poorly studied. The information on the Republics of North Ossetia, Ingushetia, Chechnya is very fragmentary. A little better is the situation on the Lepidoptera fauna in the Republic of Dagestan, but it is still impossible to say that it has been studied sufficiently. In the Catalog of Lepidoptera of Russia (ANIKIN *et al.*, 2019), the Caucasus was divided into two sub-regions: the West Caucasian region (region No. 13), including the Krasnodar and Stavropol Territories, the Republic of Adygea, Kabardino-Balkaria, Karachay-Cherkesskaya, North Ossetia-Alania, Ingushetia and the East Caucasian region (region # 14), including the Chechen Republic and the Republic of Dagestan. For the West Caucasian region, 2811 species of Lepidoptera are given, and for the East Caucasian region - 2112 species.

The format of this work does not provide the inclusion of a full essay on the history of the study of Lepidoptera in Dagestan; therefore, we will focus only on the main publications.

The fauna of Lepidoptera in the East Caucasian region is the best studied in the Republic of Dagestan (Figs 1-2). Traditionally, the best studied are Papilionoidea. A near-exhaustive essay on the history of study on Papilionoidea of Dagestan with a full bibliography is given on the website Butterflies of Caucasus (TIKHONOV *et al.*, 2021). Detailed data on the faunistics of Papilionoidea in Dagestan are provided on this website and in recent publications (ILYINA & MORGUN, 2010, 2011; TSHIKOLOVETS & NEKRUTENKO, 2012).

The study of moths, first of all, can be associated with the activity of the outstanding Russian entomologist M. A. Ryabov, who lived in Makhachkala from 1924 to 1925 and from 1933 to 1952. Although he did not publish a large number of works, he collected significant materials in various parts of Dagestan. Additionally, A. K. Zagulyaev collected a lot of specimens, mostly Microlepidoptera, in the vicinity of the village Kurush (1990).

In recent years, large materials have been collected in Dagestan by the entomologists V. Tikhonov (Pyatigorsk), E. Ilyina (Makhachkala), V. Kovtunovich and D. Morgun (Moscow), etc. The information obtained by these researchers has been published in a large number of different taxonomic and faunistic summaries on different groups of Lepidoptera (POLTAVSKY & ILYINA, 2002, 2003; KOVTUNOVICH, 2006; ILYINA *et al.*, 2012; YAKOVLEV *et al.*, 2015; LEILEI, 2016; SINEV, 2019; DUBATOLOV *et al.*, 2021).

Material and methods

COLLECTING LOCALITIES

1. RUSSIA, Dagestan Rep., Dagestan Reserve, Kumtor-Kale Station, Sary-Kum dune, 43° 00' 14" N / 47° 14' 1" E, 60 m, 21-22-IX-2020 and 30-IX-2020, P. Ya. Ustjuzhanin & R.V. Yakovlev leg. (locality 1, Fig. 3).

2. RUSSIA, Dagestan Rep., Dagestan Reserve, Magaramkent distr., Samur Forest, 41° 52' 0" N / 48° 33' 23" E, - 20 m, 23-24-IX-2020, P. Ya. Ustjuzhanin & R. V. Yakovlev leg. (locality 2, Fig. 4).
3. RUSSIA, Dagestan Rep., Tabasaran distr., 5 km W Sirtych vill., 41° 48' 6" N / 48° 10' 31" E, 200 m, 25-IX-2020, P. Ya. Ustjuzhanin & R.V. Yakovlev leg. (locality 3, Fig. 5).
4. RUSSIA, Dagestan Rep., 12 km SE Novokayakent, 42° 20' 21" N / 48° 4' 9" E, -10 m, 26-28-IX-2020, P. Ya. Ustjuzhanin & R.V. Yakovlev leg. (locality 4, Fig. 6).

HABITATS DESCRIPTIONS

Locality 1. Sarykum

The highest (about 250 m above sea level) central portion of the eolian-accumulative complex "Sarykum", divided by the Shura-Ozen river into two unequal halves - the left bank Big (Western) and the right bank Small (Eastern) Sarykums - is occupied with blown sands. In geomorphological terms, they represent a system of dunes with a south-west-north-east orientation, with length from 300-400 m to 1200 m (IDRISOV, 2010; GUSAROV, 2015). This system of dune-ridge sands is surrounded by a complex of semi-fixed hilly-cellular sands, which, in turn, smoothly turn into flat surfaces.

The vascular plants flora of Sarykum according to ADZHIEVA (2015) includes 438 species belonging to 279 genera and 74 families.

In botanical terms, it is of interest to find a number of psammophilic species in the flora of Sarykum (*Astragalus lehmannianus* Bunge, *A. karakugensis* Bunge, *Eremosparton aphyllum* (Pall.) Fisch. et C. A. Mey. (Fabaceae), *Calligonum aphyllum* (Pall.) Gurke. (Polygonaceae), the main part of the range of which is confined to the Central Asian deserts (MAIOROV, 1928; ABACHEV, 1995; ADZHIEVA, 2007).

In the crest of the dunes, where the sandy substrate is in constant motion, there are no plants. In areas with less mobile sands, along with the Central Asian species mentioned above, shrubs are observed: *Artemisia procera* Willd., *A. tschernieviana* Bess., *Senecio schischkinianus* Sof. (Asteraceae), *Corispermum aralo-caspicum* Iljin (Amaranthaceae), *Leymus racemosus* (Lam.) Tzvelev. (Poaceae).

Down the slope, where the eolian activity of sand is significantly reduced, along with an increase in the species diversity, the projective cover also increases. On slopes of different exposure and steepness, various associations of semi-desert and dry-steppe vegetation can be found.

The natural picture of vegetation is disturbed by artificial planting of trees and shrubs (*Sophora japonica* L., *Amorpha fruticosa* L., *Gleditschia triacanthos* L., *Robinia pseudoacacia* L. (Fabaceae), *Ailanthus altissima* (Mill.) Swingle (Simaroubaceae), *Armeniaca vulgaris* L., and *Morus nigra* Lam. (Rosaceae) along the railway, protecting it from sand drifts.

Locality 2. Samur Forest

In the Samur delta ecosystem, we observe a complex combination of plant communities, in terms of the area they are dominated by forests of temperate subtropical appearance, with a characteristic abundance of lianas: *Vitis sylvestris* S.G. Gmel. (Vitaceae), *Smilax excelsa* L. (Smilicaceae), *Hedera pastuchowii* Woronow (Araliaceae), *Periploca graeca* L. (Apocynaceae), *Lonicera caprifolium* L. (Caprifoliaceae), *Clematis vitalba* L. (Ranunculaceae), etc. Samur forests are a complex of trees of *Populus* L. (Salicaceae), *Quercus* L. (Fagaceae), *Alnus* Mill. and *Caprinus* L. (Betulaceae), previously covering almost the entire area of the delta with a continuous massif. Currently, large areas are occupied by artificial plantations of *Juglans regia* L. (Juglandaceae), *Robinia* L. and *Gleditsia* J. Clayton (Fabaceae), and *Pinus* L. (Pinaceae). The associated tree species include *Fraxinus excelsior* (Oleaceae), three species of maple (*Acer campestre* L., *A. platanoides* L., *A. laetum* C.A. Mey.) (Sapindaceae), several species of the genus *Salix* L. (Salicaceae), *Pyrus caucasica* Browicz (Rosaceae), *Tilia begoniifolia* Steven (Malvaceae), etc.

The common species of the underbrush are: *Crataegus* Tourn. ex L., *Mespilus germanica* L.

(Rosaceae), *Corylus avellana* L. (Betulaceae), *Euonymus verrucosa* Scop. (Celastraceae), *Swida australis* (C.A. Mey.) Pojark. ex Grossh. (Cornaceae), *Viburnum opulus* L. (Adoxaceae), *Frangula alnus* Mill. (Rhamnaceae), etc. (Rhamnaceae), etc.

In open spaces, there are areas with cereal-wormwood vegetation. On the coastal sands, sparse psammophytic plant complexes are found. Meadow vegetation occurs in the form of disseminations in the forest areas and is confined mainly to the coastal strip of branches. Along the coast of the sea, in shallow lagoon waters and in artificial reservoirs, meadow-bog vegetation has formed with the predominance of *Phragmites* (Poaceae), *Thypha* (Thyphaceae), and *Carex* (Cyperaceae).

The most striking characteristic feature of the Samur delta forests is the continuous and very dynamic successional processes that support the existence of various forest communities, with regular changes from one forest type to another (NOVIKOVA & POLYANSKAYA, 1994). The spatio-temporal changes in moisture supply conditions caused by seasonal floods, fluctuations in the water content of branches and the restructuring of the main watercourses in the delta are the direct cause of changes in the plant complexes accompanying the evolutionary development of the deltaic landscapes.

Locality 3. Sirtych

It is dominated by wormwood-saltwort semi-shrub and small-shrub communities, the species composition of which varies depending on the exposure and steepness of the slope. The main factor determining the species diversity is the degree and nature of soil salinization.

The projective cover ranges from 20 to 70%. We have noted *Artemisia* L. (Asteraceae) with *Halothamnus glaucus* (M. Bieb.) Botsch., *Climacoptera crassa* M. Bieb.) Botsch., *Salsola soda* L., *S. ericoides* M. Bieb., *Kalidium foliatum* (Pall.) Moq., *Petrosimonia oppositifolia* (Pall.) Litv. (Amaranthaceae).

Locality 4. Novokayakent

The natural landscape in the area of Lake Adzhi-Papas is formed by a massif of poorly fixed shallow sands with sandy loam and clay loamy takyr-like depressions. About 50-55% of this area is occupied by arable lands.

Of the natural vegetation, predominantly semi-desert areas (mostly with excessive soil salinity) and fragmented tree and shrub vegetation have been preserved here. *Festuca valesiaca* Gaudin, *Poa bulbosa* L., *Bromus squarrosus* L., *Elytrigia trichophora* (Link) Nevski, *Cynodon dactylon* (L.) Pers., *Agropyron cristatum* (L.) Gaertn. (Poaceae), *Artemisia austriaca* Jacq., *A. monogyna* Waldst. et Kit., and *A. lercheana* Weber ex Stechm. (Asteraceae) are characteristic of the area. On highly saline soils, halophilic species prevail, such as *Salsola dendroides* Pall., *S. laricina* Pall., *Kochia prostrata* (S.G.Gmel.) Borb., *Suaeda physophora* Pall., *Halimione verrucifera* (Bieb.) Aell., *Camphorosma lessingii* Litv., *Petrosimonia brachiata* (Pall.) Bunge (Amaranthaceae), *Limonium meyeri* (Boiss.) O. Kuntze (Limoniaceae), *Puccinellia gigantea* (Grossh.) Grossh. (Poaceae), and *Tamarix amosissima* Ledeb. (Tamaricaceae). The sandy massifs and the coastal strip are characterized by psammophytic and littoral vegetation of *Convolvulus persicus* L. (Convolvulaceae), *Cakile euxina* Pobed. (Brassicaceae), *Argusia sibirica* (L.) Dandy (Boraginaceae), *Artemisia procera* Willd. (Asteraceae), *Anisantha tectorum* (L.) Nevski, *Leymus racemosus* (Lam.) Tzvelev (Poaceae) and others, among which there are shrubs of *Elaeagnus angustifolia* L. (Elaeagnaceae). In some places, as a result of overgrazing, siblijak thickets are formed from species of *Crataegus* (Rosaceae) with participation of *Paliurus spina-christi* Mill. and *Rhamnus pallasii* Fisch. et C.A. Mey. (Rhamnaceae).

Collecting methods

1. Collecting with butterfly net at different times of the day and night.
2. Collecting at light (we used autonomous LED light traps and a DRV-250W lamp).

Determination and nomenclature

In the presented list of species, the genus names are placed as in the second edition of the

“Catalogue of the Lepidoptera of Russia” (ANIKIN *et al.*, 2019). All definitions are made from the genital structures of the species according to the standard method (ROBINSON, 1976).

Results

SPECIES LIST

(* new for Eastern Caucasus; ** new for Russia; + - collecting in the locality; - - not collecting in the locality)

Taxa	localities			
	1	2	3	4
Cossidae				
<i>Phragmataecia castaneae</i> (Hübner, 1790)	-	+	-	+
Coleophoridae				
* <i>Perygra glaucicolella</i> (Wood, 1892)	-	+	-	-
* <i>Ecebalia halophilella</i> (Zimmermann, 1926)	-	+	-	+
* <i>Ecebalia linosyris</i> (E. Hering, 1937)	-	+	-	+
** <i>Casignetella texanella</i> (Chambers, 1878)	+	+	-	-
* <i>Ionescumia clypeiferella</i> (O. Hofmann, 1871)	+	-	-	-
* <i>Carpochena trientella</i> (Christoph, 1872)	+	+	-	-
Choreutidae				
* <i>Tebenna micalis</i> (Mann, 1857)	+	+	-	-
Ethmiidae				
* <i>Ethmia candidella</i> (Alpheraky, 1908)	+	-	-	+
<i>Ethmia bipunctella</i> (Fabricius, 1775)	+	-	-	-
Pterophoridae				
<i>Agdistis adactyla</i> (Hübner, [1823])	-	+	-	-
<i>Agdistis frankeniae</i> (Zeller, 1847)	-	-	-	+
<i>Agdistis intermedia</i> Caradja, 1920	-	-	-	+
<i>Agdistis tamaricis</i> (Zeller, 1847)	-	+	-	-
* <i>Stenoptilia zophodactyla</i> (Duponchel, 1838)	-	+	-	-
* <i>Stenoptilodes taprobanes</i> (Felder & Rogenhofer, 1875)	-	+	-	+
<i>Capperia maratonica</i> Adamczewski, 1951	+	-	-	-
* <i>Crombrugghia laetus</i> (Zeller, 1847)	+	-	-	-
<i>Emmelina monodactyla</i> (Linnaeus, 1758)	+	-	-	-
<i>Wheeleria obsoleta</i> (Zeller, 1841)	-	-	-	+
<i>Tabulaeophorus marptys</i> (Christoph, 1873)	+	-	-	-
<i>Pterophorus ischnodactyla</i> (Treitschke, 1833)	-	+	-	-
Pyralidae				
<i>Endotricha flammealis</i> ([Denis & Schiffermüller], 1775)	-	+	-	-
<i>Hypsopygia (Hypsopygia) costalis</i> (Fabricius, 1775)	-	+	-	-
<i>Hypsopygia (Ocrasa) glaucinalis</i> (Linnaeus, 1758)	-	+	-	-
<i>Pyralis kacheticalis</i> (Christoph, 1893)	-	+	+	-
<i>Oncocera semirubella</i> (Scopoli, 1763)	-	+	-	-
<i>Acrobasis tumidana</i> ([Denis & Schiffermüller], 1775)	-	+	-	-
<i>Acrobasis advenella</i> (Zincken, 1818)	-	+	-	-
* <i>Glyptoteles leucacrinella</i> Zeller, 1848	-	+	-	-
<i>Bradyrrhoa gilveolella</i> (Treitschke, 1832)	-	+	-	+

<i>Isauria dilucidella</i> (Duponchel, 1836)	-	+	-	-
<i>Gymnancyla hornigii</i> (Lederer, 1852)	-	+	-	-
<i>Nyctegretis lineana</i> (Scopoli, 1786)	-	-	+	-
<i>Ancylosis oblitella</i> (Zeller, 1848)	-	+	-	+
* <i>Cadra calidella</i> (Guenée, 1845)	-	+	-	-
<i>Cadra furcatella</i> (Herrich-Schäffer, 1849)	-	+	-	-
<i>Coenochroa ablutella</i> (Zeller, 1839)	-	+	-	-
Crambidae				
<i>Chilo phragmitellus</i> (Hübner, [1805])	-	+	-	-
<i>Calamotropha paludella</i> (Hübner, [1824])	-	+	-	-
<i>Euchromius ocella</i> (Haworth, 1811)	+	+	-	+
<i>Agriphila deliella</i> (Hübner, [1813])	-	+	-	+
* <i>Agriphila selasella</i> (Hübner, [1813])	-	+	-	+
** <i>Agriphila cyrenaicellus</i> (Ragonot, 1887)	-	+	-	+
<i>Agriphila tersellus</i> (Lederer, 1855)	-	+	-	
* <i>Agriphila tolli</i> (Bleszyński, 1952)	-	+	-	+
<i>Agriphila tristella</i> ([Denis & Schiffermüller], 1775)	+	+	-	+
* <i>Agriphila poliellus</i> (Treitschke, 1832)	-	+	-	-
* <i>Pediasia contaminella</i> (Hübner, 1796)	-	+	-	+
* <i>Pediasia fascelinella</i> (Hübner, [1813])	+	-	-	-
<i>Pediasia matricella</i> (Treitschke, 1832)	+	+	-	+
<i>Ancylolomia palpella</i> ([Denis & Schiffermüller], 1775)	-	+	-	+
** <i>Thyridiphora furia</i> (Swinhoe, 1884)	-	+	-	+
<i>Parapoynx stratiotata</i> (Linnaeus, 1758)	-	+	+	+
<i>Cynaeda dentalis</i> ([Denis & Schiffermüller], 1775)	-	+	-	+
<i>Tegostoma comparalis</i> (Hübner, 1796)	-	+	-	-
<i>Hellula undalis</i> (Fabricius, 1781)	+	+	-	-
<i>Loxostege sticticalis</i> (Linnaeus, 1761)	-	+	+	-
<i>Pyrausta aurata</i> (Scopoli, 1763)	-	+	-	+
<i>Pyrausta despicata</i> (Scopoli, 1763)	-	+	-	+
* <i>Uresiphita gilvata</i> (Fabricius, 1794)	-	+	-	-
<i>Euclasta splendidalis</i> (Herrich-Schäffer, 1848)	-	+	-	-
<i>Anania verbascalis</i> ([Denis & Schiffermüller], 1775)	-	+	-	-
<i>Patania ruralis</i> (Scopoli, 1763)	-	+	-	-
** <i>Haritalodes derogata</i> (Fabricius, 1775)	-	+	-	-
<i>Diasemia reticularis</i> (Linnaeus, 1761)	-	+	-	-
<i>Spoladea recurvalis</i> (Fabricius, 1775)	-	+	-	-
<i>Udea ferrugalis</i> (Hübner, 1796)	-	+	+	+
<i>Nomophila noctuella</i> ([Denis & Schiffermüller], 1775)	-	+	-	+
<i>Cydalima perspectalis</i> (Walker, 1859)	-	-	-	+
<i>Dolicharthria punctalis</i> ([Denis & Schiffermüller], 1775)	-	+	+	+
* <i>Antigastra catalaunalis</i> (Duponchel, 1833)	-	+	-	-
<i>Glyphodes pyloalis</i> Walker, 1859	-	+	-	-
Lemoniidae				
<i>Lemonia balcanica</i> (Herrich-Schäffer, 1847)	+	-	-	-
Lasiocampidae				
<i>Pachygastris trifolii</i> ([Denis & Schiffermüller], 1775)	-	+	-	-
Drepanidae				
* <i>Watsonalla binaria</i> (Hufnagel, 1767)	-	+	-	-

<i>Habrosyne pyritoides</i> (Hufnagel, 1766)	-	+	-	-
Geometridae				
<i>Erannis defoliaria</i> (Clerck, 1759)	-	-	+	
<i>Biston betularia</i> (Linnaeus, 1758)	-	+	-	-
<i>Peribatodes rhomboidaria</i> ([Denis & Schiffermüller], 1775)	+	+	-	-
<i>Eumannia oppositaria</i> (Mann, 1864)	-	+	-	-
<i>Odontognophos zacharia</i> (Staudinger, 1879)	+	-	+	-
<i>Thetidia smaragdaria</i> (Fabricius, 1787)	-	-	+	+
<i>Hemithea aestivaria</i> (Hübner, [1799])	-	+	-	-
<i>Microloxia herbaria</i> (Hübner, [1813])	-	-	+	+
* <i>Idaea degeneraria erschoffi</i> (Christoph, 1872)	+	+	+	-
<i>Idaea dimidiata</i> (Hufnagel, 1767)	-	+	-	-
<i>Idaea camparia</i> (Herrich-Schäffer, 1852)	+	-	-	-
<i>Idaea elongaria</i> (Rambur, 1833)	+	-	-	-
<i>Idaea rusticata</i> ([Denis & Schiffermüller], 1775)	+	-	-	-
<i>Idaea subsericeata</i> (Haworth, 1809)	-	+	-	-
* <i>Scopula nigropunctata</i> (Hufnagel, 1767)	+	+	-	-
** <i>Scopula minorata</i> (Boisduval, 1833)	-	+	+	-
<i>Scopula marginepunctata</i> (Goeze, 1781)	+	+	-	-
<i>Scopula ochraceata</i> (Staudinger, 1901)	+	+	-	-
<i>Scopula ornata</i> (Scopoli, 1763)	-	+	-	-
<i>Cyclophora annularia</i> (Fabricius, 1775)	-	+	-	-
<i>Cyclophora punctaria fritzae</i> Hausmann, 2003	+	-	-	-
* <i>Rhodometra sacraria</i> (Linnaeus, 1767)	+	+	-	+
<i>Casilda antophillaria</i> (Hübner, [1813])	-	-	+	-
<i>Orthonama obstipata</i> (Fabricius, 1794)	-	+	-	-
<i>Xanthorhoe fluctuata</i> (Linnaeus, 1758)	+	+	-	-
<i>Camptogramma bilineata</i> (Linnaeus, 1758)	+	+	-	+
<i>Costaconvexa polygrammata</i> (Borkhausen, 1794)	-	-	+	+
<i>Epirrhoe rivata</i> (Hübner, [1813])	-	+	-	-
<i>Pelurga comitata</i> (Linnaeus, 1758)	-	+	-	-
<i>Gymnoscelis rufifasciata</i> (Haworth, 1809)	-	+	-	-
<i>Eupithecia ochridata</i> Schütze & Pinker, 1968	+	+	+	+
<i>Eupithecia variostrigata</i> Alphéraky, 1876	+	+	+	+
Sphingidae				
<i>Laothoe populi</i> (Linnaeus, 1758)	-	+	-	-
<i>Agrilus convolvuli</i> (Linnaeus, 1758)	+	-	-	-
<i>Macroglossum stellatarum</i> (Linnaeus, 1758)	+	-	-	-
<i>Hyles euphorbiae</i> (Linnaeus, 1758)	-	+	-	-
Lycaenidae				
<i>Aricia agestis</i> ([Denis & Schiffermüller], 1775)	+	-	-	-
<i>Lycaena phlaeas</i> (Linnaeus, 1761)	+	-	+	-
<i>Polyommatus icarus</i> (Rottemburg, 1775)	+	+	+	+
Pieridae				
<i>Pieris brassicae</i> (Linnaeus, 1758)	+	-	-	-
<i>Pieris rapae</i> (Linnaeus, 1758)	+	-	-	-
<i>Colias croceus</i> (Geoffroy, 1785)	+	-	-	-
<i>Colias erate</i> Esper, 1805	+	-	-	+

Nymphalidae				
<i>Argynnis pandora</i> ([Denis & Schiffermüller], 1775)	+	-	-	-
<i>Danaus chrysippus</i> (Linnaeus, 1758)	+	-	-	-
Satyridae				
<i>Pararge aegeria</i> (Linnaeus, 1758)	-	+	-	-
<i>Hipparchia autonoe</i> (Esper, 1783)	+	-	-	-
Erebidae				
<i>Paracolax tristalis</i> (Fabricius, 1794)	-	+	-	-
<i>Herminia tarsicrinalis</i> (Knoch, 1782)	-	+	-	-
<i>Zanclognatha lunalis</i> (Scopoli, 1763)	-	+	-	-
<i>Pechipogo plumigeralis</i> (Hübner, [1825])	-	+	-	-
<i>Rivula sericealis</i> (Scopoli, 1763)	-	+	-	-
<i>Eublemma amoena</i> (Hübner, [1803])	+	-	-	-
<i>Eublemma ostrina</i> (Hübner, 1790)	-	+	-	-
<i>Eublemma parva</i> (Hübner, [1808])	-	-	+	-
<i>Eublemma purpurina</i> ([Denis & Schiffermüller], 1775)	+	-	-	-
<i>Catocala deducta</i> (Esper, 1787)	-	+	-	-
<i>Drasteria herzi</i> (Alphéraky, 1892)	-	-	+	-
<i>Dysgonia rogenhoferi</i> (Bohatsch, 1880)	+	-	-	-
<i>Grammodes bifasciata</i> (Petagna, 1787)	-	+	-	-
<i>Grammodes stolidia</i> (Fabricius, 1775)	+	+	-	-
<i>Lygephila cracca</i> ([Denis & Schiffermüller], 1775)	-	+	-	-
<i>Cymbalophora rivularis</i> (Ménétriés, 1832)	+	-	+	+
<i>Utetheisa pulchella</i> (Linnaeus, 1758)	+	-	-	-
<i>Katha depressa</i> (Esper, 1787)	-	+	-	-
<i>Manulea complana</i> (Linnaeus, 1758)	+	+	+	-
<i>Manulea pygmaeola</i> (Doubleday, 1847)	+	-	-	-
<i>Pelosia muscerda</i> (Hufnagel, 1766)	-	+	+	-
<i>Lithosia quadra</i> (Linnaeus, 1758)	+	+	-	-
<i>Dysauxes famula</i> (Freyer, 1836)	+	+	-	-
<i>Orgyia antiqua</i> (Linnaeus, 1758)	-	+	-	-
Noctuidae				
<i>Chrysodeixis chalcites</i> (Esper, 1789)	-	-	+	-
<i>Macdunnoughia confusa</i> (Stephens, 1850)	-	-	+	-
<i>Autographa gamma</i> (Linnaeus, 1758)	+	-	+	+
<i>Mycteropus puniceago</i> (Boisduval, 1840)	-	-	-	+
<i>Sympistis nigricula</i> (Eversmann, 1847)	+	-	-	-
<i>Amphipyra pyramidea</i> (Linnaeus, 1758)	-	+	-	-
<i>Heliothis peltigera</i> ([Denis & Schiffermüller], 1775)	+	-	+	-
<i>Helicoverpa armigera</i> (Hübner, [1808])	+	-	-	-
<i>Spodoptera exigua</i> (Hübner, [1808])	+	-	+	+
<i>Caradrina kadenii</i> Freyer, 1836	-	+	-	-
<i>Hoplodrina ambigua</i> ([Denis & Schiffermüller], 1775)	+	+	-	+
<i>Athetis furvula</i> (Hübner, [1808])	-	-	+	-
<i>Athetis lepigone</i> (Möschler, 1860)	-	+	-	-
<i>Mormo maura</i> (Linnaeus, 1758)	-	+	-	-
<i>Thalpophila matura</i> (Hufnagel, 1766)	-	+	-	-
<i>Phlogophora meticulosa</i> (Linnaeus, 1758)	+	-	-	-
<i>Auchmis detera</i> (Esper, 1787)	-	-	+	-

<i>Luperina rjabovi</i> Kljutschko, 1967	-	+	-	+
<i>Rhizedra lutos</i> (Hübner, [1803])	+	-	-	-
<i>Apamea monoglypha</i> (Hufnagel, 1766)	-	-	+	-
<i>Apamea oblonga</i> (Haworth, 1809)	+	-	-	-
<i>Cirrhia gilvago</i> ([Denis & Schiffermüller], 1775)	-	+	-	-
<i>Sunira circellaris</i> (Hufnagel, 1766)	-	+	-	-
<i>Episema glaucina</i> (Esper, 1789)	+	-	+	-
<i>Episema lederi</i> Christoph, 1895	+	-	-	+
<i>Cleoceris scoriacea</i> (Esper, 1789)	+	-	-	-
<i>Mesogona acetosella</i> ([Denis & Schiffermüller], 1775)	-	-	+	-
<i>Aporophyla lutulenta</i> ([Denis & Schiffermüller], 1775)	-	-	-	+
<i>Tholera decimalis</i> (Poda, 1761)	-	-	-	+
<i>Anarta trifolii</i> (Hufnagel, 1766)	+	-	+	+
<i>Lacanobia oleracea</i> (Linnaeus, 1758)	-	+	-	-
<i>Mythimna albipuncta</i> ([Denis & Schiffermüller], 1775)	+	-	-	-
<i>Mythimna congrua</i> (Hübner, [1817])	-	+	-	-
<i>Mythimna ferrago</i> (Fabricius, 1787)	-	+	+	-
<i>Mythimna l-album</i> (Linnaeus, 1767)	+	+	-	-
<i>Mythimna unipuncta</i> (Haworth, 1809)	-	+	-	+
<i>Mythimna vitellina</i> (Hübner, [1808])	+	+	+	+
<i>Leucania loreyi</i> (Duponchel, 1827)	-	-	-	+
<i>Leucania punctosa</i> (Treitschke, 1825)	+	+	-	-
<i>Actebia fugax</i> (Treitschke, 1825)	+	+	-	-
<i>Actebia praecox</i> (Linnaeus, 1758)	-	+	-	-
<i>Dichagyris flammatra</i> ([Denis & Schiffermüller], 1775)	-	-	+	-
<i>Euxoa conspicua</i> (Hübner, [1824])	+	-	-	-
<i>Euxoa obelisca</i> ([Denis & Schiffermüller], 1775)	-	-	+	-
<i>Euxoa segnilis</i> (Duponchel, 1836)	+	-	-	+
<i>Euxoa temera</i> (Hübner, [1808])	+	-	-	+
<i>Agrotis segetum</i> ([Denis & Schiffermüller], 1775)	-	-	+	+
<i>Agrotis spinifera</i> (Hübner, [1808])	+	-	-	+
<i>Agrotis vestigialis</i> (Hufnagel, 1766)	+	-	-	-
<i>Agrotis villosus</i> Alpheraky, 1887	-	+	-	-
<i>Ochropleura plecta</i> (Linnaeus, 1761)	-	+	-	-
<i>Rhyacia arenacea</i> (Hampson, 1907)	-	-	+	-
<i>Noctua comes</i> Hübner, [1813]	+	+	+	+
<i>Noctua janthe</i> (Borkhausen, 1792)	-	+	-	-
<i>Noctua orbona</i> (Hufnagel, 1766)	+	-	+	-
<i>Noctua pronuba</i> Linnaeus, 1758	+	+	-	+
<i>Xestia c-nigrum</i> (Linnaeus, 1758)	-	+	-	-
<i>Xestia cohaesa</i> (Herrich-Schäffer, 1849)	+	-	-	+
<i>Xestia xanthographa</i> ([Denis & Schiffermüller], 1775)	+	+	+	+

Notes about new records

Perygra glaucicolella (Wood, 1892)

The species was not previously recorded for Dagestan (ANIKIN & SHCHUROV, 2001, 2004), but is known from other republics of the Northern Caucasus (ANIKIN *et al.*, 2019) and the Caucasus (BUDASHKIN *et al.*, 2015; BALDIZZONE, 2016).

Ecebalia halophilella (Zimmermann, 1926)

Previously, the species was not recorded for Dagestan and other republics of the Northern Caucasus (ANIKIN & SHCHUROV, 2001, 2004; ANIKIN *et al.*, 2019).

Ecebalia linosyris (E. Hering, 1937)

Previously, the species was not recorded for Dagestan and other republics of the Northern Caucasus (ANIKIN & SHCHUROV, 2001, 2004; ANIKIN *et al.*, 2019).

Casignetella texanella (Chambers, 1878)

The species is first noted for the fauna of the Russian Federation. The species is known from Southern Europe, the larvae feeds on *Portulaca oleracea* L. (Portulacaceae), develops in 2 generations (BALDIZZONE & NEL, 2009).

Ionescumia clypeiferella (O. Hofmann, 1871)

The species was not previously recorded for Dagestan (ANIKIN & SHCHUROV, 2001, 2004), but is known from other republics of the Northern Caucasus (ANIKIN *et al.*, 2019) and the Caucasus (BUDASHKIN *et al.*, 2015; BALDIZZONE, 2016).

Carpochena trientella (Christoph, 1872)

The species was not previously recorded for Dagestan (ANIKIN & SHCHUROV, 2001, 2004), but is known from other republics of the Northern Caucasus (ANIKIN *et al.*, 2019).

Ethmia candidella (Alpheraky, 1908)

Previously, the species was not recorded for Dagestan and the other republics of the Northern Caucasus (ANIKIN *et al.*, 2019).

Tebenna micalis (Mann, 1857)

Previously, the species was not recorded for Dagestan and the other republics of the Northern Caucasus. Reported for Russia only from Crimea (ANIKIN *et al.*, 2019).

Stenoptilia zophodactyla (Duponchel, 1838)

The species was not previously recorded for Dagestan but is known from other republics of the Northern Caucasus and the Crimea (KOVTONOVICH, 2006; ANIKIN *et al.*, 2019).

Stenoptilodes taprobanes (Felder & Rogenhofer, 1875)

Previously, the species was not recorded for Dagestan and the other republics of the Northern Caucasus. Reported for Russia only from Crimea (KOVTONOVICH, 2006; ANIKIN *et al.*, 2019).

Crombrugghia laetus (Zeller, 1847)

The species was not previously recorded for Dagestan but is known from other republics of the Northern Caucasus and the Crimea (KOVTONOVICH, 2006; ANIKIN *et al.*, 2019).

Glyptoteles leucacrinella Zeller, 1848

The species was not previously recorded for Dagestan (POLTAVSKY & ILYINA, 2016), but is known from other republics of the Northern Caucasus and is widespread in the forest zone of Eurasia (ANIKIN *et al.*, 2019; SLAMKA, 2019).

Cadra calidella (Guenée, 1845)

The species was not previously recorded in Dagestan (POLTAVSKY & ILYINA, 2016), in Russia it was found in the Volga region and in the Southern Urals (ANIKIN *et al.*, 2019), outside Russia it is distributed in Europe and North Africa, Central Asia and the Canary Islands (LERAUT, 2014).

Agriphila selasella (Hübner, [1813])

The species was not previously recorded in Dagestan (POLTAVSKY & ILYINA, 2016), in Russia it is widespread in the European part and in the south of Western Siberia (ANIKIN *et al.*, 2019).

Agriphila cyrenaicellus (Ragonot, 1887) (Figs 7-8)

First recorded for the fauna of the Russian Federation. The species is known from Southern Europe, North Africa, Transcaucasia, Turkey, Israel, Iraq, Iran, Syria, and Central Asia (SLAMKA, 2008).

Agriphila tolli (Błeszyński, 1952)

The species was not previously recorded for Dagestan and East Caucasian region but is known from other republics of the Northern Caucasus and Crimea (ANIKIN *et al.*, 2019).

Agriphila poliellus (Treitschke, 1832)

The species was not previously recorded in Dagestan (POLTAVSKY & ILYINA, 2016), in Russia it is widespread in the European part and in the south Siberia up to Tuva (ANIKIN *et al.*, 2019).

Pediasia contaminella (Hübner, 1796)

The species was not previously recorded in Dagestan (POLTAVSKY & ILYINA, 2016), in Russia it is widespread in the European part and in the south of Western Siberia (ANIKIN *et al.*, 2019).

Pediasia fascelinella (Hübner, [1813])

The species was not previously recorded in Dagestan (POLTAVSKY & ILYINA, 2016), in Russia it is widespread in the European part and in the south Siberia up to Tuva Republic (ANIKIN *et al.*, 2019).

Thyridiphora furia (Swinhoe, 1884) (Figs 9-10)

First recorded for the fauna of the Russian Federation. The species is known from Greece, Transcaucasia, Turkey, Africa, Syria, India, Pakistan and Central Asia (SLAMKA, 2008).

Uresiphita gilvata (Fabricius, 1794)

In Dagestan, the species was not previously recorded (POLTAVSKY & ILYINA, 2016); in Russia, it is found in the center of the European part, in the Volga region and the Southern Urals, in the Crimea and the Far East (ANIKIN *et al.*, 2019).

Haritalodes derogata (Fabricius, 1775) (Figs 11-12)

First recorded for the fauna of the Russian Federation. The species is known from the tropics and subtropics of the Old World (SLAMKA, 2008); there are indications of a find in Holland. Another species of this genus, *Haritalodes basipunctalis* (Bremer, 1864), is widespread in the Russian Far East (ANIKIN *et al.*, 2016). Differences between species of the genus *Haritalodes* Warren, 1890 are well shown in the article by YAMANAKA (2008).

Antigastra catalaunalis (Duponchel, 1833)

Previously, in Dagestan and in the North Caucasus as a whole, the species was not recorded. Recorded for Russia only from Crimea (ANIKIN *et al.*, 2019).

Watsonalla binaria (Hufnagel, 1767)

The species was not previously recorded for Dagestan (ANIKIN *et al.*, 2019).

Idaea degeneraria erschoffi (Christoph, 1872)

The species was not previously recorded for Dagestan and East Caucasian region but is known from other republics of the Northern Caucasus (ANIKIN *et al.*, 2019).

Scopula nigropunctata (Hufnagel, 1767)

The species was not previously recorded for Dagestan and East Caucasian region but is known from other republics of the Northern Caucasus (ANIKIN *et al.*, 2019).

Scopula minorata (Boisduval, 1833)

The species is first noted for the fauna of the Russian Federation. The species is known from Africa, the Arabian Peninsula and southern Europe (HAUSMANN, 2004).

Rhodometra sacraria (Linnaeus, 1767)

The species was not previously recorded for Dagestan and East Caucasian region but is known from Crimea and Lower Volga region (ANIKIN *et al.*, 2019).

Danaus chrysippus (Linnaeus, 1758)

Reported for Dagestan (Miatli (October 2020, 43.074755° N / 46.834346° E, Kizilyurt District) only in 2021 (MORGUN & ILYINA, 2021). Found by us in September 2020 (about 10 males, one of which was caught) in the vicinity of sand-dune Sarykum.

Sympistis nigricula (Eversmann, 1847)

Very rare species in Daghestan. Our record is third (POLTAVSKY *et al.*, 2007).

Mormo maura (Linnaeus, 1758)

Very rare species in Daghestan. Our record is third (POLTAVSKY & ILYINA, 2016).

Agrotis villosus Alphéraky, 1887

Very rare species in Daghestan. Our record is third (POLTAVSKY *et al.*, 2007).

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BIBLIOGRAPHY

- ABACHEV, K. YU., 1995.– *Flora and vegetation of the Sarykum dune and their protection*: 45 pp. Makhachkala. (in Russian).
- ADZHIEVA, A. I., 2007.– Some results of the study of the vegetation cover of the dune Sarykum (Dagestan).– *Tribune of Dagestan State University*, **2007**(4): 44–47. (in Russian).
- ADZHIEVA, A. I., 2015.– Abstract of the flora of vascular plants of the Sarykum massif (Dagestan).– *Botanical Journal*, **100**(12): 1298–1310. (in Russian).
- ANIKIN, V. V., BARYSHNIKOVA, S. V., BELYAEV, E. A., DUBATOLOV, V. V., EFETOV, K. A., ZOLOTUKHIN, V. V., KOVTUNOVICH, V. N., KOZLOV, M. V., KONONENKO, V. S., LVOVSKY, A. L., NEDOSHIVINA, S. V., PONOMARENKO, M. G., SINEV, S. YU., STRELTZOV, A. N., USTJUZHANIN, P. YA., CHISTYAKOV, YU. A. & YAKOVLEV, R. V., 2016.– *Annotated catalogue of the insects of Russian Far East. Volume II. Lepidoptera*: 812 pp. Vladivostok. (in Russian).
- ANIKIN, V. V., BARYSHNIKOVA, S. V., BELJAEV, E. A., BUDASHKIN, YU. I., VAN NIEUKERKEN, E. J., GORBUNOV, O. G., DUBATOLOV, V. V., EFETOV, K. A., ZOLOTUHIN, V. V., KNYAZEV, S. A., KOVTUNOVICH, V. N., KOZLOV, M. V., KONONENKO, V. S., LOVTSOVA, JU. A., LUKHTANOV, V. A., LVOVSKY, A. L., MATOV, A. YU., MIRONOV, V. G., NEDOSHIVINA, S. V., PONOMARENKO, M. G., SVIRIDOV, A. V., SINEV, S. YU., SOLOVJEV, A. V., STRELTZOV, A. N., TROFIMOVA, T. A.,

- USTJUZHANIN, P. YA., SHOVKON, D. F. & YAKOVLEV, R. V., 2019.– *Catalogue of the Lepidoptera of Russia*: 448 pp. St. Petersburg.
- ANIKIN, V. V. & SHCHUROV, V. I., 2001.– Casebearers from Caucasus (Lepidoptera: Coleophoridae).– *Zoosystematica Rossica*, **10**: 171-179.
- ANIKIN, V. V. & SHCHUROV, V. I., 2004.– To the Casebearers fauna (Lepidoptera: Coleophoridae) of the North Caucasus with description natural landscapes.– *Proceedings of III International Conference: Biodiversity of Caucasus*, **1**: 68-76.
- BALDIZZONE, G., 2016.– The Coleophoridae of Armenia collected by Ole Karsholt in 2011. Contributions to the knowledge of the Coleophoridae CXXXI (Lepidoptera: Coleophoridae).– *SHILAP Revista de lepidopterología*, **44**(173): 129-144.
- BALDIZZONE, G. & NEL, J., 2009.– On the biology of *Coleophora coxi* Baldizzone & van der Wolf, 2007 (Lepidoptera: Coleophoridae).– *SHILAP Revista de lepidopterología*, **37**(148): 515-518.
- BUDASHKIN, YU. I., RICHTER, I. & TABELL, J., 2015.– A new finds of the casebearer moths (Lepidoptera: Coleophoridae) in Russia and Armenia.– *Eversmannia*, **41**: 11-22.
- DUBATOLOV, V. V., POLTAVSKY, A. N. & ILYINA, E. V., 2021.– Lithosiini and Arctiini of Daghestan (NE Caucasus) (Lepidoptera: Erebidae, Arctiinae).– *SHILAP Revista de lepidopterología*, **49**(193): 129-148.
- GUSAROV, A. V., 2015.– Aeolian-accumulative complex “Sarykum” as a unique geomorphological object of Russia: history of study, hypotheses of origin.– *Geomorphology*, **2015**(2): 54-71. (in Russian).
- HAUSMANN, A., 2004.– *The Geometrid Moths of Europe*, **2**: 600 pp. Apollo Books. Stenstrup.
- IDRISOV, I. A., 2010.– On the history of the formation and development of the sandy massif Sarykum.– *Proceedings of the Reserve “Dagestansky”*, **3**: 19-27. (in Russian).
- ILYINA, E. V., POLTAVSKY, A. N., MATOV, A. YU. & GASANOVA, N. M.-S., 2012.– *Catalogue of Owllet-Moths (Lepidoptera: Nolidae, Erebidae, Noctuidae) of Dagestan*: 192 pp. Makhachkala. (in Russian).
- ILYINA, E. V. & MORGUN, D. V., 2010.– Ecological and faunistic review of butterflies (Lepidoptera, Hesperioidea et Papilionoidea) of Daghestan: Part 1.– *Entomological Review*, **90**(9): 1167-1191.
- ILYINA, E. V. & MORGUN, D. V., 2011.– Ecological and faunistic review of butterflies (Lepidoptera, Hesperioidea et Papilionoidea) of Daghestan: Part 2.– *Entomological Review*, **91**(4): 450-466.
- KOVTUNOVICH, V. N., 2006.– Materials on the fauna of Plume Moths (Lepidoptera, Pterophoridae) of Dagestan.– *Scientists notes of BGPU, Biology*, **23**: 70-85. (in Russian).
- LELEI, A. S., 2016 (ed.).– *Annotated catalogue of the insects of Russian Far East. Lepidoptera*, **2**: 812 pp. Dalnauka, Vladivostok. (in Russian).
- LERAUT, P., 2014.– *Moths of Europe, Pyralids 2*, **4**: 441 pp. N. A. P. Editions, Verrières-le-Buisson.
- MAIOROV, A. A., 1928.– *Aeolian desert at the foot of Dagestan*: 116 pp. Makhachkala. (in Russian).
- MORGUN, D. V. & ILYINA, E. V., 2021.– The first record of *Danaus chrysippus* (Linnaeus, 1758) (Lepidoptera: Danaidae) in Russia in the context of the contemporary distribution of this species in the Western Palaearctic.– *Caucasian Entomological Bulletin*, **17**(1): 115-119. DOI: 10.23885/181433262021171-115119.
- NOVIKOVA, N. M. & POLYANSKAYA, A. V., 1994.– *Samur Liana Forests: the Problem of Biodiversity Conservation in a Developing Water Economy*: 106 pp. Moscow. (in Russian).
- POLTAVSKY, A. N. & ILYINA, E. V., 2002.– The Noctuidae (Lepidoptera) of the Daghestan Republic (Russia).– *Phegea*, **30**(1): 11-36.
- POLTAVSKY, A. N. & ILYINA, E. V., 2003.– The Noctuidae (Lepidoptera) of the Daghestan Republic (Russia). II.– *Phegea*, **31**(4): 167-181.
- POLTAVSKY, A. N. & ILYINA, E. V., 2016.– Materials to the Snout-Moths Fauna (Lepidoptera: Pyraloidea) of Dagestan Republic.– *Tribune of Dagestan State Pedagogical University*, **1**: 53-59. (in Russian).
- POLTAVSKY, A. N., ILYINA, E. V. & MATOV, A. Y., 2007.– Owllets (Lepidoptera: Noctuidae) of Dagestan.– *Trudy Yuzhnogo Nauchnogo Tsentra Rossiyskoy Akademii Nauk*, **3**: 164-226. (in Russian).
- ROBINSON, G., 1976.– The preparation of slides of Lepidoptera genitalia with special reference to the Microlepidoptera.– *Entomologist's Gazette*, **27**: 127-132.
- SINEV, S. YU., 2019 (ed.).– *Catalogue of the Lepidoptera of Russia*: 448 pp. Zoological Institute RAS, St. Petersburg.
- SLAMKA, F., 2008.– *Pyraloidea of Europe (Lepidoptera). Crambinae & Schoenobiinae. Identification, distribution, habitat, biologie*, **2**: 224 pp. František Slamka, Bratislava.
- SLAMKA, F., 2013.– *Pyraloidea of Europe (Lepidoptera). Pyraustinae & Spilomelinae. Identification, distribution, habitat, biologie*, **3**: 357 pp. František Slamka, Bratislava.
- SLAMKA, F., 2019.– *Pyraloidea of Europe (Lepidoptera). Phycitinae. Part 1. Identification, distribution, habitat, biologie*, **4**: 432 pp. František Slamka, Bratislava.

- TIKHONOV, V. V., STRADOMSKIY, B. V., KUZNETSOV, G. V. & ANDREEV, S. A., 2021.– *Butterflies of Caucasus and South of Russia*: (Available from <http://www.babochki-kavkaza.ru>).
- TSHIKOLOVETS, V. V. & NEKRUTENKO, Y., 2012.– *The Butterflies of Caucasus and Transcaucasia (Armenia, Azerbaijan, Georgia and Russian Federation)*: 424 pp. Kyev.
- YAKOVLEV, R. V., POLTAVSKY, A. N., ILYINA, E. V., SHCHUROV, V. I. & WITT, T. J., 2015.– Cossidae (Lepidoptera) of the Russian Caucasus with the description of a new species.– *Zootaxa*, **4044**(2): 270-288.
- YAMANAKA, H., 2008.– Revisional study of some species of the genus *Haritalodes* Warren (Pyralidae, Pyraustinae) from eastern Palaearctic and Oriental region.– *Tinea*, **20**(4): 243-252.

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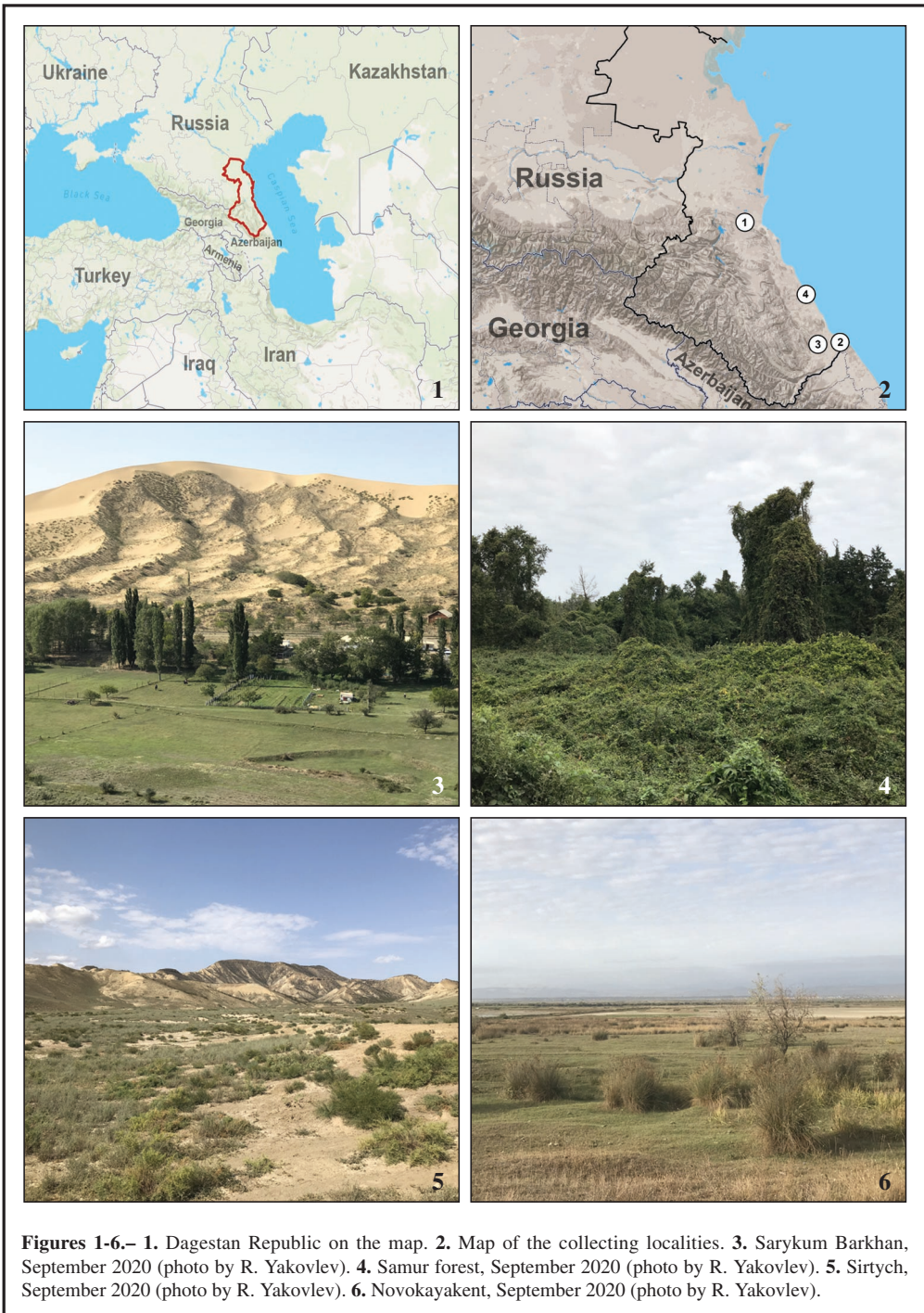
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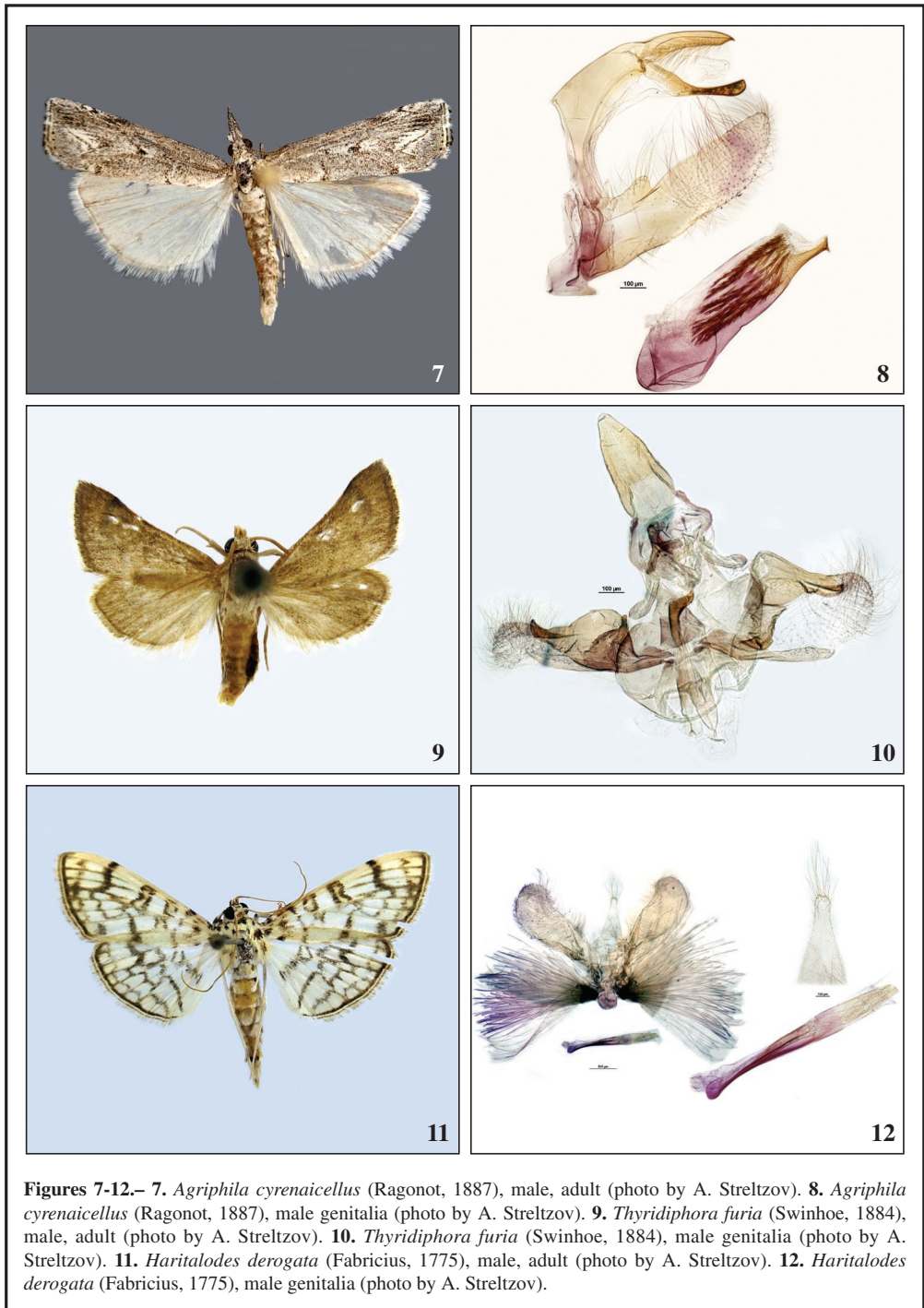
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An additional record of *Microsphecia tineiformis* (Esper, 1789) for the Maltese Islands (Lepidoptera: Sesiidae)

J. Agius & A. Sciberras

Abstract

An additional record of *Microsphecia tineiformis* (Esper, 1789) is reported for the Maltese Islands. The status of this local species is discussed.

KEY WORDS: Lepidoptera, Sesiidae, *Microsphecia tineiformis*, Maltese Islands.

Un registro adicional de *Microsphecia tineiformis* (Esper, 1789) para Malta (Lepidoptera: Sesiidae)

Resumen

Un registro adicional de *Microsphecia tineiformis* (Esper, 1789) es citado para Malta. Se discute el estatus local de esta especie.

PALABRAS CLAVE: Lepidoptera, Sesiidae, *Microsphecia tineiformis*, Malta.

Introduction

The Sesiidae are a diurnal moth family known for their Batesian mimicry in both appearance and behaviour of various Hymenoptera. Most species of Sesiidae have wings with areas where scales are nearly completely absent, resulting in partial, marked transparency. Forewings are commonly elongated and narrow in the basal half. In many species, the abdomen is elongated, with an anal tuft, and striped or ringed with yellow, red, or white, sometimes very brightly so. Legs are long, thin, and frequently coloured, and in some species the hind-legs are elongated. In European species, the wingspan ranges from 8 to 48 mm.

The larvae of the Sesiidae typically bore in wood or burrow in plant roots. Many species are serious pests of fruit-trees or timber cultivation, or crop plants (EDWARDS *et al.*, 1999). In Malta, the larvae of *Synanthedon myopaeiformis cruentata* (Mann, 1859) are known to feed inside loquat trees (SAMMUT, 2000) sometimes causing extensive damage to the trees in the long term. Larval development lasts 1-4 years whilst pupal stage takes 10-20 days.

The family consists of 151 genera spread over two subfamilies, the Sesiinae and the Tinthiinae, and containing in total 1370 species and 50 subspecies, most of which occur in the tropics, though there are many species both in the Holarctic and the Palearctic regions, including over a hundred species known to occur in Europe (LAŠTŮVKA & LAŠTŮVKA, 2001). In Malta, six species of Sesiidae have been documented so far with *Microsphecia tineiformis* (Esper, 1789) being the latest Sesiidae addition to the Maltese Islands. The species recorded so far are: *Bembecia albanensis tunetana* (Le Cerf, 1920),

Synanthedon myopaeformis cruentata (Mann, 1859), *Microsphecia tineiformis* (Esper, 1789), *Paranthrene tabaniformis synagriformis* (Rambur, 1866), *Chamaesphesia aerifrons* (Zeller, 1847), *Chamaesphesia anthraciformis* (Rambur, 1832).

Both *Chamaesphesia* species are mentioned as rare in Maltese literature (SAMMUT, 2000) and have not been recently recorded. *Paranthrene tabaniformis* (Rottemburg, 1775) was accidentally imported with a lot of *Populus alba* L., but the entire consignment of trees was destroyed by fire to safeguard against the dispersal of *P. tabaniformis* (MIFSUD *et al.*, 2003).

Microsphecia tineiformis (Esper, [1789]) is a Mediterranean species found in Bulgaria, Italy, Southern France, Portugal, Spain, Sicily, Morocco, and Algeria (LAŠTŮVKA, 1985). It was recorded for the first and only time in Malta during 2018 (MIFSUD *et al.*, 2019). The larvae of *Microsphecia* sp. are known to live inside roots of *Convolvulus* plants (BERTACCINI & FIUMI, 2002) and the various *Convolvulus* species which inhabit the Maltese islands provide a suitable habitat for this species.

Material

MALTA: 1 ♀, Il-Ħaġra tas-Sajjetta (Cheirolophus Rock), 11-VI-2020, leg. A. Sciberras (in coll. J. Agius) (Figure 1).

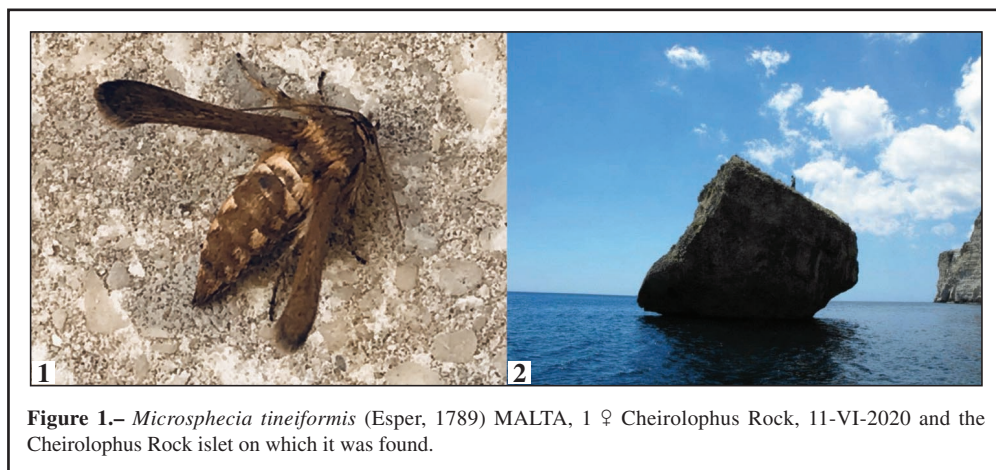


Figure 1.– *Microsphecia tineiformis* (Esper, 1789) MALTA, 1 ♀ Cheirolophus Rock, 11-VI-2020 and the Cheirolophus Rock islet on which it was found.

Discussion

Cheirolophus Rock or Il-Ħaġra tas-Sajjetta as known in Maltese, is a 9- to 12-metre-high islet situated at the South of Malta (coordinates 35°48'48.06"N 14°29'42.91"E) and lies 20 metres away from mainland Malta. The surface area of this small islet is circa 200 square metres, being 11 metres long and 17 metres wide. The plateau (top slanting side) is just 130 square metres. Due to its size and the exposure to weather conditions, very few flora grows on this islet but the following six species of plants have been recorded (SCIBERRAS *et al.*, 2012): *Cheirolophus crassifolius* (Bertol.) Susanna, *Crithmum maritimum* L., *Salsola melitensis* Bothsch., *Daucus carota* L., *Limbardia crithmoides* (L.) Dumort., and *Limonium virgitanum* (Willd.) Fourr.

What is strange is that no *Convolvulus* species has ever been recorded on this islet. Thus, the presence of *Microsphecia tineiformis* (Esper, 1789) on Cheirolophus Rock could be explained either by the fact that it reached the islet from mainland Malta where there is a sheer 60 metre drop or the larvae feeds on one of the plants documented for the Cheirolophus Rock, but such behaviour has not yet been recorded. The female specimen collected on Cheirolophus Rock islet laid circa 150 infertile oval eggs. Unfortunately, even if the eggs were fertile and hatched, it is not easy to breed and study this species

since the larvae are thought to feed inside the roots of plants, so further research is required to possibly identify the origin of *Microsphaecia tineiformis* (Esper, 1789) on Cheirolophus Rock.

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BIBLIOGRAPHY

- BERTACCINI, E. & FIUMI, G., 2002.– *Bombici and Sfingi d'Italia (Lepidoptera: Sesiioidea)*, **4**: 181 pp. Filograf, Forli.
- EDWARDS, E. D., GENTILI, P., HORAK, M., KRISTENSEN, N. P. & NIELSEN, E. S., 1999.– The Cossoid / Sesioid assemblage: 183-185.– In N. P. KRISTENSEN (Ed.). *Lepidoptera, Moths and Butterflies: Evolution, Systematics, and Biogeography. Handbuch der Zoologie. Eine Naturgeschichte der Stämme des Tierreiches / Handbook of Zoology. A Natural History of the phyla of the Animal Kingdom. Band / Volume IV Arthropoda: Insecta Teilband / Part 35, 1*: 491 pp. Walter de Gruyter, Berlin, New York.
- LAŠTŮVKA, Z., 1985.– On the taxonomy of *Microsphaecia tineiformis* (Esper) and *M. brosiiformis* (Hübner) (Lepidoptera, Sesiidae).– *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, **33**(2263): 183-190.
- LAŠTŮVKA, Z. & LAŠTŮVKA, A., 2001.– *The Sesiidae of Europe*: 245 pp. Apollo Books, Stenstrup.
- MIFSUD, D., FARRUGIA, C. & SAMMUT, P., 2003.– On the Introduction of *Paranthrene tabaniformis* (Rottemburg, 1775) in Malta.– *The Central Mediterranean Naturalist*, **4**(1): 65-69.
- MIFSUD, C. M., MAGRO, D. & VELLA, A., 2019.– First record and DNA barcode of the clearwing moth *Tinithia tineiformis* (Esper, 1789) from Malta, central Mediterranean.– *Check List the journal of biodiversity data*, **15**(4): 595-599.
- SAMMUT, P., 2000.– Kullana Kulturali. 12 - *Il-Lepidoptera*: X + 246 pp. Pubblikazzjonijiet Indipendenza, Malta.
- SCIBERRAS, J., SCIBERRAS, A. & PISANI, L., 2012.– Updated checklist of flora of the satellite islets surrounding the Maltese Archipelago.– *Biodiversity Journal*, **3**(4): 385-396.

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REVISIÓN DE PUBLICACIONES *BOOK REVIEWS*

R. Yus & J. M. Cabo

Historia Natural de la Región de Melilla (Guelaya, Alborán y Chafarinas)

3112 páginas

Formato: 29'5 x 21 cm

Fundación Gaselec, Melilla, 2013

ISBN: 978-84-616-4054-6

Tenemos en nuestras manos, lo que podemos considerar una versión mejorada y actualizada, de la que los autores publicaron en 1986 como “*Guía de la Naturaleza de la región de Melilla*” que ha pasado de ser un libro de 431 páginas a convertirse en una Enciclopedia de 3.112 páginas, distribuidas en 12 volúmenes.

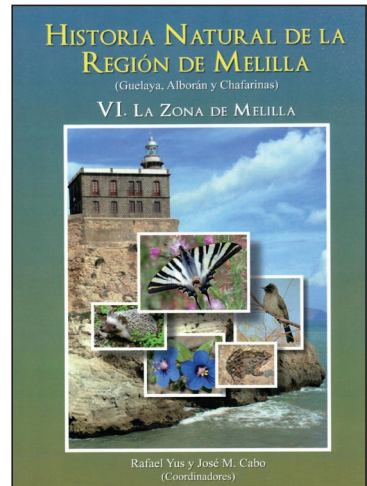
La obra abarca la conocida como región de Guelaya formada por las unidades ambientales españolas de la Isla de Alborán, Melilla e Islas Chafarinas (no están incluidos el Peñón de Vélez de la Gomera y el Peñón de Alhucemas con las islas de Tierra y de Mar) y las marroquíes de la Península de Tres Forcas, Macizo del Gourougou, Bajo Kert, Macizo de Beni Bou Ifrou, Mar Chica y Llanura de Zeluán.

La obra está formada por tres volúmenes de Generalidades, el cuarto trata la isla de Alborán, el quinto la Península de Tres Forcas, el sexto la Zona de Melilla, el séptimo el interesante Macizo del Gourougou, el octavo la Cuenca del Bajo Kert, el noveno el Macizo de Beni Bou Ifrou, el décimo la Mar Chica, el undécimo la Llanura de Selouane (Zeluán) y el duodécimo las Islas Chafarinas.

Sobre la base principal de los estudios históricos de cada una de las zonas consideradas y principalmente referidas a la Historia Natural, nos presentan numerosas e interesantes biografías de los más destacados investigadores que han realizado aportaciones científicas a lo largo del tiempo. Nos hablan de su geografía y geología, destacando los aspectos sobre la botánica y la zoología de los vertebrados e invertebrados (tanto marinos como terrestres), con gran detalle y profusamente ilustrada, haciendo hincapié en las especies endémicas descubiertas, que para ser una zona “pequeña”, son memorables.

No podemos terminar estas líneas, sin felicitar a los autores por un trabajo bien realizado, así como a la Editorial que no ha escatimado medios para mantener el mismo nivel de calidad a lo largo de toda la obra, por lo que recomendamos vivamente su adquisición y no pudiendo faltar en cualquier biblioteca de todos aquellos interesados en la Historia Natural de esta interesante región hispano-marroquí. El precio de este libro es de 260 euros más gastos de envío y los interesados deben dirigirse a:

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Rafael Yus y José M. Cabo
(Coordinadores)

The first record of *Jordanita (Solaniterna) subsolana* (Staudinger, 1862) from Kazakhstan (Lepidoptera: Zygaenidae, Procridinae)

K. A. Efetov, S. A. Knyazev & E. E. Kucherenko

Abstract

Jordanita (Solaniterna) subsolana (Staudinger, 1862) was discovered in eastern Kazakhstan using the sex attractant EFETOV-2 (2-butyl 2-dodecenoate) synthesised in the Crimean Federal University. This is the first record of *J. (S.) subsolana* from Kazakhstan. As this species is now found on the border of Kazakhstan and China, most probably that *J. (S.) subsolana* is also present in China. An overview of the Zygaenidae fauna of Kazakhstan is presented.

KEY WORDS: Lepidoptera, Zygaenidae, Procridinae, *Jordanita (Solaniterna) subsolana*, fauna, sex attractant, EFETOV-2, Kazakhstan, China.

El primer registro de *Jordanita (Solaniterna) subsolana* (Staudinger, 1862) de Kazajstán (Lepidoptera: Zygaenidae, Procridinae)

Resumen

Jordanita (Solaniterna) subsolana (Staudinger, 1862) fue descubierta en el este de Kazajstán usando el atrayente sexual EFETOV-2 (2-butil 2-dodecenoato) sintetizado en la Universidad Federal de Crimea. Este es el primer registro de *J. (S.) subsolana* de Kazajstán. Como esta especie se ahora se ha encontrado en la frontera de Kazajstán y China, es más que probable que *J. (S.) subsolana* esté también presente en China. Se presenta una visión general de la fauna de Zygaenidae de Kazajstán.

PALABRAS CLAVE: Lepidoptera, Zygaenidae, Procridinae, *Jordanita (Solaniterna) subsolana*, fauna, atracción sexual, EFETOV-2, Kazajstán, China.

Introduction

New data on the biology, morphology, karyology and DNA barcoding of Zygaenidae species, which have been obtained over the past 20 years, have significantly increased our knowledge on this family and stimulated numerous systematic changes in it (EFETOV, 1999; EFETOV *et al.*, 2006, 2014a, 2014b, 2015a; EFETOV & SAVCHUK, 2009; EFETOV & TARMANN, 2014, 2016, 2017b; EFETOV & KNYAZEVA, 2014; KNYAZEVA *et al.*, 2015a, 2015b). As a consequence, the Zygaenidae family now includes five subfamilies: Inouelinae Efetov & Tarmann, 2017; Procridinae Boisduval, 1828; Chalcosiinae Walker, 1865; Callizygaeninae Alberti, 1954; and Zygaeninae Latreille, 1809 (EFETOV *et al.*, 2014b; EFETOV & TARMANN, 2017a). According to previous publications the Zygaenidae fauna of Kazakhstan is represented by two subfamilies: Procridinae (12 species) and Zygaeninae (13 species) (EFETOV, 1995, 1997, 2001, 2004; EFETOV & TARMANN, 1999; HOFMANN & TREMEWAN, 1996; MOLLET, 2008). New data presented in this paper on the distribution of zygaenids in Kazakhstan became possible due to the field experiments with attractant baits. It is well known that sex pheromones and sex attractants play an increasingly important role in

faunal investigations of Lepidoptera, because they allow researchers to discover new species, detect populations of pest or rare species, monitor and control the seasonal flight of moths (SUBCHEV *et al.*, 2012, 2013, 2016; RAZOV *et al.*, 2017; CAN CENGIZ *et al.*, 2018; CAN *et al.*, 2019; EFETOV *et al.*, 2010, 2011, 2015b, 2019; TARMANN *et al.*, 2019; VRENOZI *et al.*, 2019).

In this study, the fauna of Zygaenidae in Kazakhstan was investigated using the attractant EFETOV-2 (2-butyl 2-dodecenoate). Its property as a sex attractant for the males of some Procridinae species has been proved in our field experiments earlier (EFETOV *et al.*, 2016, 2018, 2019, 2020; EFETOV & KUCHERENKO, 2020).

Materials and methods

Field observations were carried out in eastern and northern Kazakhstan in VI-VII-2018. To prepare the baits, the substance EVETOV-2 (2-butyl 2-dodecenoate) was used. This attractant was synthesised in the Crimean Federal University as described in EFETOV *et al.* (2014c). For this study, the sex attractant was applied onto grey rubber vial caps in dose of 200 mcl. The baits were prepared in 2014, wrapped singly in aluminium foil and stored in a freezer for the first year and then at room temperature until the date of the fieldwork. In study biotopes the lures were hung on bushes at a height 0.5-1.0 m above the ground. The attracted specimens were collected by netting them near the lure. All moths were determined by genitalia examination.

The map (Fig. 1) is compiled by the BioOffice software, Tiroler Landesmuseen, Ferdinandeum, Hall in Tirol, Austria.

Results and discussion

Jordanita (Solaniterna) subsolana (Staudinger, 1862) is the type species of the subgenus *Solaniterna* Efetov, 2004. In 2018 this species was collected for the first time in Kazakhstan. This became possible due to an application of the sex attractant EFETOV-2. One male of this species was attracted to the bait with EFETOV-2 in Zaysan District, 19 km S of Zaysan, Saur Mountains, 47°17'50,07" N, 84°48'28,54" E, 1100 m, 1-2-VII-2018, S. Knyazev leg. (Figs 1-4). This species was recorded (EFETOV, 1990) from the Russian Altai (Fig. 1), but until now, there was no information about the presence of *J. (S.) subsolana* in eastern Kazakhstan based on original material. The known distribution of *J. (S.) subsolana* outside of Kazakhstan: Morocco (Rif), Spain, France, Belgium, Germany, Switzerland, Austria, Italy (including Sicily), Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Montenegro, Albania, North Macedonia, Greece, Czech Republic, Slovakia, Hungary, Romania, Bulgaria, Ukraine, Moldova, Russia (European part including Crimea, Northern Caucasus, southern Siberia), Georgia, Armenia, Azerbaijan, and Turkey (EFETOV, 2004; BioOffice database, Tiroler Landesmuseen, Ferdinandeum, Hall in Tirol, Austria). Moreover, as this species is now found on the border of Kazakhstan and China, most probably that *J. (S.) subsolana* is also present in China.

The list of the Zygaenidae fauna of Kazakhstan includes 26 species which are listed below.

Procridinae:

1. *Rhagades (Rhagades) pruni* ([Denis & Schiffermüller], 1775)
2. *Adscita (Procriterna) subtristis* (Staudinger, 1887)
3. *Adscita (Procriterna) subdolosa* (Staudinger, 1887) (EFETOV, 1995)
4. *Adscita (Adscita) statices* (Linnaeus, 1758)
5. *Jordanita (Roccia) budensis* (Speyer & Speyer, 1858)
6. *Jordanita (Roccia) paupera* (Christoph, 1887)
7. *Jordanita (Roccia) volgensis* (Möschler, 1862)
8. *Jordanita (Roccia) naufocki* (Alberti, 1937)
9. *Jordanita (Roccia) almatiensis* Mollet, 2008
10. *Jordanita (Tremewania) splendens* (Staudinger, 1887)
11. *Jordanita (Jordanita) chloros* (Hübner, 1813) (EFETOV, 1997)

12. *Jordanita (Solaniterna) subsolana* (Staudinger, 1862)
13. *Jordanita (Solaniterna) solana* (Staudinger, 1887) (EFETOV, 1995)

Zygaeninae:

14. *Zygaena (Mesembrynus) purpuralis* (Brünnich, 1763)
15. *Zygaena (Mesembrynus) cynarae* (Esper, 1789)
16. *Zygaena (Mesembrynus) centaureae* Fischer von Waldheim, 1832
17. *Zygaena (Mesembrynus) laeta* (Hübner, 1790)
18. *Zygaena (Agrumenia) truchmena* Eversmann, 1854
19. *Zygaena (Agrumenia) sogdiana* Erschoff, 1874
20. *Zygaena (Agrumenia) separata* Staudinger, 1887
21. *Zygaena (Agrumenia) carniolica* (Scopoli, 1763)
22. *Zygaena (Agrumenia) exulans* (Hohenwarth, 1792)
23. *Zygaena (Agrumenia) viciae* ([Denis & Schiffermüller], 1775)
24. *Zygaena (Lictoria) loti* ([Denis & Schiffermüller], 1775)
25. *Zygaena (Zygaena) osterodensis* Reiss, 1921
26. *Zygaena (Zygaena) lonicerae* (Scheven, 1777)

The systematic position of two taxa, viz. *Jordanita (Roccia) scintillosa* Zolotuhin, 2020, and *Jordanita (Roccia) smaragdonna* Zolotuhin, 2020, both mentioned recently for Kazakhstan (ZOLOTUHHIN, 2020), needs verification. *J. scintillosa* and *J. smaragdonna* have no genitalia differences from *J. paupera*. Moreover, the colour and shape of wings and colour and length of proboscis mentioned by Zolotuhin (2020) as important characters are variable even in *J. paupera* in Turkmenistan, from where the latter species had been described. In this publication we consider *J. scintillosa* and *J. smaragdonna* as the synonyms (**syn. n.**) of *J. paupera*. These two taxa of Zolotuhin will be discussed in a separate publication (EFETOV & TARMANN, in prep.).

It is known that (2*R*)-butyl 2-dodecenoate, named as EFETOV-S-2, is a very effective sex attractant for the detection of *J. (S.) subsolana* in different biotopes (EFETOV *et al.*, 2020). However, males of this species also actively respond to the attractant EFETOV-2 (2-butyl 2-dodecenoate). Previously, this was shown in the Crimea (Russia) (EFETOV *et al.*, 2016) and in the Thrace Region (European Turkey) (CAN CENGİZ *et al.*, 2018). It is interesting that the baits with the attractant EFETOV-2 used in this study were prepared in 2014. This means that EFETOV-2 retains its attractive properties for several years. Of course, evaporation from rubber caps occurs, but the remaining dose is sufficient to attract and accordingly to detect *J. (S.) subsolana* in biotopes. We reported about a long duration of the activity of EFETOV-2 lures, but only during one season (three months) (VRENOZI *et al.*, 2019). Now we have the proof for a much longer activity. This is convenient because we can use attractive baits for a long time without the need to change dispensers. Moreover, it is cost-effective.

In addition, one more species, viz. *Adscita (Adscita) statures* (Linnaeus, 1758), was attracted to EFETOV-2 lures in Kazakhstan by the second author in 2018. Totally 17 males of *A. (A.) statures* were caught: 1 ♂ - eastern Kazakhstan, Katon-Karagay District, Southern Altai Ridge, bank of Kara-Kaba River, 49°01'42.96" N, 86°01'04.44" E, 1653 m, 28-VI-2018; 11 ♂♂ - eastern Kazakhstan, Markakol District, 1.5 km N of village Urunkhaika, eastern bank of Markakol Lake, 48°48'24.83" N, 86°02'00.19" E, 1450 m, 29-VI-2018; 5 ♂♂ - northern Kazakhstan, North Kazakhstan Region, Taiynshinsky District, 6 km. SE of village Akkudyk, 53°37'58.64" N, 70°42'47.80" E, 145 m, 08-VII-2018. This result was expected and confirmed our data obtained in Turkey (CAN CENGİZ *et al.*, 2018). Besides this, *A. (A.) statures* males were also attracted to the sex attractant EFETOV-S-2 (mentioned above) in Russia (EFETOV & GORBUNOV, 2016) and Italy (EFETOV *et al.*, 2020).

Conclusions

The males of two Procridinae species, viz. *A. (A.) statures* and *J. (S.) subsolana*, were attracted to

the lures with the sex attractant EFETOV-2 in Kazakhstan. *J. (S.) subsolana* is reported for Kazakhstan for the first time.

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BIBLIOGRAPHY

- CAN, F., EFETOV, K. A., BURMAN, J., KAYA, K., KUCHERENKO, E. E., ULAŞLI, B. & TARMANN, G. M., 2019.– A study of the Zygaenidae (Lepidoptera) fauna of Central Anatolia, Turkey.– *Turkish Journal of Entomology*, **43**(2): 189-199. Available from <https://doi.org/10.16970/entoted.512580>.
- CAN CENGİZ, 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. Available from <https://doi.org/10.3897/nl.41.21065>.
- EFETOV, K. A., 1990.– Family Zygaenidae, pp. 84-85.– In K. A. EFETOV & YU. I. BUDASHKIN. *Lepidoptera of the Crimea*: 112 pp., 40 pls. Tavriya, Simferopol.
- EFETOV, K. A., 1995.– New foresters (Lepidoptera, Zygaenidae) for the fauna of Kazakhstan.– *Vestnik zoologii*, **29**(1): 32.
- EFETOV, K. A., 1997.– *Jordanita (Jordanita) chloros* (Hübner, [1813]) (Lepidoptera, Zygaenidae) - a new forester for the fauna of Kazakhstan and Asian part of Russia.– *Vestnik zoologii*, **31**(3): 85.
- EFETOV, K. A., 1999.– *Inouela* gen. n. from Japan and Taiwan (Lepidoptera: Zygaenidae, Chalcosiinae).– *Entomologist's Gazette*, **50**(2): 91-95.
- EFETOV, K. A., 2001.– *Jordanita (Jordanita) chloros* (Lepidoptera, Zygaenidae) - a new forester for the fauna of Kazakhstan and Asian part of Russia.– *Vestnik zoologii*, **35**(3): 45.
- 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., CAN, F., TOSHOVA, T. B. & SUBCHEV, M., 2010.– New sex attractant for *Jordanita anatolica* (Naufock) (Lepidoptera: Zygaenidae: Procridinae).– *Acta Zoologica Bulgarica*, **62**(3): 315-319.
- EFETOV, K. A. & GORBUNOV, O. G., 2016.– Attraction of the males of *Adscita statices* (Linnaeus, 1758) (Lepidoptera: Zygaenidae, Procridinae) by synthetic sex attractant in Moscow Region.– *Tavrisheskiy Mediko-biologicheskii Vestnik*, **19**(3): 40-46.
- EFETOV, K. A., HOFMANN, A. & TARMANN, G. M., 2014a.– 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. Available from <https://doi.org/10.3897/nl.37.7871>.
- EFETOV, K. A., HOFMANN, A., TARMANN, G. M. & TREMEWAN, W. G., 2014b.– 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. Available from <https://doi.org/10.3897/nl.37.7940>.
- 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., 2020.– Structural analysis of sex pheromones and attractants in Zygaenidae (Insecta, Lepidoptera): biochemical and evolutionary aspects.– *Journal of Evolutionary Biochemistry and Physiology*, **56**(5): 381-395. Available from <https://doi.org/10.1134/S0022093020050014>.

- 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., KUCHERENKO, E. E. & TARMANN, G. M., 2019.– New synthetic sex attractants for the males of two endemic Iberian Procridinae species (Lepidoptera: Zygaenidae).– *SHILAP Revista de lepidopterología*, **47**(186): 307-315.
- EFETOV, K. A., KUCHERENKO, E. E. & TARMANN, G. M., 2020.– An application of the synthetic sex attractants from the series “EFETOV-2” for studying Procridinae in Italy (Lepidoptera: Zygaenidae).– *SHILAP Revista de lepidopterología*, **48**(192): 733-749.
- 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. Available from <https://doi.org/10.15407/ubj86.06.175>.
- EFETOV, K. A., PARSHKOVA, E. V., TARASOVA, L. G. & TARMANN, G. M., 2015a.– 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., SUBCHEV, M. A., TOSHOVA, T. B. & KISELEV, V. M., 2011.– Attraction of *Zygaenoprocris taftana* (Alberti, 1939) and *Jordanita horni* (Alberti, 1937) (Lepidoptera: Zygaenidae, Procridinae) by synthetic sex pheromones in Armenia.– *Entomologist's Gazette*, **62**(2): 113-121.
- EFETOV, K. A. & TARMANN, G. M., 1999.– *Forester Moths. The genera Theresimima Strand, 1917, Rhagades Wallengren, 1863, Jordanita Verity, 1946, and Adscita Retzius, 1783* (Lepidoptera: Zygaenidae, Procridinae): 192 pp. Apollo Books, Stenstrup.
- EFETOV, K. A. & TARMANN, G. M., 2014.– 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., 2016.– *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., 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. Available from <https://doi.org/10.18473/lepi.v71i1.a5>.
- 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.
- EFETOV, K. A., TARMANN, G. M., TOSHOVA, T. B. & SUBCHEV, M. A., 2015b.– Enantiomers of 2-butyl 7Z-dodecenoate are sex attractants for males of *Adscita mannii* (Lederer, 1853), *A. geryon* (Hübner, 1813), and *Jordanita notata* (Zeller, 1847) (Lepidoptera: Zygaenidae, Procridinae) in Italy.– *Nota lepidopterologica*, **38**(2): 161-169. Available from <https://doi.org/10.3897/nl.38.6312>.
- HOFMANN, A. & TREMEWAN, W. G., 1996.– *A Systematic Catalogue of the Zygaeninae* (Lepidoptera: Zygaenidae): 251 pp. Harley Books, Colchester.
- KNYAZEV, S. A., EFETOV, K. A. & PONOMARYOV, K. B., 2015a.– Zygaenidae (Lepidoptera) from Omsk Region.– *Zoologicheskii Zhurnal*, **94**(11): 1297-1302. Available from <https://doi.org/10.7868/S0044513415110069>.
- KNYAZEV, S. A., EFETOV, K. A. & PONOMARYOV, K. B., 2015b.– Zygaenidae (Lepidoptera) of Omsk Province.– *Entomological Review*, **95**(8): 1106-1111. Available from <https://doi.org/10.1134/S0013873815080175>.
- MOLLET, B., 2008.– *Jordanita (Roccia) almatiensis* sp. nov. from Kazakhstan (Lepidoptera, Zygaenidae, Procridinae).– *Entomologist's Gazette*, **59**(1): 57-62.
- RAZOV, J., EFETOV, K. A., FRANIN, K., TOSHOVA, T. B. & SUBCHEV, M. A., 2017.– The application of sex pheromone traps for recording the Procridinae fauna (Lepidoptera: Zygaenidae) in Croatia.– *Entomologist's Gazette*, **68**(1): 49-53.
- SUBCHEV, M. A., EFETOV, K. A., TOSHOVA, T. B. & KOSHIO, C., 2016.– Sex pheromones as isolating mechanisms in two closely related *Illiberis* species – *I. (Primilliberis) rotundata* Jordan, 1907, and *I. (P.) pruni* Dyar, 1905 (Lepidoptera: Zygaenidae, Procridinae).– *Entomologist's Gazette*, **67**(1): 51-57.
- SUBCHEV, M. A., KOSHIO, C., TOSHOVA, T. B. & EFETOV, K. A., 2012.– *Illiberis (Primilliberis) rotundata* Jordan

- (Lepidoptera: Zygaenidae: Procridinae) male sex attractant: Optimization and use for seasonal monitoring.– *Entomological Science*, **15**: 137-139. Available from <https://doi.org/10.1111/j.1479-8298.2011.00485.x>.
- SUBCHEV, M., KOSHIO, C., TOSHOVA, T., EFETOV, K. A. & FRANCKE, W., 2013.– (2R)-butyl (7Z)-dodecenoate, a main sex pheromone component of *Illiberis (Primilliberis) pruni* Dyar (Lepidoptera: Zygaenidae: Procridinae)?.– *Acta Zoologica Bulgarica*, **65**(3): 391-396.
- TARMANN, G. M., EFETOV, K. A. & KUCHERENKO, E. E., 2019.– A second generation of *Theresimima ampellophaga* (Bayle-Barelle, 1808) (Lepidoptera: Zygaenidae, Procridinae) discovered by using the sex attractant EFETOV-2 on the Kassandra peninsula (Halkidiki) in Greece.– *Entomologist's Gazette*, **70**(1): 19-26.
- VRENOZI, B., TOSHOVA, T. B., EFETOV, K. A., KUCHERENKO, E. E., RREDHI, A. & TARMANN, G. M., 2019.– The first well-documented record of the vine bud moth *Theresimima ampellophaga* (Bayle-Barelle, 1808) in Albania established by field screening of sex pheromone and sex attractant traps (Lepidoptera: Zygaenidae, Procridinae).– *SHILAP Revista de lepidopterología*, **47**(187): 567-576.
- ZOLOTUHIN, V. V., 2020.– What is *Jordanita paupera* (Christoph, 1887) in the Lower Volga Region? (Lepidoptera: Zygaenidae).– *Eversmannia*, **62**: 3-11.

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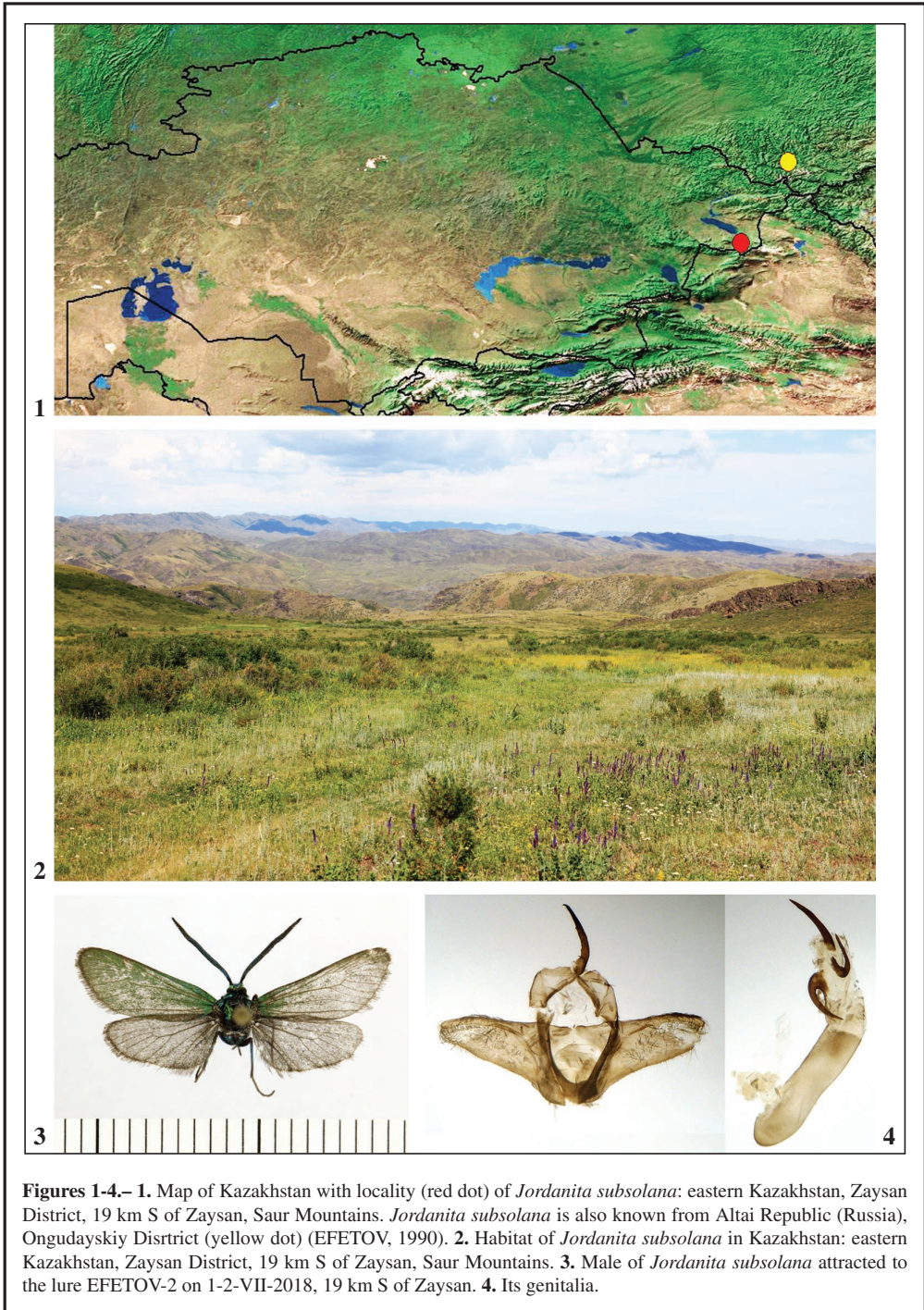
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REVISIÓN DE PUBLICACIONES BOOK REVIEWS

A. F. Hofmann & W. G. Tremewan
The Natural History of Burnet Moths. Part III-2
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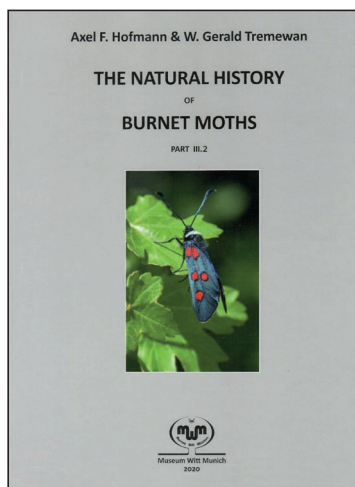
Tenemos en nuestras manos el segundo volumen, en realidad la parte III-2, de esta monografía de primer nivel sobre la fauna de Zygaenidae de la Región Paleártica, de la mano de los destacados especialistas de referencia mundial en esta familia como son Axel Hofmann y W. Gerald Tremewan, que constituye su obra cumbre.

Esta tercera parte está dividida en dos subpartes, la primera ya tratada en una anterior revisión y en el caso que nos ocupa dentro del subgénero *Agrumenia* Hübner, [1819] 1816, a continuación empiezan a tratarse las diferentes especies-grupo de *olivieri*, con siete especies distribuidas desde los Balcanes hasta el Asia Central, destacándose la riqueza faunística de las poblaciones en Irán; en las especies-grupo de *fraxini*, con nueve especies, restringida al este de Anatolia e Irán, prolongándose por el Cáucaso hasta el oeste de Pakistán; en las especies-grupo de *felix*, con tres especies, encontrándose en el norte de África; en las especies-grupo de *orana*, con una especie, endémica del norte de África; en las especies-grupo de *carniolica*, con dos especies, relativamente próximas que se distribuyen, por el sur de Francia y España, con la elevada variabilidad de *Z. carniolica* (Scopoli, 1763); en las especies-grupo de *exulans*, con una especie, restringida a la zona boreo-alpina de los Alpes, Pirineos y Apeninos; en las especies-grupo de *viciae*, con dos especies, distribuidas desde el norte de España, por Siberia hasta Japón; en las especies-grupo de *loti*, con cinco especies, distribuidas desde España central hasta el Altái; en las especies-grupo de *anthyllidis*, con una especie, endémica de la zona alpina de los Pirineos de España y Francia; en las especies-grupo de *lavandulae*, con dos especies alopátricas, restringidas desde el oeste del Mediterráneo y el norte de África; en las especies-grupo de *rhadamantus*, con tres especies alopátricas, restringidas por el norte del Mediterráneo; en las especies-grupo de *persephone*, con una especie, restringidas a la zona del Atlas marroquí; en las especies-grupo de *nevadensis*, con cuatro especies bien distinguibles, se distribuyen desde el norte de África hasta Mongolia; en las especies-grupo de *trasalpina*, con cuatro especies, localizadas en el oeste Paleártico y en las especies-grupo de *filipendulae*, con tres especies, uno de los grupos más homogéneos que se distribuyen por el oeste de la Región Paleártica.

De todas las especies consideradas nos dan información sobre su descubrimiento, conceptos generales sobre su variabilidad y su distribución localizada en mapas generales y detallados, datos sobre su biología desde el huevo hasta el adulto, todo ello profusamente ilustrado a todo color, tanto de los adultos, como su variabilidad larval, biotopos más característicos, con un apartado "Varia" con fotografías de las aberraciones más características y finalizando con un índice.

No podemos terminar estas líneas, sin felicitar a los autores por un trabajo colosal, así como a la Editorial que continúa apoyando la publicación de estas obras, con una calidad excelente, por lo que recomendamos su adquisición y no pudiendo faltar en cualquier biblioteca de todos los interesados en Zygaenidae. El precio de este libro es de 150 euros y los interesados deben dirigirse a:

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A new species of *Europlema* Holloway, 1998 from Korea (Lepidoptera: Uraniidae, Epipleminae)

J.-C. Sohn

Abstract

A new species of Epipleminae, *Europlema koreana* Sohn, sp. n. is described from Korea on the basis of 15 specimens in the type series. It is distinguished from a congener, *E. nubifasciaria* (Leech, 1897) in the wing patterns and the features of the male and female genitalia. Its generic assignment to *Europlema* Holloway, 1998 is discussed. KEY WORDS: Lepidoptera, Uraniidae, Epipleminae, *Europlema*, North Korea, South Korea.

Una nueva especie de *Europlema* Holloway, 1998 de Corea (Lepidoptera: Uraniidae, Epipleminae)

Resumen

Se describe de Corea una nueva especie de Epipleminae, *Europlema koreana* Sohn, sp. n. sobre la base de 15 especímenes en la serie tipo. Se distingue de su congénere, *E. nubifasciaria* (Leech, 1897) en los dibujos de las alas y en la genitalia del macho y de la hembra. Se discute la asignación genérica de *Europlema* Holloway, 1998. PALABRAS CLAVE: Lepidoptera, Uraniidae, Epipleminae, *Europlema*, Corea del Norte, Corea del Sur.

Introduction

Europlema was designated by HOLLOWAY (1998) who divided the previously ill-defined genus, *Epiplema* Herrich-Schäffer, 1855. The *Europlema* differs from other resembling epiplemine genera in having the characteristic fascies on the white wings, the triangular uncus, and a slender process on each valva in the male genitalia. The adults of *Europlema* exhibit a unique resting posture with the forewings and hindwings folded in a Z-shaped way in cross-section (HOLLOWAY, 1998).

The genus comprises a total of 13 species occurring in a broad zone spanning the Indo-Australian region to the temperate Asia (HOLLOWAY, 1998; SINEV, 2016). *Europlema semibrinnea* (Pagenstecher, 1888) shows the broadest distribution in the genus, possibly associated with its stepping-stone dispersals along the Australasian archipelagoes (DE FREINA & FISHER, 2013). There are just few studies on the life history of *Europlema* but all known hostplants for the genus belong to Verbenaceae.

The first record of *Europlema* from Korea was given by SOHN *et al.* (2019) with *Europlema nubifasciaria* (Leech, 1897) (= *E. leleji* Sinev, 2016). The aim of this article is to describe a new species of *Europlema* from Korea and to discuss the comparative morphology between the two closely related congeners, *E. nubifasciaria* and *E. koreana* Sohn, sp. n. and their distribution within the country.

Material and methods

Specimens examined were obtained from the insect collections of the Department of Science Education, Gongju National University of Education, South Korea (GNUE) and the Hungarian Natural History Museum, Budapest, Hungary (HNHM). The genitalia were dissected following CLARKE (1941), except for staining with Chlorazol black and permanently mounting with Euparal medium and essence. Terms for genitalia and wing venation followed KLOTS (1970) and WOOTTON (1979), respectively. Verbatim label data were provided only for the primary type. In the label data, the pipe marks (“|”) indicated the line spacing and the abbreviation “GSN” stood for genitalia slide number.

Taxonomic accounts

Europlema Holloway, 1998

Europlema Holloway, 1998. *Malay. Nat. J.*, **52**: 116.

Type species: *Erosia desistaria* Walker, 1861.

Europlema koreana Sohn, sp. n.

[Korean name: Woori-goun-ssangkorinabang]

Holotype ♂: “HOLOTYPE / *Europlema* / *koreana* Sohn” [red label], “KOREA, Gyonggi Prov. / Pocheon, Gwangleung / 3-VI-1999 / coll. Jae-Cheon Sohn”, “Sohn / Genitalia slide ♂ / (SJC-81)-()” [pink label], deposited in GNUE.

Paratypes (2 ♂♂, 12 ♀♀): SOUTH KOREA: [Gangwon Prov.] Gangleung, Sogeumgang, 2 ♀♀, 11-VII-2004 (JC Sohn), [GSN] SJC-48, GNUE; Pyeongchang, Mitán-myeon, Mt. Jaechisan, 1 ♀, 29-VII-1996 (JC Sohn), [GSN] SJC-138, GNUE; Yeongwol, Mt. Jangseongsan, 1 ♂, 25-VII-1999 (JC Sohn), [GSN] SJC-137, GNUE. [Chungbuk Prov.], Boeun, Mt. Sogrisan, Templ. Beopjusa, 1 ♀, 25-VIII-2002 (JC Sohn), GNUE; Jecheon, Hansu-myeon, Songgae, Mt. Weolagsan, 4 ♀♀, 20-VI-2006 (JC Sohn), [WSN] SJC-W056, [GSN] SJC-1107, GNUE; ditto (N36°51'56.0" E128°05'20.0", Alt. 222 m), 2 ♀♀, 15-18-VI-2007 (JC Sohn), GNUE; Jincheon, Jincheon-eup, Mt. Taeryongsan, 1 ♀, 11-VII-2005 (JC Sohn), GNUE. [Gyeongnam Prov.], Masan, Hapcho-gu, Jinjeon-ri, Mt. Yeohangsan, Osilgol [valley], 1 ♀, 12-13-VI-1999 (JS Park), [GSN] SJC-1108, GNUE. NORTH KOREA [Gaeseong], Hotel Janamsan, 1 ♀, 29-VII-1982 (L. Forró, L. Ronkay), No. 873, HNHM.

Diagnoses: This species is similar to another congener from Korea, *E. nubifasciaria* in overall appearance but it differs from the latter in having the broader postmedian line on the forewing, the narrower uncus, the broader valva in the male genitalia, and the smaller signum in the female genitalia.

Description: Adults (Figs 1-4): Head with vertex white; frons dark grayish brown. Antenna 1/2 as long as forewing costa; scape white, intermixed with pale brownish gray scales ventrally; flagellomere I-V entirely white dorsally; remaining flagellomeres white on dorso-distal half, grayish brown on dorso-basal half. Labial palpus short, dark grayish brown on outer surface, white on inner surface; 1st segment 1/2 as long as 2nd, 3rd segment 1/3 as long as 2nd, acuminate apically. Thorax with patagium, tegula, mesonotum white; mesoscutellum pale brownish gray. Foreleg with coxa and femur grayish brown mesally, white laterally; tibia and tarsomeres grayish brown dorsally, white ventrally. Midleg with coxa grayish brown, tinged with white marginally; femur white, intermixed with pale grayish brown scales dorsally; tibia pale grayish brown dorsally, white ventrally; tarsomeres dark grayish brown dorsally, white ventrally. Hindleg with coxa pale grayish brown, tinged with white marginally; femur and tibia pale grayish brown dorsally, white ventrally; 1st tarsomere white, intermixed with dark grayish brown scales on dorso-basal half; remaining each tarsomere dark brown dorsally, white ventrally, with white ring distally. Forewing length 7.0-8.3 mm, white, mottled with pale grayish brown on subcostal area of antemedian and subbasal zones, striolate with dark brown along costal area and sparsely on dorsal area; median area mottled with dark grayish brown; discal patch as four lunulate marks reddish brown on basal half, dark brown on distal half; postmedian and tornal area mottled with

dark grayish brown, densely intermixed with pale grayish blue scales; submarginal area with mottled grayish brown markings along row of three black dots; fringe white, tinged with dark grayish brown on apical, medial, and tornal areas. Hindwing white, with a tail at vein M_3 ; subbasal area striolate with dark brown; longitudinal fascia comprising dark brown and pale grayish blue scales running from base to middle of termen; median line dark brown, strongly convex medially, broadened on posterior 1/3, juxtaposed with reddish brown along inner margin and with pale grayish blue along outer margin; postmedian area broadly tinged with grayish brown on posterior 4/5, intermixed with pale grayish blue scales, with oblique, reddish brown bar at anterior 1/3; submarginal area with four reddish brown ocellate markings; marginal line present between M_1 and M_3 , dark brown; fringe pale reddish brown, tinged with white on anterior 1/5 of termen. Abdomen with 1st tergum white; remaining terga dark grayish brown, with white band distally on each segment; sterna white.

Male genitalia (Figs 3-4): Uncus lanceolate in distal half, obtuse apically, with dense downward-directing, long setae laterally. Tegumen trapezoidal; gnathos band-like, angulate medially. Valva subrhomboidal, narrowly round apically, half-length of uncus, densely setose on distal 1/3; basal process digitate, as long as uncus, densely setose on distal 1/2; costa convex at distal 2/5; sacculus slightly convex at distal 2/5. Anellus short, scobinate; juxta broad-elliptical, concave medioposteriorly. Vinculum broadly round. Phallus (Fig. 4) tapered to apex from middle, with spinulate zone in distal half.

Female genitalia (Fig. 2): Papilla analis subquadrate, long-setose, spinulate on apical area. Postvaginal area with transverse wrinkles. Apophysis posterioris slender, 2x longer than apophysis anterioris. Ostium bursae small, on bowl-like, invaginated area. Ductus bursae broadened at middle, as long as corpus bursae; antrum 1/16 as long as ductus bursae, ring-like, depressed medially; ductus seminalis coiled. Corpus bursae globular, with a signum at middle; signum elliptical, slightly constricted medially, denticulate.

Distribution: South Korea, North Korea.

Remarks: This species distributes broadly in the central and southern parts of the Korean peninsula. Given the collecting records in the present study and the on-line observation data by the citizen scientists, no allopatric relationships were detected in the distributions of two closely related congeners, *E. koreana* and *E. nubifasciaria*, in Korea.

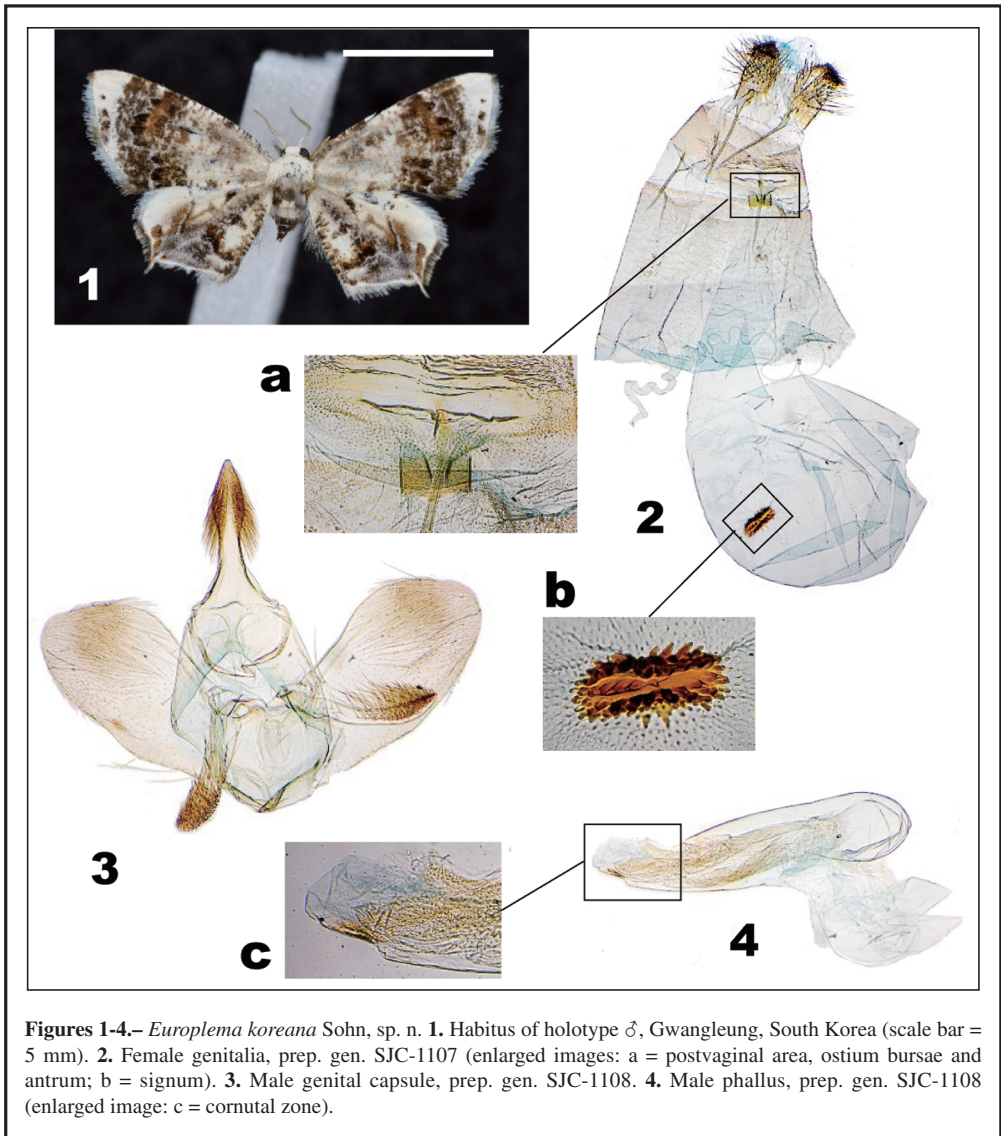
Discussion

Overall morphological features indicate that two species, *Europlema koreana* and *E. nubifasciaria*, are closely related and they belong to the *Epilema styx* species-complex sensu SOHN & YEN (2005). The species-complex shares a few characteristics with *Europlema* sensu HOLLOWAY (1998) in the male genitalia: i) the triangular uncus folded longitudinally in a roof-like manner, ventrally setose and ii) the valvae with a distinctive, slender process arising from the base ventrally. SINEV (2016) assigned *E. nubifasciaria* (= *E. leleji*) to *Europlema*, based on those similarities.

An association of the *Epilema styx* species-complex with *Europlema* seems premature and thus needs further attention. The species-complex differs from *Europlema* in two characteristics: i) the forewing venation with the Rs_1 separated from Rs_{2+3} and ii) the medial part of gnathos in the male genitalia as a convergent band. These differences may merit a new genus for the *Epilema styx* species-complex. To test that possibility, an integrative study with morphological and molecular data is on the way by the present author.

Acknowledgements

I am grateful to Dr. Laszlo Ronkay (Hungarian Natural History Museum, Budapest) for allowing my access to the Museum collection. This work was supported by a grant from the National Institute of Biological Resources (NIBR), funded by the Ministry of Environment (MOE) of the Republic of Korea (NIBR202002205).



BIBLIOGRAPHY

- CLARKE, J. F. G., 1941.– The preparation of slides of the genitalia of Lepidoptera.– *Bulletin of the Brooklyn Entomological Society*, **36**: 149-161.
- DE FREINA J. J. & FISHER, H., 2013.– Zur verbreitung und morphologie von *Europlema semibrunnea* (Pagenstecher, 1884) mit erstnachweis für die Malediven und bemerkungen zur besiedlungsgeschichte des Archipels (Lepidoptera: Uraniidae, Epipleminae).– *Nachrichten des entomologischen Vereins Apollo N. F.*, **34**: 127-132.
- HOLLOWAY, J. D., 1998.– The moths of Borneo: families Castniidae, Callidulidae, Drepanidae and Uraniidae.– *The Malayan Nature Journal*, **52**: 1-155.

- KLOTS, A. B., 1970.– Lepidoptera, pp. 115-130.– In S. L. TUXEN (ed.). *Taxonomist's Glossary of Genitalia in Insects*: 359 pp. Munksgaard, Copenhagen.
- SINEV, S. Y., 2016.– New species of the genus *Europlema* Holloway, 1998 (Lepidoptera: Uraniidae: Epipleminae) from the Russian Far East.– *Euroasian Entomological Journal*, **1**: 129-131.
- SOHN, J.-C. & YEN, S.-H., 2005.– A taxonomic revision of the Korean Epipleminae (Lepidoptera: Uraniidae), with phylogenetic comments on the involved genera.– *Zoological Studies*, **44**: 44-70.
- SONH, J.-C., KIM, S.-S. & CHOI, S.-W., 2019.– Three species of Epipleminae (Lepidoptera: Uraniidae) new to Korea, with a new synonym for *Epiplera nubifasciaria* Leech.– *Korean Journal of Applied Entomology*, **58**: 63-68.
- WOOTTON, R. J., 1979.– Function, homology and terminology in insect wings.– *Systematic Entomology*, **4**: 81-93.

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REVISIÓN DE PUBLICACIONES *BOOK REVIEWS*

S.-Y. Lang

The Nymphalidae of China (Lepidoptera, Rhopalocera). Part II

200 páginas, 15 láminas color

Formato 29,5 x 21 cm

Tshikolovets Publications, Pardubice, 2017

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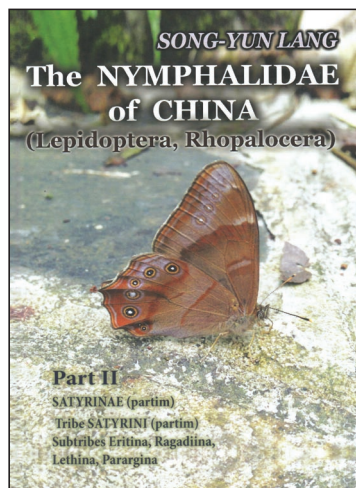
Tenemos en nuestras manos una nueva serie sobre los Nymphalidae de China, concretamente esta es la segunda parte. Se trata la primera parte de la subfamilia Satyrinae, con una tribu Satyrini y cuatro subtribus: Eritina (con tres géneros), Ragadiina (con dos géneros), Lethina (con cuatro géneros) y Parargina (con seis géneros), que abarca un total de 168 especies y sus numerosas subespecies, estableciéndose 6 nuevas combinaciones, 1 estatus nuevo y 15 nuevas sinonimias, que representan todas las especies que se encuentran en el tercer país más grande del mundo.

Después de unas primeras palabras de lo que significa esta publicación, aparecen los agradecimientos y una interesante introducción que abarca sobre cómo está compuesto este libro, acerca de las especies y su sistemática, sobre los mapas de distribución, terminología, nombres científicos, geografía y las diferentes colecciones consultadas, continuando con un lista de todas las especies y subespecies consideradas.

Ya dentro de la parte más importante del libro se nos presenta la familia, subfamilia y el género considerado con su información bibliográfica, la especie tipo, la descripción de la genitalia del macho y su distribución. De cada especie podemos ver los datos bibliográficos y las subespecies admitidas, su descripción, material estudiado, su distribución conocida, un mapa indicando con un círculo, donde se ha muestreado y, en algunos casos, notas adicionales. Todas las especies están excelentemente fotografiadas en 15 láminas a todo color, así como en 15 láminas podemos apreciar unas fotografías y dibujos muy detallados de la genitalia del macho, que permiten y facilitan la identificación de las especies consideradas, apoyadas por cinco láminas con fotografías de los adultos en vivo y principales paisajes de las zonas de captura. La obra finaliza con un índice y una extensa bibliografía, básica, para poder abarcar el ingente trabajo que ha supuesto esta obra.

No podemos terminar estas líneas, sin felicitar al autor, por tan minucioso trabajo y a la Editorial por continuar con la publicación de estas obras de referencia, por la excelente impresión del texto y fotografías de las genitalias, así como de las láminas en color, por lo que recomendamos esta obra, no sólo a los interesados en esta familia en particular, sino a todos los interesados en los Lepidoptera en general, donde esta obra no debería de faltar. El precio de este libro es de 90 euros más gastos de envío y los interesados lo pueden pedir a:

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Estados inmaduros de Lepidoptera (LXII). Dos especies del género *Lobesia* Guenée, 1845 cuyas orugas se alimentan de *Limonium* sp. en Huelva, España (Lepidoptera: Tortricidae)

M. Huertas-Dionisio

Resumen

Se describen e ilustran los estados inmaduros de dos especies del género *Lobesia* Guenée, 1845: *Lobesia indusiana* (Zeller, 1847) y *L. limoniana* (Millière, 1860) que vuelan en Huelva, España, así como su ciclo biológico, sus plantas nutricias *Limonium* sp. y la distribución.

PALABRAS CLAVE: Lepidoptera, Tortricidae, *Lobesia*, estados inmaduros, *Limonium*, Huelva, España.

Immature stages of Lepidoptera (LXII). Two species of the genre *Lobesia* Guenée, 1845, whose caterpillars feed on *Limonium* sp., in Huelva, Spain (Lepidoptera: Tortricidae)

Abstract

The immature stages of two species of the genre *Lobesia* Guenée, 1845: *Lobesia indusiana* (Zeller, 1847) and *L. limoniana* (Millière, 1860) are described and illustrated in Huelva, Spain, as so as the biologic cycle, its foot plant *Limonium* sp. and the distribution.

KEY WORDS: Lepidoptera, Tortricidae, *Lobesia*, immature states, *Limonium*, Huelva, Spain.

Introducción

El género *Lobesia* Guenée, 1845, está representado en Europa, por 16 especies, con dos generaciones al año, sus orugas se alimentan de las hojas, flores y tallos de diversas plantas, aunque de algunas no se conocen sus estados inmaduros. Los adultos tienen en general, en las alas delanteras una mancha basal, a veces muy dividida y una banda mediana irregular, complementándose con manchas en la zona apical (RAZOWSKI, 2003). Aquí estudiaremos dos especies que se alimentan de *Limonium* (*Stachys*): *Lobesia indusiana* (Zeller, 1847) y *L. limoniana* (Millière, 1860). Ambas con las características mencionadas anteriormente, la primera de 11 mm (fig. 18) y la segunda de mayor tamaño, de 16 mm (fig. 36).

Material y métodos

Las orugas que han servido para este estudio, se recogieron con sus plantas nutricias y se introdujeron en vasijas de plástico de boca ancha; debido al deterioro de las plantas, estas se renovaron cada semana hasta el total desarrollo de las orugas. Se siguió su ciclo biológico hasta la salida de los adultos, que fue cuando se identificaron. Varias orugas y crisálidas de cada especie fueron sacrificadas para su estudio, primero se anestesiaron con agua para poder dibujarlas y luego se conservaron en alcohol de 70°.

Estados inmaduros

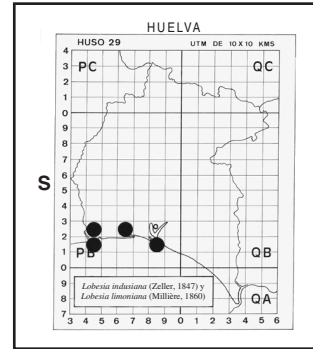
Lobesia indusiana (Zeller, 1847): El huevo (fig. 16) es elíptico, aplastado, de 0,75 x 0,55 mm, color poco rugoso, verde claro, luego amarillento y después rosáceo. La oruga en su último estadio (figs 1 y 2) mide 11 mm de longitud, pardo amarillento. Los pináculos anchos, portando setas rubias (fig. 3). Patas torácicas amarillentas, los tarsos más oscuros. Las patas abdominales del color del cuerpo, las ventrales coronadas con ganchos amarillos. Los espiráculos redondeados o en forma de elipse, amarillos con el peritrema castaño. La cápsula cefálica (fig. 4) mide de 0,80 a 0,90 mm de ancha, castaño claro; los ocelos y la mancha postocelar alargada, oscuras. En las antenas, la antacoria translúcida con la zona inferior amarillenta; el artejo basal translúcido; el artejo medio amarillo con la zona baja translúcida y el artejo terminal amarillo claro. Escudo protorácico (fig. 5) pardo claro con el borde posterior más oscuro; en algunos ejemplares todo pardo oscuro; está dividido en dos por una línea fina muy clara. Tabula alargada pardo amarillenta (fig. 8). El escudo anal (en la fig. 6 con el 9º urito) cuadrangular, pardo amarillento. El expulsor de excrementos (fig. 7) está situado debajo de la placa anal y cuya función se explica en HUERTAS-DIONISIO (1987), tiene de 5 a 6 espinas amarillentas insertadas en una gran base carnosa subcuadrangular. La crisálida macho (figs 9, 10 y 11) mide de 5 a 6 mm de longitud, de color pardo; cabeza redondeada, grande en relación con el cuerpo, con formación de un cuello en la zona del protórax; final de las antenas envolviendo el extremo de las patas mesotorácicas. La hembra es mayor, mide 6,50 mm y tiene las antenas más cortas (fig. 12). En el dorso de los uritos 2 a 8 tiene doble hilera de espinas, las anteriores de mayor tamaño (a veces, algunos ejemplares, no tienen la segunda hilera en el 8º urito); en el noveno solo tiene una hilera y en el décimo un pequeño grupo de espinas que tocan a la seta ganchuda D1 (fig. 13). Cremaster poco rugoso, castaño, borde irregular, con quiebras formados por líneas curvas; tiene ocho setas ganchudas, correspondientes a las D1, D2, SD1 y SD2 del escudo anal (fig. 14) y con estrías en la zona ventral (fig. 15).

Lobesia limoniana (Millière, 1860): El huevo (fig. 34) es lenticular, oval o elíptico, aplastado, color liso, verde claro, de 0,75 x 0,60 mm. La oruga en su último estadio (figs 19 y 20) mide de 14 a 15 mm de longitud, gris claro a gris rosáceo. Los pináculos anchos, bien señalados, grises, más oscuros los subventrales de los uritos 3 a 6; setas rubio muy claro (translúcidas) (fig. 21). Patas torácicas castaño oscuro. Las patas abdominales del color del cuerpo, las ventrales con una mancha gris oscuro, coronadas con ganchos amarillos. Los espiráculos redondeados o elípticos, pardo muy claro con el peritrema castaño. La cápsula cefálica (fig. 22) mide 1 mm de ancho, castaño claro; área ocelar y postocelar oscuras. En las antenas, la antacoria translúcida con la zona inferior gris oscuro; artejo basal y terminal translúcidos; artejo medio castaño oscuro. El escudo protorácico (fig. 23) castaño oscuro, dividido en dos por una línea clara muy fina. Tabula subcuadrangular castaño oscuro (fig. 26). El escudo anal (en la fig. 24 con el 9º urito) castaño oscuro, subtriangular. El expulsor de excrementos (fig. 25) (HUERTAS-DIONISIO, 1987), tiene 6 espinas amarillentas insertadas en una base carnosa subrectangular. La crisálida macho (figs 27, 28 y 29) mide de 8 a 9 mm de longitud, pardo a castaño claro; cabeza redondeada, pequeña en relación con el cuerpo, con formación de un cuello en la zona del protórax; final de las antenas envolviendo el extremo de las patas mesotorácicas. La hembra tiene las antenas más cortas (fig. 30). En el dorso de los uritos 2 a 8 tiene doble hilera de espinas, las anteriores de mayor tamaño; en el noveno urito solo tiene una hilera y en el décimo dos hileras largas y una corta que llegan hasta las setas ganchudas SD2 y D1 (fig. 31). Cremaster castaño oscuro, poco rugoso en la zona dorsal y con estrías en la zona ventral (a veces difuminada) (fig. 33); borde irregular, con quiebras formados por líneas curvas, tiene ocho setas ganchudas, correspondientes a las D1, D2, SD1 y SD2 del escudo anal (fig. 32).

Quetotaxia: Para la denominación de las setas, se ha seguido a HINTON (1946), descubriendo que su distribución en ambas especies es prácticamente idéntica, solo hemos observado que las setas L1, L2 y L3 del protórax, que están insertadas dentro de la tabula, están en línea recta en *indusiana* y formando un triángulo en *limoniana*. En el mesotórax, el grupo SD1-SD2, está más separado de L2 en *limoniana*. En el noveno urito, se observa que el conjunto de todas las setas, forman un arco en *indusiana*, y más

recto en *limoniana*. Por lo demás son muy parecidas, con ligeras variaciones en su ubicación. (figs 8 y 26).

Ciclo biológico y distribución: *Lobesia indusiana*, ha sido descrita del sur de Francia como *Lobesia statticeana* Millière, 1868, describiendo la oruga y su planta nutricia, *Limonium cordatum* (L.) Mill. Citada como *Polychrosis statticeana*, del sur de Francia y Sicilia, la larva sobre *Limonium sinuatum* (L.) Mill. de abril a mayo y los adultos en junio-julio y septiembre-octubre, y como *Polychrosis indusiana*, de Sicilia (KENNEL, 1916). También como *P. statticeana* en Biskra (Argelia), la oruga en abril sobre *Limonium tournefortii* (Boiss.) Erben y el imago en mayo (CHRÉTIEN, 1917). Descrita de Ucrania como *Polychrosis cognata* (OBRAZTSOV, 1949). Citada de España como *L. cognata* y *L. indusiana* (OBRAZTSOV, 1953). La oruga de



P. statticeana, ha sido descrita someramente, encontrándose en las flores de *Statice limonium* desde agosto hasta mayo en el sur de Francia (SWATSCHEK, 1958). Vuela en agosto en Marruecos (RUNGS, [1980]). Citada de España por VIVES MORENO (1992, 1994 y 2014). Se extiende por la zona mediterránea de Francia, España, Cerdeña, Sicilia, Italia y Yugoslavia (KARSHOLT & RAZOWSKI, 1996). Ha sido citada de final de agosto de Rumania, y sus orugas en *Limonium gmelinii* (Willd.) Kuntze (KOVÁCS & KOVÁCS, 2001). También de Macedonia, Bulgaria, Crimea y Daghestan (Caucasus); la larva en los tallos de *Limonium meyeri* (Boiss.) Kuntze, y adultos en mayo y junio (RAZOWSKI, 2003). Citada de Meia Praia (Algarve) Portugal, 4 octubre 1999 (CORLEY, 2005). De las salinas de Santa Pola (Alicante) (HUEMER & WIESER, 2010). En el litoral de Huelva, “Marismas de Isla Cristina” UTM 29SPB41 y 42, “Marismas del Río Piedras y Flecha del Rompido” UTM 29SPB62, “Marismas del Odiel” y “Estero de Domingo Rubio” UTM 29SPB81 (ver mapa), han sido localizadas las orugas en un tubo de seda sobre las ramas y flores de *Limonium ferulaceum* (L.) Chaz. (fig. 17), en mayo y junio, hacen los capullos protegidos por excrementos y restos de flores, saliendo los adultos a final de junio.

Lobesia limoniana ha sido descrita como *Sciaphila limoniana*, del sur de Francia por MILLIÈRE (1860), describiendo la oruga y la crisálida, alimentándose de las flores de *Limonium sinuatum*, con una generación en marzo y abril. Citada también como *Polychrosis limoniana* del sur de Francia por KENNEL (1916). Citada de España por OBRAZTSOV (1953), y de Cataluña sin indicar localidad por BAI-XERAS (1990). Citada de España por VIVES MORENO (1992, 1994 y 2014). Vuela en Francia, España, Italia y Sicilia (KARSHOLT & RAZOWSKI, 1996). En las marismas de Ayamonte (Huelva), las orugas sobre *Limonium algarvense* Erben (fig. 35) (HUERTAS-DIONISIO, 2002). Está citada, volando en septiembre, de España, Sur de Francia y Córcega (RAZOWSKI, 2003). Se han localizado a las orugas, alimentándose de las inflorescencias, yemas y hojas de *Limonium algarvense* y de *L. narbonense* Mill., de diciembre hasta abril, también en junio y octubre, con adultos de enero a abril y en agosto-octubre, en los mismos Parajes Naturales del litoral de Huelva señalados en *L. indusiana* (ver mapa) (HUERTAS-DIONISIO, 2007). Está citada de las salinas de Santa Pola (Alicante) (HUEMER & WIESER, 2010).

Discusión

Las dos especies pueden separarse fácilmente por sus dibujos alares y su tamaño (figs 18 y 36). Las orugas por su color, pardo amarillento en *L. indusiana* y gris claro a gris rosáceo en *L. limoniana*, pero sobretudo por la mancha gris oscuro que tiene *L. limoniana* en las patas ventrales (fig. 21) y de la que carece *indusiana* (fig. 3). En las crisálidas, se ha apreciado el distinto grueso de la cabeza en relación con el cuerpo y las espinas del dorso del décimo urito (figs 14 y 32). Las plantas nutricias de *indusiana* que han sido citadas son: *Limonium cordatum*, *Limonium sinuatum*, *Limonium tournefortii*, *Limonium gmelinii* y *Limonium meyeri*, en Huelva ha sido hallada sobre *Limonium ferulaceum* (fig. 17), con

dos generaciones, una de mayo a julio y otra en septiembre-octubre. De *limoniana*, solo ha sido citada *Limonium sinuatum*, en Huelva ha sido encontrada sobre *Limonium algarvense* (fig. 35) y *Limonium narbonense*, con dos o tres generaciones solapadas, con adultos de enero a abril y de julio a octubre. La genitalia de las dos especies en RAZOWSKI (2003).

Agradecimientos

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BIBLIOGRAFÍA

- BAIXERAS, J., 1990.– Situación actual del conocimiento de la familia Tortricidae Latreille, 1803, en Catalunya (Lepidoptera).– *Sessió Conjunta d'Entomologia ICHN-SCL*, **6**(1989): 131-138.
- CHRETIEN, P., 1917.– Contribution à la connaissance des lépidoptères du Nord de l'Afrique. Notes biologiques et critiques.– *Annales de la Société Entomologique de France*, **85**(1916): 369-502.
- CORLEY, M. F. V., 2005.– Further additions to the Lepidoptera of Algarve, Portugal. II (Insecta: Lepidoptera).– *SHILAP Revista de lepidopterología*, **33**(131): 347-364.
- 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.
- HUEMER, P. & WIESER, C., 2010.– Beitrag zur Faunistik der Schmetterlinge (Lepidoptera) in der Region Valencia (Spanien) - Teil II.– *Denisia*, **29**: 139-164.
- HUERTAS-DIONISIO, M., 1987.– Estados inmaduros de Lepidoptera (IV). El expulsor de excrementos.– *SHILAP Revista de lepidopterología*, **15**(60): 381-386.
- HUERTAS-DIONISIO, M., 2002.– Lepidópteros de Huelva (I). Especies detectadas en las márgenes del río Guadiana.– *Boletín de la Sociedad Andaluza de Entomología*, **4**: 6-27.
- HUERTAS-DIONISIO, M., 2007.– Lepidópteros de los Espacios Naturales Protegidos del Litoral de Huelva (Micro y Macrolepidóptera).– *Sociedad Andaluza de Entomología, Monográfico*, **2**: 1-248.
- KARSHOLT, O. & RAZOWSKI, J., 1996.– *The Lepidoptera of Europe. A Distributional Checklist*: 380 pp. Apollo Books, Stenstrup.
- KENNEL, J., 1908-1921.– Die Palaearktischen Tortriciden.– *Zoologica*, **21**(54): 1-742, 24 pls. Stuttgart.
- KOVÁCS, Z. & KOVÁCS, S., 2001.– First record of *Thodia caradjana* Kennel, 1916 (Lepidoptera: Tortricidae) to the fauna of Europe; new records of Tortricidae to the fauna of Romania.– *Entomologica romanica*, **6**: 45-52.
- MILLIÈRE, P., 1860.– *Iconographie et description de chenilles et lépidoptères inédits*, **1**(3): 113-192 + pl. 1-10. Lyon.
- MILLIÈRE, P., 1868.– *Iconographie et description de chenilles et lépidoptères inédits*, **2**: 430-448, pl. 95.
- OBRAZTSOV, N., 1949.– Neue und wenig bekannte Tortriciden-Arten und -Formen.– *Mitteilungen der Münchner Entomologischen Gesellschaft*, **35/39** (1945-1949): 200-201, fig. 1.
- OBRAZTSOV, N., 1953.– Classification of Holarctic species of the genus *Lobesia* Guenée, with description of *Paralobesia* gen. nov. (Lepidoptera, Tortricidae).– *Tijdschrift voor Entomologie*, **96**: 85-94.
- RAZOWSKI, J., 2003.– Olethreutinae.– *Tortricidae of Europe*, **2**: 301 pp. František Slamka, Bratislava.
- RUNGS, C., [1980].– Catalogue raisonné des lépidoptères du Maroc. Inventaire Faunistique et Observations écologiques.– *Travaux de l'Institut Scientifiques. Rabat. Série Zoologie*, **39**(1979), **1**: [14] + 222 + [10], 2 mapas.
- SWATSCHKE, B., 1958.– Die Larvalsystematik der Wickler II - [Olethreutinae - Cochylidae - Copromorphaidea (Phaloniidae)].– *Abhandlungen zur Larvalsystematik der Insekten*, **3**: 1-269.
- VIVES MORENO, A., 1992.– *Catálogo sistemático y sinonímico de los lepidópteros de la Península Ibérica y Baleares (Insecta: Lepidoptera)*: 378 pp. Ministerio de Agricultura Pesca y Alimentación. Madrid.
- VIVES MORENO, A., 1994.– *Catálogo sistemático y sinonímico de los lepidópteros de la Península Ibérica y Ba-*

leares (Insecta: Lepidoptera) (Segunda parte): X + 775 pp. Ministerio de Agricultura, Pesca y Alimentación. Madrid.

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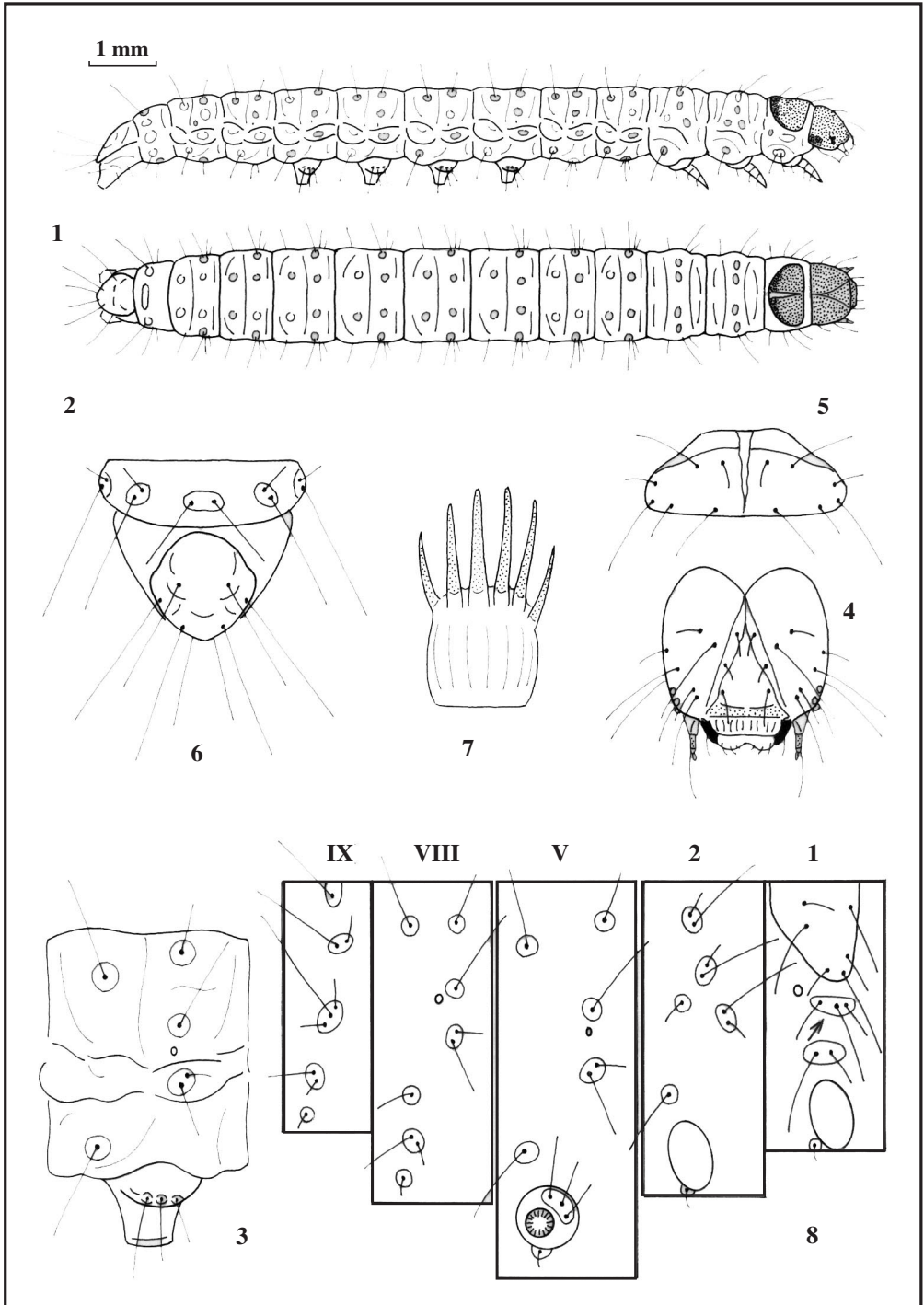
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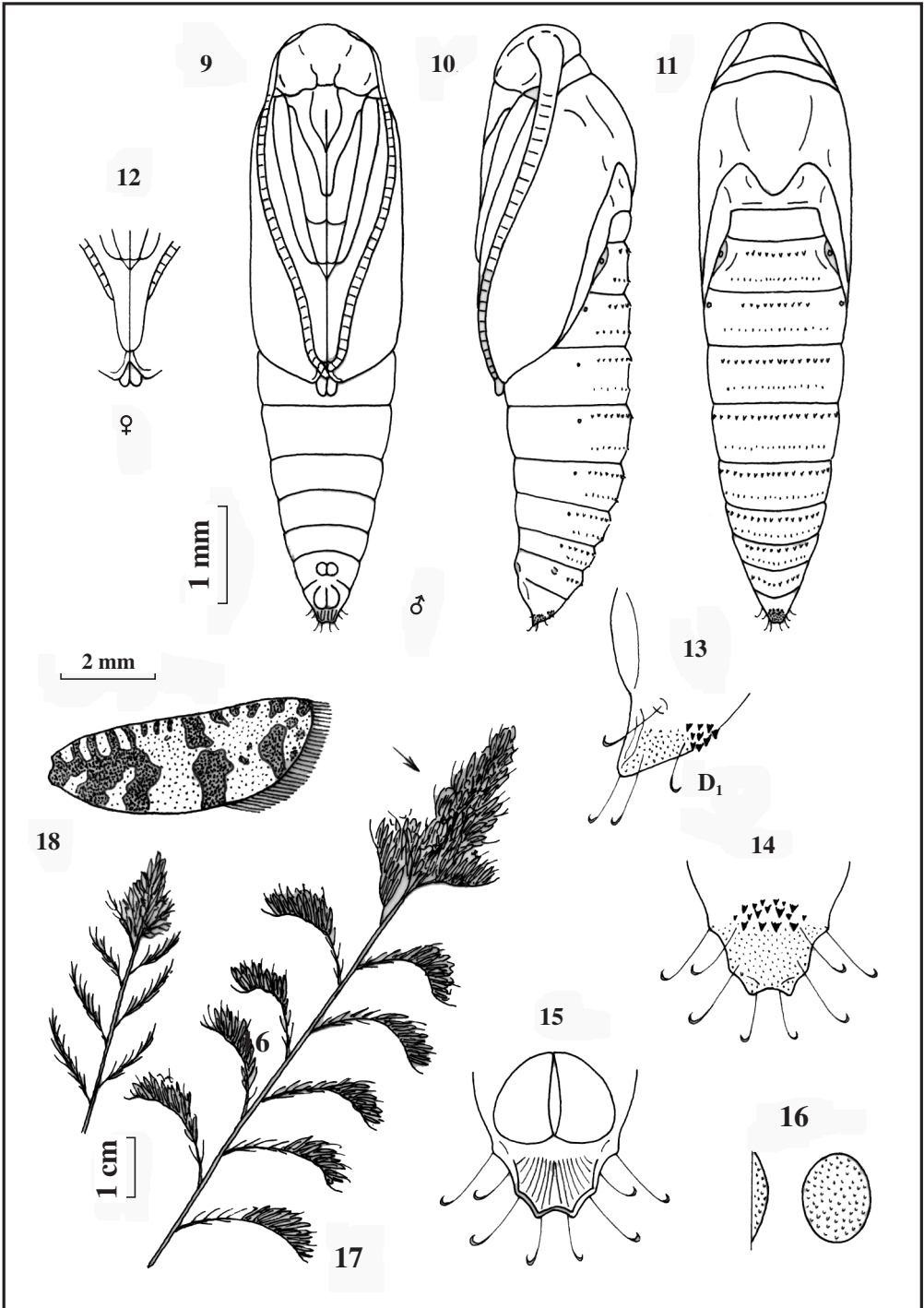
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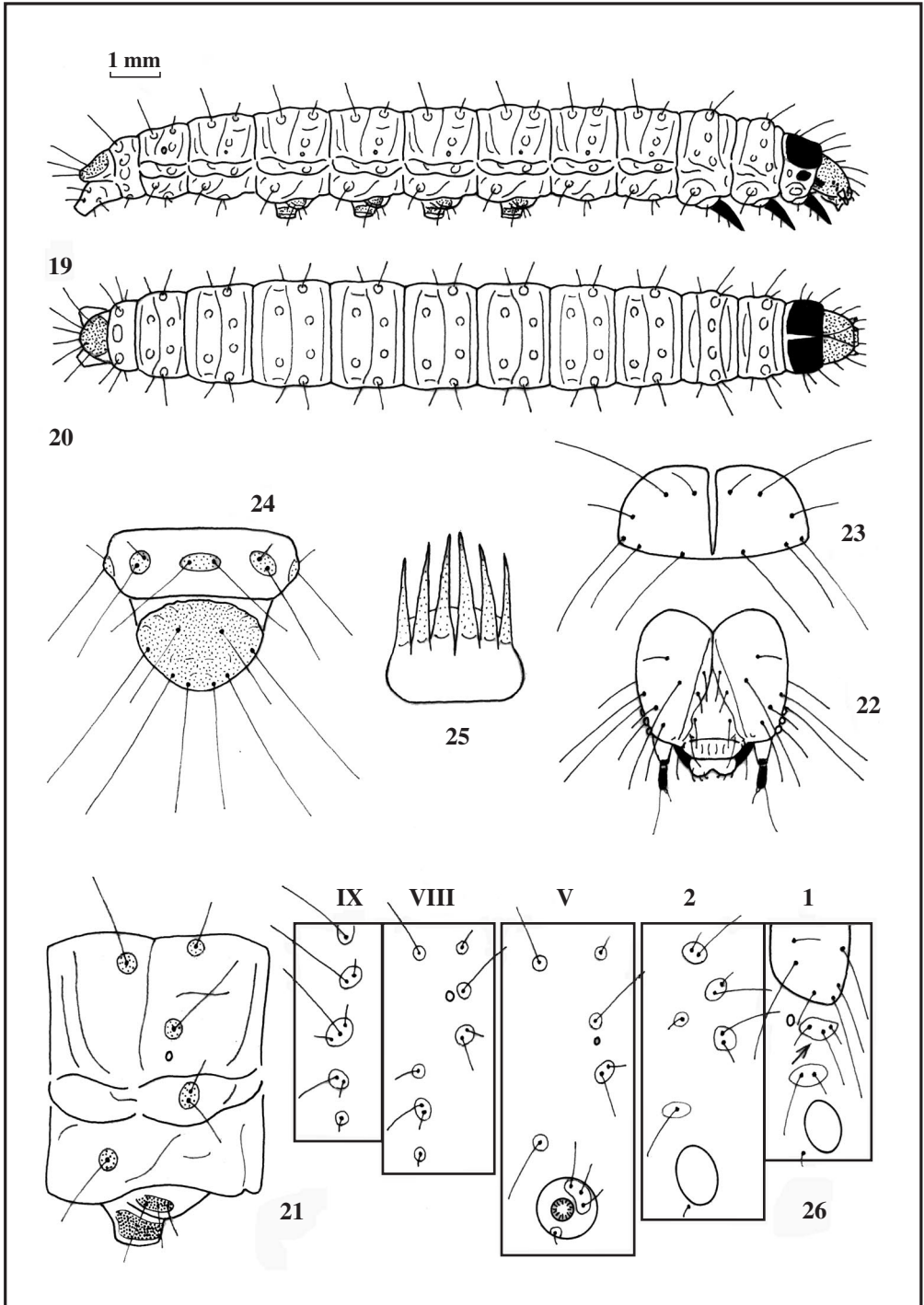
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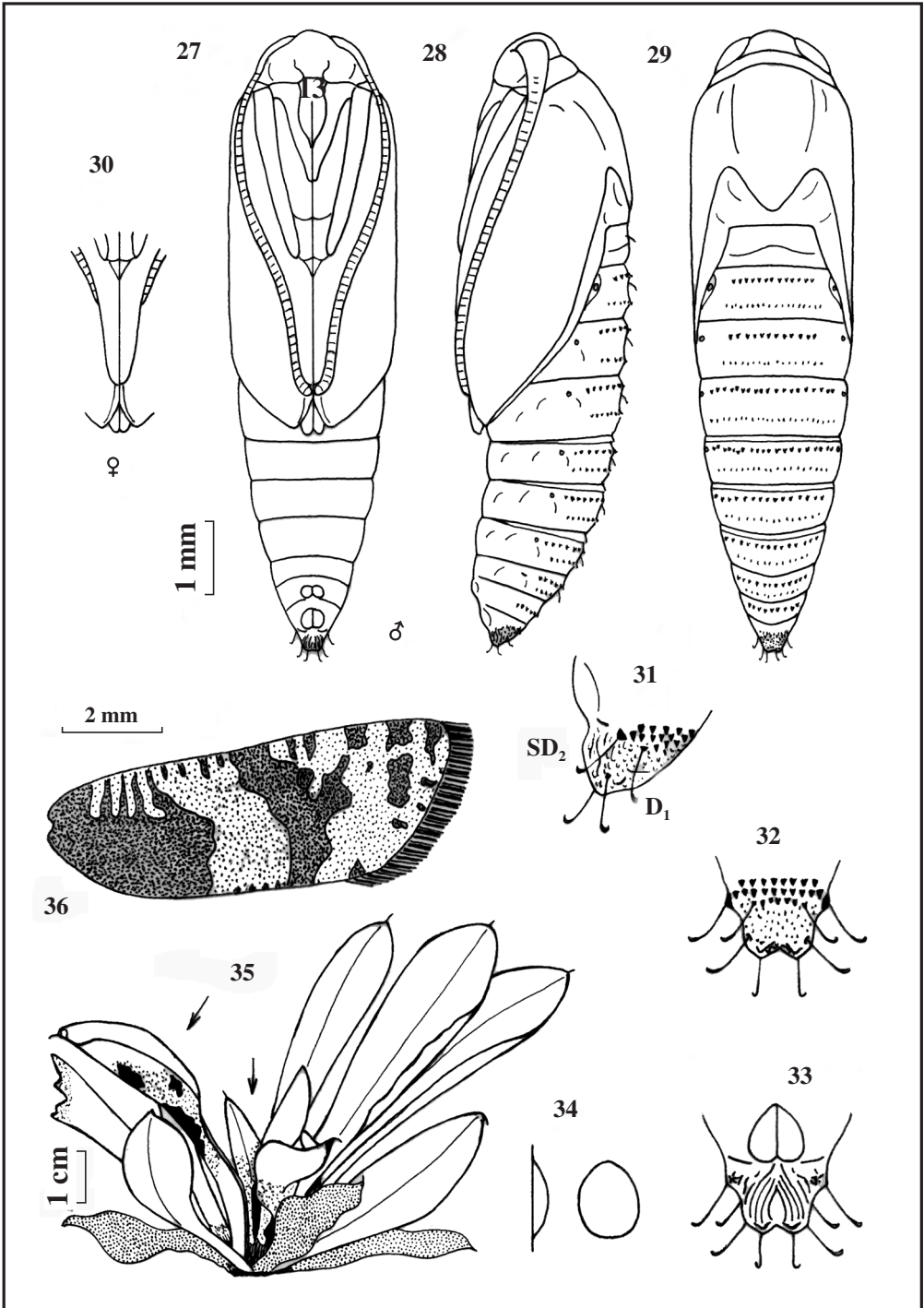
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What species of *Mecyna subsequalis* (Herrich-Schäffer, 1854) - group occurs in highlands of Central Asia? (Lepidoptera: Crambidae, Spilomelinae)

S. Yu. Sinev & S. K. Korb

Abstract

By male genitalia and external characters as well as by the mtDNA COI sequence, the species from mountain of Central Asia reported earlier as *Mecyna lutulentalis* (Lederer, 1858) now is identified as *Mecyna salangalis* Amsel, 1970. The species inhabits dry steppe slopes of Hindukush, West Pamir, Central Alai and western part of Alai valley, West Tian-Shan and western part of Inner Tian-Shan. The variability of *M. salangalis* is shown, and the female and its genitalia are described for the first time.

KEY WORDS: Lepidoptera, Crambidae, Spilomelinae, *Mecyna subsequalis*, Central Asia.

¿Qué especie del grupo *Mecyna subsequalis* (Herrich-Schäffer, 1854) existe en las tierras altas de Asia Central?
(Lepidoptera: Crambidae, Spilomelinae)

Resumen

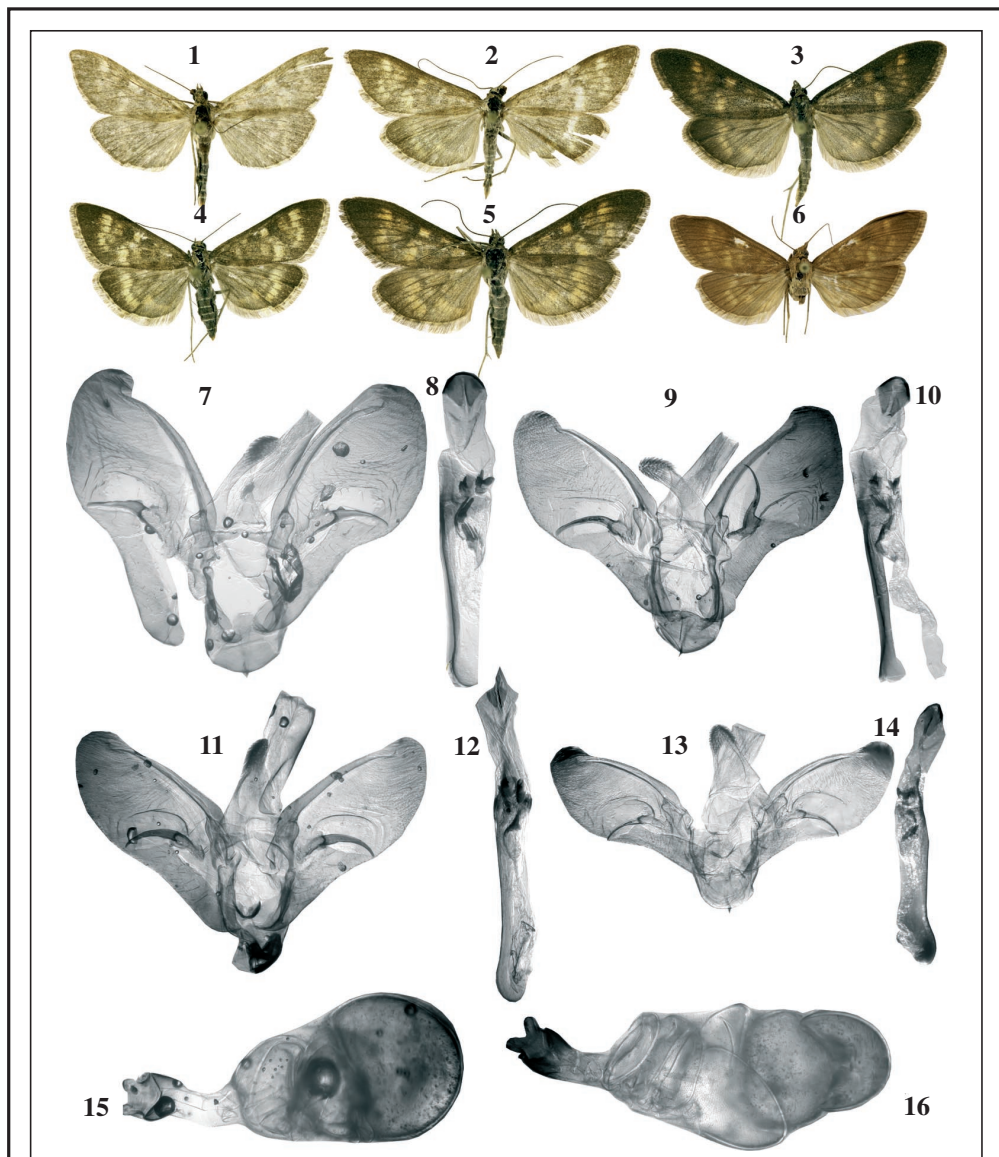
Por la genitalia de los machos y caracteres externos tanto como por la secuencia mtADN COI la especie de las Montañas de Asia Central *Mecyna lutulentalis* (Lederer, 1858) identificada como *Mecyna salangalis* Amsel, 1970. La especie habita en las secas estepas de Hindukush, oeste del Pamir, Alai central y parte occidental del Valle de Alai, oeste de Tian-Shans y la parte occidental de Tian-Shans. Se muestra la variabilidad de *M. salangalis* y la hembra y su genitalia se describen por primera vez.

PALABRAS CLAVE: Lepidoptera, Crambidae, Pyraustinae, *Mecyna subsequalis*, Asia Central.

Introduction

Three species of *Mecyna* Doubleday, 1849 were known from Central Asia so far: *M. flavalis* ([Denis & Schiffermüller], 1775) from “C. Asia” (SLAMKA, 2013: 96), *M. asiaticalis* Caradja, 1916, from “Issykkul” (CARADJA, 1916: 35) and *M. lutulentalis* (Lederer, 1858) from “Alai” (CARADJA, 1916: 36). The latter species originally described from Damask (Syria) (LEDERER, 1858: 148) now treats as a subspecies of *M. subsequalis* (Herrich-Schäffer, 1854) (SLAMKA, 2013); its record for the highlands of Central Asia looks doubtful and needs careful verification.

The specimens with habitus closely related to *M. subsequalis lutulentalis* were collected by the second author from several places in the highlands of Inner Tian-Shan, West Tian-Shan and Alai (Kyrgyzstan) in 2009-2019 and of West Pamir (Tajikistan) in 2011. We tried to clarify the species affiliation of these specimens using both morphological and molecular data.



Figs 1-16.– *Mecyna salangalis* Amsel, 1970. General appearance (1-6): **1.** male, sample GWOUC159-19, Talassky Mts., Kara-Buura river coast, 35 km S Klyuchevka, 1707 m. **2.** male, sample GWOUC168-19, Alai Mts., small valley near Archaty, 2667 m. **3.** male, sample GWOUC169-19, same locality. **4.** female, sample GWOUC174-19, same locality. **5.** female, sample GWOUC175-19, same locality. **6.** male, Moldo-Too Mts., near Koro-Goo Pass, 2400 m. Male genitalia (7-14). **7-8.** sample GWOUC159-19, Talassky Mts., Kara-Buura river coast, 35 km S Klyuchevka, 1707 m. **9-10.** sample GWOUC168-19, Alai Mts., small valley near Archaty, 2667 m. **11-12.** sample GWOUC169-19, same locality. **13-14.** sample GWOUC174-19, same locality. Female genitalia (15-16): **15.** Moldo-Too Mts., near Koro-Goo Pass, 2400 m. **16.** Alai Mts., small valley near Archaty, 2667 m.

Materials and methods

Traditional methods of genitalia dissection have been used (ROBINSON, 1976). In total, we dissected 27 males and 3 females. The figures were taken by digital camera Canon EOS 5D Mark II with Canon EF 100 mm macro lens for imago and MS-VP microscope for genitalia.

Material examined: TAJIKISTAN, 1 ♂, 19-VII-2011, Shakhdarinsky Mts., Vezdara river valley near kishlak Vodzh, 37°42.254'N, 71°57.325'E, 2886 m, leg. S. Korb. KYRGYZSTAN, 2 ♂♂, 1 ♀, 14-VII-2015, Alai Mts., small valley between Tashkoro and Karabulak, 40°14.119'N 73°24.484'E, 1805 m, leg. S. Korb; 5 ♂♂, 2 ♀♀, 15-VII-2015, Alai Mts., small valley near Archaty, 39°50.370'N, 73°19.593'E, 2667 m, leg. S. Korb; 6 ♂♂, 2 ♀♀, 22-VII-2017, same locality, leg. S. Korb; 4 ♂♂, 1 ♀, 16-18-VII-2019, same locality, leg. S. Korb; 2 ♂♂, 21-22-VII-2019, Alai Mts., Kyzyl-Eshme valley, 39.620689°N 72.286766°E, 2961 m, leg. S. Korb; 3 ♂♂, 10-VII-2014, Moldo-Too Mts., near Koro-Goo Pass, 41°31.363'N, 74°40.517'E, 2400 m, leg. S. Korb; 4 ♂♂, 26-VII-2017, same locality, leg. S. Korb; 6 ♂♂, 2 ♀♀, 22-25-VI-2009, Dzhumgaltoo Mts., Sary-Kaiky gorge, 42°11.254'N, 74°3.171'E, 2144 m, leg. S. Korb; 1 ♂, 17-VII-2015, same locality, leg. S. Korb; 1 ♂, 25-VII-2016, same locality, leg. S. Korb; 4 ♂♂, 1 ♀, 19-VII-2017, same locality, leg. S. Korb; 10 ♂♂, 2 ♀♀, 26-VII-2016, Dzhumgaltoo Mts., Kekemeren river valley near Kyzyl-Oi, 42°11.339'N, 74°3.193'E, 2093 m, leg. S. Korb; 1 ♂, 30-VII-2019, same locality, leg. S. Korb; 20 ♂♂, 4 ♀♀, 27-28-VII-2019, Talassky Mts., Kara-Buura river coast, 35 km S Klyuchevka, 42.337976°N 71.60727°E, 1707 m, leg. S. Korb.

For DNA analysis, the samples of the Cytochrome Oxidase Subunit I sequence (COI) were used. The following 5 samples have been processed from the own material (all in BOLD): GWOUC159-19 - West Tian-Shan, Talas Mts., Kara-Buura river, 1800 m; GWOUC168-19, GWOUC169-19, GWOUC174-19 and GWOUC175-19 - Alai Mts., Archaty valley, 2800 m.

The following 10 samples were obtained from the BOLD online database: *M. lutealis* (Duponchel, 1833) - FBLMZ562-12 and LEATA556-1: ITALY, South Tirol; *M. flavalis* ([Denis & Schiffermüller], 1775) - FBLMS070-09 and FBLMS071-09: GERMANY; *M. gracilis* (Butler, 1879) - GWOR3208-08: CHINA, Hebei; *M. balcanica* Slamka & Plant, 2016 - PHLAF240-11 and PHLAF257-11: CROATIA; *M.* sp. (forming same BIN with our samples) - LEKIR053-13: Jalal-Abad, KYRGYZSTAN; *M. subsequalis* (Herrich-Schäffer, 1854) - IBLPC309-10: Zanzan, IRAN; IBLPC310-10: Erzurum, TURKEY; FBLMZ431-12: Ionian islands, GREECE.

DNA sampling and sequencing were implemented in the University of Guelph (Canada) by the BOLD program (RATNASINGHAM & HEBERT, 2007); it was made using processes and protocols described in HUEMER *et al.* (2014). The length of COI sequences obtained for this analysis is 658 sites.

Results and discussion

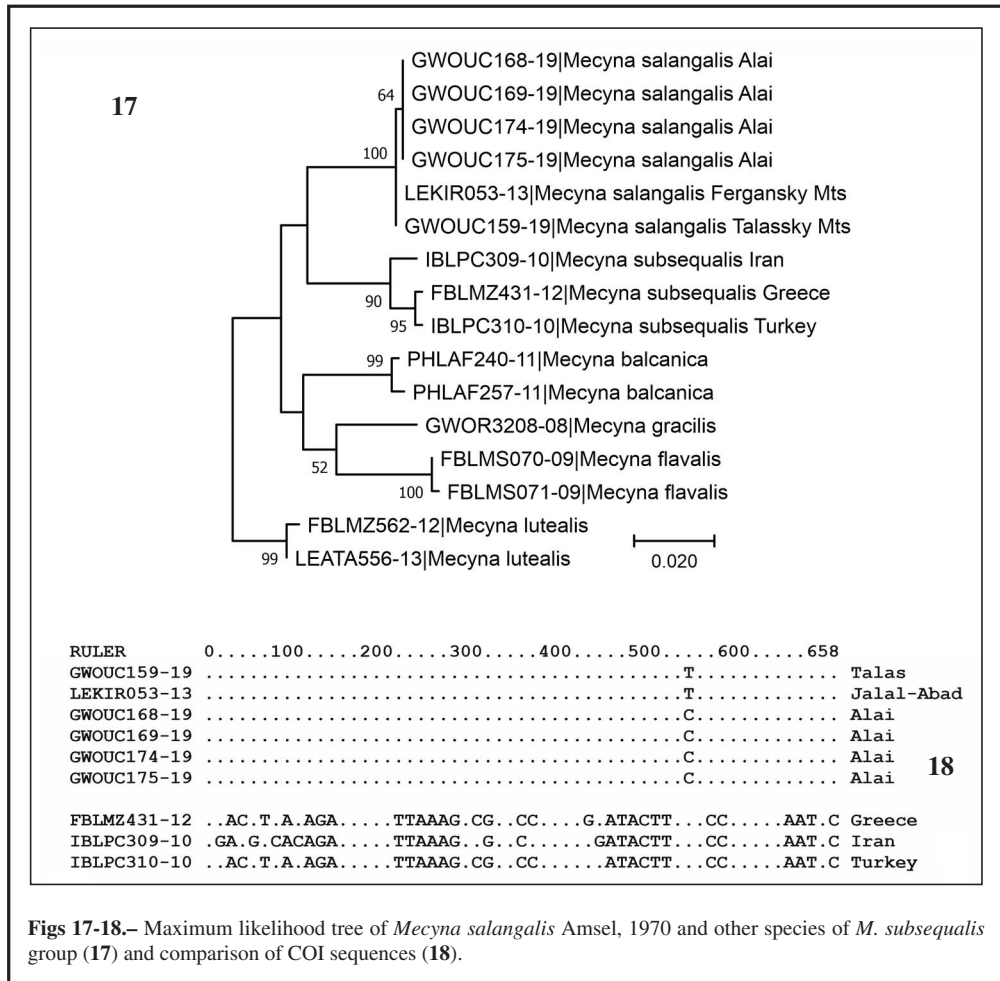
The external morphology of studied specimens differs considerably (figs 1-6). The ground color of the wings varies from light brown to dark brown or even brownish-grey. Light spots on the wings vary in size and color, from yellow to pale ochreous and light brown. The females are of the same size as males or slightly smaller, with the same ground color of wings; however, in females the light belts and spots are wider.

Male genitalia (figs 7-14): Valvae wide, slightly variable in shape, but always with distinctly convex dorsal margin and concave ventral margin. Harpa very narrow, pointed, sickle-shaped or nearly straight. Aedeagus longer than valva, straight and narrow, with 4 cornuti which differ in size, shape and number of thorns.

Female genitalia (figs 15-16): Antrum not longer than wide, of the same length with the rest of ductus bursae (in *M. subsequalis* antrum long and cylindrical, see SLAMKA, 2013: pl. 109, fig. 153); its lateral lobes rounded and distinctly spread apart. Bursa copulatrix oval, without pronounced signum.

By general appearance, our specimens well correspond to *M. subsequalis* but their male genitalia are quite different having thin and only slightly curved harpa and four cornuti in aedeagus;

M. subsequalis has well sclerotized strongly curved harpa and single large cornutus (see SLAMKA, 2013, pl. 36, fig. 153). By male genitalia, our specimens are nearly identical with *M. amasialis* (Staudinger, 1880) (see SLAMKA, 2013, pl. 35, fig. 149); however, the latter species has yellowish wings with plumbeous spots, while in our specimens wings are brownish with yellowish spots. Taking into account the variation in wing coloration and in male genitalia between specimens, we decided to use the mtDNA analysis. As it turned out all phenotypes (large or small and light or dark, with slightly different wing spotting) from the same locality have identical COI sequences and clustered together (fig. 17). The specimens taken from the distant localities (Talassky and Fergansky mountain ridges) differ from other specimens only by one site (fig. 18), while the differences in COI between *M. subsequalis* and our samples embraced 30 sites and p-distances of COI vary from 4.3 to 4.6, that is enough for the species delimitation in *Mecyna*. Thus, all collected specimens belong to the same separate species.



Five more *Mecyna* species from the neighboring areas of Central Asia are known so far. *M. bandiamiralis* Amsel, 1970, described from Afghanistan (Band-i-Amir, 2900 m) has coloration and wing pattern as in *M. subsequalis*, but 3 cornuti in aedeagus. *M. babalis* Amsel, 1970, described from the

same locality, has lemon-yellow wings. *M. micalis* (Caradja, 1916), described from Kazakhstan (Emba) has coloration and wing pattern as in *M. subsequalis*, but very short labial palpi. *M. marioni* Amsel, 1957, described from Uzbekistan (Samarkand) has yellow wings. *M. salangalis* Amsel, 1970, described from Afghanistan (Salang-Paß, 2100 m) has wing pattern and coloration as in *M. subsequalis*, but four cornuti in aedeagus and almost straight harpa (AMSEL, 1970: fig. 16). Our specimens differ from the latter species only by the sharp apex of harpa and shape of cornuti, which are rather variable.

We believe that the known Central Asian representatives of *M. subsequalis*-group belong to *M. salangalis*. The distribution range of this species includes Hindukush (Salang Pass), West Pamir (Shakhdarinsky Mts.), Central Alai and western part of Alai valley, West Tian-Shan (Talassky Mts.) and western part of Inner Tian-Shan (Dzhungaltoo and Moldo-Too mountain ranges) (fig. 19). The species inhabits dry and steppe biotopes near small rivers at the altitudes from 1700 to 2900 m a.s.l. (figs 20-23).

Acknowledgements

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Fig. 19.— Distribution map of *Mecyna salangalis* Amsel, 1970 (pentagon - type locality).

BIBLIOGRAPHY

AMSEL, H. G., 1970.— Afghanische Pyraustinae (Lepidoptera: Pyralidae). Ergebnisse der 1. Und 2. Afghanistan-Expedition der Landessammlungen für Naturkunde Karlsruhe.— *Beiträge zur naturkundlichen Forschung in Südwestdeutschland*, 29(1): 25-66.

- CARADJA, A., 1916.– Beitrag zur Kenntnis der geographischen Verbreitung der Pyraliden und Tortriciden des europäischen Faunengebietes, nebst Beschreibung neuer Formen.– *Deutsche entomologische Zeitschrift Iris*, **30**(1): 3-88.
- HUEMER, P., MUTANEN, M., SEFC, K. M. & HEBERT, P., 2014.– Testing DNA barcode performance in 1000 species of European Lepidoptera: large geographic distances have small genetic impacts.– *PLoS One*, **9**(12): e115775.
- LEDERER, J., 1858.– Noch einige syrische Schmetterlinge.– *Wiener entomologische Monatschrift*, **2**(5): 135-152.
- RATNASINGHAM, S. & HEBERT, P., 2007.– BOLD: The Barcode of Life Data System.– *Molecular ecology notes*, **7**: 355-364.
- ROBINSON, G. S., 1976.– The preparation of slides of Lepidoptera genitalia with special reference to the Microlepidoptera.– *Entomologist's Gazette*, **27**: 127-132.
- SLAMKA, F., 2013.– *Pyraloidea (Lepidoptera) of Europe. Pyraustinae & Spilomelinae. Identification - Distribution - Habitat - Biology*, **3**: 357 pp. František Slamka, Bratislava.

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Figs 20-23.– Biotopes of *Mecyna salangalis* Amsel, 1970. **20.** Alai Mts., Kyzyl-Eshme valley. **21.** Talassky Mts., Kara-Buura river. **22.** Moldo-Too Mts. near Koro-Goo Pass. **23.** Dzhumgaltoo Mts., Sary-Kaiky gorge.

**COMITÉ PARA LA PROTECCIÓN DE LA NATURALEZA, PROYECTO DE
INVESTIGACIÓN CIENTÍFICA DE SHILAP / COMMITTEE FOR THE PROTECTION
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- 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.
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A review of the Antillean genus *Murgisca* Walker, 1863 with descriptions of four new species (Lepidoptera: Pyralidae, Chrysauginae)

V. O. Becker

Abstract

Six species of the genus *Murgisca* Walker, 1863 are recognized, four of them new: *Murgisca antillana* Becker, sp. n., from Jamaica and Dominican Republic, and *M. cubana* Becker, sp. n., *M. sympatrica* Becker, sp. n. and *M. taina* Becker, sp. n., from Cuba. The genus is restricted to the Antilles, with *M. cervinalis* Walker, 1863 previously described from the Dominican Republic and *M. subductella* (Möschler, 1890) from Puerto Rico. Two species are not congeneric and transferred to *Lepidomys* Guenée, 1852 as *L. diplommatialis* (Dyar, 1914), comb. n., from Panama and *L. pyrophoralis* (Hampson, 1916), comb. n., from Peru.

KEY WORDS: Lepidoptera, Pyralidae, Chrysauginae, *Murgisca*, new species, *Lepidomys*, new combinations, taxonomy, Antilles.

Una revisión del género antillano *Murgisca* Walker, 1863 con descripción de cuatro nuevas especies (Lepidoptera: Pyralidae, Chrysauginae)

Resumen

Se reconocen seis especies del género *Murgisca* Walker, 1863, cuatro de ellas nuevas: *Murgisca* antillana Becker, sp. n., de Jamaica y República Dominicana y *M. cubana* Becker, sp. n., *M. sympatrica* Becker, sp. n. y *M. taina* Becker, sp. n., de Cuba. El género está restringido a las Antillas, con *M. cervinalis* Walker, 1863 previamente descrita en la República Dominicana y *M. subductella* (Möschler, 1890) en Puerto Rico. Las dos especies no son congéneres y transferidas a *Lepidomys* Guenée, 1852 como *L. diplommatialis* (Dyar, 1914), comb. n., de Panamá y *L. pyrophoralis* (Hampson, 1916), comb. n., de Perú.

PALABRAS CLAVE: Lepidoptera, Pyralidae, Chrysauginae, *Murgisca*, nuevas especies, *Lepidomys*, combinaciones nuevas, taxonomía, Antillas.

Introduction

Murgisca Walker, 1863 was established as a monotypic genus. Currently it includes four species: two from the Antilles and two from Panama and Peru respectively (SOLIS *et al.*, 1995). Examination of the material in the author's collection (VOB) and the type material, revealed that six species occur in the Antillean islands, four of them new, described herein. The two species from the American mainland are not congeneric with *Murgisca cervinalis* Walker, 1863 the type of the genus, and are transferred to *Lepidomys* Guenée, 1852: *L. diplommatialis* (Dyar, 1914), **comb. n.**, from Panama, and *L. pyrophoralis* (Hampson, 1916), **comb. n.**, from Peru (WOLCOTT, 1951).

Material and methods

This review is based on 47 specimens (16 g. s.) in VOB, 10 in the USNM, and two in the

CMNH. The holotypes of the new species, except for that of *M. antillana*, deposited in the CMNH, are provisionally deposited in VOB, and will be transferred, along with the rest of the collection, to a Brazilian Institution in the future. Some paratypes will be deposited in the USNM. Genitalia were prepared following the methods described by ROBINSON (1976). Terms for morphological characters follow HODGES (1971) and KRISTENSEN (2003).

Abbreviations

CMNH	=	Carnegie Museum of Natural History, Pittsburgh, USA
FW	=	Forewing
g. s.	=	genitalia slide
HW	=	Hind wings
MNHU	=	Museum für Naturkunde Humboldt Universität, Berlin, Germany
NHMUK	=	Natural History Museum, London, United Kingdom
TS	=	Type-species
USNM	=	United States National Museum, Washington, USA
VOB	=	Vitor O. Becker collection, Serra Bonita Reserve, Camacan, Bahia, Brazil

Results and discussion

Murgisca Walker, 1863

Murgisca Walker, 1863, *List specimens lepid. Insects Colln Br. Mus.*, **27**: 11

TS: *Murgisca cervinalis* Walker, 1863. *List specimens lepid. Insects Colln Br. Mus.*, **27**: 12, by monotypy.

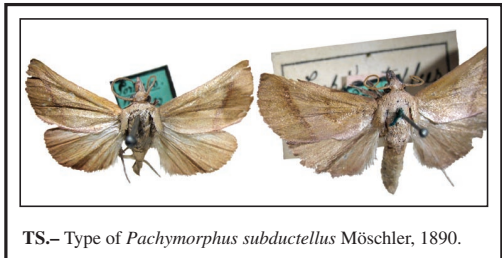
= *Pachymorphus* Möschler, 1890. *Abh. senckenb. naturforsch. Ges.*, **16**: 324

TS: *Pachymorphus subductellus* Möschler, 1890. *Abh. senckenb. naturforsch. Ges.*, **16**: 324, by monotypy. Junior homonym of *Pachymorphus* Chaudoir, 1838. *Bull. Soc. imp. Nat. Moscou*, **1838**: 12 (Coleoptera). [Synonymized by FLETCHER & NYE, 1984: 109].

Diagnosis: Medium to large (24-50 mm wingspan), reddish brown. Labial palpus porrect, downcurved, 2X as long as eye diameter in males, 3-4X in females; antenna, in males filiform or pectinate, filiform in females. FW with costa nearly straight, apex acute, termen round; antemedial and postmedial bands straight or slightly curved, Cu1 before angle of cell, M2-M3 stalked from lower angle, M1 from near upper angle. Male genitalia with uncus broad, gnathos as long as, or longer than uncus; valva long, costa nearly straight, sacculus 1/3 to 1/2 length of valva; vinculum round or projected as thin, sharp pointed saccus; phallus nearly straight or bent ventrad, expanded apically. Female genitalia with papillae anales broad; antrum wide, sclerotized; ductus bursae thin, shorter than corpus diameter; corpus bursae oblong; signum absent.

Host plants: Two of the species: *M. subductella* (Möschler) and *M. sympatricus* Becker, sp. n., were reared from larvae boring the shoots of *Tabebuia* spp. (Bignoniaceae), in Puerto Rico and Cuba, respectively.

Remarks: *Pachymorphus* was established in the Crambidae and transferred to Chrysauginae by BŁESZYŃSKI (1966: 492). HAMPSON (1897: 635) regarded *Murgisca* as derived from *Bonchis* Lederer, whose larvae are pod-borers of the same host plants (MARTORELL, [1976]). They are easily distinguished by the shape of FW dorsum: expanded at middle in *Bonchis*, whereas straight in *Murgisca*. Their male genitalia are also distinct: *Bonchis* has a short, shallow, broad uncus, whereas in *Murgisca* it is expanded as projections, constricted at base.



TS.— Type of *Pachymorphus subductellus* Möschler, 1890.

Key do species (males):

1. Antennae with pectination long, at least twice as long as flagellum diameter.....2
 Antennae filiform3
2. Dominican Republic.....*cervinalis*
 Cuba.....*cubana*
3. Area distad of postmedial band whitish.....*antillana*
 Area distad of postmedial band concolor, basad whitish or concolor.....4
4. Lesser Antilles*subductella*
 Cuba5
5. FW length >15 mm*taina*
 FW length <11 mm.....*sympatrica*

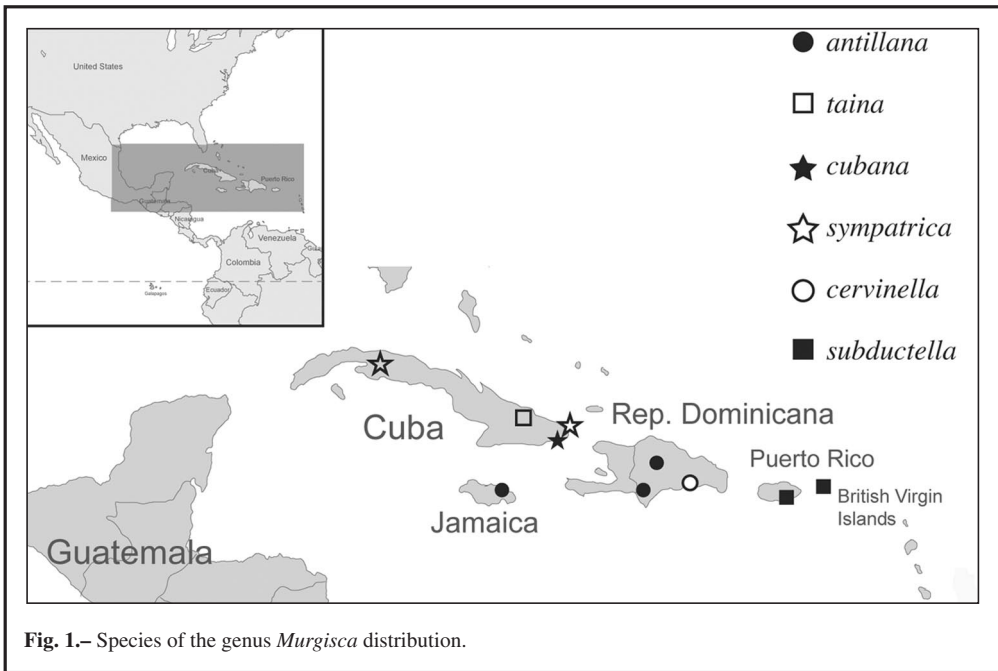


Fig. 1.– Species of the genus *Murgisca* distribution.

Murgisca cervinalis Walker, 1863 (Figs 1, 11, 15-17)

Murgisca cervinalis Walker, 1863. *List Specimens lepid. insects Colln Br. Mus.*, 27: 12

Holotype ♀, DOMINICAN REPUBLIC, “St. Domingo” (Tweedy) (NHMUK) [examined].

Material examined (Types, 1 male, 1 g. s.: 5689): DOMINICAN REPUBLIC, 1 ♂, Independencia, 4 km S Los Pinos, Loma de Vientos, 18°35'N - 71°46'W, 455 m, semideciduous forest with pastures, 23-VII-1992 (Davidson, Rawlins, Thomson & Young) (VOB).

Diagnosis: Male (Fig. 11) FW length 13 mm (29 mm wingspan); female FW length 15-17 mm (wingspan 32-36 mm). Pale reddish brown; palpi porrect, downcurved; antennae pectination long, at

least twice as long as flagellum diameter; HW pinkish. Tympanal case (Fig. 15) closed medially, as typical to Pyralidae. Male genitalia (Figs 16-17): Uncus large, almost square, slightly constricted basad, slightly round distad; gnathos thin, longer than uncus, apical end curved. Valva almost as long as uncus, distal half tapering distad, slightly constricted beyond sacculus; costa slightly curved; sacculus 1/3 as long as valva, slightly expanded ventrally; juxta broad U-shaped, arms short, tapering distad to a sharp tip; vinculum triangular; phallus (Fig. 17) long, thin, almost straight.

Remarks: Walker had two female specimens, from the same locality: the type, and a second, described apart as a "Var". Males share the long pectination with *M. cubana*, described below (see *M. cubana* for differences), however the male genitalia is more similar to those of *M. taina*, a species belonging to the group with filiform antenna.

***Murgisca cubana* Becker, sp. n.** (Figs 1, 8, 10, 24-25)

Holotype ♂, CUBA: Guantanamo, Imias, 10 m, 17-VII-1990 (Becker 72764) (VOB). Paratypes (6 specimens, 3 g. s.: 5246, 5677, 5678), 4 ♂♂, 2 ♀♀, same data as holotype (VOB).

Diagnosis: Small, pale reddish brown. Antennae pectination long, at least twice as long as flagellum diameter; FW costa almost straight, apex acute, postmedial band straight, thin, dark fuscous. HW pale reddish brown, slightly darker towards margins.

Description: Male (Fig. 8) FW length 9-11 mm (21-26 mm wingspan), female (Fig. 10) FW length 14-16 mm (32-36 mm wingspan). Pale reddish brown. FW with costa straight, apex acute; antemedial band straight, ill-defined, postmedial straight, thin, dark fuscous, area distad slightly darker. HW pale reddish brown, gradually reddish brown towards margins. Female with pattern less contrasting.

Male genitalia (Figs 24-25): Uncus short, almost as wide as long, apex strongly indented; gnathos longer than uncus. Valva longer than uncus, broad, distal half tapering distad, not constricted beyond sacculus, costa slightly curved; sacculus half as long as valva, slightly round ventrally; juxta U-shaped, arms long; vinculum round; phallus (Fig. 25) thin, long, curved ventrad, slightly expanded at apex.

Female genitalia: Papillae anales triangular, ostium narrow, antrum as long as ductus bursae, tapering basad; ductus bursae short, thin; corpus bursae oblong.

Distribution (Fig. 1): Cuba, eastern side, in dry forest; known from the type locality only.

Remarks: Males share the long pectination with *M. cervinalis*, described above however the male genitalia is more similar to those of *M. sympatricus*. Similar in size and sympatric with *M. sympatricus*, but *M. sympatricus* has filiform antenna and the antemedial band curved and the postmedial sinuose.

Etymology: In reference to the type locality.

***Murgisca antillana* Becker, sp. n.** (Figs 1-3, 22-23)

Holotype ♂, DOMINICAN REPUBLIC, San Juan, 7 km N Arroyo Cano, 1 km S Los Fríos, pine forest 12°52'N - 71°01'W, 120 m, 1-IX-1995 (Rawlins, Onore & Davidson) (CMNH). Paratypes: DOMINICAN REPUBLIC, Pedernales, 30 km N Cabo Rojo, 18°07'N - 71°39'W, 1070 m, 1 ♂, 23-24-VIII-1990, g. s. 5673 (Young, Rawlins & Thomson) (VOB). JAMAICA, Gordon Town, Mt. Mansfield House, 1 ♂, 12-VII-1936, g. s. 5672 (Avinoff & Schumatoff) (VOB).

Diagnosis: Large, dark reddish brown. FW apex sharp with postmedial band sharp, curved, dark gray, paler on distal side; darker along termen.

Description: Male (Figs 2-3) FW length 14-16 mm (32-36 mm wingspan). Dark reddish brown. Labial palpus, legs, thorax and abdomen ventrally dark brown. Frons with thin, white line laterally. Basal half of antenna with white line dorsally. FW with costa straight, apex acute, postmedial band thin, sharp, bordered pale brown outside; dark brown along termen. HW pale reddish brown, fringes dark brown. Female unknown.

Male genitalia (Figs 22-23): Uncus wide, slightly constricted at middle, apex shallowly concave; gnathos almost as long as uncus. Valva narrow, as long as uncus, bent dorsad, constricted beyond

sacculus; costa strongly sclerotized; sacculus nearly half as long as valva; juxta U-shaped; saccus long, thin, sharply pointed; phallus (Fig. 23) long, almost straight, expanded distad.

Distribution (Fig. 1): Greater Antilles: Dominican Republic, Jamaica.

Remarks: Similar to *M. taina* in color and size but easily distinguished by the position of the whitish shade along the post medial band: basad of this band in *M. taina*, distad in *M. antillana*. Also allopatric: *M. antillana* is known from the Dominican Republic and Jamaica whereas *M. taina* is restricted to Cuba.

Etymology: In reference to the Antilles.

***Murgisca taina* Becker, sp. n.** (Figs 1, 5-7, 18-19, 28)

Holotype ♂, CUBA, Holguin, Pinares de Mayari, 640 m, VII-1990 (Becker 71863) (VOB). Paratypes (19 specimens, 3 g. s.: 5674-5676): 17 ♂♂, 2 ♀♀, same data as holotype (VOB, USNM).

Diagnosis: Large, purple-brown. Antennae filiform. FW with area basad of postmedial band paler.

Description: Male (Figs 5-7) FW length 15-17 mm (34-40 mm wingspan), female (Fig. 6) FW length 20-22 mm (45-50 mm wingspan). Labial palpus, body and FW underside, dark brown. Frons, vertex and FW area basad of postmedial band pale reddish brown; antemedial band indistinct, postmedial thin, sharp, dark gray. HW with basal half pale reddish brown, darker towards margins. Female FW with pattern less contrasting.

Male genitalia (Figs 18-19): Uncus very wide, constricted at base, longer than valva; gnathos shorter than uncus. Valva broad, tapering towards round apex, constricted beyond sacculus, costa nearly straight, sacculus 1/3 as long as valva, round ventrally; basal half of juxta rectangular, distal half U-shaped; vinculum round; phallus (Fig. 19) slightly bent, expanded distad.

Female genitalia (Fig. 29): Papillae anales broad; ostium wide, antrum cup-shaped, sclerotized; ductus bursae narrow, short; corpus bursae oblong.

Distribution (Fig. 1): Cuba, at the type locality only.

Remarks: This is the largest species of the genus, and with the widest uncus. Similar to *M. antillana* in color and size but easily distinguished by the position of the paler area along the post medial band: basad of this band in *M. taina*, distad in *M. antillana*. Also allopatric: *M. taina* is restricted to Cuba, whereas *M. antillana* is known from the Dominican Republic and Jamaica.

Etymology: In reference to the Taino people, the original inhabitants of the Antilles.

Murgisca subductella (Möschler, 1890) (Figs 1, 12-14, 20-21, 28)

Pachymorphus subductellus Möschler, 1890. *Abh. senckenb. naturforsch. Ges.*, **16**: 324

Holotype ♂, PUERTO RICO, [No further data] (MNHU) [image examined].

Material examined (27 specimens, 5 g. s.: 5245, 5668-5671): PUERTO RICO, Maricao, 770 m, 3 ♂♂, 12-VIII-1987, g. s. 5669 (Becker 67546) (VOB); Guanica, 170 m, 1 ♂, 29-VIII-1987, g. s. 5245 (Becker 67814) (VOB); Patillas, 590 m, 5 ♂♂, VIII-1987, g. s. 5668 (Becker, 68120) (VOB). BRITISH VIRGIN ISLANDS, Guana, 12 ♂♂, 6 ♀♀, 9-23-VII-1987, X-1989, 24-X-5-XI-1990, g. s. 5670, 5671 (Becker & Miller 66703, S. Miller & T. Kuklenski, Becker 70864) (VOB, USNM).

Diagnosis: Male (Figs 12-13) FW length 11-13 mm (25-30 mm wingspan), female (Fig. 14) FW length 13-16 mm (30-36 mm wingspan). Reddish brown. Antennae filiform. FW with antemedial and postmedial bands slightly curved, dark gray, distinct, or absent. HW gradually darker towards margins. Male genitalia (Figs 20-21): uncus wide, slightly constricted basally, apex concave; gnathos shorter than uncus, apex curved, sharp pointed. Valva broad, long, tapering distally, constricted beyond sacculus, apex round, costa straight, sacculus 1/3 length of valva; juxta half-moon shape; saccus an acute triangle; phallus (Fig. 21) long, sinuose, flattened dorso-ventrally; vesica without cornuti. Female genitalia (Fig. 28): papillae anales tapering distally; ostium and antrum wide, round basad, sclerotized; ductus bursae membranous, short, narrow; corpus bursae oblong.

Distribution (Fig. 1): Lesser Antilles (Puerto Rico, Virgin Islands).

Host plants: Larvae boring in twigs of various species of “roble” (*Tabebuia* spp.) (Bignoniaceae) (MARTORELL, [1976]).

Remarks: Similar to *M. sympatrica*, but allopatric: *M. sympatrica* is restricted to Cuba, whereas *M. subductella* known from the Lesser Antilles only. The type material not examined. The identity is based on an image of the types and on the identified as such in NHMUK and USNM, and by the fact that so far it is the only species known for the Lesser Antilles.

***Murgisca sympatrica* Becker, sp. n.** (Figs 1, 4, 9, 26-27)

Holotype ♂, CUBA, Guantanamo, Imias, 10 m, 17-VII-1990, g. s. 5247 (Becker 72765) (VOB). Paratypes: CUBA, Matanzas, Ciénaga de Zapata, 2 ♂♂, 18-VII-1990, g. s. 5679 (Becker 73701) (VOB).

Diagnosis: Small. Antennae filiform. FW dark reddish brown; area between antemedial and postmedial band whitish.

Description: Male (Figs 4, 9) FW length 9-11 mm (22-26 mm wingspan). Pale reddish brown. FW with costa straight, apex a sharp right-angle, termen round. FW dark fuscous, area between antemedial and postmedial bands pale reddish brown; with small, ill defined, dark dot at end of cell. HW whitish, slightly brown towards margins.

Male genitalia (Figs 26-27): Uncus wide, as long as valva, margins parallel, apex slightly concave; gnathos shorter than uncus. Valva broad, tapering towards apex beyond sacculus, not constricted; juxta U-shaped distally; vinculum round; phallus (Fig. 28) short, thick, bent dorsad, expanded towards apex.

Distribution (Fig. 1): Cuba, at the type locality and on the southern coast.

Remarks: Specimens from Ciénaga de Zapata (Fig. 9) are smaller and with a less distinct pattern, but their genitalia are almost identical. Very similar in habitus and size as *M. cubana*; easily distinguished by the filiform antennae and by the antemedial band: curved in *M. sympatrica*, straight in *M. cubana*. The genitalia are also very distinct, resembling those of *M. subductella*. In the USNM collection there is a series of six specimens, also from Cuba, with the pupal skin pinned to each specimen, which certainly belongs to the material mentioned by BRUNER *et al.* (1975: 332) as “*Pachymorpha* [sic!], sp. n. (Heinrich, ‘44). Una oruga taladradora de las ramas [del roble blanco: *Tabebuia pentaphylla* (Bignoniaceae)]”.

Etymology: From the Latin *patria* = fatherland, with the prefix *sym* = together, with.

Acknowledgements

Paulo Nunes and Robiara U. S. Becker (Serra Bonita Reserve, Camacan, Bahia, Brazil), prepared the illustrations; Dr. James Hayden (Florida Department of Agriculture and Consumer Services), reviewed the manuscript, made several corrections and suggested some changes that improved the article. Dr. John E. Rawlins (CMNH) kindly presented some specimens from the Dominican Republic and from Jamaica. Scott E. Miller (USNM), and James Lazell provided support to the author to collect in the Antilles. Special thanks to Dr. Antonio Vives, the editor, for his generosity and patience with the authors, and for his dedication to maintaining the high quality of the *SHILAP Revta. lepid.*

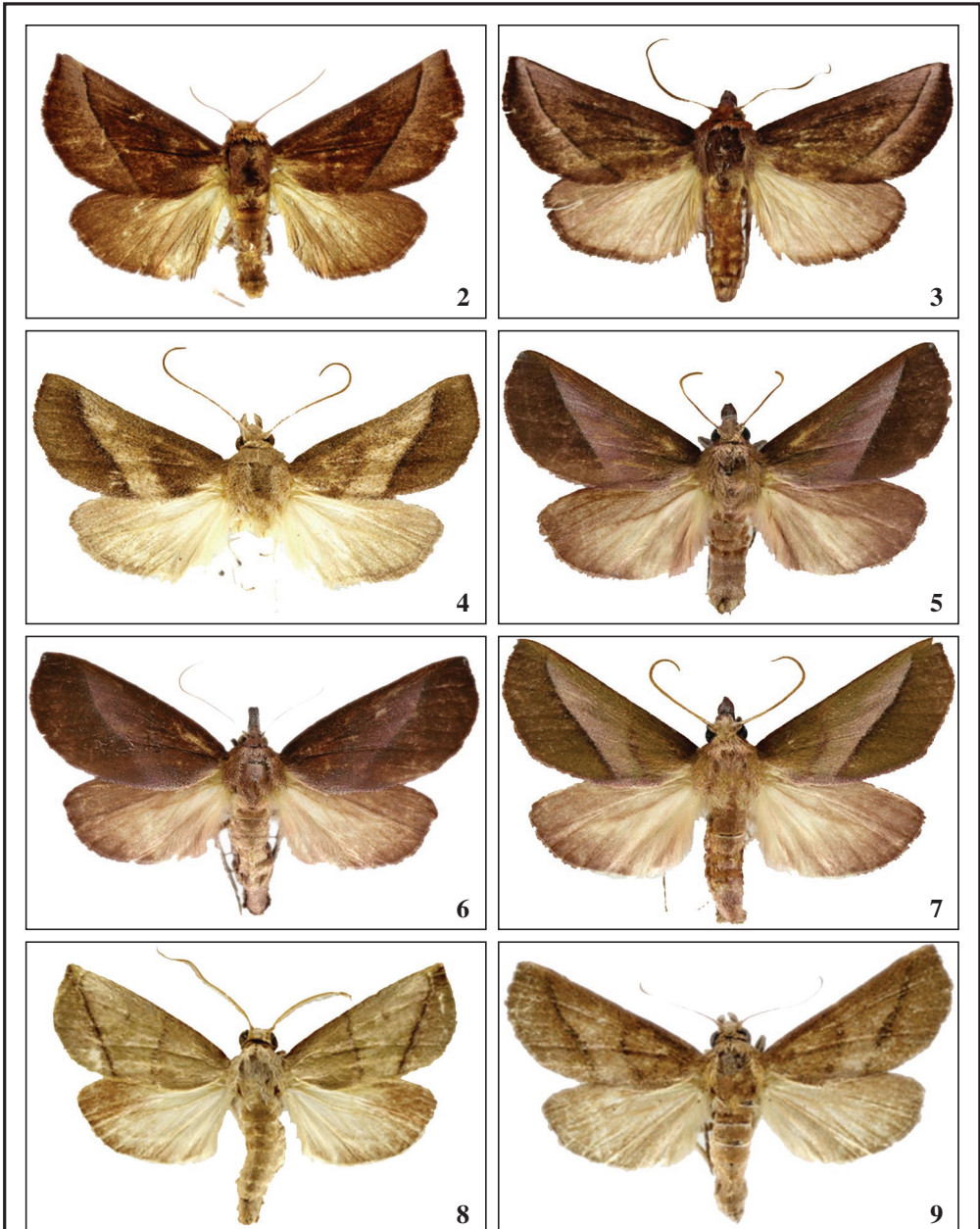
BIBLIOGRAPHY

- BLESZYŃSKI, S., 1966.— Studies on Crambinae (Lepidoptera). Part 43. Further taxonomic notes on some tropical species.— *Acta Zoologica Cracoviensia*, **11**: 452-497.
- BRUNER, S. C., SCARAMUZZA, L. C. & OTERO, A. R., 1975.— *Catálogo de los insectos que atacan a las plantas económicas de Cuba*: 399 pp. Instituto de Zoología, La Habana.
- DYAR, H. G., 1914.— Report on the Lepidoptera of the Smithsonian Biological Survey of the Panama Canal Zone.— *Proceedings of United States National Museum*, **47**: 139-350.
- FLETCHER, D. S. & NYE, I. W. B., 1984.— Pyraloidea.— In I. W. B. NYE (ed.). *The generic names of the moths of the World*, **4**: 185 pp. British Museum (Natural History), London.

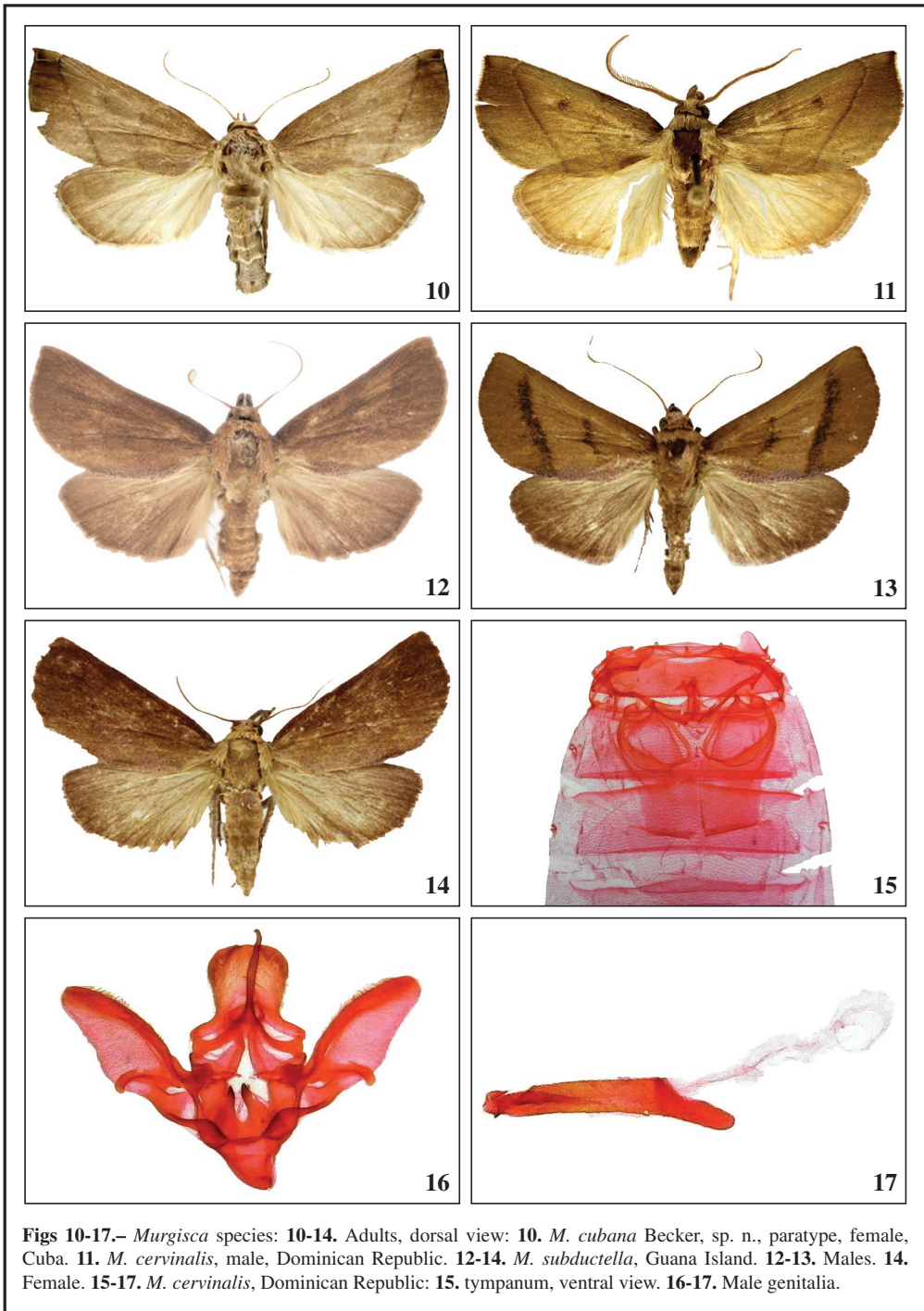
- HAMPSON, G. F., 1916.– Descriptions of new Pyralidae of the subfamily Chrysauginae.– *Annals and magazine of natural History*, (8) **18**: 349-372.
- HODGES, R. W., 1971.– Sphingoidea.– In R. B. DOMINICK *et al.* *The moths of America North of Mexico*, **21**: 158 pp. Classey and R. B. D. Publications, London.
- KRISTENSEN, N. P. 2003.– Skeleton and muscles: adults: 39-131.– In N. P. KRISTENSEN. Lepidoptera, moths and butterflies, vol. 2: Morphology, physiology, and development.– In M. FISCHER, ed. *Handbook of Zoology*, IV(36).– Walter de Gruyter, Berlin and New York.
- MARTORELL, L. F., [1976].– *Annotated food plant catalog of the insects of Puerto Rico*: 303 pp. Agricultural Experiment Station, University of Puerto Rico.
- MÖSCHLER, H. B., 1890.– Die Lepidopteren-Fauna von Portorico.– *Abhandlungen von der Senckenbergischen naturforschenden Gesellschaft, Frankfurt*, **16**: 69-360.
- ROBINSON, G. S., 1976.– The preparation of slides of Lepidoptera genitalia with special reference to the Microlepidoptera.– *The Entomologist's Gazette*, **27**: 127-132.
- SOLIS, M. A., BECKER, V. O. & MUNROE, E., 1995.– Chrysauginae: 81-88.– In J. B. HEPPNER (ed.). *Atlas of Neotropical Lepidoptera*. Checklist: Part 2.– Association of Tropical Lepidoptera, Gainesville.
- WALKER, F., 1863.– *List of the specimens of lepidopterous insects in the collection of the British Museum*, **27**: 1-286. E. Newman, London.
- WOLCOTT, G. N., 1951.– The insects of Puerto Rico.– *The Journal of Agriculture of the University of Puerto Rico*, **32**: 1-975. (1948).

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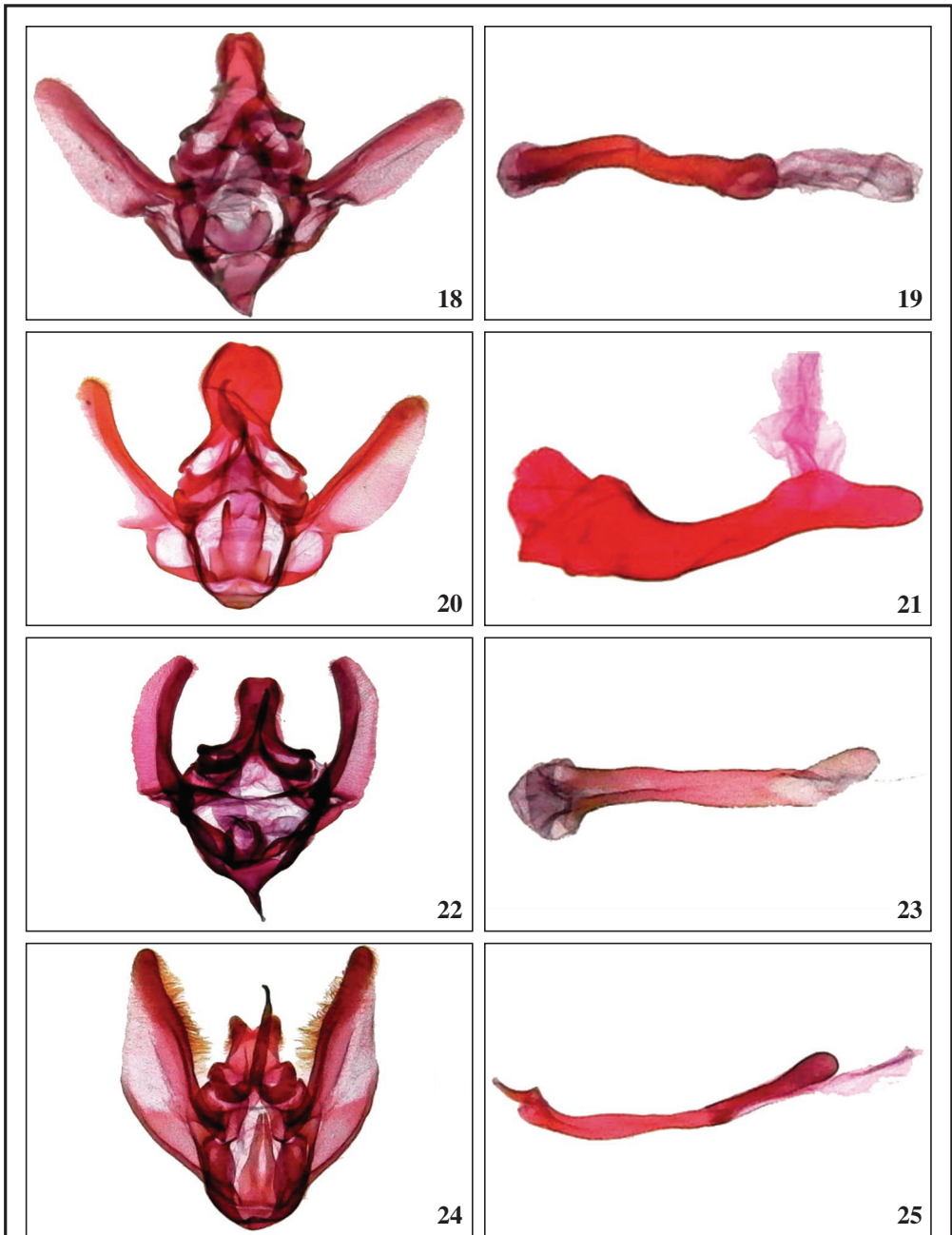
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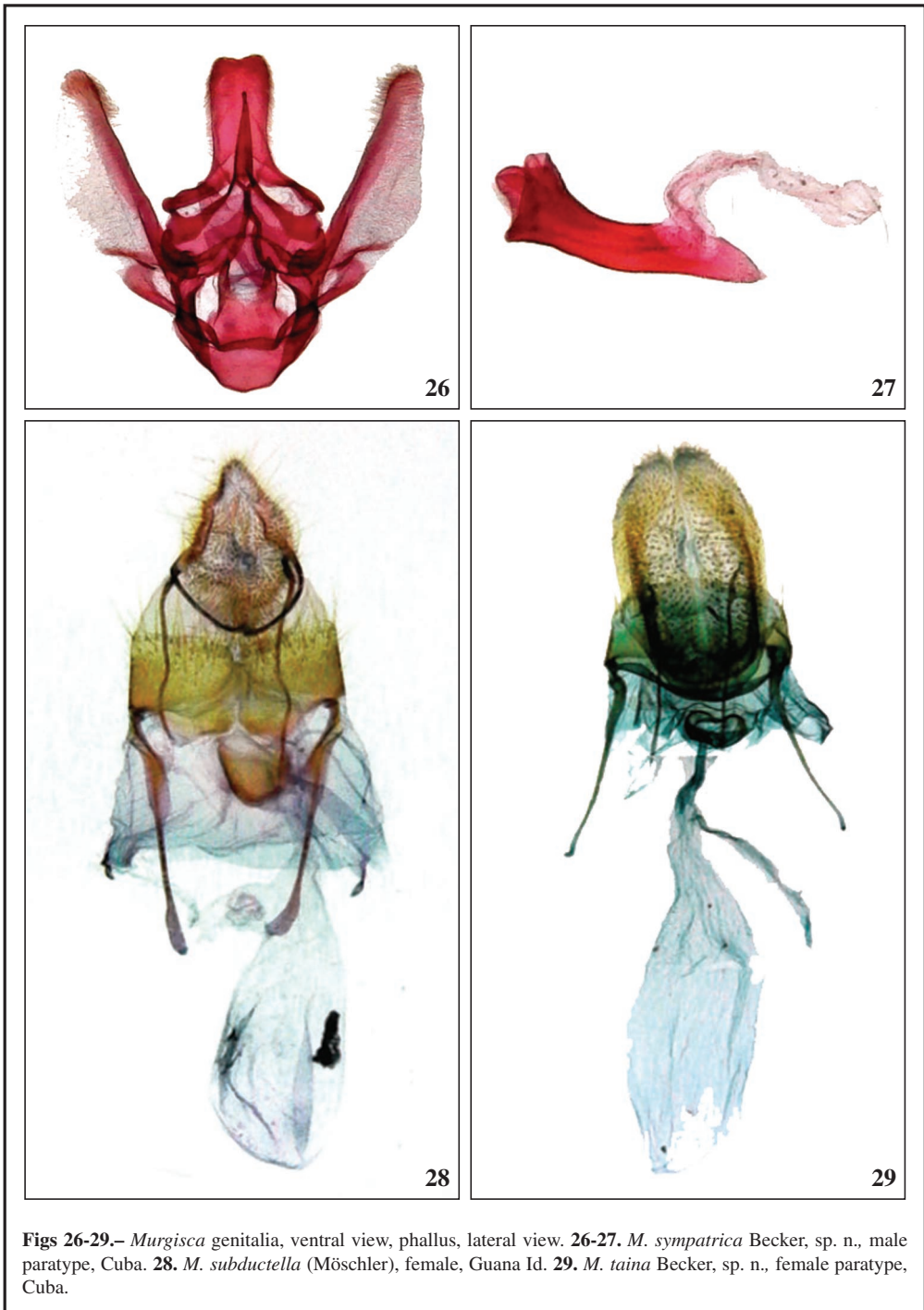
Figs 2-9.— *Murgisca* adults, dorsal view. 2-3. *M. antillana* Becker, sp. n., male paratypes: 2. Jamaica. 3. Dominican Republic. 4. *M. sympatrica* Becker, sp. n., male holotype, Cuba. 5-7. *M. taina* Becker, sp. n., Cuba. 5-6. male, female paratypes. 7. male holotype. 8. *M. cubana* Becker, male paratype, Cuba. 9. *M. sympatrica* Becker, sp. n., male paratype, Cuba.



Figs 10-17.– *Murgisca* species: **10-14.** Adults, dorsal view: **10.** *M. cubana* Becker, sp. n., paratype, female, Cuba. **11.** *M. cervinalis*, male, Dominican Republic. **12-14.** *M. subductella*, Guana Island. **12-13.** Males. **14.** Female. **15-17.** *M. cervinalis*, Dominican Republic: **15.** tympanum, ventral view. **16-17.** Male genitalia.



Figs 18-25.— *Murgisca* genitalia, ventral view, phallus, lateral view. **18-19.** *M. taina* Becker, sp. n., male paratype, Cuba. **20-21.** *M. subductella* Becker, sp. n., male Puerto Rico. **22-23.** *M. antillana* Becker, sp. n., male paratype, Dominican Republic. **24-25.** *M. cubana* Becker, sp. n., male paratype, Cuba.



Figs 26-29.– *Murgisca* genitalia, ventral view, phallus, lateral view. **26-27.** *M. sympatrica* Becker, sp. n., male paratype, Cuba. **28.** *M. subductella* (Möschler), female, Guana Id. **29.** *M. taina* Becker, sp. n., female paratype, Cuba.

REVISIÓN DE PUBLICACIONES *BOOK REVIEWS*

A. V. Solovyev

***Parasa* Moore auct.: phylogenic review of the complex from the Palaearctic and Indomalayan regions (Lepidoptera, Limacodidae)**
239 páginas

Formato: 30'5 x 21'5 cm

Museum Witt Munich, Munich and Vilnius, 2014

ISBN: 978-9986-443-75-9

Tenemos en nuestras manos un nuevo volumen del conocido especialista Dr. Solovyev y en esta ocasión nos trata la familia Limacodidae, dentro de la misma el complejo de las bellas especies verdes de los géneros *Parasa* Moore, 1859 y *Latoia* Guérin-Ménéville, 1844 sensu auctorum, que se distribuyen por el norte de África, Próximo Oriente y en las regiones del Paleártico oriental e Indomalaya.

Este complejo de especies es uno de los más complicados de ahí que se está insistiendo en los estudios genéticos, pero desafortunadamente, queda mucho trabajo por hacer.

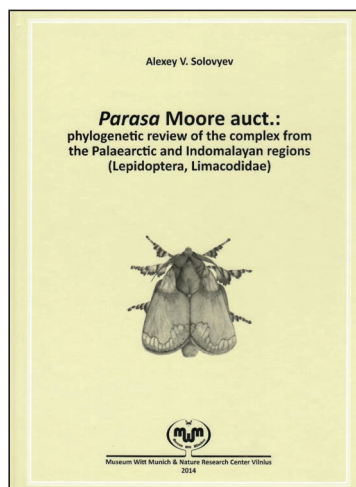
Después de una introducción, material y métodos, principales colecciones consultadas y los agradecimientos, entramos en el resumen de la parte taxonómica y sistemática de la obra, donde se describen, como nuevos, once géneros, trece especies, cuatro subespecies, se designan diez lectotipos, se establecen cuatro sinonimias y se establecen cuarenta y cinco nuevas combinaciones. Nos habla de la sistemática de la Familia Limacodidae, datos sobre su morfología y de los principales caracteres cladísticos utilizados en los análisis, claves de los doce géneros considerados y agrupados en diez grupos.

De todas las especies consideradas nos dan información sobre su descubrimiento, conceptos generales sobre su especificidad y las principales subespecies aceptadas, su descripción, diagnosis bionomía, distribución localizada en mapas generales y la etimología.

Finaliza la obra con una serie de interesantes apéndices donde se detalla la matriz de datos de los adultos, el índice alfabético de los nombres con interesantes comentarios, los análisis moleculares, seguida de las 74 láminas en blanco y negro de las fotografías de la genitalia de los machos y hembras, de 120 especies; diez laminas a color de los adultos y una lámina de los estados larvarios, finalizando con un índice.

No podemos terminar estas líneas, sin felicitar al autor por un trabajo minucioso y necesario, así como a la Editorial que continúa apoyando la publicación de estas obras, con una calidad excelente, por lo que recomendamos su adquisición y no pudiendo faltar en cualquier biblioteca de todos los interesados en los Limacodidae. El precio de este libro es de 89 euros y los interesados deben dirigirse a:

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Análisis del complejo *Dichomeris rasilella* (Herrich-Schäffer, 1854) y descripción de una nueva especie para España (Lepidoptera: Gelechiidae)

J. Gastón, R. Macià, J. Ylla & J. Bau

Resumen

Se estudia el complejo que forma la especie *Dichomeris rasilella* (Herrich-Schäffer, 1854), elevando a *Uliaria rasilella occidentella* Zerny, 1927 a la categoría específica como *Dichomeris occidentella* (Zerny, 1927) y describiendo la nueva especie *Dichomeris merceae* Gastón, Ylla, Macià & Bau, sp. n., para España. Se establece su proximidad con *Dichomeris rasilella* (Herrich-Schäffer, 1854) analizando las diferencias observadas entre las tres especies y definiendo sus respectivas posiciones en el árbol filogenético.

PALABRAS CLAVE: Lepidoptera, Gelechiidae, *Dichomeris*, nuevas especies, España.

Analysis of the complex *Dichomeris rasilella* (Herrich-Schäffer, 1854) and description of a new species for Spain (Lepidoptera: Gelechiidae)

Abstract

The complex formed by the species *Dichomeris rasilella* (Herrich-Schäffer, 1854) is studied, elevating *Uliaria rasilella occidentella* Zerny, 1927 to a specific category as *Dichomeris occidentella* (Zerny, 1927) and describing the new species *Dichomeris merceae* Gastón, Ylla, Macià & Bau, sp. n., for Spain. Its proximity to *Dichomeris rasilella* (Herrich-Schäffer, 1854) is established analyzing the differences observed between the three species and defining their respective positions in the phylogenetic tree.

KEY WORDS: Lepidoptera, Gelechiidae, *Dichomeris*, new species, Spain.

Introducción

Dichomeris Hübner, [1818] es un extenso género de la familia Gelechiidae Stainton, 1854 presente en todo el mundo y que comprende algo más de mil especies descritas. En España, hasta 2014, el género contaba con once especies (VIVES MORENO, 2014), y que con la incorporación posterior de *Dichomeris ustalella* (Fabricius, 1794) y *Dichomeris limosellus* (Schläger, 1849), (GASTÓN *et al.*, 2018) el número se elevó a trece. El género se puede reconocer con facilidad por el examen del segundo segmento del palpo labial con un mechón de pelos escamiformes bien desarrollados y el tercer segmento vuelto hacia arriba sobre el vertex de la cabeza (LI *et al.*, 2010). Enclavado en la tribu Dichomeridini Hampson, 1918, tiene como característica en la estructura genital de los machos, la fusión de la juxta con el vinculum (muy desarrollado en todas las especies), por lo que aquella pierde su capacidad de

movilidad. Precisamente, la juxta (o más bien los lóbulos superiores de la misma) en este género es muy representativa, constituyendo un claro elemento diferenciador de los distintos taxones.

Al revisar el material disponible del taxón *Dichomeris rasilella* (Herrich-Schäffer, 1854) en las colecciones de los autores y muy especialmente los individuos recolectados en la Sierra de Ávila, en la localidad de Amavida (Ávila, España), a 1.430 m, nos llamó la atención la morfología externa de los mismos y su gran tamaño (que rondaba los 20 mm de promedio). El fondo de sus alas anteriores presentaba un color grisáceo muy oscuro en donde apenas se podía percibir una mácula algo más oscura en el extremo exterior de su celda, recordando más a las especies del género *Acompsia* Hübner, [1825] 1816. De todos es conocido que *D. rasilella* presenta diferentes formas adultas que pueden resumirse en dos: la primera con cabeza marrón y alas anteriores marrones grisáceas con pequeñas manchas de color más oscuro en el centro y el extremo de la celda, y una segunda forma con cabeza blanca, algo teñida con escamas marrones en el vertex, torax blanquecino y alas delanteras con fondo blanco o grisáceo muy claro con una gran mancha oscura redondeada al final de la celda y otras más suaves en la zona basal. Los ejemplares procedentes de Amavida no encajaban en estos patrones, y una vez hecha la preparación de su genitalia, resultó que la misma se diferenciaba de los patrones conocidos de *D. rasilella*.

Esto nos llevó a analizar otras poblaciones de *Dichomeris* del complejo *rasilella*, procedentes de las provincias de Soria, Teruel, Barcelona y Tarragona coincidentes en su morfología externa con las poblaciones típicas de Europa central y septentrional, en donde sí se daban los patrones de un tamaño y una morfología claramente ajustado a la forma clara de esta especie. Se pudo comprobar, una vez realizadas las preparaciones de la genitalia, que estos individuos también presentaban diferencias con la especie europea de *D. rasilella*, por lo que se procedió, para una mayor seguridad, a secuenciar las muestras de todas estas poblaciones (Ávila, Soria y Teruel), confirmando lo que ya se suponía por la preparación de la genitalia, *D. occidentella* (Zerny, 1927) es una buena especie, por lo que la redescubimos a continuación y también una nueva especie de la Sierra de Ávila.

Material y métodos

El material utilizado para el estudio se ha obtenido mediante muestreos nocturnos y diurnos, con trampas de luz actínica distribuidas en los biotopos apropiados en 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 la genitalia se ha efectuado siguiendo las técnicas estándar (ROBINSON, 1976), con modificaciones.

El ADN total se extrajo de las patas de especímenes secos con Chelex 100 al 10 % (Bio-Rad, Richmond, CA). Todo el material de laboratorio utilizado en este proceso (tijeras, fórceps e instrumentos de molienda) se lavó secuencialmente en lejía al 20% y etanol absoluto entre muestras consecutivas. Se amplificaron por PCR las secuencias parciales del gen de la subunidad I del citocromo c oxidasa mitocondrial (COI), utilizando los cebadores LCO y HCO (FOLMER *et al.*, 1994). Las muestras de PCR exitosas se limpiaron con el método Exo-SAP; la secuenciación de Sanger en ambas direcciones fue realizada por Eurofins Genomics, Alemania. Finalmente, se utilizó MEGA 10.1.8 (KUMAR *et al.*, 2018) para ensamblaje y alineación de secuencias.

Se analizaron con éxito un total de seis muestras (Tabla 1). Los datos se compilan en el conjunto de datos públicos DICH *Dichomeris* en BOLD v4 (<http://v4.boldsystems.org/>). Para el estudio filogenético se añadió también una selección de secuencias descargadas de la BOLD Public Record Barcode Database (<http://v4.boldsystems.org/>) correspondientes a especímenes del género *Dichomeris* recolectados en diversos países europeos (1-2 secuencias por país). En total se añadieron 76 secuencias de 15 especies de *Dichomeris* y 2 secuencias de *Aproaema anthyllidella* (Hübner, [1813] 1796) como grupo externo.

La determinación del modelo de ADN de mejor ajuste y el análisis de distancia por pares se realizaron con MEGA 10.1.8 (KUMAR *et al.*, 2018). Las estimaciones de la divergencia evolutiva sobre los pares de secuencias entre grupos y dentro de los grupos se calcularon como el número de sustituciones de bases por sitio a partir del promedio de todos los pares de secuencias entre grupos. Se utilizó la dis-

tancia Tamura-Nei (distancia TN-Dist) para las secuencias COI con un análisis Bootstrap de 1.000 repeticiones. Los análisis filogenéticos se realizaron bajo inferencia bayesiana usando BEAST2 v. 2.6.6 Boukaert *et al.* (2019) utilizando el modelo GTR+G.

Tabla 1.– Lista de especímenes investigados para el análisis genético en este estudio.

ID de Muestra	Especie	Recolector	Fecha de recolección	Ubicación	COI-5P Genbank Acc.
UVIC_JG01	<i>Dichomeris merceae</i>	J. Gastón	24/5/2017	Amavida - Ávila	ON534079
UVIC_JG04	<i>Dichomeris occidentella</i>	J. Gastón	22/7/2020	Calatañazor - Soria	ON534084
UVIC_JG05	<i>Dichomeris occidentella</i>	J. Gastón	22/7/2020	Aldehuela de Calatañazor - Soria	ON534083
UVIC_JG06	<i>Dichomeris occidentella</i>	J. Gastón	22/7/2020	Calatañazor - Soria	ON534082
UVIC_JG07	<i>Dichomeris occidentella</i>	J. Gastón	22/7/2020	Calatañazor - Soria	ON534081
UVIC_JG11	<i>Dichomeris occidentella</i>	J. Ylla	15/7/2021	Río Matarraña - Beseit - Teruel	ON534080

Para la documentación fotográfica de las preparaciones de la genitalia se han utilizado microscopios, Nikon stereoscopic SMZ-1 y Nikon Eclipse E400 con cámara digital NIKON D3100. Para la documentación fotográfica de los ejemplares adultos se ha utilizado la cámara digital Sony α 100 DSLR-A100K con objetivo AF 100 MACRO 1:2.8 (32). Los retoques fotográficos se han realizado con el programa Adobe Photoshop ©.

Abreviaturas

JG	Javier Gastón
JY	Josep Ylla
ER	Emili Requena
MNCN	Museo Nacional de Ciencias Naturales, Madrid, España
UVic-UCC	Universidad de Vic - Universidad Central de Cataluña, Vic (Barcelona), España
comb. n.	combinación nueva.
PP	Probabilidad Posterior en el análisis filogenético bayesiano
prep. gen.	preparación de genitalia
sp. n.	especie nueva
TN-Dist	Distancia genética calculada según (según TAMURA & NEI, 1993).

Resultados

GELECHIIDAE

Dichomeris occidentella (Zerny, 1927) **comb. n.**

Uliaria rasilella occidentella Zerny, 1927; *Eos*, **3**: 478-479 (tipo no examinado)

LT: ESPAÑA, TERUEL, Albarracín

Material examinado (14 ♂♂, 1 ♀): ESPAÑA, BARCELONA, 1 ♂, Anoia, Castellfullit de Riubregós, Torrente de Magrá, a 516 m, 15-VII-2012, F. Vallhonrat y C. Coll leg., prep. gen. 9045JG; Anoia, Castellfullit de Riubregós, a 560 m, 1 ♂, 15-VI-2012, F. Vallhonrat leg., E. Requena col., prep. gen. ER3649; idem, Bosc de Roters, 560 m, 1 ♂, 14-VII-2012, F. Vallhonrat y C. Coll leg., J. Gastón col., prep. gen. 9044JG; Idem, 1 ♂, 1-VII-2013, E. Requena leg., J. Ylla col., prep. gen. 9048JG; Argensola, 1 ♂, 10-VII-1988, E. Requena leg. y col.; La Llacuna, 1 ♂, 10-VIII-1990, E. Requena leg. y col.; Santa María de Miralles, 1 ♂, 27-VII-2000, E. Requena leg. y col., prep. gen. ER3648. SORIA, Calatañazor, a 1.100 m, 2 ♂♂, 22-VII-2020, J. Gastón leg. y col.; idem, 1 ♂, prep.

gen. 9004JG; Aldehuela de Calatañazor, a 1.125 m, 1 ♂, 22-VII-2020, J. Gastón leg. y col., prep. gen. 9012JG. TARRAGONA, Esblada, Alt Camp, 1 ♂, 8-VII-2000, E. Requena leg., J. Gastón col., prep. gen. 9047JG; idem, 1 ♂, prep. gen. 9046JG. TERUEL, Río Matarraña, Beceite, a 600 m, 1 ♂, 15-VII-2021, J. Ylla leg. y col., prep. gen. 9049JG; Valdevecar, Albarracín, 1.147 m, 1 ♀, 8-VII-2010, R. Macià leg., J. Ylla col., prep. gen. JY5776.

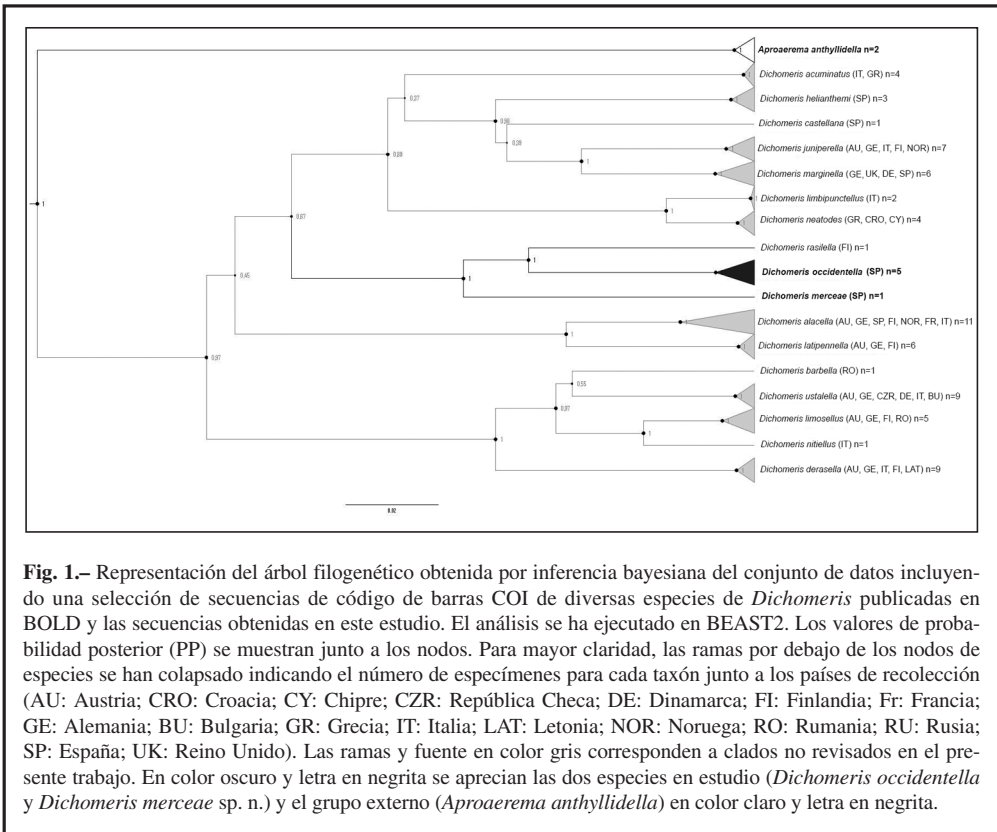
REDESCRIPCIÓN DE LA MORFOLOGÍA EXTERNA

Macho (fig. 2): Envergadura, 13,2 mm (n=8). Cabeza bien desarrollada con pelos escamiformes de color crema muy claro, casi blancos, compactos en la frente y en la zona alta del epicráneo; palpos labiales bien desarrollados, el tercer segmento vuelto hacia arriba y recubiertos de pequeñas escamas de color ocre oscuro en su lado externo, exceptuando el extremo apical del tercer segmento que es de color casi blanco. Por su lado interno, los palpos también están recubiertos de escamas de color ocre oscuro salvo el borde superior del segundo segmento en donde se aprecia un conjunto de pelos de mayor longitud de color ocre muy claro; el tórax y las tégulas están recubiertos de pelos escamiformes de color crema muy claro, como la cabeza; el abdomen está forrado de escamas de color algo más ocre que las del tórax; las antenas son filiformes y anilladas combinando las cerdas de color ocre muy claro y ocre oscuro; las patas están recubiertas de escamas de color crema claro y ocre oscuro que se alternan de forma ajedrezada; los cinco últimos artejos presentan sus extremos forrados de pelos crema claro; las alas delanteras son estrechas y muy apuntadas en el ápex. El color de fondo de las escamas varía desde un crema casi blanco a un crema más oscuro ligeramente manchado de gris, sobre todo en la costa y en el margen interno. En la zona basal existen dos máculas oscuras colocadas en diagonal, que en ciertos exx. se funden en una sola; en la zona discal, en la parte más próxima a la base de las alas, hay otras dos máculas algo mayores que las anteriormente descritas y algo más oscuras, también distribuidas de forma diagonal; en el extremo exterior de la zona discal hay una mácula circular situada sobre la vena M2; se aprecian una serie de líneas oscuras situadas sobre las venas M2, M3 Cu1 y Cu2, que comienzan en el centro de la zona discal y finalizan en la zona postdiscal contra una línea oscura paralela al margen externo del ala y que gira, junto a la costa, bruscamente hacia la base de las alas; el margen externo dispone de una línea oscura paralela a la anterior y que forma con esta una mácula blanca muy significativa junto al apex; las fimbrias son de color casi blanco con su extremo ocre oscuro; las alas posteriores son estrechas y de color uniforme gris claro.

Hembra (fig. 3): Envergadura, 13 mm (n=1). No presenta diferencias con los machos.

Descripción de la genitalia del macho (figs 7-8): Uncus de tamaño medio, ligeramente redondeado en su extremo; tegumen estrecho; gnathos potente, curvado en su primera mitad y muy esclerotizado; valvas con la base estrecha, ensanchadas en su parte central con el extremo redondeado y un sacculus no reseñable; lóbulos de la transtilla medianamente cortos y estrechos; vinculum de gran tamaño, característico del género, con la juxta soldada al mismo y la presencia en la misma de un único lóbulo de mediano tamaño, cilíndrico y con su extremo redondeado; phallus con el coecum y parte anular grueso y abultado, afinándose progresivamente hacia el extremo distal y con la presencia de un proceso anular en forma de gruesa espina larga, esclerotizada y afilada que alcanza la parte distal del phallus.

Descripción de la genitalia de la hembra (figs 11-11a): Papilas anales bien desarrolladas y ligeramente esclerotizadas; apófisis posteriores de mediano tamaño, superior al de las apófisis anteriores; 8º segmento relativamente corto; ostium membranoso y antrum con forma de copa, también membranoso; ductus bursae muy corto y membranoso que incluye desde su contacto con el antrum, una placa esclerotizada bífida con forma de cinta y de una longitud que alcanza la zona media de la bursa; bursa membranosa, ovoidal, con una placa esclerotizada en su parte posterior, junto al ductus bursae, que se presenta parcialmente soldada a la placa longitudinal del ductus bursae. Del centro de la bursa parte un appendix bursae.



Diagnóstico molecular: Las cinco muestras secuenciadas con éxito de *Dichomeris occidentella* (Zerny, 1927) presentan una baja distancia interna (TN-Dist = 0.59%) y se agrupan en el árbol en un clado que cuenta con un fuerte soporte bayesiano (PP=1) que, a su vez, se encuentra formando parte de un grupo también con el valor máximo de soporte bayesiano (PP=1) y compuesto por *Dichomeris rasilella* y *D. merceae* Gastón, Macià, Ylla & Bau, sp. n. (Fig. 1). La menor distancia genética se encuentra con *D. rasilella* (TN-dist = 9.32%), aunque representa ya un valor indicativo de su estatus de especie propia, dado que el promedio de distancias interespecíficas entre todas las especies consideradas es de 11.90% (Tabla 2), con un mínimo de 3.24% (entre *D. limbipuctellus* y *D. neatodes*) y un máximo de 19.25 (entre *D. occidentella* y *D. nitiellus*).

Biología: Desconocida. No se conocen los estados inmaduros ni las plantas nutricias de las orugas.

Distribución (fig. 6): Se han estudiado poblaciones en las provincias de Soria y Teruel en cotas que oscilan entre los 1.100 a 1.125 m, en el piso bioclimático supramediterráneo con una vegetación predominante constituida básicamente por bosques de sabina albar (*Juniperus thurifera* L.) y encina (*Quercus ilex* L.); también se han estudiado colonias en las provincias de Barcelona y Tarragona; en este caso en el piso bioclimático mesomediterráneo (RIVAS-MARTÍNEZ, 1987).

Detalles: Especie con una genitalia muy próxima a *Dichomeris rasilella* (Herrich-Schäffer, 1854), de la que apenas se diferencia en su morfología externa (con la forma clara de *D. rasilella*), pero sí lo hace en la genitalia. En *D. rasilella*, los lóbulos de la juxta son cortos, poco estilizados y bífidos, mientras que en *Dichomeris occidentella* (Zerny, 1927) solo se presenta un único lóbulo de similares características. La genitalia masculina y femenina de *D. rasilella* está bien representada (ELSNER *et al.*, 1999).

Tabla 2.– Estimaciones de divergencia evolutiva sobre pares de secuencias entre grupos para el marcador COI-5P. El número de sustituciones de base por sitio del promedio de todos los pares de secuencias entre especies se muestra en porcentajes con estimaciones de error estándar debajo de cada valor. Los análisis se realizaron utilizando el modelo Tamura de 3 parámetros (TAMURA, 1993) y la variación de la tasa entre sitios se modeló con una distribución gamma (parámetro de forma = 1). El análisis involucró 78 secuencias de nucleótidos con un total de 658 posiciones. El número de sustituciones de bases intraespecífico (dentro del grupo) obtenidas en las mismas condiciones se muestra en la línea diagonal (negrita). Las celdas sombreadas en verde claro resaltan distancias TN <10 % y los recuadros en negra encierran datos para cuatro grupos de especies que muestran un alto soporte bayesiano en el árbol filogenético (PP>0.85).

Marcador Mitocondrial COI	Grupo Externo	Dichomeris acuminatus n=4	Dichomeris castellana n=1	Dichomeris helianthem n=3	Dichomeris juniperella n=7	Dichomeris marginella n=2	Dichomeris rimbunct n=2	Dichomeris rasetodes n=4	Dichomeris barbellata n=1	Dichomeris ustulata n=9	Dichomeris limosellus n=5	Dichomeris nitellus n=1	Dichomeris dersellei n=9	Dichomeris alceata n=11	Dichomeris latipennis n=6	Dichomeris rasilella n=1	Dichomeris merceae n=1	Dichomeris occidentella n=5
Dichomeris acuminatus		17,61% ±0,08 SE																
Dichomeris castellana		16,24 SE	9,26%															
Dichomeris helianthem		17,66%	11,32 SE	n. a.														
Dichomeris juniperella		19,09%	11,61 SE	9,26%	5,49%	0,52%												
Dichomeris marginella		18,14%	11,46 SE	11,38 SE	10,98 SE	10,23 SE	0,55%											
Dichomeris rimbunct		18,58%	12,29 SE	11,56 SE	11,35 SE	11,30 SE	11,21%	0,80%										
Dichomeris rasetodes		18,75%	12,29 SE	11,52 SE	11,37 SE	11,26 SE	11,26 SE	10,20 SE	0,23%									
Dichomeris barbellata		15,77%	10,80%	11,20%	10,80%	10,80%	13,57%	12,64%	12,68%	12,91%								
Dichomeris ustulata		12,06 SE	11,62%	11,88%	10,99%	12,61%	13,50%	12,06%	12,86%	4,89%	0,10%							
Dichomeris limosellus		16,60%	11,67%	11,68%	12,31%	13,02%	13,48%	14,31%	15,48%	7,17%	6,26%	0,71%						
Dichomeris nitellus		15,40%	12,00%	11,36%	11,91%	14,85%	13,46%	15,15%	15,7%	7,74%	7,59%	5,41%						
Dichomeris dersellei		17,44%	11,42%	9,84%	9,71%	11,92%	13,12%	12,13%	7,45%	5,94%	6,79%	9,57%	0,07%					
Dichomeris alceata		12,35 SE	11,81 SE	11,59 SE	10,87%	11,93 SE	11,85 SE	11,92 SE	11,95 SE	11,96 SE	11,97 SE	11,95 SE	12,29 SE	12,25 SE	0,81%			
Dichomeris latipennis		19,99%	12,93%	10,34%	11,93%	11,99%	13,24%	13,44%	17,51%	15,00%	16,39%	17,81%	14,37%	14,19%	14,11%			
Dichomeris rasilella		18,97%	12,08%	10,48%	10,83%	11,29%	12,17%	13,59%	12,60%	13,68%	13,23%	15,72%	16,93%	13,25%	13,99%	12,85%	8,88%	
Dichomeris merceae		22,21%	15,23%	10,23%	11,54%	12,90%	12,74%	15,31%	15,26%	16,54%	15,61%	17,05%	19,25%	14,44%	15,10%	15,37%	9,32%	9,74%
Dichomeris occidentella		12,86 SE	11,82 SE	11,49 SE	11,63 SE	11,79 SE	11,70 SE	12,04 SE	12,02 SE	12,16 SE	12,06 SE	12,16 SE	12,65 SE	11,88 SE	11,98 SE	12,00 SE	11,54 SE	11,52 SE

Disponible en https://Lepiforum.org/wiki/page/Dichomeris_rasilella, en el apartado 1.1 (figs 10-11); apartado 2.1 (fig. 4) y apartado 2.3.1 (figs 3-4), se representan fotografías de un individuo adulto y su preparación de genitalia, capturado en España, Teruel, zona de Albarracín a 1.152 m, con fecha 9-VII-2021 (leg., det. gen. y fot.: Friedmar Graf), y que ha sido determinado como *Dichomeris rasilella*. A nuestro juicio, dicho espécimen está mal identificado, refiriéndose al taxón *Dichomeris occidentella*.

Todas las citas estudiadas hasta el momento de España y publicadas como *Dichomeris rasilella* (REQUENA, 2009) han resultado ser *Dichomeris occidentella*, por lo que cabe la sospecha razonable de que *Dichomeris rasilella* esté sustituida en España por esta especie.

Según nuestros datos *D. rasilella* se distribuye por China, Korea, Japón, Rusia y Europa (LI *et al.*, 2010). En Europa, aunque localmente, está ampliamente distribuido en Francia, Italia, Finlandia, Ucrania, Bielorrusia, Rumanía, República Checa y Eslovaquia. También se conoce de Estonia, Letonia, Lituania y Polonia (BARAN, 2008).

En una reciente lista comentada de los Gelechiidae europeos (HUEMER & KARSHOLT, 2020) se indica que han realizado un único DNA Barcode a un ejemplar de Rusia comprobando una gran divergencia con otras muestras y grupos en un BIN separado (6,26% de distancia mínima).

La larva de *D. rasilella* se alimenta de diferentes especies de Compositae, como *Artemisa vulgaris* L., *A. pontica* L., *Centaurea* sp., *Acosta rhenana* (Boreau) Soják (LI *et al.*, 2010).

***Dichomeris merceae* Gastón, Macià, Ylla & Bau, sp. n.**

Material examinado: Holotipo, 1 ♂, ESPAÑA, ÁVILA, a 1.430 m, 24-V-2017, prep. gen. 7190JG, depositado en el Museo Nacional de Ciencias Naturales, en Madrid, España (MNCN).

Paratipos: ESPAÑA, ÁVILA, a 1.430 m, 1 ♂, 24-V-2017, prep. gen. 9011JG, J. Gastón leg. y col.; ídem., 1 ♀, prep. genit. 7228JG, J. Gastón leg. y col.

Descripción del macho (fig. 3): Envergadura, 19,20 mm (n=2). Cabeza bien desarrollada con pelos escamiformes de color ocre/gris claros compactos en la frente y algo más oscuros en la zona alta del epicráneo; palpos labiales bien desarrollados, con el segundo segmento dirigido hacia el frente y el tercero fuertemente curvado hacia arriba. El color de las escamas en los palpos es ocre/gris oscuro, exceptuando un cepillo de pelos de mayor longitud ubicado en la parte superior del segundo segmento, cuyo color es ocre más claro; tórax y tégulas recubiertos de escamas de color ocre oscuro; abdomen del mismo color que el tórax; alas anteriores relativamente estrechas, muy apuntadas en su ápex, con el margen externo oblicuo; el color de fondo de las alas anteriores es ocre oscuro uniforme, apreciándose con dificultad dos pequeñas máculas situadas en diagonal en zona discal, en su parte más cercana a la base de las alas. En la parte opuesta de la zona discal, hacia el extremo de las alas y sobre la vena M2 hay otra mácula algo más ostensible; alas posteriores algo más anchas que las anteriores, de color uniforme gris, ligeramente más claras que aquellas.

Genitalia del macho (figs 9-10): Uncus ancho y corto, forrado con pequeñas cerdas con su extremo superior poco apuntado, casi horizontal; gnathos en forma de gancho, muy potente y fuertemente esclerotizado, con una base circular amplia en su entronque con el uncus; tegumen corpulento y ancho; valvas con la base estrecha, ensanchadas bruscamente en su parte central de forma simétrica, con el extremo redondeado y un sacculus no reseñable; lóbulos de la transtilla medianamente cortos y gruesos. Vinculum de gran tamaño, característico del género, con la juxta soldada al mismo y la presencia en la misma de una pieza bilobular, cilíndrica, de extremos redondeados y forrados de pequeñas cerdas; phallus con el coecum y parte anular grueso y abultado, afinándose progresivamente hacia el extremo distal; presencia de un proceso anular cercano al coecum del que surge una gruesa espina larga, recta, esclerotizada y afilada que sobrepasa la parte distal del phallus.

Descripción de la hembra (fig. 4): Envergadura, 18 mm (n=1). No presenta diferencias con los machos.

Genitalia de la hembra (figs 12-12a): Papilas anales bien desarrolladas y ligeramente esclerotizadas; apófisis posteriores relativamente largas, alcanzando el ostium; papilas anteriores cortas, relativamente gruesas, rematadas en su extremo con un ligero ensanchamiento; 8º segmento relativamente corto; ostium membranoso y antrum campaniforme y membranoso; ductus bursae cilíndrico, alargado, ancho y membranoso, provisto de una placa alargada y bífida en forma de cinta muy esclerotizada ensanchada parcialmente en su parte central, con una longitud que alcanza la tercera parte del ductus; ductus seminalis en la parte posterior del ductus; bursa membranosa, de la misma anchura que el ductus, por lo que es difícil establecer el límite entre ambos; presencia de un appendix bursae en el centro de la misma.

Diagnos molecular: La única muestra que se ha conseguido secuenciar con éxito de *Dichomeris merceae* sp. n. muestra una distancia suficiente a los especímenes de la especie próxima *Dichomeris occidentella* (TN-Dist = 8.88%) para pertenecer claramente a una especie distinta. Ésta última especie, junto a *D. merceae* y *D. rasilella* forman parte de un clado con alto soporte bayesiano (PP=1).

Biología: Desconocida.

Distribución (fig. 6): Hasta el momento solo se conoce una colonia situada en la provincia de Ávila (España). Piso bioclimático supramediterráneo (RIVAS-MARTÍNEZ, 1987).

Etimología: Se dedica esta especie a Mercè Casademunt esposa del segundo autor.

Detalles: La morfología externa de *D. merceae* es claramente diferente a las otras especies del grupo ya que además de disponer de un mayor porte, el color de fondo de sus alas anteriores es de un ocre grisáceo plomizo oscuro en donde apenas se distinguen las manchas negras. Su genitalia es muy próxima a *Dichomeris rasilella* (Herrich-Schäffer, 1854), bien representada (ELSNER *et al.*, 1999) y a *Dichomeris occidentella* de las que se diferencia en los siguientes detalles: en los machos, el uncus es más ancho y más chaparro rematado horizontalmente en su parte distal, por lo que aparece amesetado y no apuntado; el tegumen es más corpulento y ancho; los lóbulos de la transtilla son más gruesos; los lóbulos de la juxta son bífidos, como en *D. rasilella*; finalmente, el phallus que comparte la misma estructura que sus dos especies próximas, se diferencia de éstas por su mayor tamaño y por la mayor potencia del proceso anular en forma de gruesa espina que supera ligeramente el extremo dis-

tal del mismo. En las hembras, *D. merceae* sp. n., se diferencia de las otras dos especies en la longitud del ductus, que es mucho mayor, y en la geometría de la bursa, mucho menos globular y esférica.

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No podemos terminar este trabajo sin agradecer la colaboración y la ayuda prestada por las siguientes personas e Instituciones: a Emili Requena (España), por poner amablemente a nuestra disposición los ejemplares de su colección, a Antonio Vives (España) por el aporte de información, a los laboratorios de la Facultad de Ciencia, Tecnología e Ingenierías de la UVic-UC y en especial a Cristina Martín Mancera (España) por su colaboración en el análisis de ADN, a las Direcciones Generales de Medio Ambiente de Castilla y León, de Aragón y de Cataluña, por las autorizaciones concedidas allí donde se han desarrollado los muestreos.

BIBLIOGRAFÍA

- BARAN, T., 2008.– On the new and rare microlepidoptera (Lepidoptera) in Polish fauna.– *Polish Journal of Entomology*, **77**: 133-143.
- BOUCKAERT, R., VAUGHAN, T. G., BARIDO-SOTTANI, J., DUCHÊNE, S., FOURMENT, M., GAVRYUSHKINA, A., HELED, J., JONES, G., KÜHNERT, D., DE MAIO, N., MATSCHINER, M., MENDES, F. K., MÜLLER, N. F., OGILVIE, H. A., DU PLESSIS, L., POPINGAI, A., RAMBAUT, A., RASMUSSEN, D., SIVERONI, I., SUCHARD, M. A., WU, C. H., XIE, D., ZHANG, C., STADLER, T. & DRUMMOND, A. J., 2019.– BEAST 2.5: An advanced software platform for Bayesian evolutionary analysis.– *PLoS computational biology*, **15**(4): e1006650.
- ELSNER, G., HUEMER, P. & TOKÁR, Z., 1999.– *Die Palpenmotten (Lepidoptera, Gelechiidae) Mitteleuropas*: 208 pp. František Slamka, Bratislava.
- FOLMER, O., BLACK, M., HOEH, W., LUTZ, R. & VRIJENHOEK, R., 1994.– DNA primers for amplification of mitochondrial cytochrome c oxidase subunit I from diverse metazoan invertebrates.– *Molecular Marine Biology and Biotechnology*, **3**(5): 294-299.
- GASTÓN, J., REVILLA, Tx. & VIVES MORENO, A., 2018.– Contribución al conocimiento de los Microlepidoptera, con nuevas citas para España y otras aportaciones de interés. (Insecta: Lepidoptera).– *SHILAP Revista de lepidopterología*, **46**(182): 221-233.
- HUEMER, P. & KARSHOLT, O., 2020.– Commented checklist of European Gelechiidae (Lepidoptera).– *Zookeys*, **921**: 65-140.
- KUMAR, S., STECHER, G., LI, M., KNYAZ, C. & TAMURA, K., 2018.– MEGA X: Molecular evolutionary genetics analysis across computing platforms.– *Molecular Biology and Evolution*, **35**(6): 1547-1549. <https://doi.org/10.1093/molbev/msy096>.
- LI, H. H., ZHEN, H., KENDRICK, R. C. & STERLING, M. J., 2010.– Microlepidoptera of Hong Kong: Taxonomic study on the genus *Dichomeris* Hübner, 1818, with descriptions of three new species (Lepidoptera: Gelechiidae).– *SHILAP Revista de lepidopterología*, **38**(149): 67-89.
- RAMBAUT, A., DRUMMOND, A. J., XIE, D., BAELE, G. & SUCHARD, M. A., 2018.– Posterior summarization in Bayesian phylogenetics using Tracer 1.7.– *Systematic Biology*, **67**(5): 901-904. <https://doi.org/10.1093/sysbio/syy032>.
- RATNASINGHAM, S. & HEBERT, P. D. N., 2013.– A DNA-Based Registry for All Animal Species: The Barcode Index Number (BIN) System.– *PLoS ONE*, **8**(7): 66213. <https://doi.org/10.1371/journal.pone.0066213>.
- REQUENA, E., 2009.– Aproximació a la fauna dels gelèquids de Catalunya i Balears (Lepidoptera: Gelechiidae).– *Treballs de la Societat Catalana de Lepidopterologia*, **16**: 5-77.
- 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.
- TAMURA, K. & NEI, M., 1993.– Estimation of the number of nucleotide substitutions in the control region of mitochondrial DNA in humans and chimpanzees.– *Molecular Biology and Evolution*, **10**(3): 512-526. <https://doi.org/10.1093/Oxfordjournals.molbev.a040023>.
- VIVES MORENO, A., 2014.– *Catálogo sistemático y sinónimo 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, Imroititalia, Madrid.

ZERNY, H., 1927.– Die Lepidopterenfauna von Albarracin in Aragonien.– *Eos*, **3**: 299- 487.

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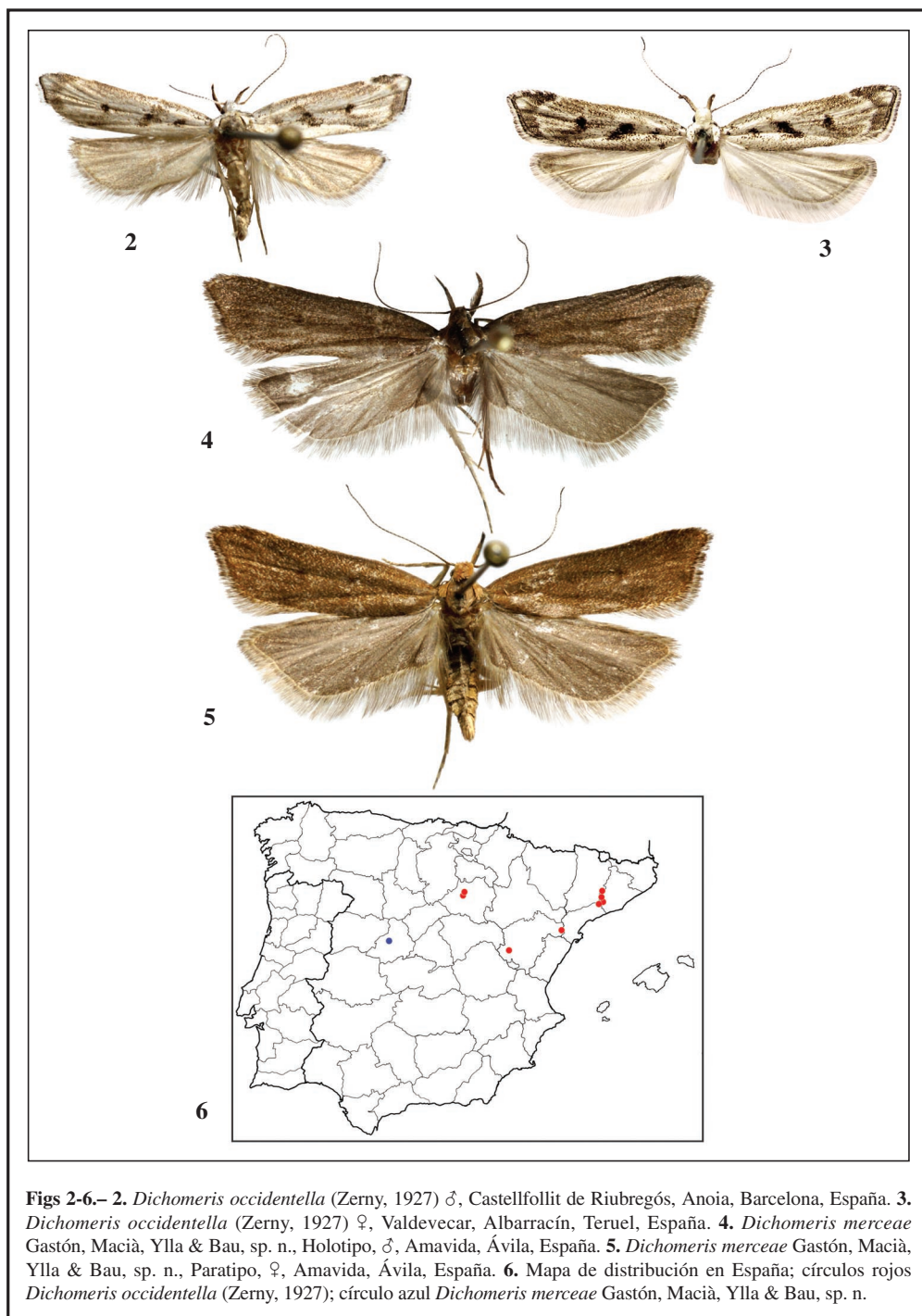
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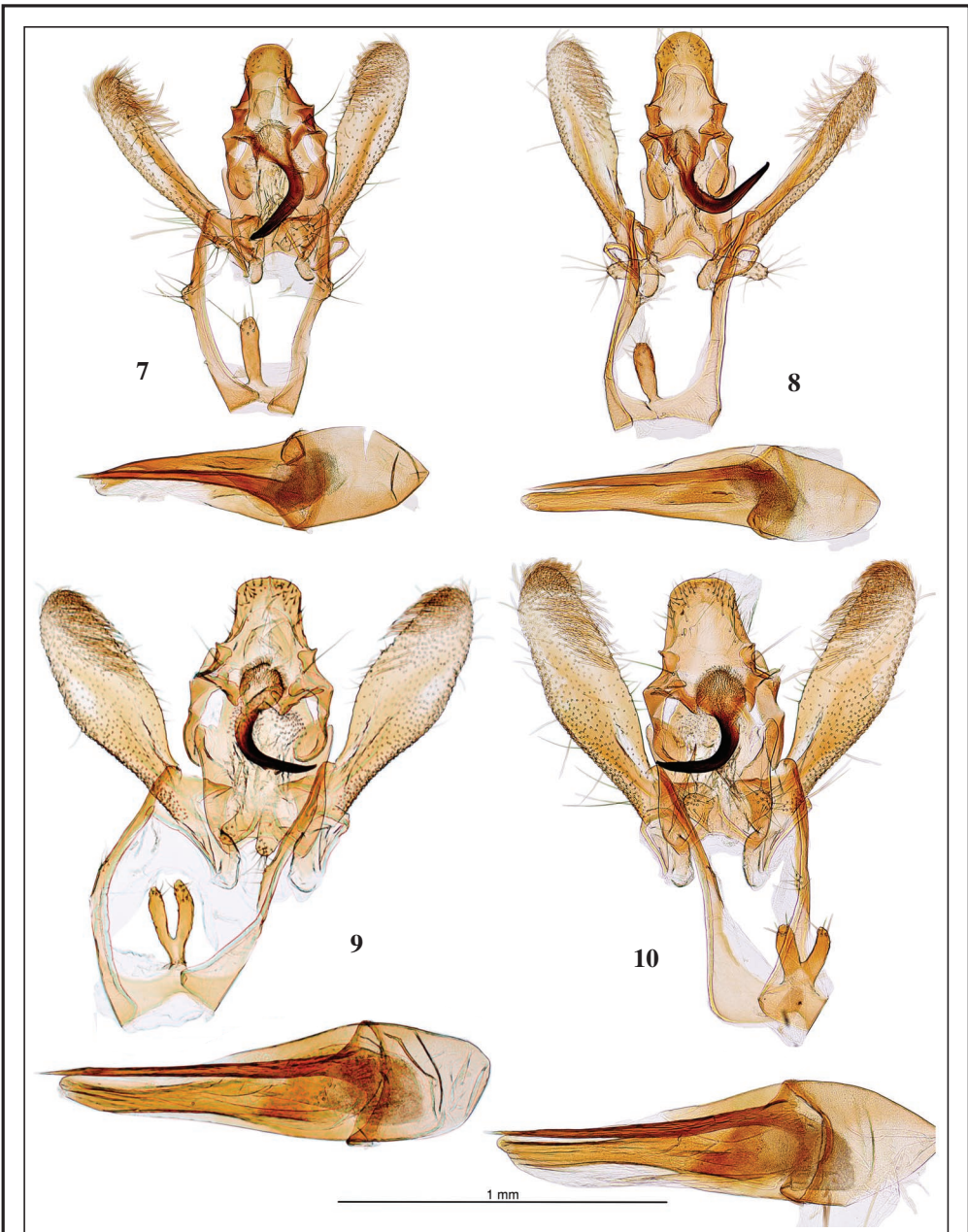
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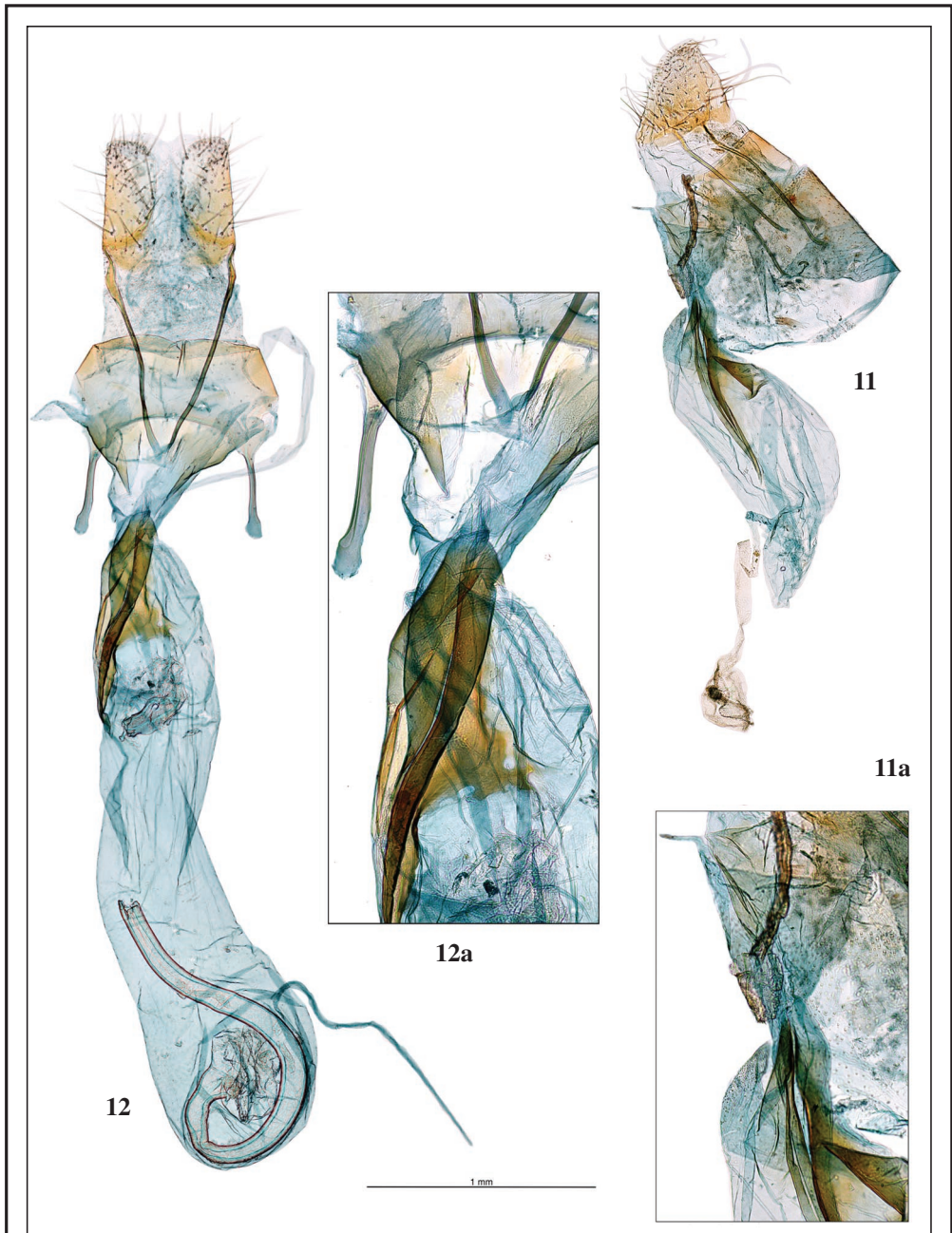
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Figs 2-6.— 2. *Dichomeris occidentella* (Zerny, 1927) ♂, Castellfollit de Riubregós, Anoia, Barcelona, España. 3. *Dichomeris occidentella* (Zerny, 1927) ♀, Valdevecar, Albarracín, Teruel, España. 4. *Dichomeris merceae* Gastón, Macià, Ylla & Bau, sp. n., Holotipo, ♂, Amavida, Ávila, España. 5. *Dichomeris merceae* Gastón, Macià, Ylla & Bau, sp. n., Paratipo, ♀, Amavida, Ávila, España. 6. Mapa de distribución en España; círculos rojos *Dichomeris occidentella* (Zerny, 1927); círculo azul *Dichomeris merceae* Gastón, Macià, Ylla & Bau, sp. n.



Figs 7-10.— Genitalia macho: **7.** *Dichomeris occidentella* (Zerny, 1927), prep. gen. 9045JG. **8.** *Dichomeris occidentella* (Zerny, 1927), prep. gen. 9004JG. **9.** *Dichomeris merceae* Gastón, Macià, Ylla & Bau, sp. n., Holotipo, prep. gen. 7190JG. **10.** *Dichomeris merceae* Gastón, Macià, Ylla & Bau, sp. n., Paratipo, prep. gen. 9011JG.



Figs 11-12.— Genitalia hembra: **11.** *Dichomeris occidentella* (Zerny, 1927), prep. gen. JY5776. **11a.** Idem, detalle del ostium y antrum. **12.** *Dichomeris merceae* Gastón, Macià, Ylla & Bau, sp. n., Paratipo, prep. gen. 7228JG. **12a.** Idem, detalle del ostium y antrum.

***Rifseria fuscotaeniaella* (Chambers, 1878) primera cita sobre *Montanoa tomentosa* Cerv. y nuevo para México (Lepidoptera: Gelechiidae, Gelechiinae)**

I. G. López-Muraira, H. Flores-Martínez, J. F. Gómez-Leyva
& H. R. Iruegas-Buentello

Resumen

Se registra por primera vez para México a *Rifseria fuscotaeniaella* (Chambers, 1878) como minador de la hoja de *Montanoa tomentosa* Cerv., anteriormente citado en varias especies de maleza de la familia Asteraceae en Estados Unidos y Canadá.

PALABRAS CLAVE: Lepidoptera, Gelechiidae, Gelechiinae, nuevo registro, México.

Rifseria fuscotaeniaella (Chambers) first record on *Montanoa tomentosa* Cerv. new to Mexico
(Lepidoptera: Gelechiidae, Gelechiinae)

Abstract

First record from México for *Rifseria fuscotaeniaella* (Chambers, 1878) as a leaf miner of *Montanoa tomentosa* Cerv. This Lepidoptera species was previously reported on several weeds of Asteracea family in the United States and Canada.

KEY WORDS: Lepidoptera, Gelechiidae, Gelechiinae, new record, Mexico.

Introducción

Rifseria fuscotaeniaella (Chambers, 1878), fue descrito como *Gelechia fuscotaeniaella* por CHAMBERS(1878), en Bosque County, Meridian, Texas, EE.UU. Posteriormente HODGES (1966) cambió esta especie al nuevo género *Rifseria* Hodges, 1966 y desde entonces se ha reportado para Canadá y los Estados Unidos. Esta es una especie bien representada en las listas de Lepidoptera colectados en diversos Estados de EE.UU. y Canadá (BECKER, 1984; NYE & FLETCHER, 1991; BROWN *et al.*, 2004; LEE *et al.*, 2009; POHL *et al.*, 2010; LEE, 2014; POHL *et al.*, 2015; POHL *et al.*, 2016). Esta especie de Lepidoptera es fácilmente reconocida por la coloración blanca de la cabeza y alas anteriores y que presenta la banda basal de color café-oscuro con dos puntos precediendo y antecediendo el área media costal, este último más grande y de forma triangular y una mancha apical de escamas café claro y oscuras.

A pesar de su amplia distribución y ser una especie relativamente bien conocida, poco se sabe de su biología y solamente se ha encontrado a la larva alimentándose de las terminales foliares y como minador de las hojas de *Anaphalis* sp. y *Gnaphalium* sp. (Asteraceae) (POWELL & OPLER, 2009). En este estudio informamos de la presencia de esta especie de Lepidoptera en México en una nueva planta nutricia.

Montanoa tomentosa Cerv. es una planta perteneciente a la familia Asteraceae y sus nombres más comunes en México son zoapatle y hierba de la mujer. Esta planta, se la conoce en la herbolaria mexicana desde tiempos prehispánicos (RÍOS *et al.*, 2012). Es considerada una planta común y es favorecida por el disturbio sin problemas de supervivencia (RZEDOWSKI *et al.*, 2011).

Materiales y métodos

Durante el período del 9-V-2019 al 12-V-2019 se realizaron tres colectas, para la búsqueda de microlepidópteros minadores del arbusto ruderal identificado como *Montanoa tomentosa* Cerv. (Fig. 1), utilizando las claves dicotómicas y descripciones de RZEDOWSKI & RZEDOWSKI (2001) y RZEDOWSKI *et al.* (2011). Esta especie, es una planta que se caracteriza por ser arbustos grandes con apariencia de árboles hasta 3 metros de alto, ramas jóvenes piloso-tomentosas, hojas opuestas, lobadas hasta 12 cm de largo y 9 cm de ancho, escábrida en el haz, suaves-velutina y con gotitas de exudado resinoso en el envés; cabezuelas florales de 1 a 1.5 cm de ancho con páleas densamente sedoso-piloso con tricomas de 2.5 mm de largo; flores liguladas y del disco blancas (MCVAUGH, 1984).

Las plantas fueron localizadas en las cercanías del poblado de Huejotitán (20°21'37.84"N 103°28'55.26"W) en el municipio de Jocotepec del Estado de Jalisco, México.

El material vegetal consistente de 45 hojas con daños visibles en forma de minaduras (Fig. 2) fue colocado en envases de plástico con capacidad de un litro (9.5cm de diámetro por 14.25 cm de alto) con tapa de malla número 30 con aperturas de 600 micrómetros y puestos en un cuarto de incubación bajo temperatura controlada a 25 grados centígrados y 55 % de humedad relativa.

Se obtuvieron un total de dos ejemplares adultos de la especie determinada como *Rifseria fuscotaeniaella* (Chambers, 1878), utilizando para su identificación la descripción original de CHAMBERS (1878), pero principalmente las descripciones e ilustraciones de HODGES (1966) y POWELL & OPLER (2009). Los insectos fueron depositados en la colección entomológica ubicada dentro del Herbario CREG del Instituto Tecnológico de Tlajomulco en Jalisco, México. Se consultaron los registros previos de Gelechiidae en México usando como base la publicación de BECKER (1984), no mostrando registro previo de *Rifseria fuscotaeniaella* (Chambers) en México, finalmente se utilizó el esquema de clasificación de NIEUKERKEN *et al.* (2011) y SOHN *et al.* (2015).

Para la disección y tinción de la genitalia del macho (Fig. 4) se utilizó la técnica de mencionada por VARGAS & PARRA (2005), que consiste en calentar el abdomen en KOH (10%) y posteriormente teñirlos con Chlorazol Black, separar las estructuras y montarlas en portaobjetos con glicerina, de esta forma podemos observar cómo características especiales de esta especie, el uncus en forma de capucha y con una hilera apical de cortas y robustas espinas (Fig. 5) que la separa de las demás especies del grupo *Lita*, vinculum ancho y cuadrado en la parte medial (Fig. 6). Aedeagus con la base expandida (Fig. 7) y segmentos abdominales 5 y 6 con un par de parches de setas espinosas cada uno (Fig. 8).

Resultados

Familia Gelechiidae Stainton, 1874
Subfamilia Gelechiinae Stainton, 1854

Rifseria Hodges, 1966. *Proc. U. S. Nat. Mus.*, **119**(3547): 62
Especie tipo: *Gelechia fuscotaeniaella* Chambers, 1878

Rifseria fuscotaeniaella (Chambers, 1878) (Fig. 3)
Gelechia fuscotaeniaella Chambers, 1878. *Bull. Geol. Surv. Terr.*, **4**: 89
Localidad tipo: Bosque County, Texas, EE.UU.

Material examinado: MÉXICO, Zapotitlán, Jalisco, México, 2 ♂♂, 12-V-2019, H. R. Iruegas leg., que resulta **nuevo para México**.

Distribución: Esta especie se conoce desde la Columbia Británica, Alberta y Manitoba en Canadá hasta California, Arizona, Colorado, Nevada, Utah y Texas en los Estados Unidos (HODGES, 1966).

Plantas alimenticias

Esta especie se alimenta de plantas de la familia Asteraceae y se ha citado para *Anaphalis* sp. y *Gnaphalium* sp. (POWELL & OPLER, 2009) y ahora para *Montanoa tomentosa* Cerv., nueva planta nutricia.

Conclusión

Nuestro análisis indica que *Rifseria fuscotaeniaella* (Chambers, 1878) se destaca por su amplia dispersión que claramente representa un patrón de distribución Neártico, cuya característica principal corresponde a taxones de Norteamérica que pueden llegar hasta la zona de transición mexicana (HALFFTER & MORRONE, 2017), que comprende la Sierra Madre Occidental, Sierra Madre Oriental, Sierra Madre del Sur y el Cinturón Volcánico Transversal y su presencia en el centro de México es posible gracias a su capacidad de expansión norte-sur a través de estas regiones biogeográficas. De acuerdo con HODGES (1966) esto corresponde con la distribución Neártica de 20 especies del Grupo *Lita* de los géneros *Arla* Clarke, 1942, *Neodactylota* Busck, [1903], *Eudactylota* Walsingham, 1911, *Sriferia* Hodges, 1966, *Rifseria* Hodges, 1966 y *Friseria* Busck, 1939. También menciona que ningún miembro del grupo *Lita* examinado presenta una distribución Neotropical.

Este trabajo es parte del esfuerzo para completar la información sobre las plantas alimenticias de los Lepidoptera minadores y de aquí se desprende que *Rifseria fuscotaeniaella* (Chambers, 1878) mantiene una preferencia alimenticia por especies de plantas de la familia Asteraceae.

BIBLIOGRAFÍA

- BECKER, V. O., 1984.– 29. Gelechiidae: 44-53.– In J. B. HEPPNER (ed.). *Atlas of Neotropical Lepidoptera. Checklist: Part 1 Micropterigoidea-Immoidea*: XXVII + 112 pp. Dr W. Junk Publishers, The Hague.
- BROWN, J. W., ADAMSKI, D., HODGES, R. W. & BAHR, A. S. M., 2004.– Catalog of the type specimens of Gelechioidea (Lepidoptera) in the collection of the National Museum of Natural History, Smithsonian Institution, Washington, D.C.– *Zootaxa*, **510**: 1-160.
- CHAMBERS, V. T., 1878.– Descriptions on new Tineina from Texas, and others from more Northern Localities.– *Geological and Geographical Survey of the Territories*, **4**: 79-106.
- HALFFTER, G. & MORRONE, J. J., 2017.– An analytical review of Halffter's Mexican transition zone, and its relevance for evolutionary biogeography, ecology and biogeographical regionalization.– *Zootaxa*, **4226**: 1-46.
- HODGES, R. W., 1966.– Revision of Nearctic Gelechiidae, I. The *Lita* Group (Lepidoptera:Gelechioidea).– *Proceedings of the United States National Museum*, **119**: 1-99.
- LEE, S., HODGES, R. W. & BROWN, R. L., 2009.– Checklist of Gelechiidae (Lepidoptera) in America North of Mexico.– *Zootaxa*, **2231**: 1-39.
- LEE, S., 2014.– Preliminary list of the lepidopterous insects in the Arizona State University Hasbrouck Insect Collection.– *Journal of Asia-Pacific Biodiversity*, **7**: e76-e94.
- MCVAUGH, R., 1984.– *Flora Novo-Galiciana. 12 Compositae*: 1157 pp. The University of Michigan Press, Michigan.
- NYE, I. W. B. & FLETCHER, D. S., 1991.– *The Generic Names of Moths of the World. Microlepidoptera*, **6**: 368. Natural History Museum Publications, London.
- NYE, G. R., ANWEILER, G. G., SCHMIDT, B. C. & KONDLA, N. G., 2010.– An annotated list of the Lepidoptera of Alberta, Canada.– *ZooKeys*, **38**: 1-549.
- POHL, G. R., ANWEILER, G. G., SCHMIDT, C. & KONDLA, N. G., 2010.– An annotated list of the Lepidoptera of Alberta, Canada.– *ZooKeys*, **38**: 1-549.
- POHL, G. R., CANNINGS, R. A., LANDRY, J. F., HOLDEN, D. G. & SCUDDER, G. G. E., 2015.– Checklist of

- the Lepidoptera of British Columbia, Canada.– *Entomological Society of British Columbia Occasional Paper*, **3**: 1-294.
- POHL, G. R., PATTERSON, B. & PELHAM, J. P., 2016.– *Annotated taxonomic checklist of the Lepidoptera of North America, North of Mexico*: 766 pp. Available from <https://www.researchgate.net/publication/302570819>.
- POWELL, J. A. & OPLER, P. A., 2009.– *Moths of Western North America*: 383 pp. University of California Press.
- RÍOS, C. T., QUIJANO, L. & REYES, R. C., 2012.– Algunas reflexiones actuales sobre la herbolaria prehispánica desde el punto de vista químico.– *Revista Latinoamericana de Química*, **40**: 41-64.
- RZEDOWSKI, G. C. & RZEDOWSKI, J., 2001.– *Flora Fanerogámica del Valle de México*: 1406 pp. Instituto de Ecología A.C.
- RZEDOWSKI, J., CALDERÓN DE R., G. & CARRILLO, R. P., 2011.– *Familia Compositae. Tribu Heliantheae II. (Géneros Lagascea - Zinnia)*. *Flora del Bajío y Regiones Adyacentes*, 172: 409 pp. Instituto de Ecología. CONABIO, CONACYT.
- VARGAS, H. A. & PARRA, L. E., 2005.– Un nuevo género y una nueva especie de Oecophyllembiinae (Lepidoptera: Gracillariidae) de Chile.– *Neotropical Entomology*, **34**: 227-233.

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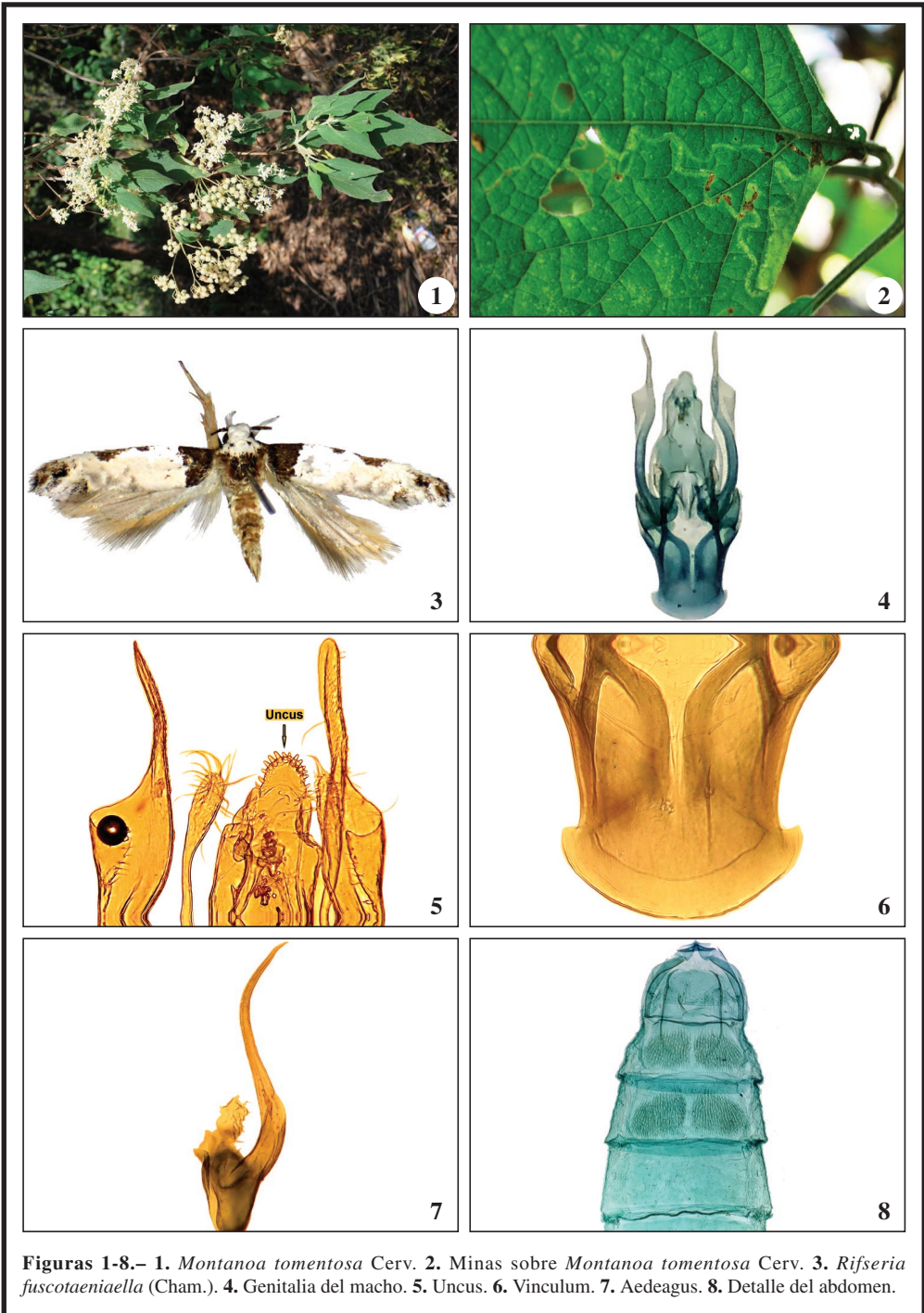
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Figuras 1-8.– 1. *Montanoa tomentosa* Cerv. 2. Minas sobre *Montanoa tomentosa* Cerv. 3. *Rifseria fuscotaeniaella* (Cham.). 4. Genitalia del macho. 5. Uncus. 6. Vinculum. 7. Aedeagus. 8. Detalle del abdomen.

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Notes on the Neotropical Midilinae, with description of one new genus and two new species (Lepidoptera: Crambidae)

V. O. Becker

Abstract

Pycnarmodes Becker gen. n. with two species from Brazil: *Pycnarmodes auricolor* Becker sp. n., and *P. parallelographa* Becker, sp. n., are described. *Malleria argenteofulva* Munroe, 1959, is transferred from the Musotiminae to the Midilinae. Diagnosis, key to species and illustrations of the two *Pycnarmodes* species and of *M. argenteofulva* are also presented.

KEY WORDS: Lepidoptera, Crambidae, Midilinae, *Malleria*, new genus, new species, taxonomy, distribution, Brazil.

Notas sobre los Midilinae neotropicales, con la descripción de un género y dos especies nuevos (Lepidoptera: Crambidae)

Resumen

Se describe *Pycnarmodes* Becker gen. n. con dos especies de Brasil: *Pycnarmodes auricolor* Becker sp. n., y *P. parallelographa* Becker, sp. n. *Malleria argenteofulva* Munroe, 1959, es transferida de los Musotiminae para los Midilinae. También se presentan las diagnósicos, descripciones e ilustraciones de las dos especies de *Pycnarmodes* y de *M. argenteofulva*.

PALABRAS CLAVE: Lepidoptera, Crambidae, Midilinae, *Malleria*, género nuevo, especies nuevas, taxonomía, distribución, Brasil.

Introduction

The Midilinae is a group of neotropical moths ranging from Mexico to Northern Argentina (MUNROE, 1970), represented by 48 species in seven genera (MUNROE, 1995). The Erupini, transferred from the Crambinae to Midilinae by HAYDEN (2012), was transferred back to the Crambinae as the sister group of all the other tribes belonging to this subfamily (LÉGER *et al.*, 2019). They are highly variable either in size, color, and shape, including the largest Pyralidae species (*Midila* Walker, 1858, *Eupastranaia* Becker, 1973), and others much smaller (*Hositea* Dyar, 1910, *Dismidila* Dyar, 1914). They do not look like a typical Pyralidae at all, the reason why they were originally established in such families as the Noctuidae, Geometridae and Limacodidae. The taxa treated here do not resemble the species currently belonging to the subfamily either, but look like other Pyralidae, such as some Spilomelinae. They also are not common. After over 50 years of intensive collecting by the author in Brazil and other Latin American countries only the 25 specimens studied here, representing three species, were collected.

Material and methods

This work is based on 25 specimens (9 g. s.) in the author's collection (VOB) and nine more in the MHNG. A synoptic collection representing the species described here were taken to the CMNH, the NHMUK and the USNM to be compared with their collections. No specimen belonging to these species were found in these museums. The holotypes of the new species are provisionally deposited in VOB, and will be transferred, together with the collection, to a Brazilian institution in the future. Genitalia were prepared following the methods described by ROBINSON (1976). Terms for morphological characters follow HODGES (1971).

Abbreviations

CMNH	=	Carnegie Museum of Natural History, Pittsburgh, USA
CNC	=	Canadian National Collection, Ottawa, Canada
FW	=	forewing
g. s.	=	genitalia slide
HW	=	hind wing
MHNG	=	Museum d'Histoire Naturelle, Geneva, Switzerland
NHMUK	=	Natural History Museum, London, United Kingdom
TS	=	Type species
USNM	=	United States National Museum, Washington DC, USA
VOB	=	Vitor O. Becker Collection, Serra Bonita Reserve, Camacan, Bahia, Brazil

Results and discussion

Examination of specimens in the author's collection (VOB) revealed that two species of Midilinae are undescribed and could not be associated to any of the genera recognized for this subfamily. A new genus is here proposed to accommodate them. Also found were six specimens belonging to *Malleria argenteofulva* Munroe, 1959. This is a monotypic genus, formerly known from the single female holotype, originally described in the Pyraustinae, and later moved to Musotiminae. The presence of chaetosemata and the characters of male genitalia, especially the articulated gnathos, described and illustrated here for the first time, as well as the reduced tympanum, indicates that it also belongs to the Midilinae, as defined by MUNROE & SOLIS (1999: 246). Descriptions, keys, and illustrations of the taxa treated here are presented to allow their identifications.

Pycnarmodes Becker, gen. n.

TS: *Pycnarmodes parallelographa* Becker, sp. n.

Diagnosis: Wings marked with, curved, parallel lines.

Description: Labial palpi curved upwards to mid frons; third segment small, 1/3 of second (thinner, much longer in females); FW marked with curved, parallel black lines, costa nearly straight, apex broadly angled, termen round; dorsum straight; M2-M3 connected at lower end of cell; Cu1 before angle. HW with thin, parallel lines along margin; pair of dots in the middle or above tornus. Male genitalia with long uncus and articulated gnathos, almost as long as uncus, valva broad and simple: costa and sacculus slightly or not defined; phallus long, thin, almost as long as valva. Female genitalia with very long ductus bursae; corpus bursae globular, signum absent.

Etymology: A masculine epithet derived from *Pycnarmon* Lederer 1863, a genus belonging to the Spilomelinae, due to the resemblance of their pattern, specially to *P. leucinodialis* (Schaus, 1912).

Remarks: The presence of chaetosemata, the short, laminate antenna and the simple male genitalia with articulated gnathos, as well as the reduced tympanum orientated posteriorly, as described by HAYDEN (2012), are characters typical to the Midilinae. In the key to the Midilinae genera

(MUNROE, 1970: 7) this genus comes out together with *Hositea*, sharing the white ground color and the shape of palpi and antennae. It differs by the lined wing pattern and the shape of the wings: FW termen angled out in the middle and HW with apex pointed in *Hositea*, whereas both wings with termen evenly round in *Pycnarmodes*. They also differ in the shape of gnathos: tapering distad in *Hositea* but spatulate in *Pycnarmodes*. Two species from Brazil are known for the genus, as described below.

Key to *Pycnarmodes* species

1. Wings ground color whitish cream *parallelographa*
 FW ground color wholly golden yellow *auricolor*

***Pycnarmodes parallelographa* Becker, sp. n.** (figs 1-3, 5, 7-8, 13)

Material examined (26 specimens, 4 g. s.): Holotype ♂, BRAZIL: Bahia, Camacan, 15°23'S - 39°33'W, 800 m, 1-15-XII-2020 (Becker 162431) (VOB); paratypes: 4 ♂♂, same data as the holotype, g. s. 5680 (VOB); 9 ♂♂, 1 ♀, Idem, but: 15-XI-1995, II-2012, IX-2010, XII-2013, 1-31-X-2020, g. s. 5242, 5243 (Becker 106232, 146747, 148877, 151199, 161633) (VOB, USNM); 6 ♂♂, Idem, 24-XI-16-XII-2013 (Landry & Becker) (MHNG 87221-87226); 2 ♂♂, Espírito Santo, Linhares, 2-XI-1988 (Santos), (VOB); 1 ♂, Paraná, Guaraqueçaba, 9-XII-1970 (Becker 7811) (VOB); 1 ♀, Santa Catarina, São Bento do Sul, Serra do Natal, 800 m, 1-29-I-1999, g. s. 5681 (Thöny) (VOB); 1 ♂, same data, but 4-9-I-2005 (Moser) (VOB).

Diagnosis: The cream wings marked with parallel lines are unique in the subfamily.

Description: Male (figs 2, 5) FW length 10-13 mm (wingspan 23-30 mm). Cream, marked with black lines and dots. Labial palpi black dorsally; vertex with posterior margin with black scales. Thorax along middle, patagia and base of tegula black; legs whitish; FW: three dots at base; antemedial band double, following parallel along dorsum and tornus, then along termen up to costa, and backwards to distal third of costa; large reniform ring at end of cell; dot on fold, below cell; double, interrupted, parallel lines close to termen. HW with three thin, parallel lines along termen; pair of dots on the middle. Abdomen cream dorsally, with pair of dots on 3rd segment, transverse bands from 4th to tip, first broad, the others narrowing gradually towards tip; whitish ventrally, with pair of dots on each segment. Genitalia (fig.7): uncus a long, sharp pointed rod; gnathos spatulate, nearly as long as uncus; valva broad, slightly constricted at middle, costa slightly defined; distal margin straight, oblique from costa to middle of ventral margin; vinculum round; juxta a large, nearly round plate; phallus (fig. 8) long, slightly bent dorsal. Female (fig. 3) FW length 13-15 mm (wingspan 30-34 mm); similar to male but larger. Genitalia (fig. 13): ostium wide, antrum conical, ductus bursae very long, nearly 2/3 of abdomen; corpus bursae globular.

Distribution (fig. 1): Brazil, along the Atlantic Forest, from Bahia south to Santa Catarina.

Etymology: A noun derived from the Greek *παράλληλος* =parallel, and *γράφω* =write, line; in reference to the parallel lines that mark their wings.

Remarks: Easily distinguished from *auricolor* by the ground colour of FW, wholly whitish cream.

***Pycnarmodes auricolor* Becker, sp. n.** (figs 1, 4, 9, 10)

Material examined: Holotype ♂, BRAZIL: Pará, Capitão Poço, 25-31-I-1984, g. s. 5682 (Becker 47830) (VOB).

Diagnosis: Medium size. Golden yellow. FW with three straights, near parallel black lines at basal third; a reniform ring on cell, followed by sinuous postmedial band.

Description: Male (fig. 4) FW length 12 mm (wingspan 27 mm). Labial palpi cream, blackish dorsally; frons golden yellow; antenna pale yellow. Thorax golden yellow, dorsal margin of patagia and dorsal margin of tegula blackish; legs ringed black on articulations. FW golden yellow, marked with

black lines: three straights, transverse, nearly parallel on basal third; reniform ring at end of cell; postmedial band from mid costa, following parallel around reniform ring to Cu₂, then down to dorsum, before tornus; two irregular black dots distad of postmedial band between M₃-Cu₂, and between anal fold-A₂; terminal line and cilia forming two parallel lines. HW with pair of dots above tornus; double, thin, parallel lines along termen. Abdomen golden yellow banded dark grey dorsally, tip blackish; whitish ventrally, with ill-defined bands towards tip. Genitalia (fig. 9): uncus a long, sharp pointed rod; gnathos a rod slightly thickened medially, almost as long as uncus; valva broad, widening slightly distad, costa slightly defined, sacculus not defined; distal margin broadly round; vinculum subsquare; juxta a large, flat plate; phallus (fig. 10) thin, long, small digital process at apex. Female unknown.

Distribution (fig. 1): Brazil, amazons; known from the type locality only.

Etymology.- From the Latin *aurum* =gold + *colour* =colour, tint; in reference to the yellow ground colour of the wings.

Remarks: Easily distinguished from *parallelographa* by the golden yellow ground colour.

Malleria Munroe, 1959

Malleria Munroe, 1959. *Can. Ent.*, **91**: 370

TS: *Malleria argenteofulva* Munroe, 1959. *Can. Ent.*, **91**: 371, by original designation.

Diagnosis: The silvery white wings mottled with multiple brownish rings is unique in the subfamily.

Remarks: This genus also keys out together with *Hositea* and *Parallelographa*, differing from them by the blotched wing pattern, the FW with acute apex and HW with slightly sinuous termen. It is a monotypic genus, described from a single female from Santa Catarina, Brazil, with no mention to its subfamily association (MUNROE, 1959). However, as all taxa described in the same article belong to what was then considered Pyraustinae, it is inferred that *Malleria* was regarded as belonging to this subfamily. It was later transferred to Musotiminae (MUNROE, 1995: 46). The characters of the male genitalia, and the orientation of tympanum, indicates that it is a true Midilinae, as shown by the illustrations presented here.

Malleria argenteofulva Munroe, 1959 (figs 1, 5, 11, 12)

Malleria argenteofulva Munroe, 1959. *Can. Ent.*, **91**: 371

Holotype ♀, BRAZIL: Santa Catarina, Corupá, IV-1955 (Maller) (CNC, type 6734) [examined].

Diagnosis: Male (fig. 5) FW length 10-14 mm (wingspan 24-32 mm), female FW length 16 mm (wingspan 36 mm). Wings silvery white, mottled with multiple brown rings outlined with yellowish orange; straight, oblique band, from basal third of costa to tornus. Genitalia (fig. 11): uncus long, thin, curved ventrad, apex sharp; gnathos almost as long as uncus, slightly thicker; valva spatulate, slightly constricted at base; vinculum round; phallus (fig. 12) long, bent dorsal at basal third.

Material examined (6 specimens, 1 g. s.): Type; BRAZIL: Bahia, 2 ♂♂, 1 ♀, Camacan, 15°23'S - 39°33'W, 800 m, 21-30-IX-1991, IV-2010, IX-2011, g. s. 5241 (Becker 84041, 146094, 147159) (VOB); 2 ♂♂, 1 ♀, Idem, 9-IV-2011 (Landry & Becker) (MHNG 87218, 87219), 1 ♂, 1 ♀, Espírito Santo, Linhares, 28-IV, 3-X-1989 (Santos) (VOB).

Distribution (fig. 1): Brazil, along the Atlantic Forest, from Bahia, south to Santa Catarina.

Remarks. It is rare at the lights; after over 50 years of intensive collecting along the Atlantic Forest of eastern Brazil only the three specimens studied here were collected. A showy species like this would not be unnoticed to any moth collector. It resembles a slightly larger *Bocchoris placitalis* Schaus, 1912 (Spilomelinae).

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Paulo Nunes, Serra Bonita Reserve, Camacan, Bahia, Brazil, prepared the illustrations; Bernard Landry (MHNG), reviewed the manuscript, made several corrections and suggested some changes that

improved the article, and sent the live image of *P. parallelographa*; one anonymous referee presented several suggestions that improved the article.

BIBLIOGRAPHY

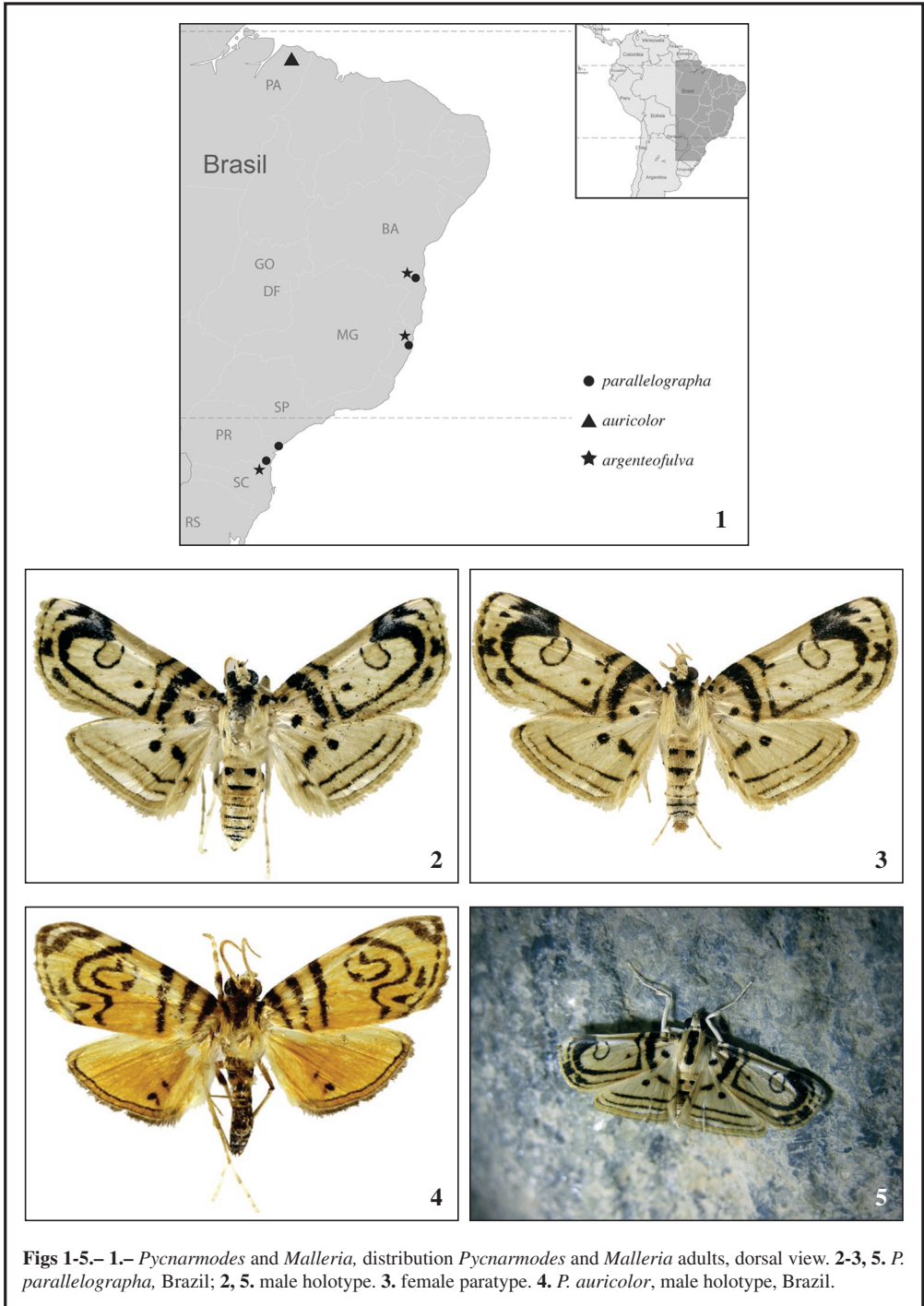
- HAYDEN, J. E., 2012.– Revision of *Odilla noralis* Schaus and transfer of Erupini to Midilinae (Lepidoptera: Crambidae).– *Annals of the Carnegie Museum*, **80**: 309-322.
- HODGES, R. W., 1971.– Sphingoidea.– In R. B. DOMINICK *et al.* *The moths of America North of Mexico*, **21**: 158 pp. Classey and R. B. D. Publications, London.
- LEDERER, J., 1863.– Beitrag zur Kenntniss der Pyralidinen.– *Wiener Entomologische Monatschrift*, **7**: 243-502.
- LÉGER, T., LANDRY, B. & NUSS, M., 2019.– Phylogeny, character evolution and tribal classification in Crambinae and Scopariinae (Lepidoptera, Crambidae).– *Systematic Entomology*, **44**: 757-776.
- MEYRICK, E., 1884.– On the classification of the Australian Pyralidina.– *Transactions of the Entomological Society of London*, **1884**: 277-350.
- MUNROE, E., 1959.– New genera and species of Pyralidae (Lepidoptera).– *Canadian Entomologist*, **91**: 359-371.
- MUNROE, E., 1970.– Revision of the subfamily Midilinae (Lepidoptera: Pyralidae).– *Memoirs of the Entomological Society of Canada*, **74**: 1-94.
- MUNROE, E. G., 1995.– Midilinae.– In J. B. HEPPNER, ed. *Atlas of Neotropical Lepidoptera*. Checklist: Part 2: 47. Association of Tropical Lepidoptera, Gainesville.
- MUNROE, E. & SOLIS, M. A., 1999.– The Pyraloidea: 231-256.– In N. P. KRISTENSEN. *Handbook of Zoology*, **35**: 564 pp. Walter de Gruyter, Berlin.
- ROBINSON, G. S., 1976.– The preparation of slides of Lepidoptera genitalia with special reference to the Microlepidoptera.– *Entomologist's Gazette*, **27**: 127-132.

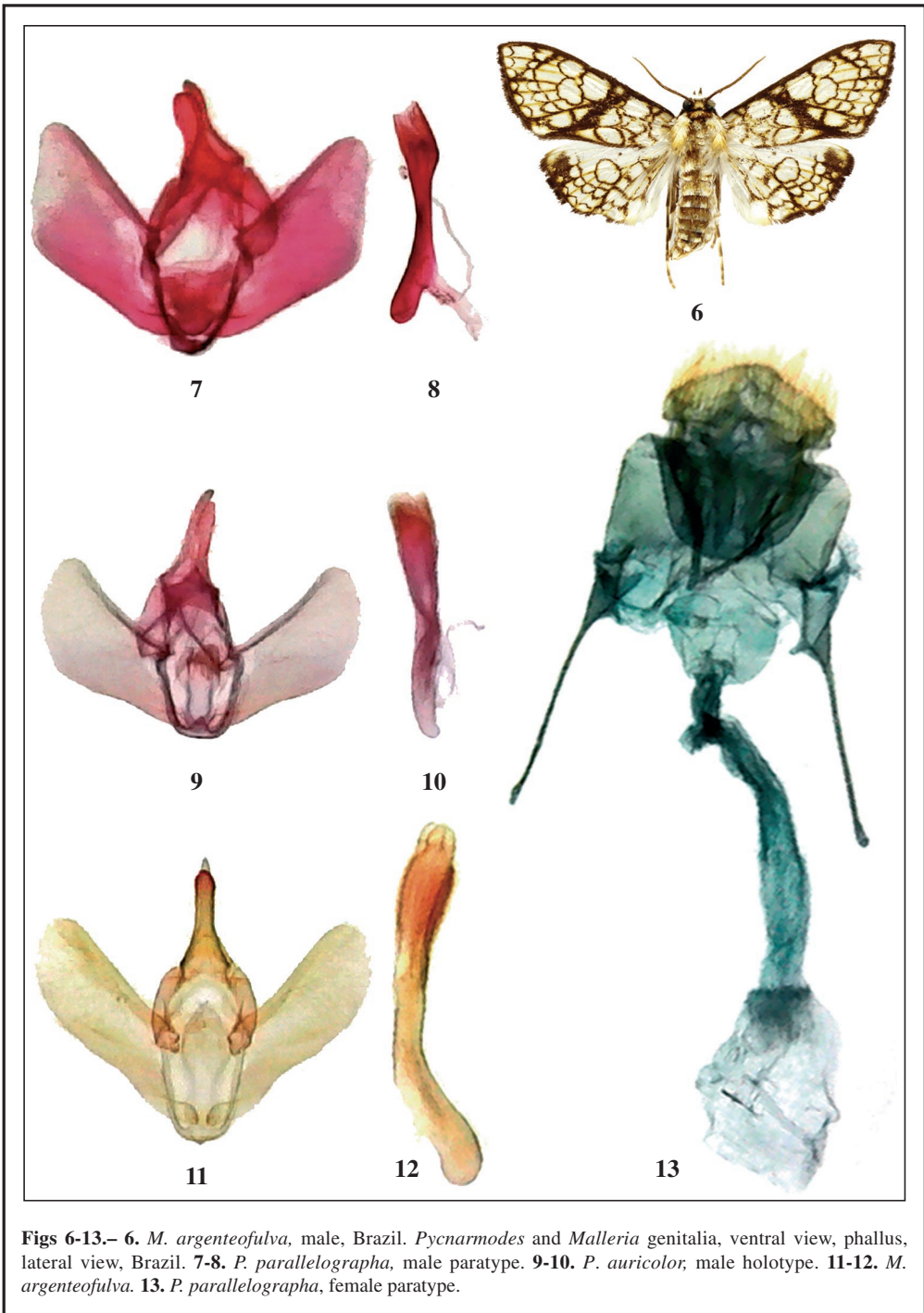
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Figs 6-13.— 6. *M. argenteofulva*, male, Brazil. *Pycnarmodes* and *Malleria* genitalia, ventral view, phallus, lateral view, Brazil. 7-8. *P. parallelographa*, male paratype. 9-10. *P. auricolor*, male holotype. 11-12. *M. argenteofulva*. 13. *P. parallelographa*, female paratype.

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Preliminary findings on the presence of a taxon with morphological traits of *Papilio saharae* Oberthür, 1879 in Lampedusa (Italy) (Lepidoptera: Papilionidae)

L.-F. Cassar & A. Catania

Abstract

Research visits to the island of Lampedusa yielded a number of adult specimens belonging to the “*machaon*-complex”, which, on closer examination of specific diagnostic features (including antennal segments, ocelli and number of teeth on the male harpe) have been found to possess morphological characters akin to *Papilio saharae* Oberthür, 1879, as well as to *P. machaon* Linnaeus, 1758, and including intermediate forms. Early stages, comprising ova and larvae, were also collected and reared, while several ova deposited by a gravid female taken in the field subsequently reached pupal stage. Ova are noticeably smaller, while larvae and pupae exhibit characters atypical of *P. machaon*. The present work examines a number of potential scenarios and provides a critique based on morphometric features of a suite of specimens examined, as well as on the history of eustatic sea-levels changes during the Quaternary Period that may potentially have abetted the species to reach Lampedusa during low-stands, before being left isolated during interglacial high-stands as sea-levels fluctuated during the Pleistocene epoch.

KEY WORDS: Lepidoptera, Papilionidae, Morphometrics, *Papilio machaon*, Thermo-Mediterranean zone, Pelagian Islands, Italy, North Africa.

Hallazgos preliminares sobre la presencia de un taxón con rasgos morfológicos de *Papilio saharae* Oberthür, 1879 en Lampedusa (Italia) (Lepidoptera: Papilionidae)

Resumen

Las visitas de investigación a la isla de Lampedusa produjeron un número de ejemplares adultos que pertenecían al complejo “*machaon*”, que, en el examen más detallado de las características de diagnóstico específicas (incluyendo los segmentos antenales, los ocelli y el número de dientes sobre el harpe del macho) hemos encontrado que poseen características morfológicas semejantes a *Papilio saharae* Oberthür, 1879, así como también respecto a *P. machaon* Linnaeus, 1758, e incluyendo las formas intermedias. Etapas tempranas, comprendiendo huevo y larva, también fueron recogidos y criados, mientras que algunos huevos dejados por una hembra grávida tomada en el campo posteriormente alcanzaban el estado de pupa. Los huevos son perceptiblemente más pequeños, mientras que las larvas y crisálidas exhiben unos caracteres atípicos de *P. machaon*. El presente trabajo examina un número de escenarios potenciales y provee una crítica sobre la base de las características morfométricas de un grupo de especímenes revisados, tanto como sobre la historia del eustatismo que los cambios del nivel del mar en el período Cuaternario que podría haber facilitado la llegada de la especie a Lampedusa durante los periodos de baja intensidad, antes de quedar aislada durante los periodos interglaciares de alta intensidad al fluctuar el nivel del mar durante el Pleistoceno.

PALABRAS CLAVE: Lepidoptera, Papilionidae, morfometría, *Papilio machaon*, zona termomediterránea, Islas Pelagias, Italia, Norte de África.

Introduction

Field research visits to Lampedusa were held for the specific purpose of collecting *Papilio machaon* Linnaeus, 1758 specimens for DNA analysis. The first field visit was held in April of 2019, during which one male specimen was taken. During a more recent research visit to the island, held between May 31st and June 4th 2021, a number of adult specimens, including a gravid female and a host of larvae and ova were collected. Regrettably, other field visits in the interval were not possible in view of the prevailing public health restrictions and travel bans associated with the COVID-19 pandemic.

The presence of *Papilio machaon* in Lampedusa has been reported by various authors (ROMANO & ROMANO, 1995; VODÁ *et al.*, 2016; ROMANO, 2020). Until recently, it was assumed that *Papilio machaon* was the sole representative “Papilio” species present in Lampedusa, although Paolo Palmi, in his website entitled “Farfalle Italiane” (<http://www.farfalleitalia.it/sito/202/index.php>), lists *Papilio saharae* Oberthür, 1879 as having been reported from the island. Palmi attributes credit to Luigi Racheli for the sighting (pers. comm. Palmi/Cassar June 2021), which Tommaso Racheli corroborated via e-correspondence with one of the authors (T. Racheli/Catania, June 2021). However, the precise details of this occurrence do not appear to have been published. VODÁ *et al.* (2016) report the presence of *Papilio machaon* in Lampedusa, assigning it to the north African clade, and further citing what the authors describe as a “substantially diverged lineage” of 0.8%.

Geography, geology, and climate: Lampedusa is the largest of the Pelagie (Pelagian island group), with a total area of just over 20 km². It lies some 130 km east of the Mahdia coastline (Tunisia), just over 150 km WSW of Gozo - *Malt*. Ghawdex - (Maltese Islands) and around 207 km south of the Sicilian coast near Agrigento. Structurally, the island of Lampedusa forms part of the Pelagian Block, representing one of its emergent segments. Notwithstanding its Italian sovereignty, it lies on the foreland domain of the African plate’s northern margin. Geologically, the island comprises depositional sequences of Meso-Cenozoic succession, forming a carbonate shelf that projects above the central Mediterranean to an altitude of 133 m amsl. Lampedusa is characterised by horst formations, the age of which extend across the late Tertiary (Neogene) - Quaternary Period boundaries. Stratigraphic exposures consist of a complex of sedimentary limestones, notably lithoclast breccias and bioclastic grainstones, and aeolian formations (GRASSO & PEDLEY, 1988a; LOMBARDO *et al.*, 2014). Topographically, Lampedusa is not unlike the Maltese islands, as a result of a relatively analogous yet more recent geo-tectonic history (GRASSO *et al.*, 1985; GRASSO & PEDLEY, 1988b). Similarly, karstic features are largely pervasive across the 11 km length of the island, as are sea-cliffs, raised beaches, and wave-cut platforms. However, in contrast to the Maltese Islands, Lampedusa does not support perched aquifers and registers an average of around 300 mm of rainfall annually. This dearth of freshwater, coupled by the island’s geographical position (latitude 35.30° N and proximity to the Tunisian mainland) and its considerably shallow and exposed soils, renders Lampedusa significantly more arid. According to the Köppen-Geiger classification, Lampedusa’s climate is subtropical/low-latitude semi-arid hot steppe (K-G category: Arid Steppe, hot - *BSh*, which is too arid to sustain a forest environment but not hot enough to be termed a desert).

Biotopes: The natural and semi-natural vegetation that colonises the island’s extensive karstland is made up of biotopes typical of the Thermo-Mediterranean zone, characterised by a suite of floral formations of central Mediterranean-Maghrebi provenance, together with a host of endemic assemblages (resulting from the island’s prolonged isolation), including the aerohaline associations *Limonietum lopadusani* and *Chiliadenetum lopadusani*. The vegetation climax on the island is represented by the *Periploco angustifoliae-Juniperetum turbinatae* association, which also occurs on the Tunisian mainland (BRULLO *et al.*, 2008). Other low maquis and garrigue floral associations resulting from degradation, or simply lower stages in the succession sequence due to abiotic conditions, consist

of the *Periploco angustifoliae-Euphorbietum dendroidis*, and the labiate *Coridothymo capitati-Cistetum parviflori* (often occurring with the endemic *Chiliadenetum lopadusani*). These and numerous other biotopes form mosaics with steppic communities, grading into one another (largely a function of edaphic factors, exposure, and slope aspect). Among the more common floral assemblages on the island, one encounters mosaics formed of elements of some of the above-named floral associations, together with other associations, namely *Triadenio-Chiliadenetum*, *Pegano-Salsoletum* and *Oryzopsis pauciflora-Hyparrhenietum hirtae*, various xerophilous grassland vegetation, including the *Lygeo-Stipetea*, *Stipo-Trachynietea* and *Tuberarietea guttatae* classes, as well as ruderal and ermes communities. In fact, although the human population of Lampedusa is relatively small (approximately 6,550) and contained within a single main conurbation, the impact of ribbon development, agricultural land abandonment, domestic dumping, and grazing, albeit limited, has contributed towards a relatively extensive spread of ruderal assemblages. This has led to the formation of a fairly well established synanthropic environment colonised by extensive stands of *Foeniculum vulgare* Mill. and other ruderal and roadside assemblages, notably represented by vegetation typical of classes such as the *Chenopodietea*, *Artemisietea* (particularly the alliance *Onopordion illyrici*), *Polygono-Poetea annuae*, and *Parietarietea judaicae* (BARTOLO *et al.*, 1988).

Papilio saharae: rank, range, and diagnostic features: The taxon was initially treated as a variety and, later, as a subspecies of *P. machaon* (Oberthür, 1879; 1888). While some authors continued to regard it as such (SEITZ, 1908; TURATI, 1942; PELLACCHIA *et al.*, 2002), several others regard *Papilio saharae* as a distinct species (LARSEN, 1990; PITTAWAY *et al.*, 1994; TENNENT, 1996; TOLMAN & LEWINGTON, 1998; TARRIER & DELACRE, 2008; TSHIKOLOVETS, 2011; LERAUT, 2016; CASSAR, 2018). The nominotypical *P. saharae saharae* is present along the northern fringes of the Sahara, from the Maghreb to Egypt's Siwa oasis, extending across the eastern desert towards the Red Sea, into the Negev and the northern Hejaz. Although it is typically found in hyper-arid locations, it has also been known to occur in arid environments in relative proximity to the Mediterranean (CLARKE & SHEPPARD, 1956; LARSEN, 1990; PIERRON, 1990; TENNENT, 1996; MOONEN, 2012; CASSAR, 2018). In contrast, *P. saharae rathjensi* Warnecke, 1932, a subspecies restricted to Yemen and the adjacent Asir region of Saudi Arabia, inhabits mesic environments within rocky, montane regions (LARSEN, 1983, 1984, 1990; PITTAWAY, 1985; MEERMAN & BOOMSMA, 1986). Various diagnostic features have been proposed to separate “*machaon*” and “*saharae*” (ELLER, 1936; SEYER, 1974; LARSEN, 1980, 1984; CLARKE & LARSEN, 1986; PIERRON, 1990), which notably rely upon coloration and markings, on anatomical characters (e.g., antennal segments; teeth on valva or harpe), and on dimensions and shape (e.g., wings or part thereof; male valvae). Beyond doubt, biometric consistency is of the essence and a reliance on morphometric analysis, both through naked-eye examination and microscopy, is noted to be more dependable for certain characters than for others (PITTAWAY *et al.*, 1994).

The aim of this contribution is to report the presence of a taxon with perceptible morphological traits of *Papilio saharae* on Lampedusa, recognized on the basis of morphometrics of wild-caught specimens, including imagines and reared lower stages (ova, larvae and pupae). It also discusses its ecology in relation to Lampedusa's geographical location and its proximity to northern Africa, as well as to the vegetation present on the island, specifically larval hostplants.

Methodology

Two five-day field visits were organised in 2019 and 2021, with the aim of collecting *Papilio machaon* specimens for DNA analysis. Adult specimens were taken via customary pursuit, using short-handled kite nets. During the second, more successful visit, ova and larvae were collected from among the florets of *Foeniculum vulgare*. Adult male specimens had their respective thorax pinched in the conventional manner of despatching most butterfly species, while a female specimen and a suite of larvae were kept alive; these, together with a number of wild-collected ova, were transported to Malta. The intention was to rear the larvae and ova to adult phase, while concurrently attempting to induce the

female specimen to oviposit in captivity, the reason for which was to examine a series of voucher specimens for morphological variability. All living material was maintained in appropriate butterfly breeding cages or larval boxes, both during fieldwork (collapsible butterfly enclosures were used for this purpose) and following the team's return to Malta. Based upon an established breeding protocol, the wild-caught larvae (including hatchlings of wild-collected ova) were reared on *Foeniculum vulgare*, while both *Foeniculum vulgare* and *Ruta graveolens* L. were introduced into the breeding cage containing the gravid, wild-caught female. Each larval instar was photographed for comparative purposes. Adult specimens were set (dry preservation) on standard spreading-boards for subsequent naked-eye and microscopic examination, while relevant body parts were extracted for eventual DNA analysis. The diagnostic assessment that follows is based on morphometric analysis.

Results and Diagnostics

A total of six adult specimens were examined, including four wild-caught specimens (3 ♂♂, 1 ♀) that were collected during the 2019 and 2021 field trips, and two specimens (2 ♀♀) reared from larvae collected on *Foeniculum vulgare* that was growing on the roadside in the main town, during the June 2021 visit. A total of 12 larvae (three: L3; six: L2; three: L1) and three ova were collected during the second field trip, of which all, except for one, reached pupal stage. Moreover, 82 ova were deposited by the wild-caught female specimen, of which 12 larvae hatched (< 15%); these were reared on *Foeniculum vulgare* and all eventually pupated. It may be of interest to add that deposition commenced after the sixth day in captivity, when the vast majority of the ova were deposited on *Ruta graveolens*, while only three ova were deposited on *Foeniculum vulgare*.

The four wild-caught adult specimens were taken in flight by means of conventional stalking with a kite net, at the following localities: limits of Cala Creta (♂); NE edge of main town, off Via Firenze (♂ ♀); and, on the cliff-top above Grotte Solaro (♂). The larvae and ova were collected from and in the vicinity of Via delle Grotte, in the main town. These were reared and two females emerged weeks later, while the rest appear to have entered pupal diapause, as did the batch reared from the wild-caught gravid female specimen; high temperatures due to a prevailing heatwave at the time may well have instigated this.

ITALY: LAMPEDUSA: Limits of Cala Creta [35°30'47.80" N, 12°37'15.21" E], 35 m amsl, 1 ♂, 05-IV-2019, leg. and coll. LFC. North-eastern periphery of main town [35°30'25.30" N, 12°36'44.10" E], 17 m amsl, 1 ♂, 03-VI-2021, leg. and coll. AC. North-eastern periphery of main town [35°30'27.60" N, 12°36'45.35" E], 17 m amsl, 1 ♀, 03-VI-2021, leg. and coll. AC. North-facing sea-cliffs above Grotte Solaro [35°31'18.43" N, 12°35'11.68" E], 72 m amsl, 1 ♂, 03-VI-2021, leg. and coll. AC. Main town at Via delle Grotte [35°30'06.00" N, 12°36'22.07" E], 13 m amsl, 2 ♀♀, 01-VI-2020, - reared from L3 larvae which emerged: 21-VI-2021, leg. AC; coll. LFC; 26-VI-2021, leg. and coll. AC.

Diagnosis: The list above (Table I) comprises selected morphological features deemed appropriate to distinguish *Papilio saharae* (LARSEN, 1980, 1983, 1990; CLARKE & LARSEN, 1986; PIERRON, 1990; PITTAWAY *et al.*, 1994; TENNENT, 1996; TOLMAN & LEWINGTON, 1998) from *Papilio machaon*. These are based on the number of antennal segments, the length and number of teeth on the harpe, and the size and general shape of the red ocellus on the hindwing's jugal area (Figure 1a and b. - specimens s2 and s3), among other features that have been proposed over the years. Although the length of the forewing is given (measured in a straight-line from the base to the apex), such dimensions may vary from individual to individual, as well as seasonally and across species, since size (within range limits of a given species) is a function of nutritional opportunities at larval stage. All adult specimens examined had a marked smattering of yellow scales over the dark regions on the forewing (FW) basal and postbasal areas, and on the hindwing (HW) basal and dorsum areas, which rendered each individual seemingly lighter in colour (note: such characteristic is also present in a number of *P. machaon* subspecies and appears to be particularly evident in, although not exclusive to, latter broods of *P. machaon hispanicus* Eller, 1936, *P. machaon mauretanicus* Verity, 1908 and *P. machaon syriacus* Verity, 1908).

Table 1– Biometric data of specimens examined. (sn = specimen-allocated code number; Flt = taken in flight; W-cL = reared wild-collected larva).

Specimen	Biotope type	Antennal segments	FW length (mm)	Red ocellus dimensions (mm)	General shape of ocellus	Teeth on harpe
♂ (Flt) s1	Habitat patch colonised by ruderals, dominated by <i>Galactites tomentosa</i>	31	38.90	3.58 x 2.45	ovoid and fairly compressed horizontally	10
♂ (Flt) s2	Synanthropic environment characterised by stands of <i>Foeniculum vulgare</i>	32	37.55	3.26 x 1.64	ovoid but very compressed horizontally	10*
♀ (Flt) s3	Synanthropic environment characterised by stands of <i>Foeniculum vulgare</i>	32	n/a**	4.73 x 3.55	domed upper part and a more horizontal bottom edge	n/a
♂ (Flt) s4	Coridothymo capitati-Cistetum parviflori and Chiliadenetum lopadusani on karstic clifftop	31	39.30	3.64 x 3.02	irregular curvilinear	12
♀ (W-cL) s5	L3 larva collected on <i>Foeniculum</i> florets in an urban environment and reared	32	45.26	3.95 x 3.28	curvilinear triangle with rounded lower edges	n/a
♀ (W-cL) s6	L3 larva collected on <i>Foeniculum</i> florets in an urban environment and reared	33	43.80	4.39 x 2.71	curvilinear triangle with rounded lower edges	n/a

* s2 harpe contains 10 well-developed teeth, together with three significantly smaller notched edges protruding from three of the teeth. ** Forewings were severely damaged as this specimen was used for rearing purposes. Measurement was, therefore, not possible.

Early life cycle stages: In comparison to the ovum of *Papilio machaon melitensis* Eller, 1936, both wild-collected ova and those deposited by the captive specimen were significantly smaller, approximately 80% of the former, but similar in shape, characteristically spherical. Initially, the yellowish coloration of freshly deposited ova was also similar to those of the Maltese subspecies. However, the “Lampedusa ova” (wild-collected and fertile ones deposited in captivity) subsequently developed hazy brown markings (after three days), unlike the distinctly uniform brown rim around the crown that typically develops on *P. machaon melitensis* ova. The fertile ova which were deposited in a rearing cage hatched after five days.

The larvae, compared with each corresponding instar of *P. machaon melitensis*, were generally smaller, while coloration and morphology were also noticeably different. The overall colour of older instars of the Maltese subspecies is green, whereas the general background coloration of the Lampedusa larvae of comparable lifecycle stage was white (Figure 2a). While it should be noted that coloration and markings in larvae of the genus *Papilio* Linnaeus, 1758, among other groups, is not necessarily a firm verification of specific status (PITTAWAY *et al.*, 1994) but potentially a function of environmental conditions and/or available food-plant, the markedly different morphology is striking and worthy of note. In particular, the black spiny setae on the subdorsal scoli of the Lampedusa L3 and L4 instars were remarkably pronounced, while the subspiracular orange bulbous verrucae formed a quasi-continuous longitudinal row (separated only by segmental divisions), which extended laterally from the mesothoracic segment (T2) to the preanal segment (A9). Likewise prominent on the L3 instars were the bright orange subdorsal protuberances at the base of the scoli (Figure 2b). L3 and later instars had discontinuous black encircling patches, mostly conspicuous in final instar (L5) larvae. Segmental

divisions of the Lampedusa L5 instar larvae were a very pale pastel green and not a velvety black as in *P. machaon melitensis* and numerous other *machaon* subspecies. The external body surface of the final instar was generally smooth and velvety to the touch, with the intense orange markings, present in L3 and L4 instars, much reduced. The white saddle, which characteristically extends from the dorsal area to the subdorsal region and across a number of segments in L1 and L2 instar larvae of *P. machaon melitensis*, was restricted to only two abdominal segments (A3 and A4) in the Lampedusa larvae of equivalent developmental stage (Figure 2c). The osmeterium of the L5 instar larva was orange in colour, similar to that of *Papilio machaon*, but much longer (Figure 3), extending to the metathoracic segment (T3). PIERRON (1990) maintains that the osmeterium of *P. saharae* is brown (as opposed to orange, as in *P. machaon*) and twice as long. The osmeterium of the Lampedusa larvae thus includes morphological traits of both taxa; however, the odour emitted when the organ was protracted was distinctly different to that of *P. machaon melitensis*.

The pupae of both wild-collected ova and larvae, and those reared from deposited ova in captivity were strikingly different to those of *P. machaon*. Compared to pupae of *P. machaon melitensis*, the “Lampedusa pupae” were fine-textured and far smoother, with less obvious protuberances. In particular, the cephalic projections, the thoracic segment (T2 region) and the latero-dorsal tubercles of “Lampedusa pupae” are significantly less pronounced than those of *P. machaon*, with the pupae of offspring of the captive female being noticeably smoother than those of wild-collected individuals (Figure 4). In comparison to the pupa of *Papilio hospiton* Gené, 1839 (a parallel also drawn by PIERRON (1990) and PITTAWAY *et al.* (1994), among others), the Lampedusa pupae are similar only insofar as the cephalic projections and thoracic segment are concerned, since the tubercles on the latero-dorsal region of the specimens under investigation are far less prominent than those of the Sardo-Corsican endemic.

Discussion and Conclusions

The closest landmass to the island of Lampedusa is the Tunisian mainland, which lies some 130 km westward. This may be regarded as a fair distance for a typically non-migrant butterfly species, considering the expanse across open Mediterranean waters, with no prospect of nectaring enroute. Preliminary findings of separate on-going studies by the present authors and colleagues, using telemetry on *Papilio machaon*, indicate a travel speed of approximately 18.3 km/hr over a distance of 2.14 km across an inter-island sea channel - in this instance, particular attention ought to be given to two divergent factors, namely, the short island-to-island distance being tested and the payload of .15gr derived from the electronic transmitter. Generally, in addition to distance, another key aspect to consider is the fact that islands, compared to continental landmasses, tend to make poor targets for immigrant organisms. Given their relatively small size, the physical location of isolated islands would make it vastly more difficult for insects to achieve landfall. That said, although seemingly implausible for non-migrant butterfly species to reach small remote islands, it is not an impossibility, and exceptional instances have been known to occur (potentially abetted by extraordinary meteorological events), as has been a case on Madeira (pers. comm. Teixeira, Silva, Cotton, Wiemers/Cassar, July, 2021). Notwithstanding such remote possibility, the probability that such an occurrence will (i) lead to the establishment of a nascent population of an immigrant species or (ii) augment an already existing population via influxes of immigrant individuals, however, remains significantly small.

Climatically, Lampedusa’s environment can best be described as arid steppe with a varying degree of dryness, as a result of the existing diverse landform and topographic relief. Its relatively low altitude (maximum height 133 m) and narrow width (3.6 km at its widest points) render the island entirely coastal. As described above, the vegetation is characteristic of the Thermo-Mediterranean zone, so, predictably, traditional and potential *Papilio saharae* larval hostplants of hyper-arid (often high altitude) environments, for example, *Deverra denudata* (Viv.) and *D. scoparia* [Family: Apiaceae] and *Haplophyllum tuberculatum* (Forssk.) A. Juss. [Family: Rutaceae], are not present. However, representative species of these two families, notably, *Foeniculum vulgare* (also listed as *F. piperitum*

Mill. by some authors - BARTOLO *et al.*, 1988), *Ferula communis* L. (a known hostplant of *P. saharae* in Yemen - LARSEN, 1983; MEERMAN & BOOMSMA, 1986) and *Ruta chalepensis* L., on the other hand, do occur in relative abundance; these latter species are known larval hostplants of *Papilio machaon*. It is also a known fact that different populations of *P. saharae* are manifestly well adapted to distinctly different habitats. These include the eremic marginal lands of the Tunisian Sahel (including coastal steppe and higher topography) and hyper-arid Moroccan highlands, occupied by *P. saharae saharae*, as well as the mesic habitats in montane regions at its easternmost range, where *P. saharae rathjensi* occurs.

Given the foregoing and the fact that the island of Lampedusa was last physically connected with the Tunisia mainland during late Pleistocene low-stands (GIRAUDI, 2004), it is not unreasonable to contemplate the possibility that a population of *Papilio saharae* was left isolated after sea-levels rose during subsequent inter-glacials. There is also no evidence contrary to the possibility of a sympatric association with *Papilio machaon*, which may account for the presence of intermediate forms. If, indeed, such coexistence still occurs, further field investigations will need to assess whether the two species have divergent lifecycle timelines (pers. comm. Cotton/Cassar, July, 2021) or whether some phases coincide with a degree of overlap and, as a result, potentially lead to natural hybridisation, including introgression. Unlike *Papilio hospiton* and *P. machaon* on Corsica and Sardinia, where the two taxa occupy somewhat different habitat niches (former flies in mountainous regions at mid to high altitude, while latter is known to occur closer to the coast), even if the two are known to occasionally hybridize, the relatively low elevation of Lampedusa does not provide for such altitude-related habitat diversity. If, on the other hand, the presence of *P. machaon* per se on the island is in question, then it would be interesting to delve deeper into the genetic make-up of the taxon that occurs on Lampedusa - (although some individuals encountered during either of the field research visits bore characteristics atypical of *P. machaon* - at larval or imago stage, or both - this does not necessarily imply that the species is not present on the island). Another plausible avenue to explore would be whether the two taxa reached the island during Quaternary low-stands and remained isolated as eustatic sea-levels rose, leading to the development of a hybrid swarm (between *P. machaon*, most likely, ssp. *mauretanica*, and *P. saharae*), but more evidence is required at this juncture. To-date, morphometric examination suggests that some of the specimens analysed demonstrate taxonomic characters, to a varying degree, of *Papilio saharae*, but the fact that some individuals examined also possessed morphological features characteristic of *P. machaon*, however minor, and therefore atypical of *P. saharae*, warrants further investigation; in fact, this is the subject of on-going research by the present authors. Might the waterway between the north African mainland and Lampedusa (which effectively brought about the island's relatively prolonged isolation), have acted as an extrinsic barrier leading to some level of taxonomic differentiation?

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BIBLIOGRAPHY

- BARTOLO, G. & BRULLO, S., MINISSALE, P. & SPAMPINATO, G., 1988.– Flora e vegetazione dell'Isola di Lampedusa.– *Bollettino dell'Accademia Gioenia di Scienze Naturali*, **21**: 119-255.
- BRULLO, S., GIANGUZZI, L., LA MANTIA, A. & SIRACUSA, G., 2008.– La classe *Quercetea ilicis* in Sicilia.– *Bollettino dell'Accademia Gioenia di Scienze Naturali*, **41**(369): 1-77.
- CASSAR, L. F., 2018.– *Papilio saharae* Oberthür, 1879 (Lepidoptera Papilionidae) on the Hyblean Plateau, Sicily: Case of a relict population due to climate-driven phenomena?.– *Naturalista siciliano*, **42**(1): 21-29.
- CLARKE, C. A. & LARSEN, T. B., 1986.– Speciation problems in the *Papilio machaon* group of butterflies.– *Systematic Entomology*, **11**: 175-181.
- CLARKE, C. A. & SHEPPARD, P. M., 1956.– A further report on the genetics of the *machaon* group of swallowtail butterflies.– *Evolution*, **10**: 103-112.
- ELLER, K., 1936.– Die Rassen von *Papilio machaon* L.– *Abhandlungen der Bayerischen Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Abteilung*, **36**: xiv + 1-96, 16 pls.
- GIRAUDI, C., 2004.– The Upper Pleistocene to Holocene sediments on the Mediterranean island of Lampedusa (Italy).– *Journal of Quaternary Science*, **19**: 537-545.
- GRASSO, M., PEDLEY, M. H. & REUTHER, C. D., 1985.– The geology of the Pelagian Islands and their structural setting related to the Pantelleria rift (central Mediterranean Sea).– *Centro*, **1**(2): 1-19.
- GRASSO, M. & PEDLEY, H. M., 1988a.– *Carta Geologica dell'Isola di Lampedusa*. Ministero della Pubblica Istruzione e Regione Sicilia.
- GRASSO, M. & PEDLEY, H. M., 1988b.– The sedimentology and development of the Terravecchia Formation carbonates (Upper Miocene) of north-central Sicily: possible eustatic influences on facies development.– *Sedimentary Geology*, **57**: 131-149.
- LARSEN, T. B., 1980.– The status of *Papilio machaon rathjensi* and its relationship to other Arabian populations (Papilionidae).– *Journal of the Lepidopterist Society*, **34**: 365-367.
- LARSEN, T. B., 1983.– Insects of Saudi Arabia; Lepidoptera, Rhopalocera (a monograph of the butterflies of Arabia).– *Fauna of Saudi Arabia*, **5**: 333-478.
- LARSEN, T. B., 1984.– The zoogeographical composition and distribution of Arabian butterflies (Lepidoptera; Rhopalocera).– *Journal of Biogeography*, **11**: 119-158.
- LARSEN, T. B., 1990.– *The Butterflies of Egypt*: 112 pp.+8 pls. Apollo Books, American University Press, Cairo.
- LELAUT, P., 2016.– *Butterflies of Europe and neighbouring regions*: 1113 pp.+ 655 pl. N. A. P. Editions. Verrières-le-Buisson.
- LOMBARDO, G., PANZERA, F., SALAMANCA, V., SICALI, S., BALDASSINI, N., BARRECA, G., DI STEFANO, A., MONACO, C. & D'AMICO, S., 2014.– Detailed geophysical and geologic study in the Lampedusa Island: SIMIT Project. 33° Convegno Nazionale.– *Atti Tema 2: Caratterizzazione sismica del territorio*: 203-209.
- MEERMAN, J. & BOOMSMA, T., 1986.– Der wenig bekannte Schwalbenschwanz aus Nordjemen, *Papilio saharae rathjensi* Warnecke, 1932 - Freilandbeobachtungen und Zucht (Lepidoptera: Papilionidae).– *Entomologische Zeitschrift*, **96**(13): 177-182.
- MOONEN, J. J. M., 2012.– Notes on the *Papilio machaon* group (Lepidoptera: Papilionidae) from the Palaearctic Papilionidae collection of the Zoological Museum of Amsterdam.– *Entomologische Berichten*, **72**(3): 184-186.
- OBERTHÜR, C., 1879.– Faunes entomologiques. Descriptions d'insectes nouveaux ou peu connus. Catalogue raisonné des Papilionidae.– *Etudes d'entomologie*, **4**: 117 pp., 6 pl. Rennes.
- OBERTHÜR, C., 1888.– Faunes Entomologiques. Descriptions d'insectes nouveaux ou peu connus. III. Lepidopteres d'Europe et d'Algerie.– *Etudes d'entomologie*, **12**: 21-46.
- PELLECCHIA, M., MARINI, M. & SCALI, V., 2002.– Diversità mitocondriale nel *Papilio machaon* species complex (Papilionidae): evidenze dai geni COI e NADH 4.– *Atti XIX Congresso Nazionale Italiano di Entomologia*: 131-134.
- PIERRON, M., 1990.– Contribution a la connaissance de la biologie de *Papilio machaon saharae* Obth. Differences

- avec *Papilio machaon machaon* L. et hybridations experimentales (Lep. Papilionidae).– *Alexanor*, **16**(6): 331-340.
- PITTAWAY, A. R., 1985.– Lepidoptera Rhopalocera from western Saudi Arabia.– *Fauna of Saudi Arabia*, **7**: 172-197.
- PITTAWAY, A. R., LARSEN, T. B., CLARKE, C. A., SMITH, C. R., CRNJAR, R. & CLARKE, F. M. M., 1994.– *Papilio saharae* Oberthür, 1879, specifically distinct from *Papilio machaon* Linnaeus, 1758 (Lepidoptera: Papilionidae).– *Entomologist's Gazette*, **45**: 223-249.
- ROMANO, F. P. & ROMANO, M., 1995.– Lepidoptera, pp. 693–722.– In B. MASSA (Ed.). Arthropoda di Lampedusa, Linosa e Pantelleria (Canale di Sicilia, Mar Mediterraneo).– *Il Naturalista Siciliano*, **19** (Suppl.): XII + 899 pp.
- ROMANO, M., 2020.– Insects of Lampedusa, Linosa and Pantelleria: Addenda to the 1995 Checklist.– In T. LA MANTIA, E. BADALAMENTI, A. CARAPEZZA, P. LO CASCIO & A. TROIA (Eds.). *Life on Islands. Biodiversity in Sicily and surrounding islands. Studies dedicated to Bruno Massa*: 492 pp. Edizioni Danaus, Palermo.
- SEITZ, A., 1908.– *Grossschmetterlinge der Erde. Die palaearktischen Tagfalter*, **1**: 379 pp.+ 89 pl. A. Kernen Verlag, Stuttgart.
- SEYER, H., 1974.– Versuch einer Revision der *Papilio machaon* subspezies in der westlichen Palaarktis.– *Mitteilungen aus der Entomologischen Gesellschaft, Basel*, **24**: 64-90, 93-117.
- TARRIER, M. R. & DELACRE, J., 2008.– Les papillons de jour du Maroc. Guide d'identification et de bio-indication.– *Museum national d'Histoire naturelle*: 1-480. Meze, Paris.
- TENNENT, J., 1996.– *The Butterflies of Morocco, Algeria and Tunisia*: xxxvi + 217 pp. Gem Publishing Co., Wallingford.
- TOLMAN, T. & LEWINGTON R., 1998.– *Die Tagfalter Europas und Nordwestafrikas*: 536 pp. Verlags-GmbH & Co., Stuttgart.
- TSHIKOLOVETS, V.V., 2011.– *Butterflies of Europe & the Mediterranean area*: 544 pp. Tshikolovets Publications, Pardubice.
- TURATI, E., 1924.– Spedizione Lepidopterologica in Cirenaica 1921-22.– *Atti della Società Italiana di Scienze Naturali e del Museo Civile di Storia Naturale*, **63**: 21-129.
- VODĀ, R., DAPPORTO, L., DINCĀ, V., SHREEVE, T. G., KHALDI, M., BARECH, G., REBBAS, K., SAMMUT, P., SCALERCIO, S., HEBERT, P. D. & VILA, R., 2016.– Historical and contemporary factors generate unique butterfly communities on islands.– *Scientific reports*, **6**: 28828. <https://doi.org/10.1038/srep28828>.

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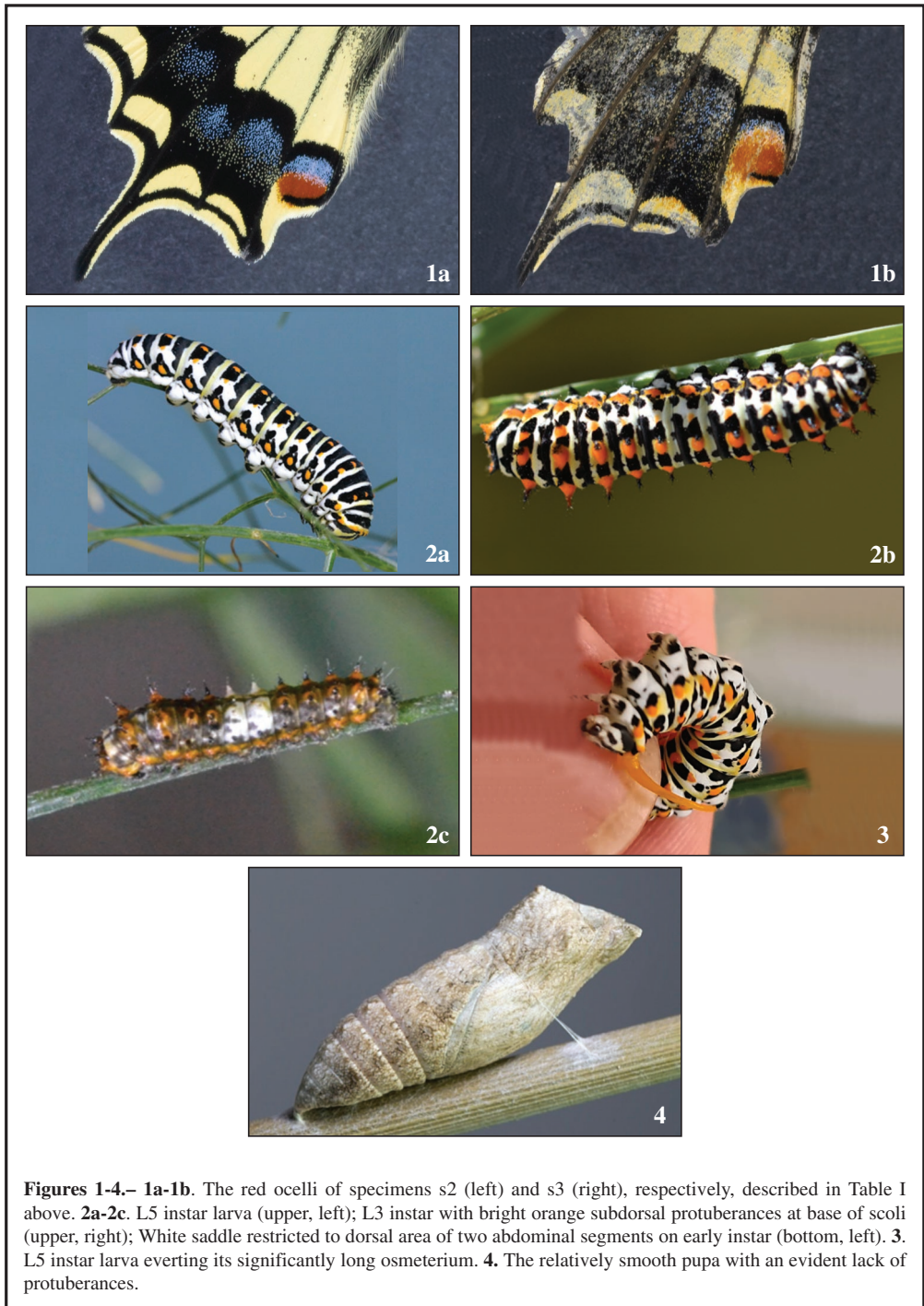
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Figures 1-4.– 1a-1b. The red ocelli of specimens s2 (left) and s3 (right), respectively, described in Table I above. **2a-2c.** L5 instar larva (upper, left); L3 instar with bright orange subdorsal protuberances at base of scoli (upper, right); White saddle restricted to dorsal area of two abdominal segments on early instar (bottom, left). **3.** L5 instar larva everting its significantly long osmeterium. **4.** The relatively smooth pupa with an evident lack of protuberances.

Some observations on hybridisation between closely related species of *Rhopalocera* (Lepidoptera: Lycaenidae, Nymphalidae)

J. A. Pateman, P. J. C. Russell & W. J. Tennent

Abstract

Details are provided of hybridisation between *Polyommatus icarus* (Rottemburg, 1775) from East Sussex (UK) and *P. celina* (Austaut, 1879) from Lanzarote (Canary Islands, Spain) under laboratory conditions. Comments are also made on natural hybrids between *Melitaea phoebe* and *M. ornata* occurring in Slovenia.

KEY WORDS: Lepidoptera, Lycaenidae, Nymphalidae, *Polyommatus*, *P. icarus*, *P. celina*, *Melitaea*, *M. phoebe*, *M. ornata*, hybridisation, Slovenia, Spain.

Algunas observaciones sobre hibridación entre especies relativamente próximas de *Rhopalocera* (Lepidoptera: Lycaenidae, Nymphalidae)

Resumen

Se proporcionan detalles sobre la hibridación entre *Polyommatus icarus* (Rottemburg, 1775) procedente de East Sussex (Reino Unido) y *P. celina* (Austaut, 1879) de Lanzarote (Islas Canarias, España) en condiciones de laboratorio. También se hacen comentarios sobre híbridos encontrados en la naturaleza entre *Melitaea phoebe* y *M. ornata* que se dan en Eslovenia.

PALABRAS CLAVE: Lepidoptera, Lycaenidae, Nymphalidae, *Polyommatus*, *P. icarus*, *P. celina*, *Melitaea*, *M. phoebe*, *M. ornata*, hibridación, Eslovenia, España.

Introduction

Hybridisation in butterflies is not unusual (DESCIMON & MALLETT, 2009). Hybrids between the two pierids *Pontia daplidice* (Linnaeus, 1758) and *P. edusa* (Fabricius, 1777) across a broad band in Italy have been known for some time (GEIGER *et al.*, 1988; PORTER *et al.*, 1997) and natural hybridisation events between species of Nymphalidae *sensu lato* have been reported relatively frequently. Recently, hybridisation between *Melitaea phoebe* ([Dennis & Schiffermüller], 1775) and *M. ornata* Christoph, 1893, in Hungary (VARGA, 1967; BÁLINT & ILONCZAI, 2001) and in Slovenia (RUSSELL *et al.*, 2014) has been reported, although TÓTH *et al.* (2017: 276-277) suggested that hybridisation between these latter two species was unproven due to a lack of statistical analysis. Natural hybrids between *Brenthis daphne* ([Denis & Schiffermüller], 1775) and *B. ino* (Rottemburg, 1775) have also been recorded (KITAHARA, 2008).

In the Satyrinae, such events appear almost commonplace. They include *Melanargia lachesis* (Hübner, 1790) and *M. russiae* (Esper, 1783) (TAVOILLOT, 1967), *Maniola telmessia* (Zeller, 1847) and the endemic Turkish (geographically) *M. halicarnassus* Thomson, 1990 (THOMSON, 1990) and the Sardinian endemic *Maniola nurag* Ghiliani, 1852 and the widespread *M. jurtina* (Linnaeus, 1758) (GRILL *et al.*, 2007). In view of the rather frequent observations of interspecific coupling reported

(RUSSELL, 2013a, 2013b), it is surprising that more hybrids involving a *M. jurtina* parent have not been recorded.

In the Lycaenidae, hybridisation in polyommata species has also been observed: between *Lysandra bellargus* (Rottemburg, 1775) and *L. albicans* (Gerhard, 1851) (GIL-T., 2007); *L. bellargus* and *L. hispana* (Herrich-Schäffer, [1851]) (CAMERON-CURRY *et al.*, 1987). So far as the authors are aware hybridisation between *Polyommatus icarus* (Rottemburg, 1775) and *P. celina* (Austaut, 1879) has not been reported previously; this is perhaps unsurprising as they were only recognised as distinct species fairly recently. DINCĂ *et al.* (2011: 3931) suggested that genitalic differences between the two species were weak enough to present the possibility of hybridisation in the contact zone in southeastern Spain.

Materials, methods and observations

Two fresh male *P. icarus* (see Figs 1-5), originating from Devil's Dyke, West Sussex. U.K., supplied by John Martin (Brighton, UK), and a single female *P. celina* (see Figs 6-9), reared by J. P. from stock originating from Playa Blanca, Lanzarote, Canary Islands, supplied by Martin Gascoigne-Pees (Stonesfield, UK) were released into a netted flower pot containing bird's foot trefoil (*Lotus corniculatus* L., Fabaceae), a known host-plant of *P. icarus* in the UK (TOLMAN 2008: 156); in Lanzarote *P. celina* utilises a similar *Lotus* species, *L. lancerottensis* Webb & Berthel (TOLMAN, 2008: 156) but this was not available. The pot was placed in the sunshine and after a few days a large number of ova were deposited; however, viability proved to be very low. To avoid potential cannibalism, larvae were separated on emergence into small individual plastic boxes with a leaf of crown vetch (*Securigera varia* (L.) Lassen, previously known as *Coronilla varia* L.). The first author has reared both *P. icarus* and *P. celina* successfully on this plant, which has the advantage that, unlike *Lotus corniculatus* L., it does not produce toxins lethal to larvae if it is eaten extensively (pers. obs., first author). Twenty larvae were reared through to pupation and adults emerged successfully from all. A representative three pairs of hybrid butterflies were retained and are figured (see Figs 10-15).

The remaining individuals were placed in a netted pot of bird's foot trefoil and a very large number of ova resulted, almost covering the plant. In this case viability was extremely poor and only six larvae of this F2 generation hatched (from an estimated 1,000+ eggs). The larvae were placed individually into plastic pots each containing a leaf of crown vetch. However, none survived beyond the 1st instar. The plant used for ovipositing was searched several times over a period to see if any larvae had survived on the plant from unobserved ova; none were found. Thus the F1 hybrids were effectively infertile, demonstrating a post-copulative barrier.

Comments on hybrids between *Melitaea phoebe* and *M. ornata*

Offspring produced from a wild caught female *M. ornata* (RUSSELL *et al.*, 2014: 137, fig. 2) from a population northwest of Rakitovec, Koper, Slovenia were considered by RUSSELL *et al.* (2014) to be naturally occurring hybrids with *M. phoebe*. TÓTH *et al.* (2017: 276-277) considered this had not been proven and that statistical analysis was required to confirm this was the case. We believe this to be unnecessary: the morphology of the larvae and adult butterflies place a hybrid source beyond doubt.

Larval survival was poor, the few surviving final instar larvae resulting from an egg batch of an estimated 60 ova produced by the female *M. ornata* had black head carapaces, suggestive of *M. phoebe* (Fig. 16); those of L4 + *M. ornata* larvae have brick red carapaces (Fig. 17). Two other females from the same *M. ornata* population also produced egg batches, from which the final instar larvae had the predicted brick red heads and from which the resultant butterflies had all the characteristics of *M. ornata* (RUSSELL *et al.*, 2014: 137, figs 3-4). Underside hindwing characters of the hybrid adults displayed a mixture of characters between those of typical *M. phoebe* and typical *M. ornata*; antennae varied between the usual club shaped typical of *M. phoebe* (Fig. 18) and spatulate typical of *M. ornata* (Fig. 19). Only a single larva entered diapause; it began feeding the following spring and a vigorous

female emerged (see Fig. 20), with wing and antennal morphology intermediate between its parents (RUSSELL *et al.*, 2014: 140, fig. 9).

It was noted (RUSSELL *et al.*, 2014: 137) that there were at least three populations of *M. phoebe* within a few kilometres of and surrounding the studied *M. ornata* population: 2 km south of Rakitovec, 3.5 km north of Rakitovec and just south of Podpec; the last site being less than 2km distant from the *M. ornata* population under study. It is noteworthy that the flight time of *M. phoebe* is approximately two weeks later than *M. ornata* and males of *M. phoebe* were captured from these three locations at the same time that freshly emerged *M. ornata* females were present at the study site. Thus, we believe that *M. phoebe* males from any of these surrounding populations are quite likely to have encountered a female *M. ornata* whilst searching for a mate. The authors are confident that hybrids between *M. phoebe* and *M. ornata* were the result of a female *M. ornata* impregnated by a *M. phoebe* male at this Slovenian locality.

Discussion and conclusion

PART 1. *POLYOMMATUS*

Distribution of *P. celina* includes the Canary Islands, North Africa (Morocco, Algeria, Tunisia and Libya(?)), southern Portugal, southern Spain (including the Balearic Islands), Malta, Sardinia and Sicily; the widespread *P. icarus* is present in both Spain and Portugal but not in other areas where *P. celina* flies. Thus there is potential for natural hybridisation only on the Iberian Peninsula; particularly in an area near Madrid where the species are sympatric (CARRILLO *et al.*, 2017). The results of this experiment suggest that F1 hybrids are quite likely to occur naturally in the zone of sympatry, where emergences of the two species are at least partially synchronic. Confirmation of such a hybridisation event is unlikely from casual field observation due to the fact that separation of the two species, let alone hybrids, is virtually impossible in the field. Separation can only be made with certainty by genitalic dissection and/or molecular analysis (DINČÁ *et al.*, 2011).

PART 2. *MELITAEA*

We consider it possible that the close proximity of these two species, coupled with the fact that *M. phoebe* males must often emerge at a time when the only females available are those of *M. ornata*, may regularly present the opportunity for natural hybridisation. Further, we consider that natural hybridisation between a male *M. ornata* and a female *M. phoebe* is unlikely in the populations studied because when female *M. phoebe* emerge most male *M. ornata* will have already mated and died. However, if both species were reared in captivity and *M. ornata* males introduced to a female *M. phoebe*, then hybridisation is conceivable, even probable. Considering that natural hybrids between closely related species have been recorded so frequently, it is a mystery why the unmistakably hybrid offspring obtained from a female *M. ornata* taken from the colony near Rakitovec should be questioned (TÓTH *et al.*, 2017: 276-277). Particularly when those authors agreed that the two species hybridised previously (TÓTH *et al.*, 2017: 277), resulting in shared COI haplotypes between western populations of *M. ornata* and *M. phoebe occitanica* Staudinger, 1871 [Type Locality: Barcelona; cf. VERITY (1928: 163), VAN OORSCHOT & COUTSIS (2014: 60) and RUSSELL *et al.*, 2020: 500-501 and Figs 5-7]. The distribution of *M. phoebe occitanica*, distinguishable from *M. phoebe phoebe* by its later instar larvae (RUSSELL & TENNENT, 2016: 43) and in adults using electrophoresis (PELTZ, 1995) is established.

Historical distribution and identification is somewhat confused since *M. ornata* was recently “discovered” in Spain (SÁNCHEZ-MESA & MUÑOZ-SARIOT, 2017), although it occurred there previously at least from the early part of last century. Specimens taken by Romei in 1925 in the Sierra Nevada and given subspecific status, as *M. phoebe bethunebakeri* by De Sagarra in 1926, were in fact *M. ornata* (see RUSSELL *et al.*, 2020: 196 and figs 14a, b and c). The proximity of some populations of *M. ornata* to those of *M. phoebe* in Spain certainly provides the potential for hybridisation.

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BIBLIOGRAPHY

- BÁLINT, Z. & ILONCZAI, Z., 2001.– Újabb adatok a Magyarországon védett nappali lepkék ismeretéhez (Lepidoptera: Lycaenidae, Nymphalidae) [New data to the knowledge of butterflies protected in Hungary (Lepidoptera: Lycaenidae, Nymphalidae)].– *Természetvédelmi közlemények*, **9**: 209-218.
- CAMERON-CURRY, V., LEIGHEB, G., RIBONI, E. & CAMERON-CURRY, P., 1987.– Possible hybrids between *Lysandra bellargus* Rott. and *L. hispana* H.-S. (Lepidoptera, Lycaenidae).– *Nota lepidopterologica*, **10**(1): 61-64.
- CARRILLO, A. G., CORBELLA, C., ILDEFONSO, M. L. & VILA, R., 2017.– Una nueva mariposa diurna para Comunidad Autónoma de Madrid (España): *Polyommatus celina* (Austaut, 1879) (Lepidoptera: Lycaenidae).– *Boletín de la Sociedad Entomológica Aragonesa*, **65**: 263-264.
- DESCIMON, H. & MALLETT, J., 2009.– *Bad Species*. Pp. [219]-249.– In J. SETTELE, T. SHREEVE, M. KONVIČKA & H. VAN DYCK (Eds). *Ecology of Butterflies in Europe*: 513 pp. Cambridge University Press, Cambridge.
- DE SAGARRA, I., 1926.– Anotaciones a la lepidopterología Ibérica IV (1).– *Butlletí de la Institució Catalana d'Història Natural*, **26**: 128-139.
- DINCÁ, V., DAPPORTO, L. & VILA, R., 2011.– A combined genetic-morphometric analysis unravels the complex biogeographical history of *Polyommatus icarus* and *Polyommatus celina* Common Blue butterflies.– *Molecular Ecology*, **20**: 3921-3995.
- GEIGER, H., DESCIMON, H. & SCHOLL, A., 1988.– Evidence for speciation within nominal *Pontia daplidice* (Linnaeus, 1758) in southern Europe (Lepidoptera: Pieridae).– *Nota lepidopterologica*, **11**(1): 7-20.
- GIL-T., F., 2007.– A natural hybrid of *Polyommatus bellargus* (Rottemburg, 1775) x *P. albicans* (Herrich-Schäffer, 1852) and notes about a probable hybrid of *P. punctifera* (Oberthür, 1876) x *P. albicans* (Lepidoptera: Lycaenidae).– *Nachrichten Entomologischen Vereins Apollo N.F.*, **28**(1-2): 11-13.
- GRILL, A., RAIJMANN, L. E. L., VAN GINKEL, W., GKIOKA, E. & MENKEN, S. B. J., 2007.– Genetic differentiation and natural hybridisation between the Sardinian endemic *Maniola nurag* and the European *Maniola jurtina*.– *Journal of Evolutionary Biology*, **20**(4): 1255-1270.
- KITAHARA, H., 2008.– Interspecific hybrid between *Brenthis daphne* and *B. ino* (Lepidoptera, Nymphalidae).– *Transactions of the Lepidopterological Society of Japan*, **59**(2): 144-148.
- MALLETT, J., BELTRÁN, M., NEUKIRCHEN, W. & LINARES, M., 2007.– Natural hybridization in heliconiine butterflies: the species boundary as a continuum.– *BMC Evolutionary Biology*, **7**: 28-43.
- PELTZ, V., 1995.– Biosystematik der europäischen Arten der Tribus Melitaeini Newman, (1870).– *Oedippus*, **11**: 1-62.
- PORTER, A. H., WENGER, R., GEIGER, H., SCHOLL, A. & SHAPIRO, A. M., 1997.– The *Pontia daplidice-edusa* hybrid zone in northwestern Italy.– *Evolution*, **51**(5): 1561-1573.
- RUSSELL, P. J. C., 2013a.– Intergeneric pairings involving *Maniola jurtina* L. (Lepidoptera: Nymphalidae, Satyrinae): are sight and smell overridden by this butterfly's sex drive?– *Entomologist's Gazette*, **64**(1): 11-17.
- RUSSELL, P. J. C., 2013b.– Further observations on intergeneric pairings involving *Maniola jurtina* (Linnaeus, 1758) (Lepidoptera: Nymphalidae, Satyrinae).– *Entomologist's Gazette*, **64**(3): 195-196.
- RUSSELL, P. J. C., BARTOLOZZI, L., HAWKINS, R. L., TENNENT, W. J. & LÉGER, T., 2020.– Designation of lectotypes for some Spanish and other western European *Melitaea* taxa, some with mixed syntypic series of *M. phoebe* ([Denis & Schiffermüller], 1775) and *M. ornata* Christoph, 1893 (Lepidoptera: Nymphalidae).– *SHILAP Revista de lepidopterología*, **48**(191): 449-472.
- RUSSELL, P. J. C., PATEMAN, J. & VEROVNIK, R., 2014.– First record of *Melitaea ornata* Christoph, 1893,

- from Slovenia, with notes on its confirmed distribution and hybridisation with *M. phoebe* ([Denis & Schiffermüller], 1775).– *Entomologist's Gazette*, **65**: 135-153.
- RUSSELL, P. J. C. & TENNENT, W. J., 2016.– A synonymic list of names associated with western Palaearctic *Melitaea phoebe* (Denis & Schiffermüller, 1775) species group taxa (*M. phoebe*; *M. punica* Oberthür, 1876; *M. ornata* Christoph, 1893) (Lepidoptera: Nymphalidae).– *Nota lepidopterologica*, **39**(1): 27-56.
- SÁNCHEZ-MESA, L. & MUÑOZ-SARIOT, G., 2017.– *Melitaea ornata* (Christoph, 1893), nueva especie para la Península Ibérica. Primeros datos de su morfología, biología y ecología comparada con los de *Melitaea phoebe* (Denis & Schiffermüller, 1775) (Lepidoptera: Nymphalidae).– *Arquivos Entomológicos*, **18**: 313-324.
- TAVOILLOT, C., 1967.– Un hybride probable entre *Melanargia russiae* et *M. lachesis*.– *Alexanor*, **5**(1): 19-24.
- THOMSON, G., 1990.– *Maniola halicarnassus* - a new Satyrid from south-western Turkey (Lepidoptera: Nymphalidae: Satyrinae).– *Phegea*, **18**(4): 149-155.
- TOLMAN, T., 2008.– *Collins Butterfly Guide*: 384 pp. HarperCollins, London.
- TÓTH, J. P., VARGA, Z., VEROVNIK, R., WAHLBERG, N., VÁRADI, A. & BEREZCKI, J., 2017.– Mito-nuclear discordance helps to reveal the phylogeographic patterns of *Melitaea ornata* (Lepidoptera: Nymphalidae).– *Biological Journal of the Linnean Society*, **121**(2): 267-281. <https://doi.org/10.1093/biolinnean/blw037>
- VAN OORSCHOT, H. & COUTSIS, J. G., 2014.– *The genus Melitaea Fabricius, 1807 (Lepidoptera, Nymphalidae, Nymphalinae) Taxonomy and Systematics with special reference to the male genitalia*: 360 pp. Tshkolovets Publications, Pardubice.
- VARGA, Z., 1967.– A *Melitaea phoebe* Schiff. délkelet-európai populációinak taxonómiai elemzése, két új alfaj leírásával [Contributions to the taxonomy of *Melitaea phoebe* Schiff. in Southeastern Europe, with description of two new subspecies].– *Acta biologica Debrecina*, **5**: 119-137.
- VERITY, R., 1926-1928.– *Zygaena*, *Grypocera* and *Rhopalocera* of the Cottian Alps compared with other races [1].– *Entomologist's Record and Journal of Variation*, **38**(1926): 101-106, 120-126, 170-176; **39**(1927): 122-126, 154-157, 172-175; **40**(1928): 142-144, 160-163.

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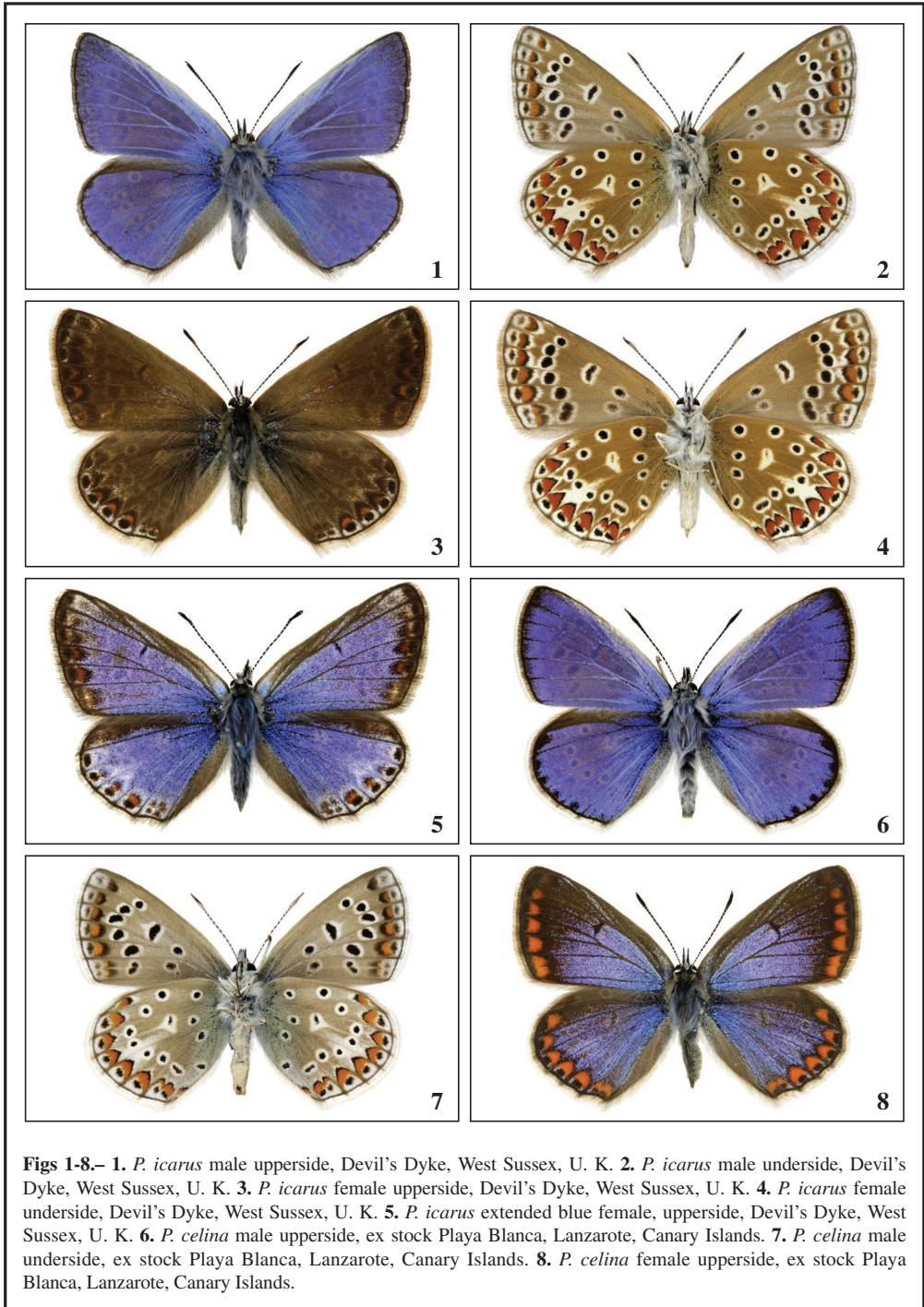
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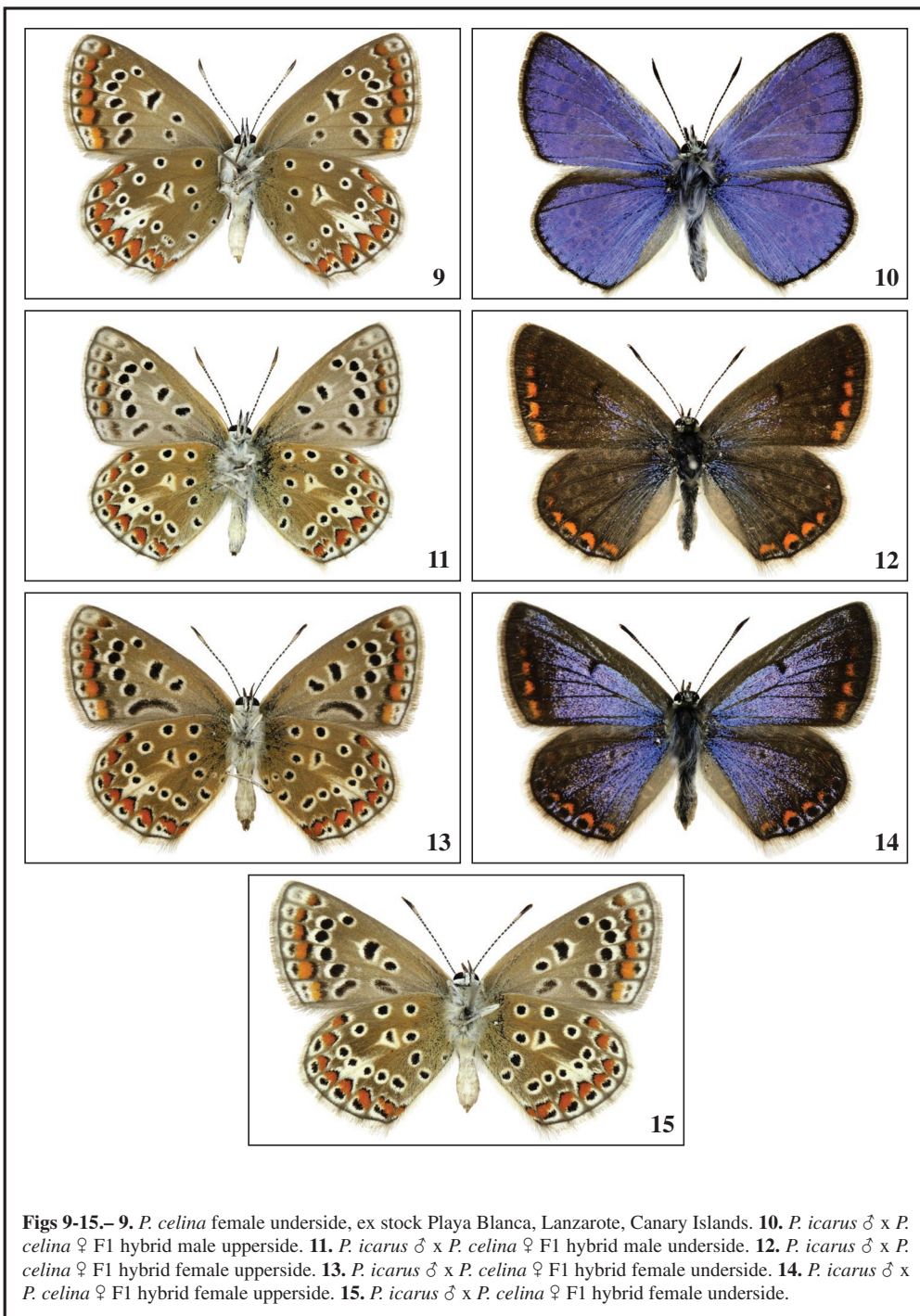
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Figs 1-8.– 1. *P. icarus* male upperside, Devil's Dyke, West Sussex, U. K. 2. *P. icarus* male underside, Devil's Dyke, West Sussex, U. K. 3. *P. icarus* female upperside, Devil's Dyke, West Sussex, U. K. 4. *P. icarus* female underside, Devil's Dyke, West Sussex, U. K. 5. *P. icarus* extended blue female, upperside, Devil's Dyke, West Sussex, U. K. 6. *P. celina* male upperside, ex stock Playa Blanca, Lanzarote, Canary Islands. 7. *P. celina* male underside, ex stock Playa Blanca, Lanzarote, Canary Islands. 8. *P. celina* female upperside, ex stock Playa Blanca, Lanzarote, Canary Islands.



Figs 9-15.— **9.** *P. celina* female underside, ex stock Playa Blanca, Lanzarote, Canary Islands. **10.** *P. icarus* ♂ x *P. celina* ♀ F1 hybrid male upperside. **11.** *P. icarus* ♂ x *P. celina* ♀ F1 hybrid male underside. **12.** *P. icarus* ♂ x *P. celina* ♀ F1 hybrid female upperside. **13.** *P. icarus* ♂ x *P. celina* ♀ F1 hybrid female underside. **14.** *P. icarus* ♂ x *P. celina* ♀ F1 hybrid female upperside. **15.** *P. icarus* ♂ x *P. celina* ♀ F1 hybrid female underside.



Figs 16-20.– 16. *M. phoebe* larva on *Centaurea scabiosa* Istria, Croatia, 27 July 2010. 17. *M. ornata* larva on *Carduus collinus* 2 km NW. of Rakitovec, Koper, Slovenia 30 April 2012. RV. 18. *M. phoebe* male underside, 2 km S. of Rakitovec, Koper, Slovenia (captured 17 May 2011). 19. *M. ornata* female underside, circa 2 km NW. of Rakitovec, Koper, Slovenia (captured 17 May 2011). 20. *M. phoebe* ♂ x *M. ornata* ♀ female hybrid underside, reared ex *M. ornata* female from Rakitovec, Slovenia, emerged 17 May 2012.

Metzneria leae Gastón & Huemer, sp. n., a new species from Spain (Lepidoptera: Gelechiidae)

J. Gastón & P. Huemer

Abstract

Metzneria leae Gastón & Huemer, sp. n., a new species in the family Gelechiidae, is described from Spain and adults and genitalia of both sexes are figured. The new species differs morphologically and in the DNA barcode from all other known representatives of the genus. Until now, the new species has been confused with *Metzneria subflavella* Englert, 1974, so both species are compared in detail.

KEY WORDS: Lepidoptera, Gelechiidae, new species, Spain.

Metzneria leae Gastón & Huemer, sp. n., una nueva especie para España
(Lepidoptera: Gelechiidae)

Resumen

Se describe una nueva especie de la familia Gelechiidae *Metzneria leae* Gastón & Huemer, sp. n., para España y se presentan adultos y genitales de ambos sexos. La nueva especie difiere, tanto morfológicamente como en el código de barras del ADN, de todos los demás representantes conocidos del género. Hasta ahora, la nueva especie ha podido ser confundida con *Metzneria subflavella* Englert, 1974, por lo que ambas especies se comparan en detalle.

PALABRAS CLAVE: Lepidoptera, Gelechiidae, nueva especie, España.

Introduction

The European Gelechiidae have received considerable interest in recent decades, boosting the numbers of nominal species records from 617 to 865 within only 24 years (HUEMER & KARSHOLT, 2020; KARSHOLT & RAZOWSKI, 1996). Nevertheless, molecular data still indicate a considerable number of previously overlooked species, particularly in some diverse but unrevised genera, e. g. *Stomopteryx* Heinemann, 1870, *Aproaerema* Durrant, 1897, *Aristotelia* Hübner, [1825] and *Monochroa* Heinemann, 1870 (HUEMER *et al.*, 2020).

However, gaps in species lists are also evident in genera that have already been revised using standard morphological methods. *Metzneria* Zeller, 1839, is one such example. The genus was extensively revised by ENGLERT (1974), and 27 species were reviewed, including four new species. Despite a modern approach at the time with the study of type material and examination of male and female genitalia, the work has serious deficits from today's point of view. In particular, the lack of images of adults and female genitalia structures is often a considerable hurdle for correct identifications.

As a consequence, uncertainties in the correct identification of individual species of *Metzneria* are

reflected in the extremely diverse fauna of Spain. VIVES MORENO (2014) listed 24 species of *Metzneria* from Spain. Two have been synonymized, viz. *M. exposito* Vives, 2001 and *M. varennei* Nel, 1997 (HUEMER & KARSHOLT, 2020), whereas *M. neli* Huemer, 2021 was recently added to the national fauna (HUEMER, 2021). Inspired by that study JG re-examined several of his *Metzneria* and found another hitherto overlooked species, closely related to *M. subflavella* Englert, 1974, which is described below.

Material and methods

Specimen's material used for the study has been obtained by sampling at night and by day, with actinic light traps distributed in the appropriate biotopes and having the authorizations of the relevant regions. We have made our identifications based on comparative examination of the external morphological characters and, above all, on the analysis of the genital structure of the specimens. Material was traditionally set and dried or only pinned.

Genitalia preparations either followed standard techniques (ROBINSON, 1976) or slides of the male genitalia were adapted by the “unrolling technique” as described by PITKIN (1986).

Tissue samples (a single hind leg) were prepared according to prescribed standards to obtain DNA barcode sequences on a 658 base-pair long segment of the mitochondrial COI gene (cytochrome c oxidase subunit 1) and processed at the Canadian Centre for DNA Barcoding (CCDB, Biodiversity Institute of Ontario, University of Guelph) using the standard high-throughput protocol described in DEWAARD *et al.* (2008). The obtained sequences cover the complete Spanish fauna of 24 *Metzneria* species with 159 barcodes > 500 bp and only a single short sequence of *M. subflavella* used for the Neighbour-Joining tree. The majority of sequences originate from our own samples, supplemented by public data from BOLD. Further details including complete voucher data and images can be accessed in the public dataset “DS-METZLEAE *Metzneria leae* sp. n.” dx.doi.org/10.5883/DS-METZLEAE in the Barcode of Life Data Systems (BOLD systems v. 4.0. <http://www.boldsystems.org> (RATNASINGHAM & HEBERT, 2007).

Degrees of intra- and interspecific variation of DNA barcode fragments were calculated using the Kimura 2 parameter model on BOLD systems v. 4.0. (<http://www.boldsystems.org>). A COI Neighbour-Joining tree was constructed using the Kimura 2 parameter model in MEGA6 (TAMURA *et al.*, 2013). A three-letter code (ISO 3166-1 alpha-3, https://en.wikipedia.org/wiki/ISO_3166-1_alpha-3) was used to abbreviate country names in this tree. DNA Barcode Identification Numbers (BINs) are automatically calculated for records in Bold Data Systems that are compliant with the DNA Barcode standard (RATNASINGHAM & HEBERT, 2013).

Photographic documentation: For the photographic documentation of the genitalia, NIKON Eclipse E400 microscopes and NIKON D3100 digital cameras have been used. For photographic documentation of the adults, SONY α 100 DSLR-A100K digital camera have been used with an AF MACRO, 100 mm 1:2.8 (32) lens. The photographic retouches have been made in the Adobe Photoshop © program.

Abbreviations:

RCFG	Research collection of Friedmar Graf, Bautzen, Germany
RCJG	Research collection of Javier Gastón, Getxo, Spain
RCJJ	Research collection of Jari Junnilainen, Vantaa, Finland
RCTM	Research collection of Toni Mayr, Feldkirch, Austria
TLMF	Tiroler Landesmuseum Ferdinandeum, Innsbruck, Austria
JG	Javier Gastón
PH	Peter Huemer
gen. prep.	genitalia preparation
sp. n.	new species

Results

MOLECULAR ANALYSIS

DNA sequencing analysis is based on barcode sequences > 600 bp for 157 specimens, two sequences > 500 bp and one with only 261 bp, covering all 24 species known from Spain. Sequences of the majority of species reveal moderate intraspecific mean distances of 0.97% but significantly higher interspecific distances with mean distances of 6.37% to the nearest neighbours (Table 1). Exceptionally large intraspecific distances beyond 3% are observed in *M. aprilella* (Herrich-Schäffer, 1854), *M. artificella* (Herrich-Schäffer, 1861), *M. diffusella* Englert, 1974, *M. metzneriella* (Stainton, 1851) and *M. neuropterella* (Zeller, 1839) and all these taxa should be re-assessed for potential cryptic diversity (HUEMER *et al.*, 2020). All species cluster in one or several unique BINs and molecular analysis also clearly supports the specific status of *M. leae* and its nearest neighbour *M. subflavella* (Fig. 1).

Table 1.– Intraspecific mean K2P (Kimura 2 Parameter) divergences, maximum pairwise distances, nearest species, nearest neighbour and distance to nearest neighbour (in %) of *Metzneria* species recorded from Spain.

Species	Mean Intra-Sp	Max Intra-Sp	Nearest Species	Distance to NN
<i>Metzneria aestivella</i>	0.77	1.98	<i>Metzneria castiliella</i>	7.86
<i>Metzneria agraphella</i>	N/A	0	<i>Metzneria lappella</i>	9.64
<i>Metzneria aprilella</i>	2.55	4.61	<i>Metzneria ehikeella</i>	5.72
<i>Metzneria artificella</i>	2.56	4.62	<i>Metzneria diffusella</i>	6.78
<i>Metzneria campicolella</i>	1.36	1.36	<i>Metzneria castiliella</i>	8.23
<i>Metzneria castiliella</i>	0.8	1.43	<i>Metzneria aprilella</i>	6.08
<i>Metzneria diffusella</i>	2.16	3.57	<i>Metzneria neuropterella</i>	5.46
<i>Metzneria ehikeella</i>	1.04	2.03	<i>Metzneria staehelinella</i>	4.59
<i>Metzneria hilarella</i>	0.71	1.87	<i>Metzneria staehelinella</i>	5.91
<i>Metzneria intestinella</i>	0.93	0.93	<i>Metzneria tristella</i>	6.18
<i>Metzneria lappella</i>	0.18	0.77	<i>Metzneria leae</i>	6.4
<i>Metzneria liitorella</i>	0.41	0.62	<i>Metzneria subflavella</i>	7.91
<i>Metzneria metzneriella</i>	2.5	4.47	<i>Metzneria ehikeella</i>	4.76
<i>Metzneria neli</i>	2.19	2.19	<i>Metzneria metzneriella</i>	5.21
<i>Metzneria neuropterella</i>	1.63	4.12	<i>Metzneria diffusella</i>	5.46
<i>Metzneria paucipunctella</i>	0.6	1.88	<i>Metzneria ehikeella</i>	5.75
<i>Metzneria riadella</i>	0.31	0.31	<i>Metzneria liitorella</i>	8.09
<i>Metzneria santolinella</i>	1.29	2.03	<i>Metzneria ehikeella</i>	5.07
<i>Metzneria leae</i>	0.62	0.93	<i>Metzneria subflavella</i>	5.58
<i>Metzneria staehelinella</i>	N/A	0	<i>Metzneria ehikeella</i>	4.59
<i>Metzneria subflavella</i>	N/A	0	<i>Metzneria leae</i>	5.58
<i>Metzneria tenuiella</i>	0	0	<i>Metzneria ehikeella</i>	8.58
<i>Metzneria torosulella</i>	0.74	0.74	<i>Metzneria neuropterella</i>	7.56
<i>Metzneria tristella</i>	N/A	0	<i>Metzneria ehikeella</i>	5.83

TAXONOMY

Metzneria leae Gastón & Huemer, sp. n.

Material examined: Holotype, 1 ♂, SPAIN, CASTELLÓN, Coves de Vinroma, Mas de la Bassa, 22-V-2004, J. Domínguez leg., ADN genetic sequence number TLMF Lep 06958, gen. prep. 9050JG, deposited in Tiroler Landesmuseum Ferdinandeum, Innsbruck, Austria (TLMF).

Paratypes 3 ♂♂, 3 ♀♀: SPAIN, TERUEL, Albarracín, 1100 m, 2 ♂♂, 30-V-1997, J. Gastón leg. and

coll., gen. prep. 4641JG and 8971JG; idem. 2 ♀♀, gen. prep. 7655JG and 8972JG; idem, 1 ♀, 24-VI-2019, F. Graf leg. and coll., ADN genetic sequence number TLMF Lep 26266; idem, Sierra de Cucalón, 1275 m, 1 ♂, 21-VI-2017, J. Junnilainen leg. and coll., ADN genetic sequence number MM26896.

Description of adult (Figs 2-3): Wingspan 17 mm (n=5). Head with compact pale ochreous scales on frons and vertex becoming black along margin of eye. Labial palpus well developed, long second segment directed forwards and slightly curved upwards, densely covered with reddish ochreous scales, distally light cream, short third segment strongly curved upwards and covered with very short reddish ochreous scales, pale cream scales at apex; antennae filiform, dark brown and ringed paler. Thorax and tegulae pale ochreous; abdomen slightly paler ochreous; femur and tibia of all legs with reddish ochreous hairs mixed with pale cream hairs. Forewing with acute apex, characteristic of the genus; pale yellowish ochre, reddish yellow in fresh specimens and especially females, broad, very dark ochreous, costal streak from base to apex, on the longitudinal veins bordering cell and in the subterminal area; discal spot dark and diffuse, sometimes obscure; hindwing narrow, grey, cilia grey, basally pale ochreous.

Male genitalia (Fig. 8): Uncus wide, short, distally with two triangular projections and broadly V-shaped median emargination; tegumen much broader than long, with rounded posterior margin; small pedunculi; valva short narrow base, strongly dilated, digitiform distal part, a pronounced and pointed tooth at apex, dorsal margin convex and nearly straight ventral margin; sacculus triangular, broad basally, abruptly narrowing to pointed apex; saccus sub-triangular, short; phallus wide, bulbous and short, apex with short finger-like subtriangular projection; subapical area of inverted vesica membranous covered with minute spinules, mixed with somewhat larger and very slightly sclerotised spines, vesica with three to four medium-long and strongly sclerotised cornuti in middle.

Female genitalia (Fig. 9): Papilla analis sub-oval, weakly setose; apophysis posterioris about two and a half times length of papilla analis; segment VIII slightly sclerotised, short with a row of setae on posterior margin; apophysis anterioris of the same length as apophysis posterioris; antrum membranous, funnel-shaped; entrance of membranous ductus bursae with a short, strongly sclerotised colliculum, anteriorly with an inconspicuous tongue-shaped projection; ductus bursae membranous, narrow and long; corpus bursae membranous, ovoid, small, without signum.

Diagnosis: *Metzneria leae* sp. n. is very similar to *M. subflavella* in the male and female genitalia. It differs from that species in several characters in the adult, especially in the forewing pattern in having mostly dark ochreous scales on the costal margin, and a poorly defined dark spot at the distal end of the cell, which is absent in *M. subflavella* (Figs 4-6). In the male genitalia of *M. subflavella* (Fig. 10) the valva is less dilate distally and the sacculus has a broader base with the dorsal margin curved upwards, whilst in *M. leae* sp. n., the base is narrower and both margins are straight. In the vesica of the phallus of *M. subflavella* a group of 3 or 4 medium-long and strongly sclerotised cornuti is present with several small and weakly sclerotised cornuti, which are absent in *M. leae* sp. n. The female genitalia of *M. subflavella* (Fig. 11) are very similar to *M. leae* sp. n. but with a significantly shorter ductus bursae.

Molecular data: BIN: BOLD:ABW1820. The intraspecific average distance of the barcode region is 0.62%, the maximum distance is 0.93% (p-dist) (n=3). The distance to the nearest neighbour in BOLD, an unidentified and unpublished gelechiid from China (BIN: BOLD:AEJ1362) which in fact belongs to the genus *Metzneria*, is 2.72%. The minimum distance to the nearest European congeneric species, *M. subflavella*, is 5.58% (BIN: BOLD:ADM8252).

Distribution (Fig. 7): *Metzneria leae* Gastón & Huemer, sp. n. is only known from a few localities in eastern Spain, in the supra-Mediterranean bioclimatic zone (RIVAS-MARTÍNEZ, 1987), but is likely to be more widely distributed on the Iberian Peninsula. The closely related *M. subflavella* is stated to occur from Western Europe to Central Asia (ELSNER *et al.*, 1999; ENGLERT, 1974; ÖZASLAN *et al.*, 2016; PASTORÁLIS *et al.*, 2018). However, several of these earlier records require verification, and uncertainties in the identification also affect previous reports from the Iberian Peninsula, i. e. Portugal (CORLEY, 2005) and Spain (DERRA & HACKER, 1982). Oleksiy Bidzilya has provided us with a photograph of a specimen captured by Ernst Arenberger on 14-VII-1967 in Beuda (Gerona,

Spain) (fig. 4) and deposited in the Staatliches Museum für Naturkunde, Karlsruhe (Germany). The habitus of this specimen corresponds to *M. subflavella*. The type series of *M. subflavella* was collected between 24-30-VI-1959 in south-east France (Durance Valley, St. Crépin) (ENGLERT, 1974).

Bionomics: Host-plants and preliminary stages are undescribed. A record of rearing *M. subflavella* from the seed-heads of *Klasea baetica* Cass., in F. Cuvier in Portugal (CORLEY, 2005) possibly refers to the new species. In Turkey *M. subflavella* has been bred from *Centaurea stapfiana* (Hand.-Mazz.) Wagenitz (ÖZASLAN *et al.*, 2016).

Remarks: A unique specimen from Iran clusters near *M. leae* in the DNA barcode. However, morphological traits, particularly the male genitalia, do not convincingly support the conspecificity and the species requires careful re-assessment from additional samples.

Etyymology: The new species is dedicated to Lea Gastón Kitamura, first author's granddaughter.

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BIBLIOGRAPHY

- CORLEY, M. F. V., 2005.– Further additions to the Lepidoptera of Algarve, Portugal. II (Insecta: Lepidoptera).– *SHILAP Revista de lepidopterología*, **33**(131): 347-364.
- DERRA, G. & HACKER, H., 1982.– Contribution to the Lepidoptera-Fauna of Spain. Heterocera of a three-week visit in summer 1980.– *SHILAP Revista de lepidopterología*, **10**(39): 187-196.
- DEWAARD, J. R., IVANOVA, N. V., HAJIBABAEI, M. & HEBERT, P. D. N., 2008.– Assembling DNA Barcodes: Analytical Protocols. Pp. 275-293.– In C. C. MARTIN (ed.) *Methods in Molecular Biology: Environmental Genomics*: 364 pp. Humana Press Inc., Totowa, USA. https://doi.org/10.1007/978-1-59745-548-0_15.
- ELSNER, G., HUEMER, P. & TOKÁR, Z., 1999.– *Die Palpenmotten (Lepidoptera, Gelechiidae) Mitteleuropas. Bestimmung - Verbreitung - Flugstandort - Lebensweise der Raupen*: 208 pp. František Slamka, Bratislava.
- ENGLERT, W. D., 1974.– Revision der Gattung *Metzneria* Zeller (Lepid., Gelechiidae) mit Beiträgen zur Biologie der Arten.– *Zeitschrift für angewandte Entomologie*, **75**: 381-421.
- HUEMER, P., 2021.– *Metzneria neli* Huemer, sp. n., a new species hitherto mixed with *M. tristella* Rebel, 1901 (Lepidoptera: Gelechiidae).– *SHILAP Revista de lepidopterología*, **49**(196): 647-655.
- HUEMER, P. & KARSHOLT, O., 2020.– Commented checklist of European Gelechiidae (Lepidoptera).– *ZooKeys*, **921**: 65-140. <https://doi.org/10.3897/zookeys.921.49197>.
- HUEMER, P., KARSHOLT, O., AARVIK, L., BERGGREN, K., BIDZILYA, O., JUNNILAINEN, J., LANDRY, J.-F., MUTANEN, M., NUPPONEN, K., SEGERER, A., ŠUMPICH, J., WIESER, C., WIESMAIR, B. & HEBERT, P. D. N., 2020.– DNA barcode library for European Gelechiidae (Lepidoptera) suggests greatly underestimated species diversity.– *ZooKeys*, **921**: 141-157. <https://doi.org/10.3897/zookeys.921.49199>.
- KARSHOLT, O. & RAZOWSKI, J., 1996.– *The Lepidoptera of Europe. A Distributional Checklist*: 380 pp. Apollo Books, Stenstrup.
- ÖZASLAN, C., BOLU, H. & AKIN, K., 2016.– A new host [*Centaurea stapfiana* (Hand.-Mazz.) Wagenitz (Asteraceae)] record for the moth *Metzneria subflavella* Englert (Lepidoptera: Gelechiidae) from Turkey.– *Oriental Insects*, **51**: 1-5. <https://doi.org/10.1080/00305316.2016.1231637>.
- PASTORÁLIS, G., KOSORÍN, F., TOKÁR, [Z.], RICHTER, I., ŠUMPICH, J., LIŠKA, J., LAŠTŮVKA, A., LAŠTŮVKA, Z. & ENDEL, B., 2018.– Šestnás druhov motýľ'ov (Lepidoptera) nových pre faunu slovenska.– *Entomofauna carpathica*, **30**(2): 1-24.

- PITKIN, L. M., 1986.– A technique for the preparation of complex male genitalia in Microlepidoptera.– *Entomologist's Gazette*, **37**: 173-179.
- RATNASINGHAM, S. & HEBERT, P. D. N., 2007.– BOLD: The Barcode of Life Data System (<http://www.barcodinglife.org>).– *Molecular Ecology Notes*, **7**: 355-364. <https://doi.org/10.1111/j.1471-8286.2007.01678.x>.
- RATNASINGHAM, S. & HEBERT, P. D. N., 2013.– A DNA-based registry for all animal species: The Barcode Index Number (BIN) system.– *PLoS ONE*, **8**(7): e66213. <https://doi.org/10.1371/journal.pone.0066213>.
- 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.
- TAMURA, K., STECHER, G., PETERSON, D., FILIPSKI, A. & KUMAR, S., 2013.– MEGA6: Molecular Evolutionary Genetics Analysis version 6.0.– *Molecular Biology and Evolution*, **30**: 2725-2729. <https://doi.org/10.1093/molbev/mst197>.
- VIVES MORENO, A., 2014.– *Catálogo sistemático y sinónimo 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.

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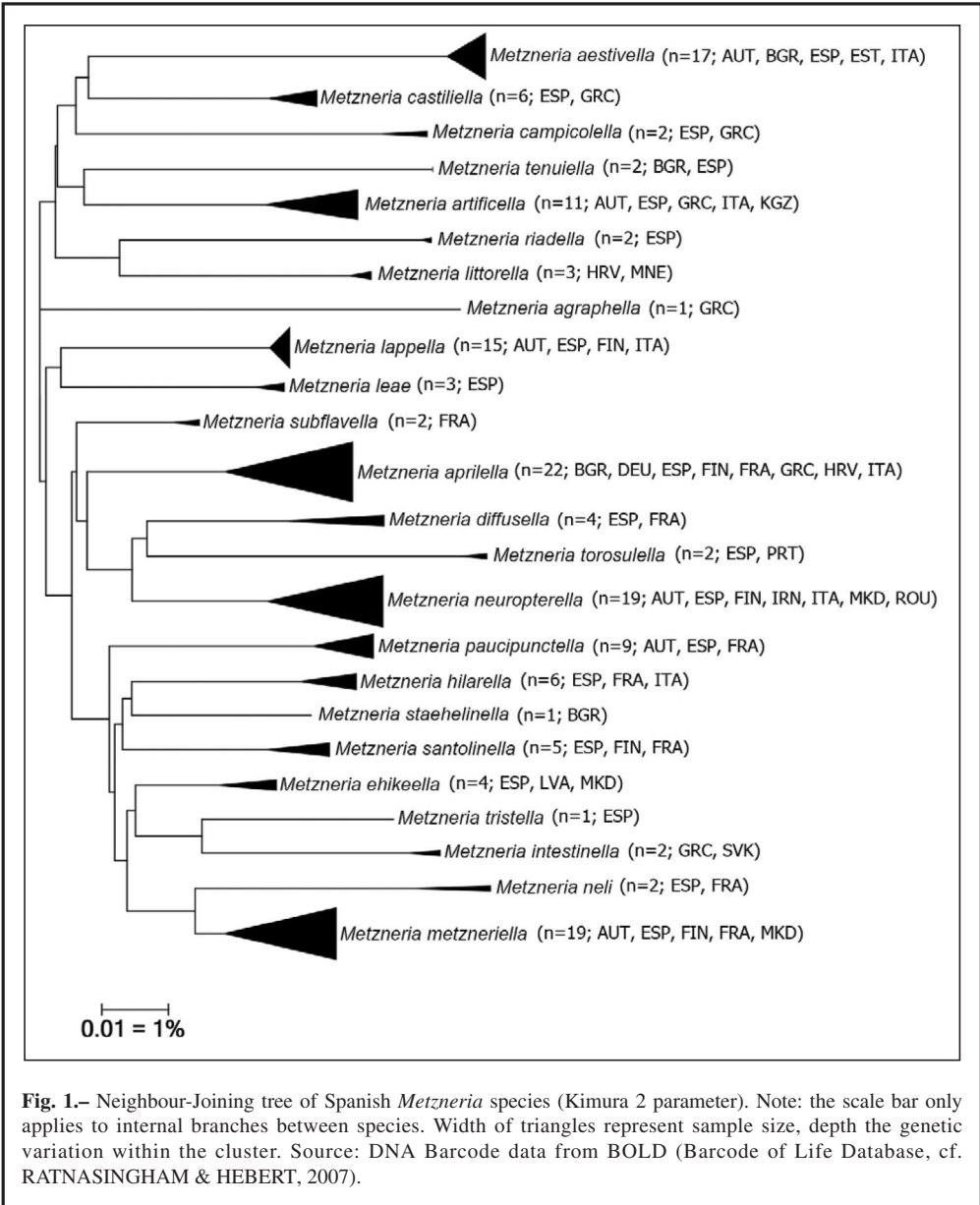
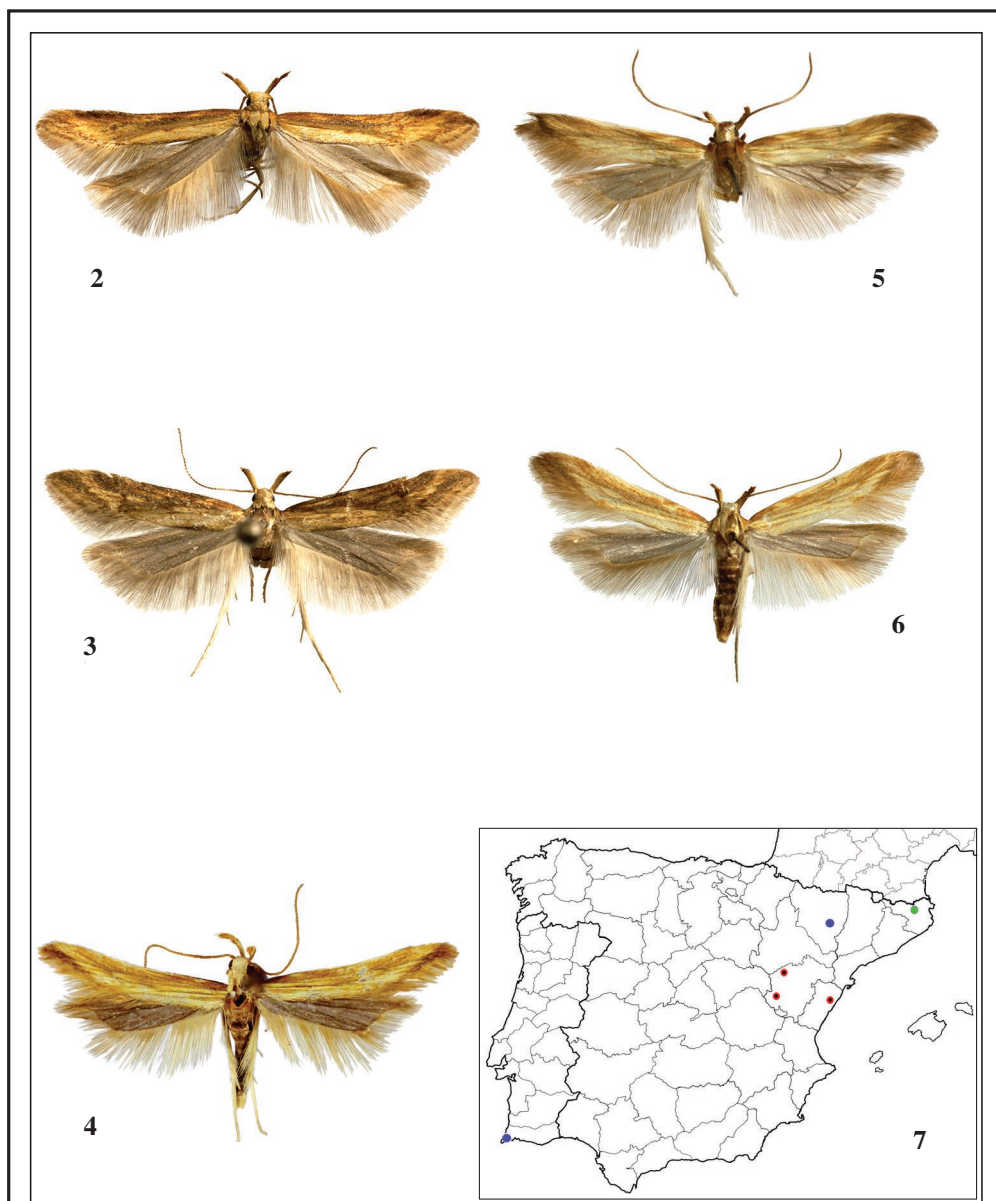
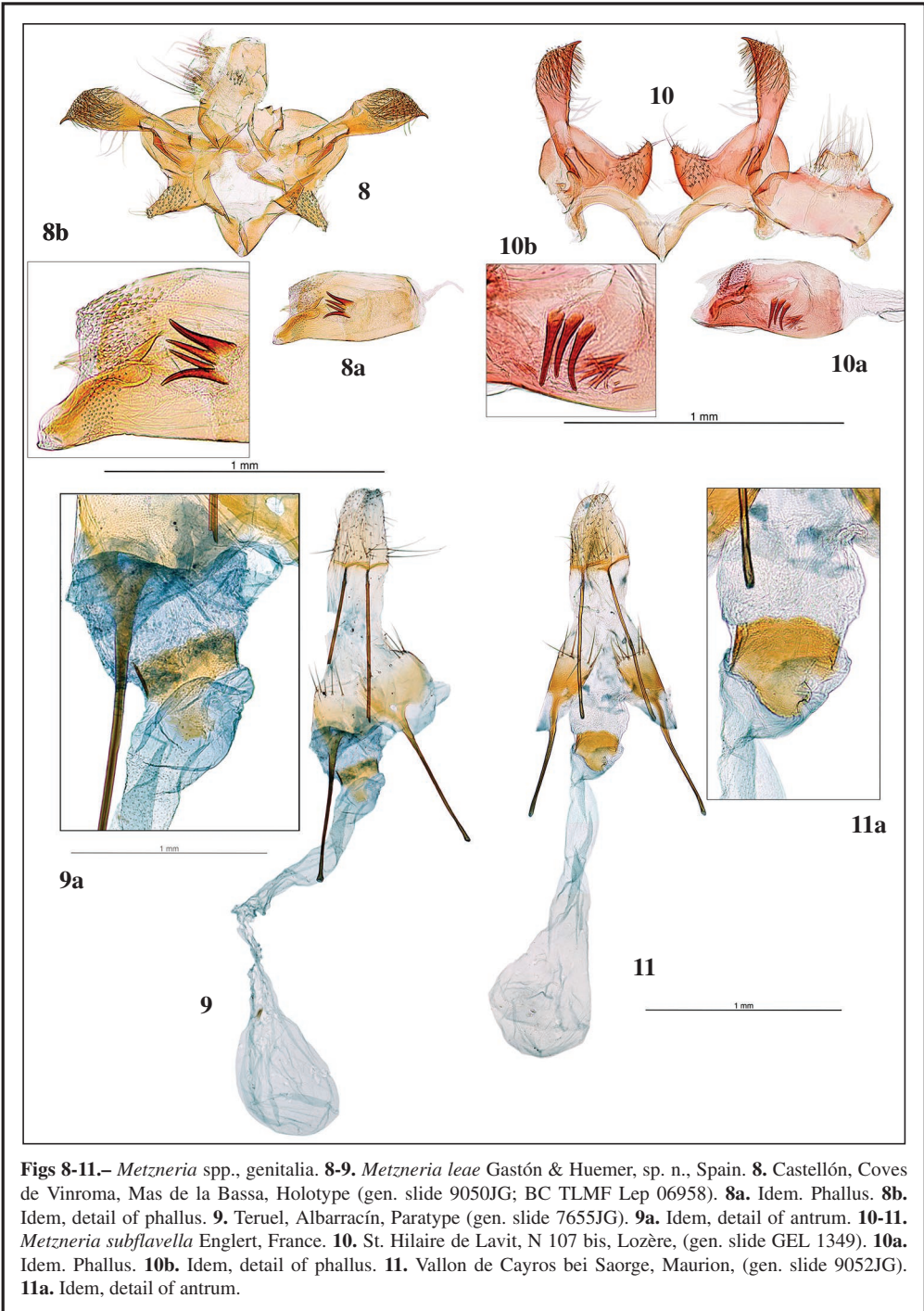


Fig. 1.– Neighbour-Joining tree of Spanish *Metzneria* species (Kimura 2 parameter). Note: the scale bar only applies to internal branches between species. Width of triangles represent sample size, depth the genetic variation within the cluster. Source: DNA Barcode data from BOLD (Barcode of Life Database, cf. RATNASINGHAM & HEBERT, 2007).



Figs 2-7.– *Metzneria* spp., adults and maps. **2-3.** *Metzneria leae* Gastón & Huemer, sp. n., Spain. **2.** Castellón, Coves de Vinroma, Mas de la Bassa, 22-V-2004, Holotype, male (gen. slide 9050JG; BC TLMF Lep 06958). **3.** Teruel, Albarracín, 1100 m, 30-V-1997, Paratype, female (gen. slide 7655JG). **4-6.** *Metzneria subflavella* Englert. **4.** Gerona, Beuda, 14-VII-1967, male. **5.** France, St. Hilaire de Lavit, N 107 bis, Lozère, 350 m, 15-V-1993, ex larva, male (gen. slide 9051JG). **6.** France, Vallon de Cayros bei Saorge, Maurion, 670 m, 6-VII-2012, female (gen. slide 9052JG). **7.** distribution map; red circle, *Metzneria leae* sp. n.; green circle, *Metzneria subflavella*; blue circle, *Metzneria subflavella* (bibliographic citations not examined).



Figs 8-11.– *Metzneria* spp., genitalia. **8-9.** *Metzneria leae* Gastón & Huemer, sp. n., Spain. **8.** Castellón, Coves de Vinroma, Mas de la Bassa, Holotype (gen. slide 9050JG; BC TLMF Lep 06958). **8a.** Idem. Phallus. **8b.** Idem, detail of phallus. **9.** Teruel, Albarracín, Paratype (gen. slide 7655JG). **9a.** Idem, detail of antrum. **10-11.** *Metzneria subflavella* Englert, France. **10.** St. Hilaire de Lavit, N 107 bis, Lozère, (gen. slide GEL 1349). **10a.** Idem. Phallus. **10b.** Idem, detail of phallus. **11.** Vallon de Cayros bei Saorge, Maurion, (gen. slide 9052JG). **11a.** Idem, detail of antrum.

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About the Presence of *Slamkania pseudosordida* (Slamka, 2019) in Turkey (Lepidoptera: Pyralidae, Phycitinae)

K. Akın

Abstract

With this study, the presence of *S. pseudosordida* (Slamka, 2019) in Turkey is confirmed and it is recorded for the first time in the fauna of Turkey. The record of the species for the Syrian fauna is also discussed. In addition, the pictures of *S. pseudosordida* and *S. sordida* (Staudinger, 1879) are present in the study.

KEY WORDS: Lepidoptera, Pyralidae, Phycitinae, *Slamkania pseudosordida*, Turkey, Syria.

Acerca de la presencia de *Slamkania pseudosordida* (Slamka, 2019) en Turquía (Lepidoptera: Pyralidae, Phycitinae)

Resumen

Con este estudio, se confirma la presencia de *S. pseudosordida* (Slamka, 2019) en Turquía y se registra por primera vez, para la fauna de Turquía. Se discute la cita de la especie para la fauna de Siria. Adicionalmente, se presentan en el estudio las figuras de *S. pseudosordida* y *S. sordida* (Staudinger, 1879).

PALABRAS CLAVE: Lepidoptera, Pyralidae, Phycitinae, *Slamkania pseudosordida*, Turquía, Siria.

Introduction

Phycitinae is one of the richest and most difficult groups of Pyralidae. KEMAL & KOÇAK (2020a) was listed 324 taxa from Turkey, 3 of which are at the genus level. With the latest studies, 12 more species have been added to the Phycitinae fauna of Turkey. These added species are as follows: *Elegia feminina* Kemal, Kızıldağ & Koçak, 2020, *E. saecula* Kemal, Kızıldağ & Koçak, 2020 (KEMAL *et al.*, 2020a); *Pseudoinsalebria zerneka* Kemal, Kızıldağ & Koçak, 2020, *Ephestia fredii* (Amsel, 1961) (KEMAL *et al.*, 2020b); *Cremonophila sedakovella* (Eversmann, 1851) (KEMAL & KOÇAK, 2020b); *Ancylosis aspilatella* (Ragonot, 1887), *A. igdirensis* Akın, Gözüaçık, Seven & Türkoğlu, 2021, *Christophia bilineella* (Ragonot, 1887), *Myelois cinctipalpella* Christoph, 1877, *Prorophora curvibasella* Ragonot, 1887, *Pseudophycita deformella* (Möschler, 1866) and *Sciota campicolella* (Erschoff, 1874) (AKIN *et al.*, 2021).

The genus *Ottomania* is established by SLAMKA (2019) with type-species *Pempelia sordida* Staudinger, 1879. However, LERAUT (2020) recommend to *Slamkania* name because of homonym of *Ottomania* de Bruijn, Ünay, Saraç & Yılmaz, 2003 (Mammalia: Rododentia), and the genus *Slamkania* includes *S. afghanica* (Slamka, 2019), *S. pseudosordida* (Slamka, 2019) and *S. sordida* (Staudinger, 1879). Among these species the *S. sordida*, the type locality is Turkey, presently distributed from Turkey, Armenia, Iraq and Afghanistan in the world (SLAMKA, 2019). In addition, SLAMKA (2019) stated that the spread of the species *sordida* in Iran is doubtful and it may be *S. pseudosordida*. Also, *S.*

sordida is known from Ankara (SLAMKA, 2019), Amasya, Bitlis, Kahramanmaraş and Mardin provinces in Turkey (KEMAL & KOÇAK, 2020a) (Figs 2-7). The species *S. pseudosordida* has been known from Israel, Cyprus and Iraq so far (SLAMKA, 2019).

This study aims to verify the presence of *S. pseudosordida* (Slamka, 2019) in Turkey. In addition, due to location of Ceylanpınar district, the presence of the species in Syria can be mentioned.

Materials and Methods

The materials were collected from Ceylanpınar (Şanlıurfa Prov.) district using a 160 W mercury vapor lamp hang downed on a white sheet and a generator as energy source. The area where the study was carried out generally includes cultivated agricultural areas and pistachio gardens (Fig. 1). While preparing the male genital, ROBINSON's study (1976) was followed in general terms.

Results

Slamkania pseudosordida (Slamka, 2019) (Figs (8-11)

Ottomania pseudosordida Slamka, 2019 *nec* de Bruijn, Ünay, Saraç & Yılmaz, 2003, homonymy

Material examined: Turkey, Şanlıurfa Prov., Ceylanpınar, TİGEM-Akrepli management, 2 ♂♂, 29-VIII-2008, leg. K. Akin.

The specimens mentioned in this study were previously identified as *Faveria sordida* (Staudinger, 1879) by AKIN (2016). SLAMKA (2019) also stated that *S. sordida* and *S. pseudosordida* can be confused. However, after study of SLAMKA (2019), it is understood that these specimens are *S. pseudosordida*. In this case, the distribution of *S. pseudosordida* in Turkey becomes clear with this study and it is a new record for the Turkish fauna. In addition to the distribution of the species in the world, the fact that it is detected in Ceylanpınar district, located on the Syrian border in Turkey (See fig. 1), suggests that this species may be a new record in the Syrian fauna as well as in Turkey. Furthermore, with this study, the number of Phycitinae species in Turkey has reached 334.

For now, the distribution of *S. pseudosordida* in Turkey is seen as the Southeast of the country. The extent of the spread of the species in Turkey will be clarified with future field studies.

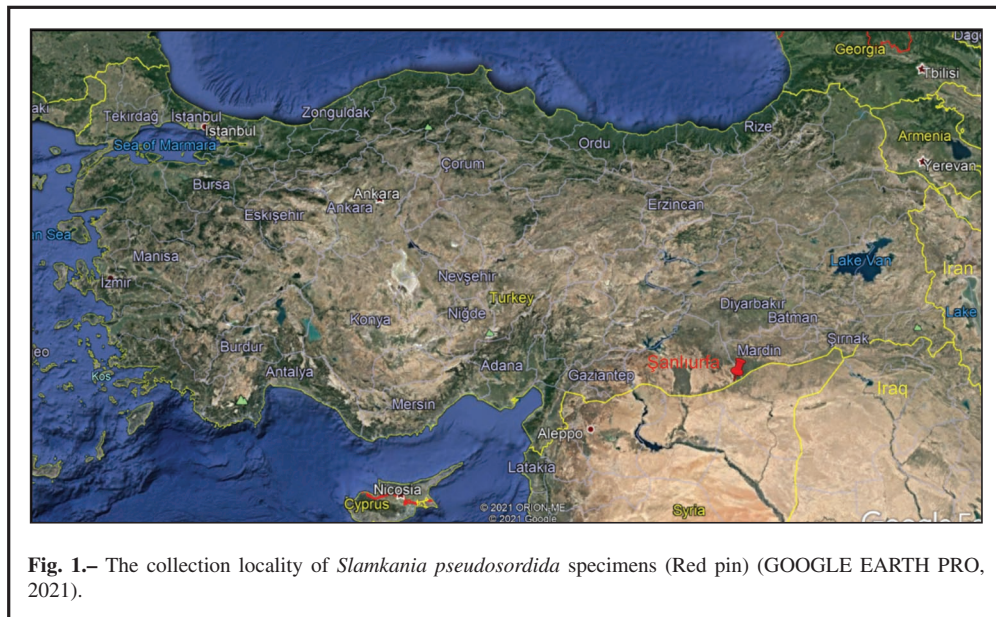


Fig. 1.– The collection locality of *Slamkania pseudosordida* specimens (Red pin) (GOOGLE EARTH PRO, 2021).

BIBLIOGRAPHY

- AKIN, K., 2016.– New Records for Pyraloidea Fauna of Şanlıurfa (Şanlıurfa Pyraloidea Faunası İçin Yeni Kayıtlar).– *International Ecology 2016 Adnan Aldemir Symposium (Uluslararası Ekoloji 2016 Adnan Aldemir Sempozyumu)*. 16-19 May 2016: 38. Kars.
- AKIN, K., GÖZÜAÇIK, C., SEVEN, E. & TÜRKOĞLU, M., 2021.– New species and new records of Pyraloid moths (Lepidoptera: Pyraloidea) from Turkey.– *Zootaxa*, **4951**(3): 529-540.
- DE BRUIJN, H., ÜNAY, E., SARAÇ, G. & YILMAZ, A., 2003.– A rodent assemblage from the Eo/Oligocene boundary interval near Süngülü, Lesser Caucasus, Turkey.– *Coloquios de Paleontologia Volumen Extraordinario*, **1**: 47-76.
- GOOGLE EARTH PRO, 2021.– Available from <https://www.google.com.tr/intl/tr/earth/download/gep/agree.html> (accessed 19th June 2021).
- KEMAL, M., KIZILDAĞ, S. & KOÇAK, A. Ö., 2020a.– Descriptions of new species of the genus *Elegia* from Turkey (Lepidoptera, Pyraloidea).– *Miscellaneous Papers*, **206**: 1-8.
- KEMAL, M., KIZILDAĞ, S. & KOÇAK, A. Ö., 2020b.– Additional annotated notes on the Heterocera fauna of Zerneke (Van Province, East Turkey) with descriptions of new species.– *Priamus*, **19**(3): 149-183.
- KEMAL, M. & KOÇAK, A. Ö., 2020a.– On the Phycitinae of Turkey: updated synonymic and distributional list of species (Lepidoptera) with some remarks.– *Priamus*, **18**(3): 130-154.
- KEMAL, M. & KOÇAK, A. Ö., 2020b.– A faunistic record of *Cremnophila* Ragonot in Turkey (Lepidoptera, Pyralidae).– *Miscellaneous Papers*, **212**: 41-43.
- LERAUT, G., 2020.– Etablissement de deux synonymes nouveaux et de deux noms de remplacement pour des Lépidoptères Pyraloidea (Pyralidae, Phycitinae).– *Revue française d'Entomologie Générale*, **2**(3): 53-59.
- ROBINSON, G. S., 1976.– The Preparation of slides of Lepidoptera genitalia with special reference to the Microlepidoptera.– *Entomologist's Gazette*, **27**: 127-132.
- SLAMKA, F., 2019.– *Pyraloidea of Europe (Lepidoptera). Phycitinae-Part 1. Identification, Distribution, Habitat, Biologie*, **4**: 432 pp. František Slamka, Bratislava.

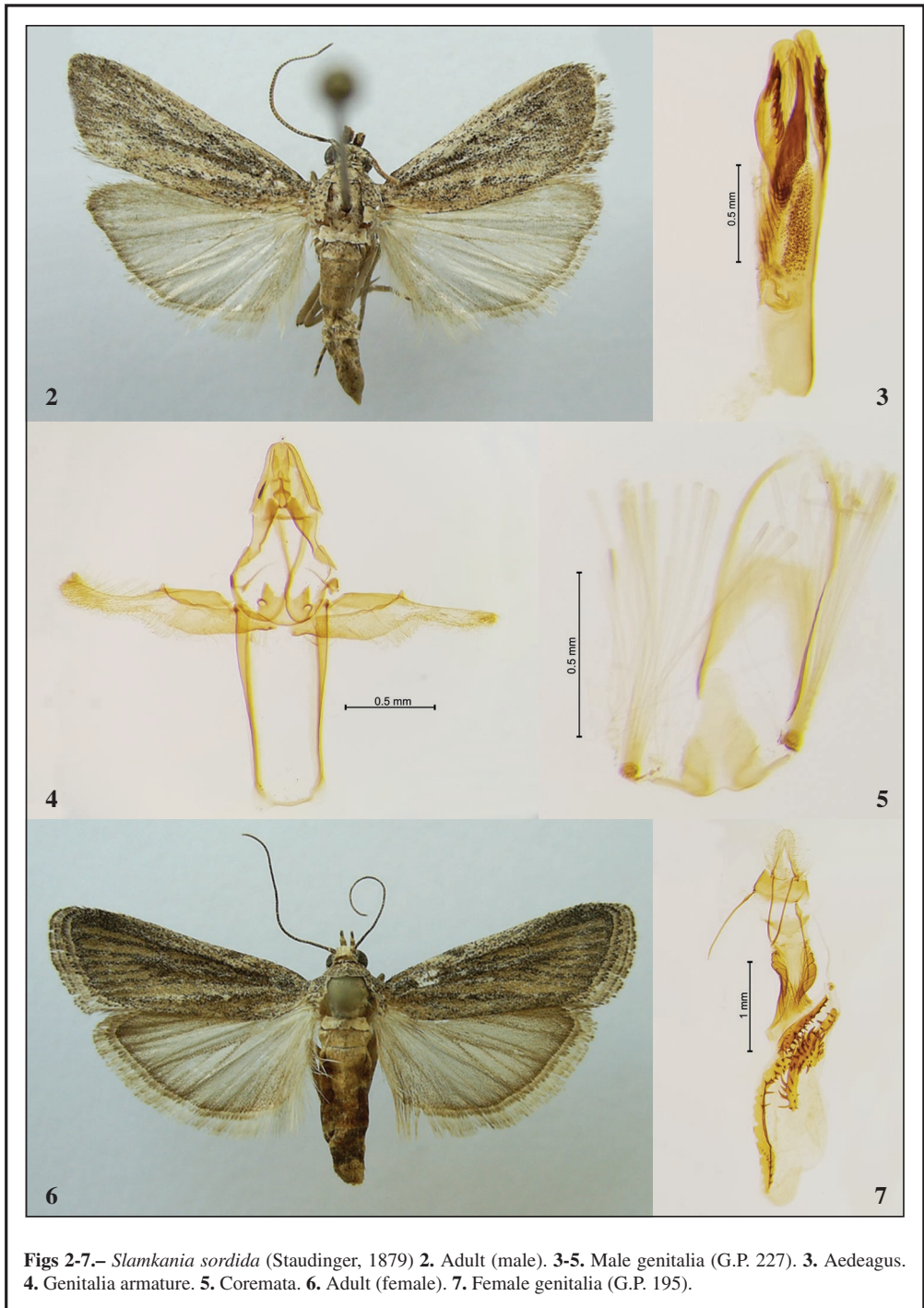
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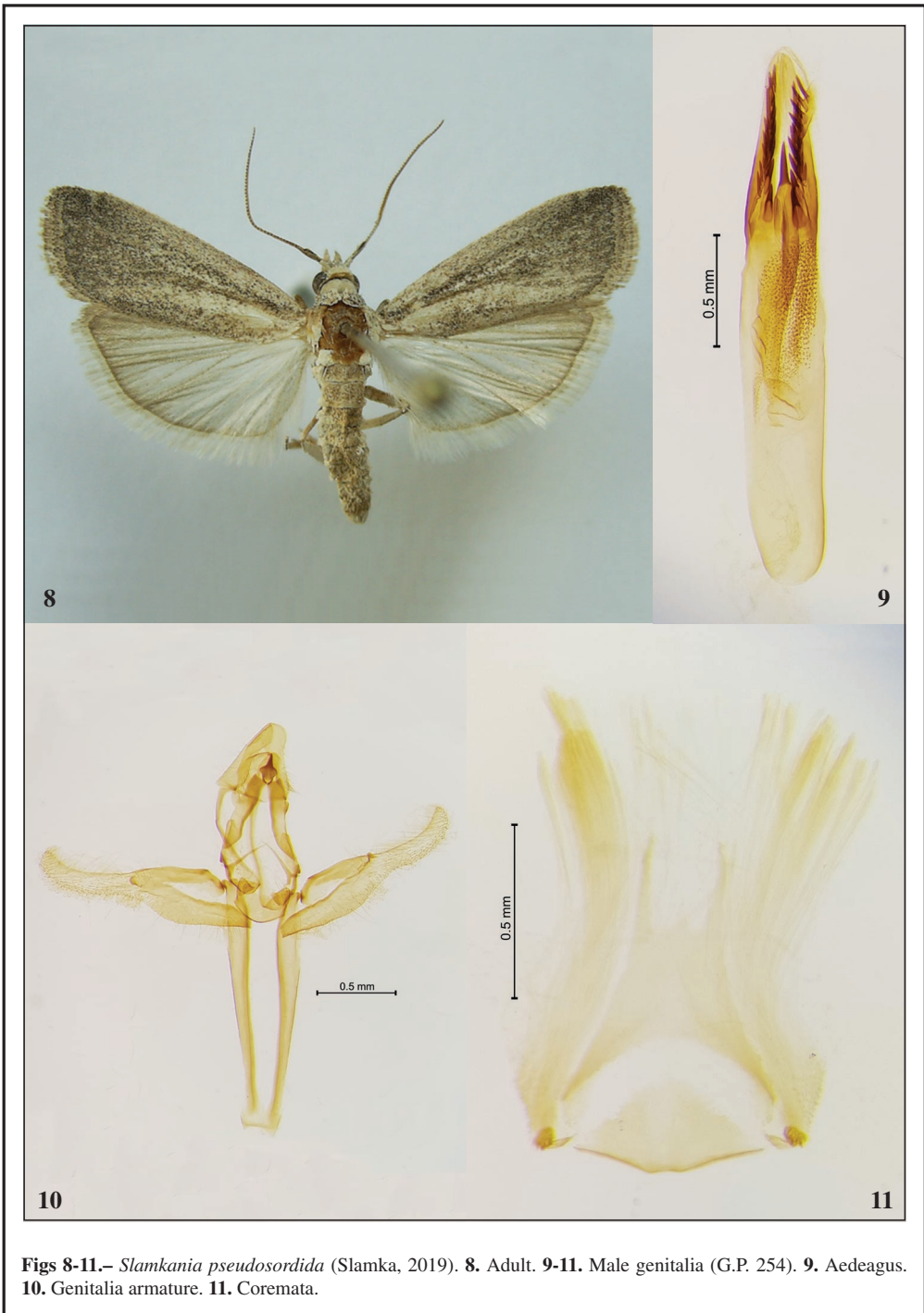
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Figs 2-7.– *Slamkania sordida* (Staudinger, 1879) **2.** Adult (male). **3-5.** Male genitalia (G.P. 227). **3.** Aedeagus. **4.** Genitalia armature. **5.** Coremata. **6.** Adult (female). **7.** Female genitalia (G.P. 195).



Figs 8-11.– *Slamkania pseudosordida* (Slamka, 2019). **8.** Adult **9-11.** Male genitalia (G.P. 254). **9.** Aedeagus. **10.** Genitalia armature. **11.** Coremata.

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Evaluación de la calidad del inventario de Macroheterocera de los humedales de Salburua (Álava, España) (Insecta: Lepidoptera)

F. de Juana

Resumen

Se evalúa la calidad de un inventario de macroheteróceros para el que se han efectuado 208 muestreos semanales a lo largo de cuatro años en los humedales de Salburua (Vitoria, Álava), analizando para ello la curva de acumulación de especies. Los resultados generales obtenidos no permiten hacer una estimación fiable de la riqueza total debido a la alta proporción de especies escasas o infrecuentes observadas. Sin embargo, excluyendo las especies que solo se registraron en uno o dos muestreos y aquellas para las que se capturó un único ejemplar, se estima que se han detectado respectivamente el 90,8% y el 89,0% de las especies de la zona. Se considera por ello que no resultaría rentable en términos de coste-eficacia proseguir los muestreos un año más, dado que la mayoría de las nuevas especies registradas tendrán probablemente carácter accidental. Estos resultados ponen de manifiesto el importante esfuerzo de muestreo necesario para completar un inventario de mariposas nocturnas con un grado de calidad aceptable en comparación con otros grupos faunísticos.

PALABRAS CLAVE: Insecta, Lepidoptera, inventario, esfuerzo de muestreo, curva de acumulación de especies, Álava, España.

Evaluation of the quality of the inventory of Macroheterocera of the Salburua wetlands (Alava, Spain) (Insecta: Lepidoptera)

Abstract

The quality of a Macroheterocera inventory for which 208 weekly samplings have been carried out over a four-year period in the Salburua wetlands (Vitoria, Alava) is evaluated through an analysis of the species accumulation curve. The overall results obtained do not allow a reliable estimate of the total species richness due to the high proportion of rare or infrequent species observed. However, excluding the species that were only recorded in one or two samples and those for which a single specimen was captured, it is estimated that 90.8% and 89.0% of the species in the area have been detected respectively. It is therefore considered that it would not be profitable in terms of cost-effectiveness to continue sampling for an additional year, since most of the new species registered will probably be accidental. These results highlight the great sampling effort required to complete an inventory of moths with an acceptable degree of quality in comparison with other faunal groups.

KEY WORDS: Insecta, Lepidoptera, inventory, sampling effort, species accumulation curve, Alava, Spain.

Introducción

A medida que se va completando un inventario faunístico se requiere cada vez un mayor esfuerzo de muestreo para conseguir el mismo incremento en el número de especies registradas. Se puede

plantear entonces la cuestión de hasta cuándo proseguir con los muestreos en términos de coste-eficacia (BÉGUINOT, 2015). Las curvas de acumulación de especies, que permiten extrapolar el número de especies observadas para estimar el total de especies presentes en la zona prospectada (SOBERÓN & LLORENTE, 1993), pueden utilizarse también para valorar la calidad de los inventarios (véase a MORENO & HALFFTER, 2000).

Aunque WILLOTT (2001) sostiene que el esfuerzo de muestreo debe medirse por el número de ejemplares capturados para que las curvas de acumulación de especies correspondientes a distintos lugares sean comparables, para la planificación de los inventarios resulta más práctico expresar el esfuerzo en unidades de muestreo estándar, tales como el número de trampas x noches (MORENO & HALFFTER, 2001).

Dado que el orden en el que se consideren los muestreos afecta a la forma de la curva de acumulación de especies, es una práctica habitual el recurrir a la “suavización” de las curvas calculando los valores medios del número de especies que se obtienen al aleatorizar el orden de los muestreos un número suficiente de veces (THOMPSON & THOMPSON, 2007).

En un inventario de lepidópteros los resultados obtenidos en cuanto a número de especies van a depender mucho de la estacionalidad de los muestreos, debido a las notables diferencias fenológicas entre especies (SUMMERVILLE & CRIST, 2005). Hemos considerado interesante por ello evaluar los resultados de un seguimiento a largo plazo en el que el esfuerzo de muestreo se ha mantenido constante a lo largo del año.

Material y métodos

Entre septiembre de 2016 y septiembre de 2020 se han llevado a cabo 208 muestreos semanales con una trampa de luz fija ubicada en los humedales de Salburua (Vitoria, Álava). Para más detalles sobre la metodología de este inventario puede consultarse DE JUANA *et al.* (2019).

Para construir las curvas de acumulación de especies se ha utilizado el programa EstimateS (COLWELL, 2019). La riqueza estimada en función del esfuerzo de muestreo realizado se calculó aleatorizando 100 veces el orden de las muestras, número que se considera suficiente para lograr el suavizado de las curvas (JIMÉNEZ-VALVERDE & HORTAL, 2003). Para el ajuste de funciones mediante regresión se ha utilizado el programa CurveExpert Professional (HYAMS, 2020).

Resultados

En los 208 muestreos realizados se capturaron un total de 8.231 ejemplares de 373 especies diferentes de Macroheterocera, considerando como tales las superfamilias Bombycoidea, Geometroidea, Cossioidea, Drepanoidea, Hepialoidea, Lasiocampoidea y Noctuoidea. El número de ejemplares por especie varió entre 1 y 520, con una mayoría de especies escasas: 189 (50,67%) con 5 o menos ejemplares frente a solo 15 (4,02%) con más de 100 (fig. 1).

En cuanto a la frecuencia de captura, 173 especies (46,38%) aparecieron en menos de cuatro muestreos (<1,5%) y solo 44 (11,80%) lo hicieron en más de 20 (>10%) (fig. 2).

Cabe concluir, a la vista de estos datos, que una alta proporción de las especies capturadas tienen una probabilidad baja de ser encontradas, bien por ser raras, bien por tener carácter accidental en la zona o bien por ser lucífugas en mayor o menor grado. Se han construido por ello tres curvas de acumulación distintas (fig. 3): una con todas las especies registradas, otra eliminando aquellas para las que se ha capturado un único ejemplar y otra eliminando las que han aparecido solo en uno o dos muestreos (<1,0%). En la tabla I se indica para cada familia el número y porcentaje de las especies que hemos considerado raras o accidentales siguiendo estos criterios. En la figura 4 se representa cómo varían esos porcentajes en función del número de muestreos realizados.

Para cada curva de acumulación de especies se han ajustado las tres funciones propuestas por SOBERÓN & LLORENTE (1993), obteniéndose en cada caso los coeficientes de regresión (R^2) que aparecen en la tabla II. Para todas ellas los mejores ajustes se consiguen con la función de Clench. En la figura 5 se representan las tres curvas de acumulación ajustadas utilizando dicha función.

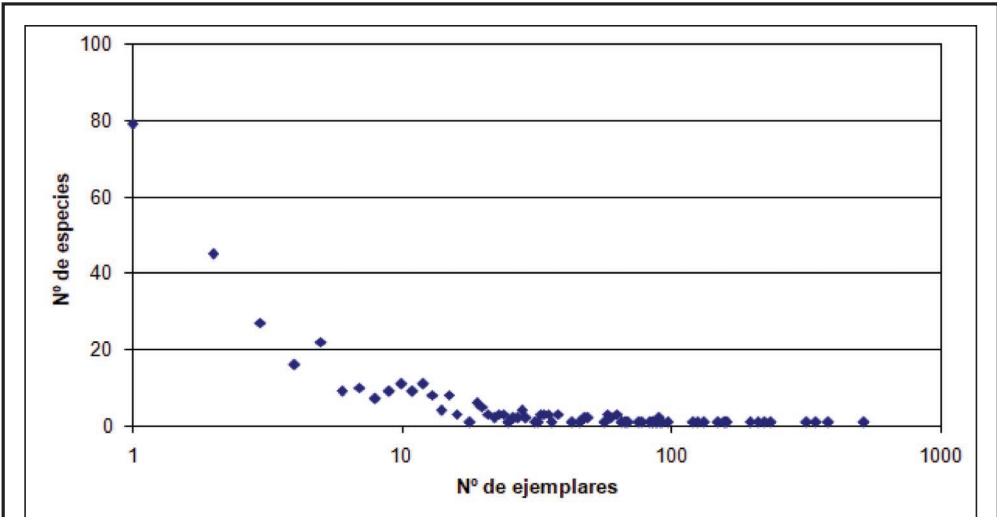


Fig. 1.- Distribución del número de especies según el número total de ejemplares capturados para cada una de ellas (en escala logarítmica).

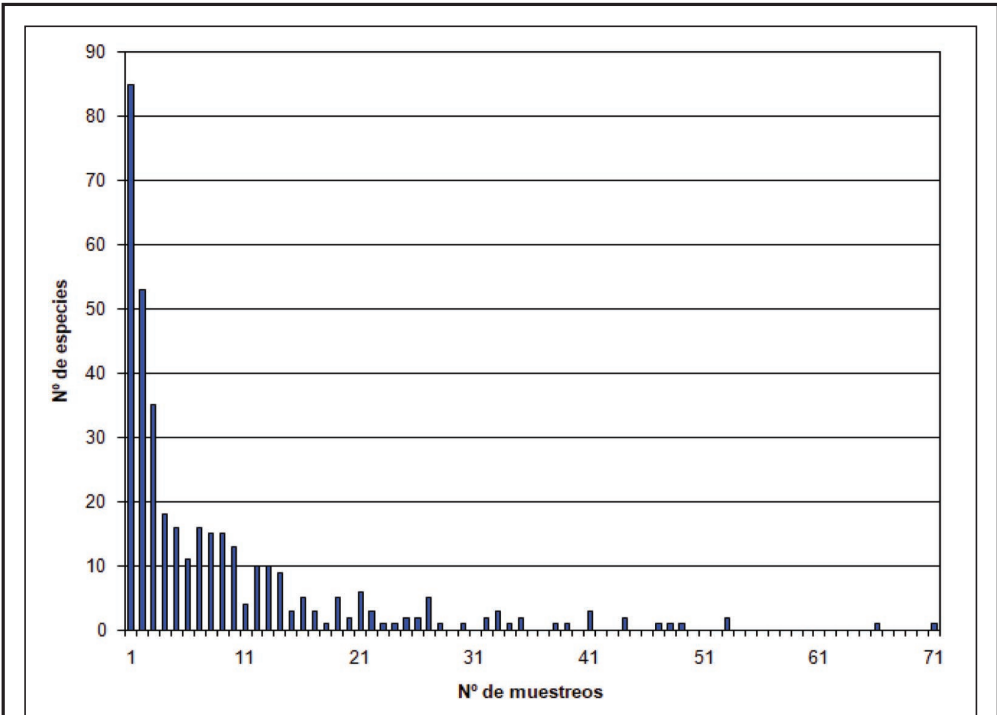


Fig. 2.- Distribución del número de especies según el número de muestreos en que se capturó cada una de ellas.

Tabla I.– Se indica para cada familia el número de especies con un solo ejemplar capturado y el de las que aparecieron solo en uno o dos muestreos, así como los respectivos porcentajes respecto del total.

	Total de especies	Especies con un solo ejemplar		Especies en 1 o 2 muestreos	
Cossidae	2	1	50,00%	1	50,00%
Drepanidae	7	0	0,00%	0	0,00%
Erebidae	40	6	15,00%	13	32,50%
Geometridae	120	37	30,83%	55	45,83%
Hepialidae	1	0	0,00%	0	0,00%
Lasiocampidae	9	2	22,22%	3	33,33%
Noctuidae	161	26	16,15%	50	31,06%
Nolidae	8	1	12,50%	4	50,00%
Notodontidae	17	4	23,53%	8	47,06%
Sphingidae	8	2	25,00%	4	50,00%
TOTAL	373	79	21,18%	138	37,00%

Tabla II.– Coeficientes de regresión (R^2) obtenidos con cada función para las curvas de acumulación del total de especies (I), de las especies con más de un ejemplar capturado (II) y de las especies que aparecieron en más de 2 muestreos (III).

	Exponencial $S_n = a \cdot b(1 - e^{-b \cdot n})$	Logarítmica $S_n = 1/z \cdot \ln(1 + z \cdot a \cdot n)$	Clench $S_n = a \cdot n / (1 + b \cdot n)$
I	0.9845	0.9934	0.9972
II	0.9902	0.9912	0.9997
III	0.9943	0.9707	0.9972

En la tabla III se muestran los valores de algunos parámetros que suelen utilizarse como indicadores de la calidad del inventario y que para el modelo de Clench se calculan mediante las siguientes fórmulas (JIMÉNEZ-VALVERDE & HORTAL, 2003):

- Riqueza estimada: $S_{est} = a/b$, donde a es la tasa de incremento de nuevas especies al comienzo del inventario y b es un parámetro relacionado con la forma de la curva.
- Número de muestreos necesarios para registrar un proporción q de las especies: $n_q = q/[b \cdot (1-q)]$.
- Pendiente de la curva para n muestreos: $p_n = a/(1+b \cdot n)^2$.

Tabla III.– Riqueza observada (S_{obs}), riqueza estimada (S_{est}), proporción de especies inventariadas (S_{obs}/S_{est}), número de muestreos necesarios para registrar el 90% de las especies ($n_{0,9}$) y pendiente de la curva para 208 muestreos (p_{208}) para las curvas de acumulación del total de especies (I), de las especies con más de un ejemplar capturado (II) y de las especies que aparecieron en más de 2 muestreos (III).

	S_{obs}	S_{est}	S_{obs}/S_{est}	$n_{0,9}$	p_{208}
I	373	427,9	87,2%	329,4	0,262
II	294	330,3	89,0%	207,4	0,143
III	235	258,9	90,8%	138,1	0,080

Siguiendo a MORENO & HALFFTER (2000), que proponen una proporción del 90% del total de especies estimadas como un objetivo conservador, pero satisfactorio, en cuanto a la calidad del inventario, hemos incluido en la tabla III el número de muestreos necesarios para alcanzar dicha proporción.

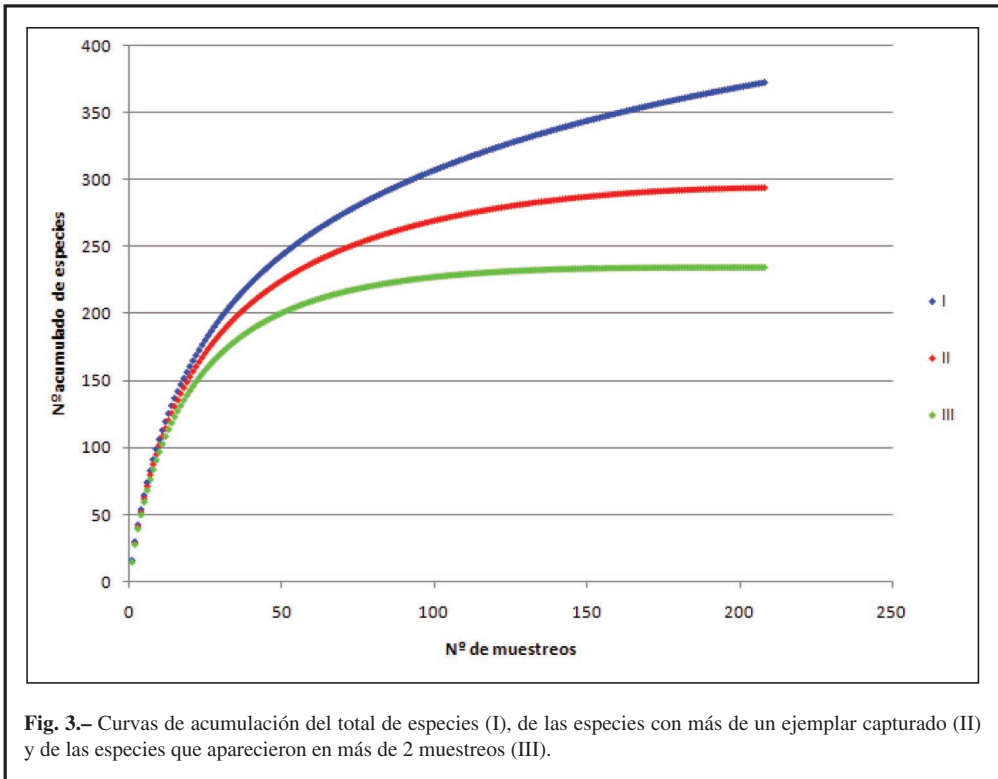


Fig. 3.- Curvas de acumulación del total de especies (I), de las especies con más de un ejemplar capturado (II) y de las especies que aparecieron en más de 2 muestreos (III).

Discusión

La curva de acumulación de especies calculada para el inventario de macroheteróceros de los humedales de Salburua se ajusta bien a una función de Clench que tiende de manera asintótica hacia las 428 especies. Sin embargo, dado que la pendiente de la curva correspondiente a los 208 muestreos realizados es muy superior a 0,1, resulta aventurado realizar una extrapolación del número total de especies que podrían llegar a inventariarse (JIMÉNEZ-VALVERDE & HORTAL, 2003). El hecho de que con el considerable esfuerzo de muestreo realizado no pueda hacerse aún una estimación fiable de la riqueza total obedece a la alta proporción de especies escasas o infrecuentes observadas, lo que en buena medida puede explicarse por la alta movilidad que presentan numerosas especies de mariposas nocturnas (BETZHOLTZA & FRANZÉN, 2013). JONASON *et al.* (2014), que realizaron un inventario de macroheteróceros en un pastizal situado en una zona de agricultura intensiva del estado alemán de Sajonia muestreando durante 225 noches con una lámpara de vapor de mercurio de 250 W y con otra de luz ultravioleta de 40 W, obtuvieron resultados parecidos a los nuestros en cuanto a la proporción de especies con un solo ejemplar capturado, con porcentajes del 22,16% y 19,73% para cada tipo de lámpara respectivamente. En otro estudio comparable, YELA (1992) realizó 46 muestreos de noctuoides (excluyendo las subfamilias Arctiinae y Lymantriinae) en un encinar, 45 en un quejigal y 46 en un valle ripario con huertas de la Alcarria (Guadalajara), con porcentajes de especies con un solo ejemplar capturado del 15,84%, 15,65% y 19,43% respectivamente. Este autor constató que en el valle ripario aparecían en verano de manera más o menos accidental muchas de las especies propias de los ambientes más xéricos de encinares y quejigares, lo que atribuyó al efecto de “refugio ecológico” que, en ecosistemas de tipo mediterráneo, caracterizados por un período estival de sequía, desempeñan los ambientes permanentemente húmedos. Es probable también que los medios abiertos presenten una

mayor permeabilidad para los ejemplares divagantes que los hábitats forestales. En cualquier caso, a la hora de comparar datos de distintos inventarios habrá que tener en cuenta que el porcentaje de especies raras o accidentales va a depender no solo del hábitat prospectado, sino de los grupos taxonómicos estudiados (tabla I), del esfuerzo de muestreo realizado (fig. 4) y del tipo de trampa empleada.

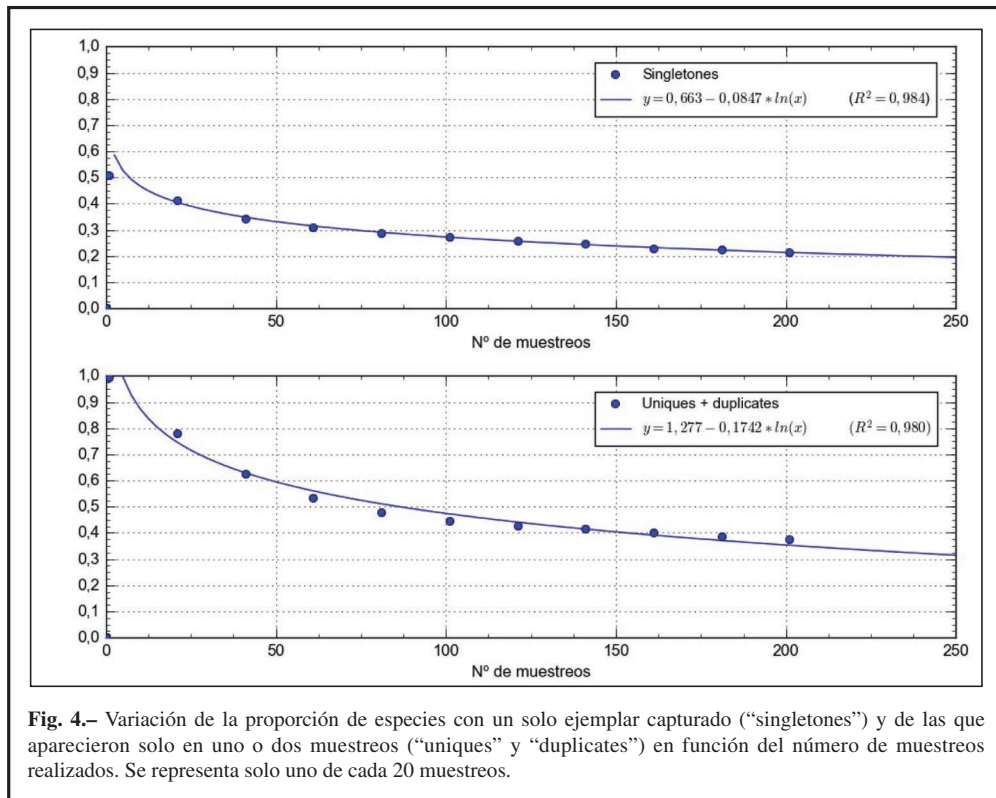
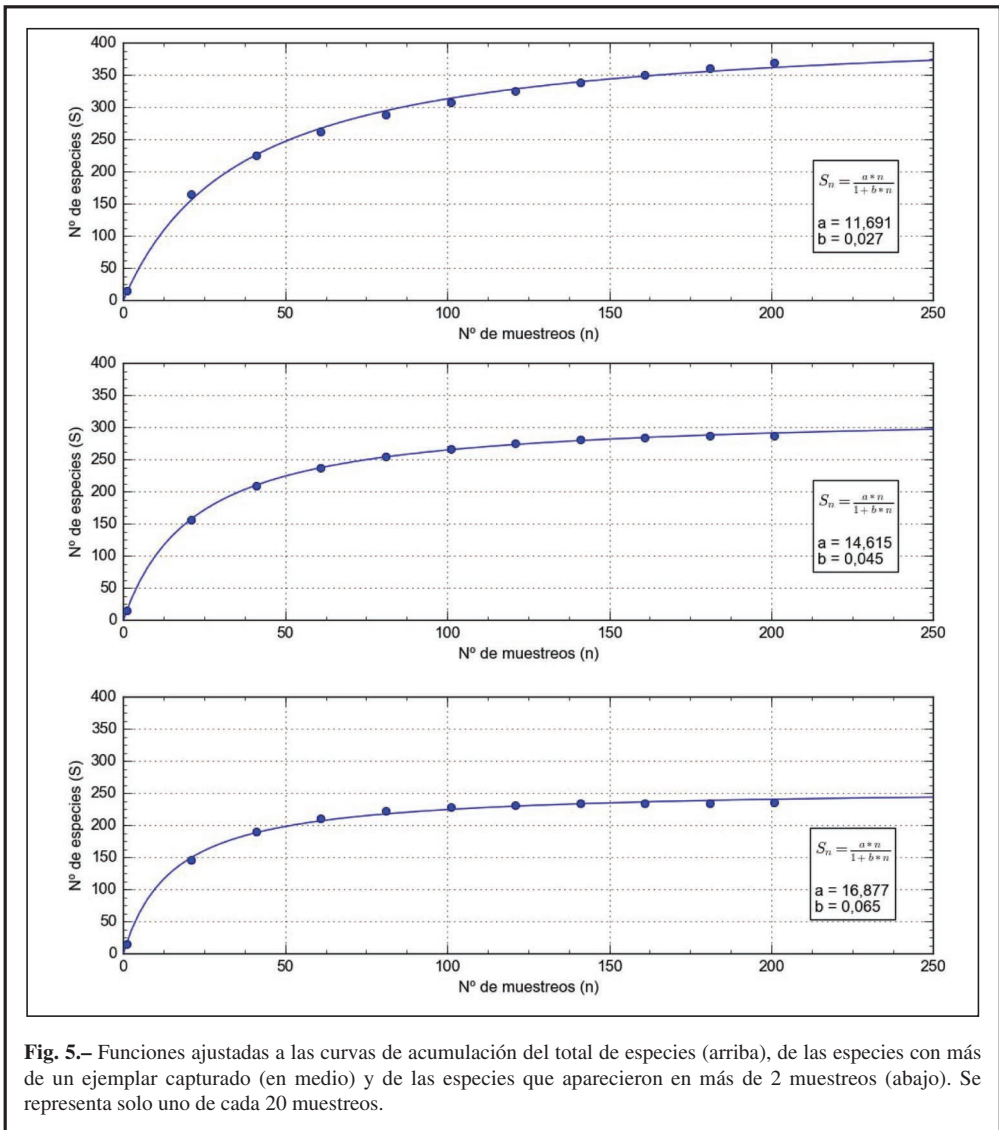


Fig. 4.– Variación de la proporción de especies con un solo ejemplar capturado (“singletons”) y de las que aparecieron solo en uno o dos muestreos (“uniques” y “duplicates”) en función del número de muestreos realizados. Se representa solo uno de cada 20 muestreos.

A efectos de valorar la calidad de un inventario de macroheteróceros, interesaría saber qué proporción se ha observado del total de especies autóctonas, considerando como tales las que habitualmente completan su desarrollo ontogénico en el hábitat muestreado (YELA, 1992). Pero esta diferenciación entre especies propias y extrañas exige un conocimiento profundo de la alimentación larvaria y la biología de cada una de ellas que complica mucho este enfoque. Cabe suponer que muchas de las especies muy escasas o muy infrecuentes tengan carácter accidental en la zona, pero no hay que olvidar que hay especies propias que resultan raras debido a su estrategia vital o a ser escasamente atraídas por la luz (YELA, 1992). *Globia algae* (Esper, 1789), por ejemplo, es una especie característica de hábitats palustres de la que no hemos capturado más que dos ejemplares en dos muestreos distintos. Aún así, y aunque hayamos podido excluir algunas especies propias de la zona húmeda objeto del inventario, hemos construido las curvas de acumulación prescindiendo de las especies más escasas (aquellas de las que se ha capturado un único ejemplar) y de las menos frecuentes (aquellas que aparecen solo en uno o dos muestreos). Ambas curvas se ajustan también bien a la función de Clench, con asíntotas en 330 y 259 especies respectivamente.

Solamente aplicando el criterio más restrictivo, es decir, el que considera únicamente las especies que aparecen en más de dos muestreos, se obtienen resultados satisfactorios en cuanto a la calidad del inventario: más de un 90% en la proporción de especies inventariadas y una pendiente de la curva inferior a 0,1 en el punto correspondiente a los 208 muestreos realizados. Para alcanzar estos objetivos,

de acuerdo con la función ajustada, hubiesen sido suficientes 138 muestreos, que equivalen a tres años de muestreos semanales. Si el criterio utilizado es el de excluir las especies con un único ejemplar capturado, el objetivo se alcanza teóricamente con 208 muestreos (4 años de muestreos semanales), aunque en nuestro caso nos hayamos quedado ligeramente por debajo del 90% en la proporción de especies inventariadas. Si bien nuestra intención es continuar los muestreos en el humedal de Salburua a largo plazo, creemos que, si el objetivo del estudio hubiese sido únicamente el de completar el inventario faunístico, no resultaría rentable en términos de coste-eficacia proseguir un año más. Según la función ajustada a la curva de acumulación de especies, la riqueza estimada para 260 muestreos es de 379 especies, es decir que en un año más se registrarían solo 6 especies nuevas, la mayoría de las cuales tendrán probablemente carácter accidental en la zona.



Los resultados de este trabajo ponen de manifiesto el importante esfuerzo de muestreo necesario para completar un inventario de mariposas nocturnas con un grado de calidad aceptable si los comparamos con los obtenidos por otros autores para otros grupos faunísticos. Así por ejemplo, de los datos presentados por JIMÉNEZ-VALVERDE & HORTAL (2003) se deduce que en el caso de las arañas de las familias Araneidae y Thomisidae harían falta 28 unidades de esfuerzo de muestreo para llegar a inventariar el 90% de las especies, mientras que según MORENO & HALFFTER (2000) se necesitarían entre 5 y 18 noches de muestreo para alcanzar ese objetivo con murciélagos, cifras referidas en ambos casos al lugar prospectado y a la metodología utilizada en esos estudios. Se ha comprobado, no obstante, que en los inventarios de lepidópteros nocturnos el número de especies capturadas puede aumentarse ligeramente eligiendo para muestrear las noches más cálidas de cada mes (JONASON *et al.*, 2014) o, en hábitats mediterráneos, las noches más cálidas en primavera, otoño e invierno y las más frescas en verano (YELA & HOLYOAK, 1997), en lugar de hacerlo siempre el mismo día de la semana.

Es importante recalcar que los resultados de este trabajo solo son comparables con inventarios de análogos características al que nosotros hemos llevado a cabo, es decir, con el mismo tipo de trampa y con muestreos homogéneamente repartidos a lo largo del año.

Agradecimiento

A Gorka Belamendia, Brian Webster y José Luis Albalá, que sustituyeron al autor en la realización de algunos de los muestreos que han servido de base a este trabajo, así como al personal técnico del Centro de Interpretación de los Humedales de Salburua (Ataria), sin cuya colaboración no se hubiese podido llevar a cabo. Al Dr. José Luis Yela por sus valiosas orientaciones y sugerencias. A los revisores anónimos del manuscrito.

BIBLIOGRAFÍA

- BÉGUINOT, J., 2015.– When reasonably stop sampling? How to estimate the gain in newly recorded species according to the degree of supplementary sampling effort.– *Annual Research & Review in Biology*, **7**(5): 300-308.
- BETZHOLTZA, P.-E. & FRANZÉN, M., 2013.– Ecological characteristics associated with high mobility in night-active moths.– *Basic and Applied Ecology*, **14**: 271-279.
- COLWELL, R. K., 2019.– *EstimateS: Statistical Estimation of Species Richness and Shared Species from Samples (Software and User's Guide), Versión 9.1.0*. Disponible en <http://viceroy.colorado.edu/estimates/EstimateSPages/EstimateSRegistration.htm>.
- DE JUANA, F., MONASTERIO, Y., ESCOBÉS, R., ALBALÁ, J. L., BELAMENDIA, G., DE OLANO, I., SEBASTIÁN, J. & WEBSTER, B., 2019.– Los macroheteróceros (Lepidoptera) de los humedales de Salburua (Vitoria-Gasteiz, Araba/Álava, España): un proyecto de ciencia ciudadana.– *Boletín Sociedad Entomológica Aragonesa*, **64**: 165-185.
- HYAMS, D. G., 2020.– *CurveExpert Professional: documentation*. Disponible en: <https://docs.curveexpert.net/curveexpert/pro/html/>.
- JIMÉNEZ-VALVERDE, A. & HORTAL, J., 2003.– Las curvas de acumulación de especies y la necesidad de evaluar la calidad de los inventarios biológicos.– *Revista Ibérica de Aracnología*, **8**: 151-161.
- JONASON, D., FRANZÉN, M. & RANIUS, T., 2004.– Surveying moths using light traps: effects of weather and time of year.– *PLoS ONE* **9**(3): e92453. doi:10.1371/journal.pone.0092453.
- MORENO, C. E. & HALFFTER, G., 2000.– Assessing the completeness of bat biodiversity inventories using species accumulation curves.– *Journal of Applied Ecology*, **37**: 149-158.
- MORENO, C. E. & HALFFTER, G., 2001.– On the measure of sampling effort used in species accumulation curves.– *Journal of Applied Ecology*, **38**: 487-490.
- SOBERÓN, J. & LLORENTE, J., 1993.– The use of species accumulation functions for the prediction of species richness.– *Conservation Biology*, **7**: 480-488.

- SUMMERVILLE, K. S. & CRIST, O. C., 2005.– Temporal patterns of species accumulation in a survey of Lepidoptera in a beech-maple forest.– *Biodiversity and Conservation*, **14**: 3393-3406.
- THOMPSON, G. G. & THOMPSON, S. A., 2007.– Using species accumulation curves to estimate trapping effort in fauna surveys and species richness.– *Austral Ecology*, **32**: 564-569.
- WILLOTT, S. J., 2001.– Species accumulation curves and the measure of sampling effort.– *Journal of Applied Ecology*, **38**: 484-486.
- YELA, J. L., 1992.– *Los noctuidos (Lepidoptera) de la Alcarria (España central) y su relación con las principales formaciones vegetales de porte arbóreo*: 569 pp. Ministerio de Agricultura, Pesca y Alimentación, Dirección General de Sanidad de la Producción Agraria, Subdirección General de Sanidad Vegetal. Madrid.
- YELA, J. L. & HOLYOAK, M., 1997.– Effects of moonlight and meteorological factors on light and bait trap catches of noctuid moths (Lepidoptera: Noctuidae).– *Environmental Entomology*, **26**(6): 1283-1290.

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REVISIÓN DE PUBLICACIONES BOOK REVIEWS

Z. Weidenhoffer, G. C. Bozano & S. Churkin
Guide to the Butterflies of the Palearctic Region: Lycaenidae
part II
94 páginas
Formato 29'5 x 21 cm
Omnes Artes, Milano, 2004
ISBN: 88-87989-06-0

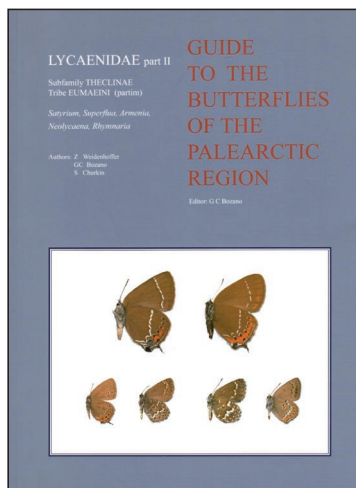
Una nueva entrega de esta interesante serie conocida como *Guide to the Butterflies of the Palearctic Region* ha sido publicada, concretamente se trata de la segunda parte de los Lycaenidae Leach, [1815], estudiándose la subfamilia Theclinae Swainson, 1831 y la Tribu Eumaeini Doubleday, 1847 (en parte) y dentro de ella los géneros *Satyrium* Scudder, 1876 (con tres subgéneros *Satyrium* Scudder 1876, *Superflua* Strand, 1910 y *Armenia* Dubatolov & Koeshunov, 1984) y *Neolycaena* Niceville, 1890 (con dos subgéneros *Neolycaena* Niceville, 1890 y *Rhynmaria* Zndanko, 1983).

En esta entrega se describe una nueva especie *Satyrium* (*Superflua*) *nikiforovi* Weidenhoffer, sp. n., se establecen 15 nuevas sinonimias, una nueva combinación y un nuevo estatus, tratándose 45 especies.

De todas y cada una de las especies, nos presentan la descripción original, así como de todas las sinonimias consideradas, al igual que ocurre con las subespecies que los autores consideran como válidas en este trabajo. También nos encontramos con las principales características que nos permiten diagnosticarlas, datos sobre la morfología de la genitalia del macho, interesantes notas taxonómicas, datos sobre su distribución (que podemos ver en un mapa de la región Paleártica) y las principales referencias bibliográficas consideradas. Es importante destacar, que se presentan excelentes fotografías de los ejemplares, no sólo de la especie original, si no de un gran número de subespecies consideradas. Termina la obra con una detallada bibliografía específica, que recoge todas las referencias contempladas a lo largo del trabajo y que consideramos imprescindibles en su conjunto.

No podemos terminar estas líneas, sobre este excelente trabajo y, de la que ya podemos considerar como una serie clásica, sin felicitar a los autores por la realización de tan importante trabajo, así como a la Editorial una vez más, por su dedicación en publicar esta obra básica, que no debe de faltar en ninguna biblioteca que se precie, tanto institucional como particular. El precio de este libro es de 32 euros y los interesados lo pueden pedir a:

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Homona spargotis Meyrick, 1910: First report on a *Eucalyptus grandis* W. Hill × *Eucalyptus pellita* F. Muell. (Myrtaceae) hybrid in Sumatra, Indonesia (Lepidoptera: Tortricidae)

T. Melia, N. G. H. B. Sinulingga, M. V. Maretha, A. Nasution, A. L. Gaol, K. D. Puspita, S. K. Kkadan, W. de S. Tavares, M. Tarigan & A. Duran

Abstract

All potential pests (e.g., defoliating lepidopterans) of *Eucalyptus* L'Hér. (Myrtaceae) are important to be recorded because of multiple species from this plant genus are ubiquitously planted in forest plantations across the tropics, including Sumatra, Indonesia. The objective of this study was to record, for the first time, a species closest to the avocado leafroller, *Homona spargotis* Meyrick, 1910 (Lepidoptera: Tortricidae) on a *Eucalyptus grandis* W. Hill × *Eucalyptus pellita* F. Muell. hybrid in Sumatra with the insect species identification performed via molecular analysis. The used molecular protocol was able to identify a similar, yet distinct insect species to *H. spargotis* through analysis of its larvae, which defines its geographical distribution to Sumatra and identified a host species (i.e., *E. grandis* × *E. pellita*) for this insect.

KEY WORDS: Lepidoptera, Tortricidae, defoliation, *Ericiana spargotis*, Myrtales, Sumatra, Indonesia.

Homona spargotis Meyrick, 1910: Primer registro sobre un híbrido de *Eucalyptus grandis* W. Hill × *Eucalyptus pellita* F. Muell. (Myrtaceae) en Sumatra, Indonesia (Lepidoptera: Tortricidae)

Resumen

Todas las plagas potenciales (por ejemplo, lepidópteros defoliadores) del *Eucalyptus* L'Hér. (Myrtaceae) son importantes para ser registradas porque múltiples especies de este género de plantas son ubiquestas en plantaciones en bosques al otro lado de los trópicos, incluyendo Sumatra, Indonesia. El objetivo de este estudio fue registrar, por primera vez, una especie próxima del aguacate, *Homona spargotis* Meyrick, 1910 (Lepidoptera: Tortricidae) sobre un híbrido del *Eucalyptus grandis* W. Hill × *Eucalyptus pellita* F. Muell. en Sumatra, la identificación de la especie del insecto funcionó vía el análisis molecular. El protocolo molecular usado podría identificar una especie de insecto similar, sin embargo, una especie de insecto similar a *H. spargotis* a través del análisis de sus larvas, que definiría su distribución geográfica en Sumatra e identificaría una especie de anfitrión (por ejemplo *E. grandis* × *E. pellita*) para este insecto.

PALABRAS CLAVE: Lepidoptera, Tortricidae, defoliación, *Ericiana spargotis*, mirtácea, Sumatra, Indonesia.

Introduction

Eucalyptus L'Hér. (Myrtales: Myrtaceae) is largely planted in Sumatra, Indonesia for production of paper, pulp and viscose goods (PRASETYO *et al.*, 2019; INAIL *et al.*, 2019). These goods are used to supply the local market as well as being imported to countries such as China, India, Malaysia,

Singapore, and South Korea (SZULECKA *et al.*, 2016). *Eucalyptus* plantations in Sumatra are predominantly grown with *Eucalyptus pellita* F. Muell. and the hybrids of *Eucalyptus grandis* W. Hill. × *E. pellita* (BOPHELA *et al.*, 2019; TACHI *et al.*, 2020; TAVARES *et al.*, 2020). Several lepidopteran species have been recorded to infest *Eucalyptus* in Sumatra, including *Ophiusa disjungens* (Walker, 1858) (Erebidae) (RAIMON *et al.*, 2020), *Polyphagozerra coffeae* (Nietner, 1861) (Cossidae) (TAVARES *et al.*, 2020; TACHI *et al.*, 2020), *Strepsicrates* sp. (Tortricidae) (KKADAN *et al.*, 2020a, 2020b), and *Tetracona amathealis* (Walker, 1859) (Crambidae) (MELIA *et al.*, 2021).

The *Homona spargotis* Meyrick, 1910 (Lepidoptera: Tortricidae), of the *coffearia* group, was known previously as *Ericiana spargotis* and native to the Northern Territory and Queensland, Australia and currently apparently distributed in the Australasian realm, where is considered a potential pest on a variety of tropical crops (HERBISON-EVANS & CROSSLEY, 2004; HULCR *et al.*, 2007). The larvae feed primarily on avocado, *Persea americana* Mill. (Laurales: Lauraceae) and sporadically on coffee, *Coffea arabica* L. (Gentianales: Rubiaceae), custard-apple, *Annona reticulata* L. (Magnoliales: Annonaceae), lychee, *Litchi chinensis* Sonn. (Sapindales: Sapindaceae), macadamia, *Macadamia* spp. (Proteales: Proteaceae), narra, *Pterocarpus indicus* Willd. (Fabales: Fabaceae), pariparoba, *Piper umbellatum* L. (Piperales: Piperaceae), star fruit, *Averrhoa bilimbi* L. (Oxalidales: Oxalidaceae), and tea plant, *Camellia sinensis* (L.) Kuntze (Ericales: Theaceae) (HERBISON-EVANS & CROSSLEY, 2004; HULCR *et al.*, 2007). *H. spargotis* has not been recorded in Australia from any native host, except *Macadamia* spp. and *P. indicus* suggesting its potential as polyphagous on rainforest plants (WHITTLE *et al.*, 1987).

Homona spargotis larvae form a shelter made of rolled leaves held with silk where it lives and feeds. The adult moths are a patchy brown (HERBISON-EVANS & CROSSLEY, 2004), inactive during daytime and found resting in leaf litter and in the canopy (WHITTLE *et al.*, 1987). The wingspan is about 14.0-19.5 mm for males and 20.0-28.0 mm for females (MEYRICK, 1910; WHITTLE *et al.*, 1987). The eggs are yellow and flatted. They are laid on the upper section of the host plant crown in overlapping masses of several hundred (HERBISON-EVANS & CROSSLEY, 2004). The moths have an unusual resting posture, with the hindwings protruding from under the forewings, and the protruded parts folded over (ZBOROWSKI & EDWARDS, 2007).

Not only to identify species, DNA barcoding may also be used to establish species boundary, as recently shown to distinguish multiple species within the *Homona* genus (HULCR *et al.*, 2007) and Hesperiiidae (HEBERT *et al.*, 2004). Genetic distances calculated from the highly conserved mitochondrial cytochrome c oxidase subunit I (mt-COI) gene were shown to form bimodal distribution, clearly separating genetic distance between insects belonging to the same species *vs.* across species, i.e., intraspecific *vs.* interspecific genetic distance. Insects within the same species were shown to share similar DNA sequences, corresponding to unique haplotypes associated with morphologically and ecologically distinct caterpillars (HULCR *et al.*, 2007), hence they have a much smaller pairwise genetic distances.

The objectives of the current study were to report the finding of *Homona spargotis* in Sumatra, Indonesia, confirmed by molecular analysis, and to add a new plant host for this insect.

Material and methods

COLLECTION OF *HOMONA SPARGOTIS*

Homona spargotis larvae were collected manually from trees of an *E. grandis* × *E. pellita* hybrid in a commercial stand during the first semester of 2020 in Pangkalan Kerinci area (0° 20' N × 101° 51' E, 10 m altitude) in Riau, Sumatra, Indonesia. Larvae were placed in one-liter plastic containers and taken to the Entomology Laboratory of the Asia Pacific Resources International Holdings Ltd. (APRIL) of the PT. Riau Andalan Pulp and Paper (RAPP), where they were kept in a room at 26 ± 2° C, 75 ± 15% RH and 14:10 (L:D) h photoperiod. Caterpillars received daily fresh shoots of *E. grandis* × *E. pellita* as a food.

MOLECULAR IDENTIFICATION OF *HOMONA SPARGOTIS*

One caterpillar was used for species name confirmation through molecular analysis. DNA extraction and PCR of the mt-COI gene were carried out as previously described (MELIA *et al.*, 2021). The PCR product was then sent to a service provider for Sanger Sequencing. Trimming and consensus sequence building were carried out using the sangeranalyseR package (CHAO *et al.*, 2020) with default settings. We used the consensus sequence to find the most similar sequence in NCBI GenBank using blastn (ALTSCHUL *et al.*, 1990). The top hit, sorted by the highest score, is kept. The consensus sequence, top hits from the blast search as well as several sequences from the *Homona* sp. Meyrick were aligned using Clustal Omega (SIEVERS *et al.*, 2011), and conserved sequences were identified using Gblocks (TALAVERA & CASTRESANA, 2007). The output was used to build a phylogenetic tree using the maximum likelihood approach (FELSENSTEIN *et al.*, 1981) with a bootstrap value of 1,000 and GTR as the DNA substitution model (TAVARÉ, 1986), which were implemented in the phangorn R package (SCHLIEP *et al.*, 2011).

Species boundary analyses were performed using mt-COI sequences from 65 insects belonging to the *Homona* genus submitted to NCBI GenBank, which were all available sequences from *H. spargotis* (13 sequences) and *Homona aestivana* (Walker, 1866) (12 sequences) as well as a maximum of 20 sequences each from *Homona mermerodes* Meyrick, 1910 and *Homona trachyptera* Diakonoff, 1941. These four species were selected following previously published data examining species determination amongst generalist moths (HULCR *et al.*, 2007). Sequences were then aligned to find conserved blocks using the same approach described previously. The resulting aligned sequences were used to calculate genetic distance as implemented in the phangorn R package with default settings. A total of 2080 genetic distances was calculated between all possible pairwise combinations within our dataset, which were then plotted as a histogram.

Results

REPORT OF *H. SPARGOTIS* IN SUMATRA

This is the first report of *H. spargotis* in Sumatra (Fig. 1).

REPORT OF *H. SPARGOTIS* ON *E. GRANDIS* × *E. PELLITA*

The *H. spargotis* larvae were collected while feeding on an *E. grandis* × *E. pellita* hybrid, which represents a new host plant species for this insect.

MOLECULAR ANALYSIS

Species identification through sequencing of the mt-COI gene has become an accepted approach given the difficulty of identification through insect body morphology. Here, we report a leafroller whose closest species is *H. spargotis* based on molecular analysis (Table 1). This similarity is stable as our sample are clustered together with *H. spargotis* in 67% of the 1,000 bootstraps (Fig. 2). Despite the sequence resemblance to *H. spargotis*,

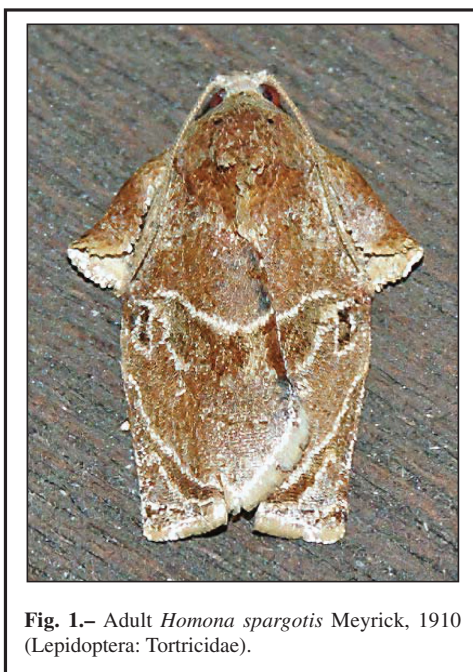


Fig. 1.– Adult *Homona spargotis* Meyrick, 1910 (Lepidoptera: Tortricidae).

our sample is clustered less tightly with the rest of *H. spargotis*, as compared to other intra-species clustering within the *Homona* genus (Fig. 2).

Origin	Score	E value	Identity	Accession
Pangkalan Kerinci, Riau, Sumatra, Indonesia	856	0.0	94%	GU688782.1 <i>Homona spargotis</i>

Table 1.– Origin, score, E value, identity, and accession

Origin	Score	E value	Identity	Accession
Pangkalan Kerinci, Riau, Sumatra, Indonesia	856	0.0	94%	GU688782.1 <i>Homona spargotis</i>

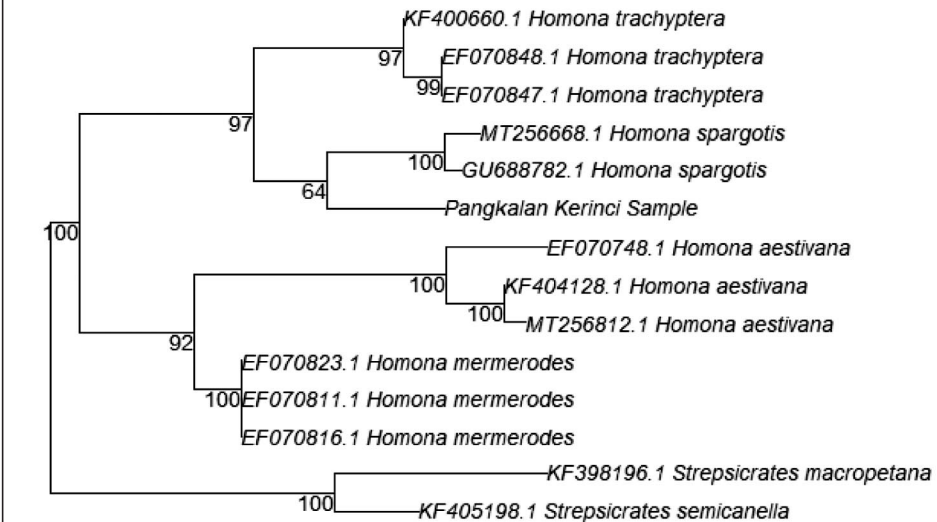


Fig. 2.– Phylogenetic tree on *Homona spargotis* Meyrick, 1910 (Lepidoptera: Tortricidae).

We calculated and plotted the distribution of all possible pairwise genetic distance in four *Homona* species included in our dendrogram (Figs. 2-3). Interestingly, we confirm the existence of bimodal distribution, separating intra species with inter species genetic distances (Fig. 3). Based on our data, any pairwise genetic distance that exceeds 0.045 are likely to come from samples of different species. The closest genetic distance of our sample to any *H. spargotis* is 0.053 (to *H. spargotis* with NCBI accession EF070841.1), which falls within the range of inter species genetic distances. Thus, we concludes our sample is *Homona spargotis*.

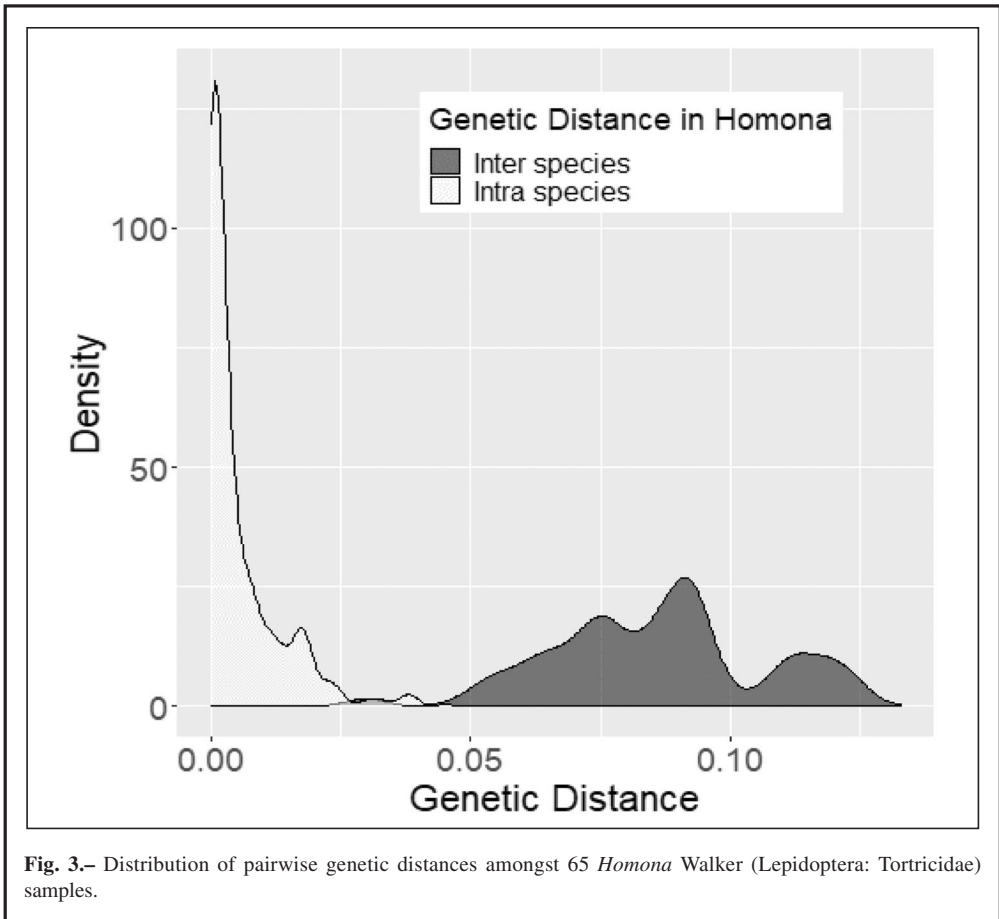


Fig. 3.– Distribution of pairwise genetic distances amongst 65 *Homona* Walker (Lepidoptera: Tortricidae) samples.

Discussion

REPORT OF *H. SPARGOTIS* IN SUMATRA

Homona spargotis has been previously reported in the Australasian realm (HERBISON-EVANS & CROSSLEY, 2004) without however confirmation of the countries with distribution of this insect. Figures of the male aedeagus in DIAKONOFF (1939, 1948) of specimens collected from Java, Indonesia agree with those of *H. spargotis* in WHITTLE *et al.* (1987). Other specimens collected beyond Australia to New Guinea (WHITTLE *et al.*, 1987) and in Sri Lanka (KOCHANSKY *et al.*, 1978) are also confirmed as *H. spargotis*. Specimens collected in Sulawesi are similar to those of *H. spargotis* described in WHITTLE *et al.* (1987). The combination of a semicircular costal fold on the fore wing together with dark grey hind wings readily distinguishes the male of *H. spargotis* from any other species of *Homona* Walker, 1863 known from Australia (WHITTLE *et al.*, 1987).

REPORT OF *H. SPARGOTIS* ON *E. GRANDIS* × *E. PELLITA*

Homona spargotis, the closest described species from *H. spargotis* collected in the present study

while feeding on a *E. grandis* × *E. pellita* clone, has been previously recorded as a predominant pest of *P. americana* and a sporadic pest of *C. arabica*, *A. reticulata*, *L. chinensis*, *Macadamia* spp., *P. indicus*, *P. umbellatum*, *A. bilimbi*, and *C. sinensis*. On *P. americana*, the infestation of *H. spargotis* appears to be determined by the presence of growth flushes. Numbers increase quickly at flushing and the moth virtually disappears when no new shoots are present (WHITTLE *et al.*, 1987).

Homona spargotis, in the current study, was seen along with the tea mosquito bug, *Helopeltis theivora* Waterhouse, 1886 (Hemiptera: Miridae), a sapsucker and other mirid species on the commercial stands of *E. grandis* × *E. pellita* clone in Sumatra (KKADAN *et al.*, 2020c). Potential monitoring and control measures of *H. spargotis* include the use of light traps (HULCR *et al.*, 2007) and sex pheromone traps (for monitoring) (WHITTLE *et al.*, 1987). *Homona spargotis* is recorded to have two flying activity periods on *P. americana* in Australia, one from March to June and another from August to December however its moths were collected using light traps throughout the summer months (WHITTLE *et al.*, 1987).

MOLECULAR ANALYSIS

We assessed the possibility of our sample belonging to another species that is similar to *H. spargotis* following an approach previously used to determine species boundaries in six tortricid moths (HULCR *et al.*, 2007) and HesperIIDae (HEBERT *et al.*, 2004). Both studies showed that genetic distances within species are much closer, as compared to between species, which can be exploited to draw species boundaries.

The confirmation of the existence of bimodal distribution, separating intra species with inter species genetic distances has been previously reported (HULCR *et al.*, 2007; HEBERT *et al.*, 2004).

Conclusions

The used molecular protocol was able to identify the insect species as *H. spargotis* through analysis of its larvae, which extends the geographical distribution to Sumatra and add a new host plant family (i.e., Myrtaceae) and genus (i.e., *Eucalyptus*) and a host species (i.e., *E. grandis* and *E. pellita*) for this insect.

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BIBLIOGRAPHY

- ALTSCHUL, S. F., GISH, W., MILLER, W., MYERS, E. W. & LIPMAN, D. J., 1990.– Basic local alignment search tool.– *Journal of Molecular Biology*, **215**(3): 403-410.
- BOPHELA, K. N., VENTER, S. N., WINGFIELD, M. J., DURAN, A., TARIGAN, M. & COUTINHO, T. A., 2019.– *Xanthomonas perforans*: A tomato and pepper pathogen associated with bacterial blight and dieback of *Eucalyptus pellita* seedlings in Indonesia.– *Australasian Plant Pathology*, **48**(1): 543-551.
- CHAO, K. H., BARTON, B., PALMER, S. & LANFEAR, R., 2020.– New results sangeranalyseR: Simple and interactive analysis of Sanger sequencing data in R.– *bioRxiv*: Available from <https://doi.org/10.1101/2020.05.18.102459>.
- DIAKONOFF, A., 1939.– The genera of Indo-Malayan and Papuan Tortricidae.– *Zoologische Mededelingen (Leiden)*, **21**(1): 111-238.
- DIAKONOFF, A., 1948.– Records and descriptions of Microlepidoptera.– *Treubia*, **19**(3): 483-524.

- FELSENSTEIN, J., 1981.– Evolutionary trees from DNA sequences: A maximum likelihood approach.– *Journal of Molecular Evolution*, **17**(1): 368-376.
- HERBISON-EVANS, D. & CROSSLEY, S., 2004.– *Homona spargotis* Meyrick, 1910.– *Australian caterpillars and their butterflies and moths*. Available at: <http://lepidoptera.butterflyhouse.com.au/tort/spargotis.html> (accessed on: 14 September 2020).
- HEBERT, P., PENTON, E., BURNS, J., JANZEN, D. & HALLWACHS, W., 2004.– Ten species in one: DNA barcoding reveals cryptic species in the neotropical skipper butterfly *Astrartes fulgurator*.– *Proceedings of the National Academy of Sciences*, **101**(41): 14812-14817.
- HULCR, J., MILLER, S. E., SETLIFF, G. P., DARROW, K., MUELLER, N. D., HEBERT, P. D. N. & WEIBLEN, G. D., 2007.– DNA barcoding confirms polyphagy in a generalist moth, *Homona mermerodes* (Lepidoptera: Tortricidae).– *Molecular Ecology Notes*, **7**(4): 549-557.
- INAIL, M. A., HARDIYANTO, E. B. & MENDHAM, D. S., 2019.– Growth responses of *Eucalyptus pellita* F. Muell plantations in South Sumatra to macronutrient fertilisers following several rotations of *Acacia mangium* Willd.– *Forests*, **10**(12): 1054.
- KKADAN, S. K., DURAN, A., WIJAYA, R., SINULINGGA, N. G. H. B., TAVARES, W. DE S., TARIGAN, M., WONG, C. Y. & SHARMA, M., 2020b.– Impact of water quality on insecticide efficacy.– *International Pest Control*, **62**(6): 314-317.
- KKADAN, S. K., SIRAIT, B. A., ASFA, R., TAVARES, W. DE S., TARIGAN, M., DURAN, A., WONG, C. Y. & SHARMA, M., 2020a.– Evaluation of a spinetoram-based insecticide against lepidopteran and thrips infesting acacia and eucalyptus in Sumatra, Indonesia.– *Journal of Entomology and Zoology Studies*, **8**(2): 1345-1351.
- KKADAN, S. K., YESHWANTH, H. M., TAVARES, W. DE S., PASARIBU, I., ABAD, J. I. M., TARIGAN, M., DURAN, A., WONG, C. Y. & SHARMA, M., 2020c.– Mirid pests of *Eucalyptus* in Indonesia: Notes on damage symptoms, alternate hosts and parasitoid.– *Journal of the Kansas Entomological Society*, **92**(4): 577-588.
- KOCHANSKY, J. P., ROELOFS, W. L. & SIVAPALAN, P., 1978.– Sex pheromone of the tea tortrix moth (*Homona coffearia* Nietner).– *Journal of Chemical Ecology*, **4**(1): 623-631.
- MELIA, T., SINULINGGA, N. G. H. B., MARETHA, M. V., WIJAYA, R., EFENDI, R. R., OLIVEIRA, L. S. S., KKADAN, S. K., TAVARES, W. DE S., TARIGAN, M. & DURAN, A., 2021.– First report of *Tetracona (Agrotera) amathealis* (Walker, 1859) on a *Eucalyptus grandis* W. Hill × *Eucalyptus pellita* F. Muell. (Myrtaceae) hybrid in Indonesia (Lepidoptera: Crambidae, Spilomelinae).– *SHILAP Revista de lepidopterología*, **49**(195): 407-412.
- MEYRICK, E., 1910.– Revision of Australian Tortricina.– *Proceedings of the Linnean Society of New South Wales*, **35**(145): 215.
- PRASETYO, A., AISO-SANADA, H., ISHIGURI, F., WAHYUDI, I., WIJAYA, I. P. G., OHSHIMA, J. & YOKOTA, S., 2019.– Variations in anatomical characteristics and predicted paper quality of three *Eucalyptus* species planted in Indonesia.– *Wood Science and Technology*, **53**(1): 1409-1423.
- RAIMON, LAKSAMANA, A., SINULINGGA, N. G. H. B., FERLIANDA, I. A., SAMOSIR, M. N., PANE, S. B., KKADAN, S. K., TAVARES, W. DE S., TARIGAN, M. & DURAN, A., 2020.– First report of *Ophiusa disjungens* (Walker, 1858) (Lepidoptera: Erebidae) on *Acacia mangium* (Fabaceae), and damage and notes of its biology on *Eucalyptus* (Myrtaceae) commercial plantations in Sumatra, Indonesia.– *SHILAP Revista de lepidopterología*, **48**(191): 439-447.
- SCHLIEP, K. P., 2011.– Phangorn: Phylogenetic analysis in R.– *Bioinformatics*, **27**(4): 592-593.
- SIEVERS, F., WILM, A., DINEEN, D., GIBSON, T. J., KARPLUS, K., LI, W., LOPEZ, R., MCWILLIAM, H., REMMERT, M., SODING, J., THOMPSON, J. D. & HIGGINS, D. G., 2011.– Fast, scalable generation of high-quality protein multiple sequence alignments using Clustal Omega.– *Molecular Systems Biology*, **7**: 539.
- SZULECKA, J., OBIDZINSKI, K. & DERMAWAN, A., 2016.– Corporate–society engagement in plantation forestry in Indonesia: Evolving approaches and their implications.– *Forest Policy and Economics*, **62**(1): 19-29.
- 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*, **54**(4): 545-555.
- TALAVERA, G. & CASTRESANA, J., 2007.– Improvement of phylogenies after removing divergent and ambiguously aligned blocks from protein sequence alignments.– *Systematic Biology*, **56**(4): 564-577.
- TAVARÉ, S., 1986.– Some probabilistic and statistical problems in the analysis of DNA sequences.– *Lectures on Mathematics in the Life Sciences*, **17**(2): 57-86.
- TAVARES, W. DE S., KKADAN, S. K., HENDRIK, A. M., TARIGAN, M., ASFA, R., YAKOVLEV, R. V., TACHI, T., DURAN, A., WONG, C. Y. & SHARMA, M., 2020.– 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).– *SHILAP Revista de lepidopterologia*, **48**(190): 333-349.

WHITTLE, C. P., BELLAS, T. E., HORAK, M. & PINESE, B., 1987.– The sex pheromone and taxonomic status of *Homona spargotis* Meyrick sp. rev., an Australian pest species of the *Coffearia* group (Lepidoptera: Tortricidae: Torticinae).– *Australian Journal of Entomology*, **26**(2): 169-179.

ZBOROWSKI, P. & EDWARDS, T., 2007.– *A Guide to Australian Moths*: 103 pp. CSIRO Publishing, Clayton South.

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Five new species of the New World genus *Thyridopyralis* Dyar, 1901 (Lepidoptera: Pyralidae, Galleriinae)

V. O. Becker

Abstract

Five new species of *Thyridopyralis* Dyar, 1901 from Brazil are described, including diagnosis and illustrations: *Thyridopyralis bonita* Becker, sp. n., *T. leucophthalma* Becker, sp. n., *T. minor* Becker, sp. n., *T. proxima* Becker, sp. n. and *T. viridescens* Becker, sp. n.; the range of *T. gallaerandialis* Dyar, 1901 is extended to Mexico and the Antilles (Guana Id., British Virgin Islands).

KEY WORDS: Lepidoptera, Pyralidae, Galleriinae, Megarthriini, taxonomy, new species, distribution, Brazil, Mexico, Antilles.

Cinco nuevas especies del género del Nuevo Mundo *Thyridopyralis* Dyar, 1901 (Lepidoptera: Pyralidae, Galleriinae)

Resumen

Cinco especies nuevas de *Thyridopyralis* Dyar, 1901 de Brasil son descritas, incluyendo diagnosis y ilustraciones: *Thyridopyralis bonita* Becker, sp. n., *T. leucophthalma* Becker, sp. n., *T. minor* Becker, sp. n., *T. proxima* Becker, sp. n. y *T. viridescens* Becker, sp. n.; se amplía la distribución de *T. gallaerandialis* Dyar, 1901 a México y las Antillas (Guana, Islas Vírgenes Británicas).

PALABRAS CLAVE: Lepidoptera, Pyralidae, Galleriinae, Megarthriini, taxonomía, especies nuevas, distribución, Antillas, Brasil, México.

Introduction

Thyridopyralis Dyar, 1901, established as monotypic, in the Thyrididae, was transferred to the Megarthriini (Galleriinae) by WHALLEY (1964: 570). It included two species from Florida and Mexico (MUNROE, 1995). Megarthriini are poorly represented in the New World: five species in two genera (WHALLEY, 1964; MUNROE, 1995). The material examined in the collections revealed five more species from Brazil, all undescribed, doubling the number of species in the tribe for the New World fauna. New records for the genus in the Antilles and Mexico were also found.

Material and methods

This work is based on 65 specimens (12 g. s.) in the author's collection (VOB), 40 in the USNM, 6 in the AMC, and one in the CPAC. Specimens representing all the species were taken to the CMNH, NHMUK and USNM to be compared with the material deposited there. Except for *T. gallaerandialis*

Dyar, 1901 and *T. illustrata* Dyar, 1920, nothing was found that matched them. The holotypes of the new species are provisionally deposited in VOB, and will be transferred, together with the collection, to a Brazilian institution in the future. Genitalia were prepared following the methods described by ROBINSON (1976). Terms for morphological characters follow HODGES (1971).

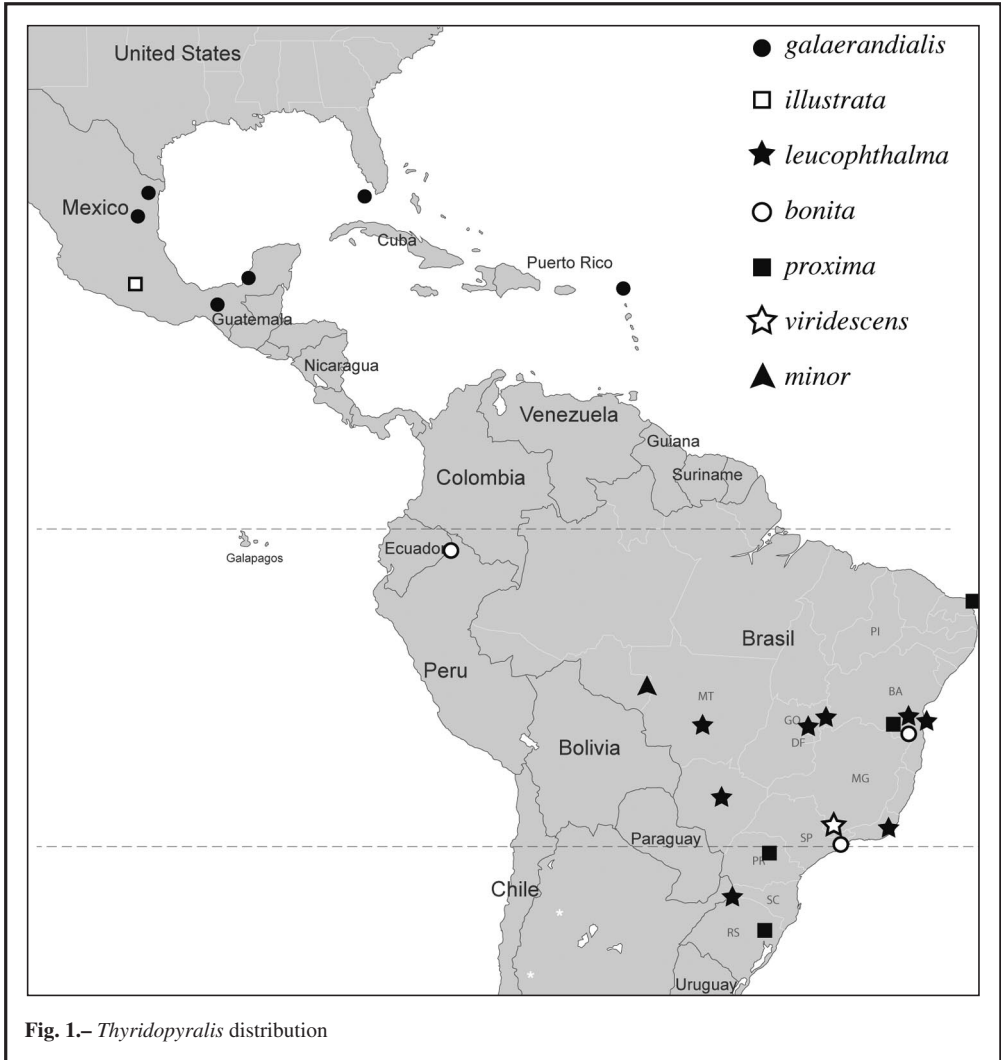


Fig. 1.- *Thyridopyralis* distribution

Abbreviations

- AMC Alfred Moser collection, São Leopoldo, Rio Grande do Sul, Brazil
- CMNH Carnegie Museum of Natural History, Pittsburgh
- CPAC Centro de Pesquisa Agropecuária dos Cerrados, Planaltina DF, Brazil
- FW Forewing
- g. s. genitalia slide

HW	Hind wings
Misspl.	misspelling
NHMUK	Natural History Museum, United Kingdom
TS	Type species
USNM	United States National Museum, Washington DC
VOB	Vitor O. Becker collection, Serra Bonita Reserve, Camacan, Bahia, Brazil

Results and discussion

The material studied revealed five undescribed species from Brazil, and the distribution of *T. gallaerandialis* Dyar, 1901 extended to Mexico and the Antilles. Except for *T. illustrata* Dyar, 1920, apparently known from the type specimen only, images of the adults and genitalia of all species are given.

Thyridopyralis Dyar, 1901

Thyridopyralis Dyar, 1901. *Jl. N. Y. ent. Soc.*, **9**: 23

TS: *Thyridopyralis gallaerandialis* Dyar, 1901. *Jl. N. Y. ent. Soc.*, **9**: 23, by monotypy.

Diagnosis: Small to large (FW length 9-20 mm; wingspan 19-45 mm). Brightly colored, with conspicuous dark blotch, or silvery dot, on FW cell. Male genitalia with uncus short, broad, blunt, densely haired dorsally; valva long, narrow, straight of slightly bent dorsad; juxta a narrow, obtuse arc; vinculum round, slightly expanded basad; manica spined distad; phallus long, thin, straight. Female genitalia with papillae anales long, narrow; ostium wide, antrum sclerotized, ductus bursae narrow, as long as bursae diameter; corpus bursae oblong or globose.

Remarks: Despite the strong phenotypic differences, male genitalia are very similar throughout the group, often showing little differences between species. The sclerotized manica (Figs 3, 18), spined distad, shows some differences between species. In order to extract the phallus the genitalia had to be boiled in KOH for almost one hour, to make possible to revert it avoiding damage to the phallus or to the manica, a procedure that was not always possible.

Thyridopyralis leucophthalma Becker, sp. n. (Figs 2-5, 7-8)

Material examined (24 specimens, 4 g. s.): Holotype ♂, BRAZIL: Bahia, Camacan, 15°23'S - 39°33'W, 800 m, 6-II-2018 (Becker 114320) (VOB); paratypes: 1 ♂, same data as holotype, but IV-2019, g. s. 5665 (Becker 158580) (VOB); 1 ♂, Idem, Porto Seguro, Arraial d'Ajuda, 16°27'S - 39°03'W, 40 m, 23-XI-2013 (Becker 150444) (VOB); 7 ♂♂, Distrito Federal, Planaltina, 15°35'S - 47°42'W, 1100 m, 26-II-1976, 10-III-1977, 15-II-1994, 24-II-1998, 18-III-1999, g. s. 337, 1957 (Becker 19225, 97052, 114949, 118404; CPAC 4684) (VOB, CPAC); 3 ♂♂, 1 ♀, Goiás, Formosa, 800 m, 28-III-1993 (Becker 89778) (VOB); 1 ♂, Mato Grosso, 60 km S Poconé, 100 m, 1-7-XII-1997 (Becker 111293) (VOB); 1 ♂, Mato Grosso do Sul, Rio Brilhante, 23-I-1971 (Becker 15719) (VOB); 5 ♂♂, Rio de Janeiro, Cachoeira do Macacu, 700 m, 23-I-1998 (Becker 113300) (VOB, USNM); 1 ♂, Rio Grande do Sul, Derrubadas, Parque do Turvo, 400 m, 14-18-I-2000 (Moser) (AMC).

Diagnosis: Large. FW brownish fuscous, costa moss-green, small, silvery dot at end of cell; HW light brown.

Description: Male (Fig. 7) FW length 13-16 mm (wingspan 30-36 mm), female (Fig. 8) FW length 20 mm (wingspan 45 mm). Labial palpi and frons dark brown; vertex with rough ferruginous scales; antenna fuscous. Thorax pale yellow, patagia dark brown; legs brown. FW violasceus, costa moss-green from near base to postmedial band; diffuse, brown fascia below costa, from base to apex; conspicuous silvery dot at end of cell; small blotch of erect, brown scales below base of cell; postmedial band hardly visible, marked with ill-defined brown lunules; termen concave between apex and M3; line of thin lunules along margin, with two large dots between M1-M2, Cu1-Cu2. Genitalia (Fig. 2): uncus short, broad, tapering distad, pair of small teeth at apex; valva long, nearly straight;

short, curved flap on articulation with sacculus; vinculum round; juxta a narrow, obtuse “U”; manica (Fig. 3) expanded distad, apex with several large teeth; phallus (Fig. 4) long, thin, straight, vesica with no spines. Female similar, larger, darker. Genitalia (Fig. 5): ostium wide, antrum conical, sclerotized along middle; ductus bursae narrow, twisted, longer than oblong corpus bursae.

Distribution (Fig. 1): Brazil, central, southeastern, and south.

Etymology: From the Greek λέκος [leukos] = white + οφθαλμός [ophthalmos] = eye; in reference to the white dot at the end of the cell of FW.

Remarks: This is the most distinct species in the genus. The conspicuous white dot at the end of cell on FW is unique to the genus.

***Thyridopyralis proxima* Becker, sp. n.** (Figs 6, 10-12, 17-18)

Material examined (13 specimens, 2 g. s.): Holotype ♂, BRAZIL: Camacan, 15°23'S - 39°33'W, 800 m, 1-15-XII-2020 (Becker 162453) (VOB); Paratypes: 2 ♂♂, same data as holotype, but XI-2009, g. s. 5237 (Becker 145136) (VOB); 3 ♀♀, Rio Grande do Norte, Pipa, 20 m, 28-31-III-1994, g. s. 1962 (Becker 91410) (VOB); 1 ♀, Paraná, Telemaco Borba, 13-19-X-1995 (Becker 97577); 5 ♂♂, 1 ♀, Rio Grande do Sul, Morro Reuter, Fazenda Padre Eterno, 29°32'S - 50°58'W, 12-II-1983, 24-28-XII-1996, 7-11-II-1997, 8-9-I-2010, 10-11-I-2016 (Moser) (AMC).

Diagnosis: Medium size. Body and FW violasceus. HW light gray, postmedial band diffuse.

Description: Male (Fig. 11) FW length 14-15 mm (wingspan 32-35 mm); female (Figs 10, 12) FW 17-19 mm (wingspan 38-42 mm). Head, thorax and abdomen dark violasceus; labial palpi with some pale yellow scales on articulations, antenna fuscous; legs brown, hind tibia, and tarsi articulations pale yellow. FW violasceus, costa dark violasceus, sparsely mixed pale yellow scales from base to near apex; dark reddish brown, mixed with golden ochreous scales on and below cell; whitish dot containing short brown dash beyond cell; postmedial band and subterminal line spotted, pale yellow; termen with black lunules between veins along margin; cilia brown, mixed with pale yellow scales. HW pale yellow dusted fuscous; postmedial band ill-defined; smoked dark fuscous distad of it; cilia pale yellow. Female similar, HW dusted fuscous along margin. Male genitalia (Fig. 17): apex of uncus constricted to small tip; valva long, straight; sacculus prominent, nearly half length of valva; vinculum slightly expanded to a small saccus; transtilla with spatulate, long, middle process; juxta a slender, obtuse U-shape; manica (Fig. 18 left) expanded distad, apex with multiple small spines, pair of large spines at tip; phallus (Fig. 18 right), long, straight, slightly expanded distad; vesica with multiple small spines. Female genitalia (Fig. 5): ostium wide; antrum broad, sclerotized; ductus bursae as long as corpus diameter, expanded gradually towards oblong corpus bursae.

Distribution (Fig. 1): Brazil, along the eastern coast, south to Rio Grande do Sul.

Etymology: From the Latin *proximus* = nearest; in reference to the similarity to *bonita*.

Remarks: Similar to *bonita*, smaller; HW slightly dusted gray, with diffuse postmedial line.

***Thyridopyralis bonita* Becker, sp. n.** (Figs 13, 19-20)

Material examined (7 specimens, 3 g. s.). Holotype ♂, BRAZIL: Bahia, Camacan, 15°23'S - 39°33'W, 800 m, XI-2011 (Becker 147541) (VOB); Paratypes: 3 ♂♂, same data as holotype, but 15-XII-2005, X-2011, XII-2013, g. s. 5662, 5663 (Becker 136795, 147371, 151203) (VOB); 2 ♂♂, São Paulo, Ubatuba, 20 m, 23°22'S - 44°50'W, 10-12-XI-2001, g. s. 5538 (Becker 134136) (VOB); 1 ♀, PERU: Napo, Parque Nacional Yasuni, Rio Tiputini, 400 m, 11-V-1996 (Hillman) (CMNH).

Diagnosis: Large. FW violaceous, with a golden ochreous patch on the basal half, below costa; brown and golden ochreous blotch filling cell. HW cream, fine, dark gray line along termen.

Description: Male (Fig. 13) FW length 20-22 mm (wingspan 45-50 mm); female FW length 20 mm (wingspan 45 mm). Head mixed brown and pale yellow long scales; labial palpi brown, pale yellow dorsally; antenna with flagellum pale yellow, brown on articulations. Thorax and abdomen pale

yellow, patagia and tegula brown; whitish below; legs brown, tarsi ringed pale yellow on articulations; fore coxae, internally, hind tibia and fore tarsi pale yellow. FW violaceous; costa dark red brown from base to $\frac{3}{4}$, then mixed pale yellow scales; basal half, below cell, above As, golden ochreous; cuneiform blotch filling cell, with a brown dot in center, edged golden yellow; U-shape white mark distad of cell; termen mixed pale yellow scales; margin with dark brown lunules between veins. HW cream yellow; margins bordered with thin fuscous line; cilia golden yellow. Genitalia (Fig. 19): uncus constricted distad; valva long straight, slightly expanded near apex; juxta an obtuse "V"; manica (Fig. 20) densely spined distad; phallus (Fig. 20) long, thin, straight [phallus inside manica]. Female unknown.

Distribution (Fig. 1): Brazil, southeastern; eastern Peru.

Etymology: From the Portuguese *bonita* =beautiful; in reference to Serra Bonita, the type locality.

Remarks: The larger species in the genus; similar to *proxima*, but without diffuse postmedial band on HW.

Thyridopyralis viridescens Becker, sp. n. (Figs 9, 21-22)

Material examined (5 specimens, 2 g. s.): Holotype ♂, BRAZIL: São Paulo, Campos do Jordão, 32°46'S – 45°31'W, 1600 m, 23-27-I-2001 (Becker 131391) (VOB); Paratypes: 4 ♂♂, same data as holotype, g. s. 5236, 5664 (VOB).

Diagnosis: Medium size. FW pale yellow, costa greenish, blackish diffuse band from mid costa to termen between M1-Cu1.

Description: Male (Fig. 9) FW length 14-16 mm (wingspan 32-36 mm). Frons brown, vertex with rough ferruginous scales; labial palpi and antenna fuscous. Thorax, FW and abdomen pale yellow; patagia ferruginous, tegula pale yellow; legs dark brown, hind tibia and tarsi articulations pale yellow. FW pale yellow, dusted brown scales below cell and Cu1 from base to termen; costa greenish; blackish, wide fascia from mid costa to termen, between M1-Cu1. Hind wings pale yellow dusted brown scales; postmedial band diffuse; costa and margins, distad of postmedial band, darker. Genitalia (Fig. 21): uncus broad, subtriangular, lateral margins slightly convex; valva long, narrow, slightly bent dorsad; sharp process at the end of sacculus; vinculum round, slightly expanded basad; juxta a subrectangular plate, small process distad, on each lateral side; manica (Fig. 22) expanded, spined distad; phallus (Fig. 22) long straight, distal half slightly thicker; vesica with no spines [phallus inside manica]. Female unknown.

Distribution (Fig. 1): Brazil, known from the type locality only, at the cool, high elevation in the Atlantic Forest.

Etymology: From the Latin *viridis* =green; in reference to the green tinge of FW.

Remarks: The greenish tinge on FW is unique in the genus.

Thyridopyralis gallaerandialis Dyar, 1901 (Figs 15-16, 23-24)

Thyridopyralis gallaerandialis Dyar, 1901: *Jl. N. Y. ent. Soc.*, **9**: 23

Lectotype ♂, USA: Florida, Key West (Schwartz) (USNM), designated by WHALLEY, 1964: 570 [examined].

= *Thyridopyralis randialis*; Dyar, 1920. *Insecutor Inscit. mestr.*, **8**: 30-35. 34, misspl.

Material examined (63 specimens, 4 g. s.): Type; 55 ♂♂ (4 g. s.), 1 ♀. BRITISH VIRGIN ISLANDS: 53 ♂♂, 1 ♀, Guana, X-1989, gs. 1963, 5660 (Becker 70866) (VOB, USNM); 24-X-5-XI-1990 (S. Miller & T. Kuklenski) (VOB, USNM). MEXICO: 1 ♂, Campeche, Escarcega, 85 m, 17-21-VI-1981 (Becker 42832) (VOB); 2 ♂♂, Tamaulipas, El Encino, 250 m, 4-12-VIII-1988, g. s. 1964, (Becker 68864) (VOB); 1 ♂, Chiapas, El Chorradero, 680 m, 12-VI-1997 (Becker 109824) (VOB); 4 ♂♂, Tamaulipas, San Fernando, 50 m, 28-VI-1997, g. s. 5661 (Becker 110532) (VOB).

Diagnosis: Male FW length 8-10 mm (wingspan 19-24 mm) (Figs 15, 16). Whitish. FW heavily dusted brown and gray scales; large, round brown dot on cell. HW white, fuscous margin, broadening toward apex. Genitalia (Fig. 23): uncus broadly triangular; valva long, narrow, slightly curved dorsad;

manica Fig. 24) expanded, densely spined distad; phallus (Fig. 24) long, thin, straight [phallus inside manica].

Distribution (fig. 1): USA (Florida Keys), Mexico, Antilles, in dry biomes.

Remarks: This small species is easily distinguished by the whitish FW with a conspicuous round, brown dot in the middle. The author collected moths at Guana Id. in 1989, just one month after Hurricane Hugo had devastated the region. It was a surprise to find this species, not recorded for the Antilles previously, in great numbers at light. In the first night over 10 specimens arrived, followed by large numbers in the subsequent nights. Collecting was stopped when 40 specimens had been collected (surprisingly not a single female). In the following year, Scott E. Miller and Tina Kuklenski collected 15 specimens more, including the single female specimen known to the species.

Thyridopyralis illustrata Dyar, 1920

Thyridopyralis illustrata Dyar, 1920. *Insecutor Inscit. mestr.*, **8**: 34

Holotype ♂, MEXICO: Mexico, Zacualpan (Müller) (USNM, 22761) [examined].

Diagnosis: Similar to *gallaerandialis* but larger.

Material examined: Type.

Distribution (fig. 1): Mexico, from the type locality only.

Thyridopyralis minor Becker, sp. n. (Figs 14, 25-26)

Material examined (1 specimen, 1 g. s.): Holotype ♂, BRAZIL: Rondônia, Vilhena, 600 m, 24-V-1998, g. s. 5666 (Becker 116845) (VOB).

Diagnosis: Small. Whitish, dusted fuscous. FW costa greenish, dark gray band from basal third of costa along costa to termen, above M3.

Description: Male (Fig. 14) FW length 11 mm (wingspan 25 mm). Labial palpi fuscous; frons and vertex ferrugineous; antenna pale yellow. Thorax and abdomen pale yellow, legs whitish, fore and mid tibia brown. FW pale yellow dusted fuscous; costa greenish; dark gray band from mid costa to termen, above M3; brown blotch of erected scales on cell; termen and cilia dark fuscous. HW dusted fuscous, cilia pale yellow. Genitalia (Fig. 25): uncus broad, base as wide as tegumen, apex sharp; valva long, thin, slightly bent dorsad; small, sharp process on articulation with sacculus; vinculum slightly expanded basad; juxta a shallow, obtuse "V"; manica (Fig. 26) slightly expanded distad, minutely spined towards distal third; phallus (Fig. 26) long, thin, nearly straight, vesica with minute spines [phallus inside manica]. Female unknown.

Distribution (Fig. 1): Brazil, southwestern amazons, in the Cerrado biome.

Etymology: From the Latin *minor* = little; in reference to the proportionally small size.

Remarks: The smaller species in the genus, resembling a small *viridescens*. Genitalia also similar, except for the shape of uncus and the small process on articulation of valva with sacculus.

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BIBLIOGRAPHY

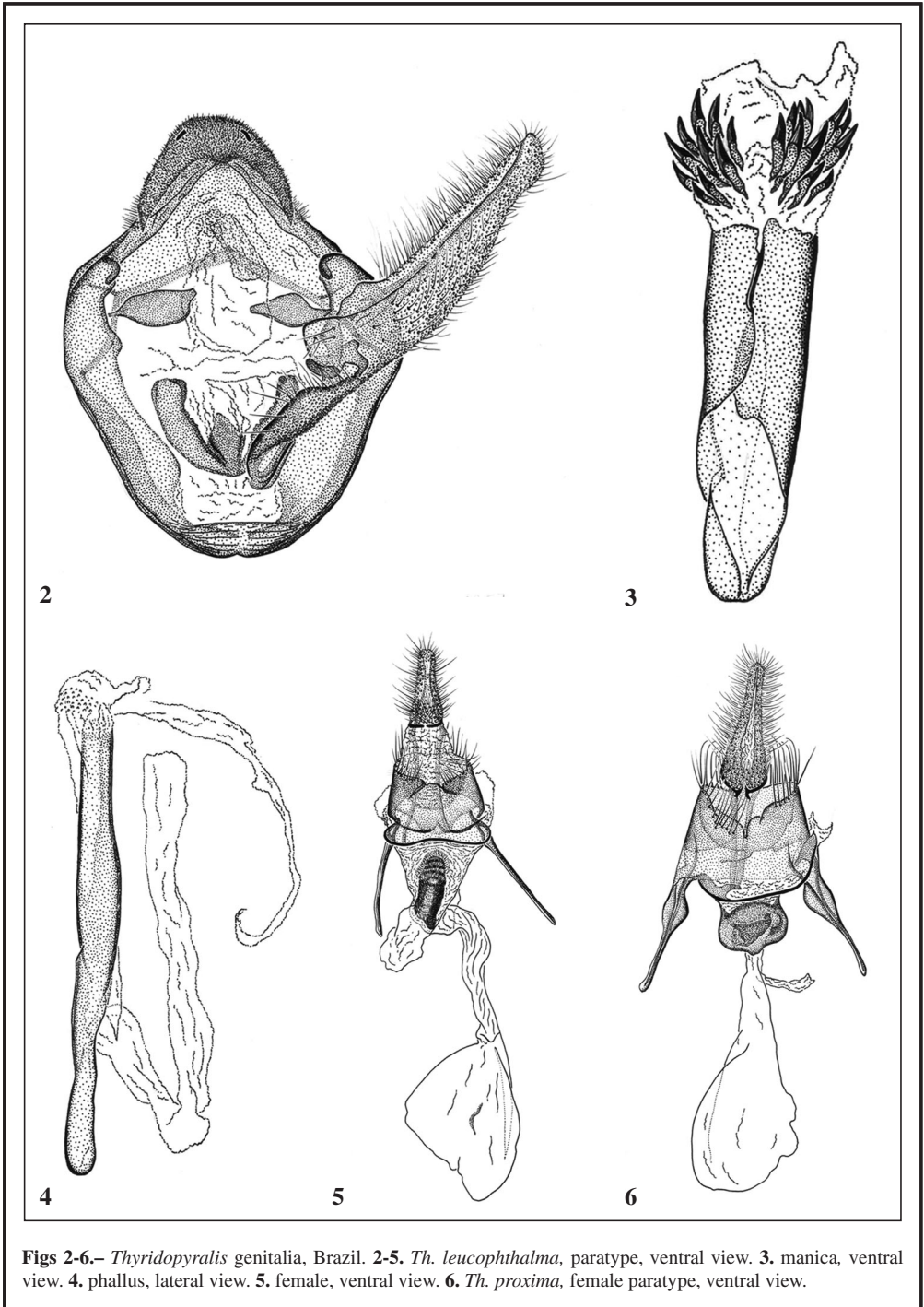
- DYAR, H. G., 1901.— Descriptions of some Pyralid larvae from Southern Florida.— *Journal of the New York Entomological Society*, **9**: 19-24.
 DYAR, H. G., 1920.— New moths from Mexico.— *Insecutor inscitiae menstruus*, **8**: 30-35.

- HODGES, R. W., 1971.– Sphingoidea.– In R. B. DOMINICK *et al.* *The moths of America North of Mexico*, **21**: 158 pp. Classey and R. B. D. Publications, London.
- MUNROE, E. G., 1995.– Galleriinae.– In J. B. HEPPNER, ed. *Atlas of Neotropical Lepidoptera. Checklist: Part 2*: 88-89. Association of Tropical Lepidoptera, Gainesville.
- ROBINSON, G. S., 1976.– The preparation of slides of Lepidoptera genitalia with special reference to the Microlepidoptera.– *Entomologist's Gazette*, **27**: 127-132.
- WHALLEY, P. E. S., 1964.– Catalogue of the Galleriinae (Lepidoptera, Pyralidae) with descriptions of new genera and species.– *Acta Zoologica Cracoviensis*, **9**: 561-618.

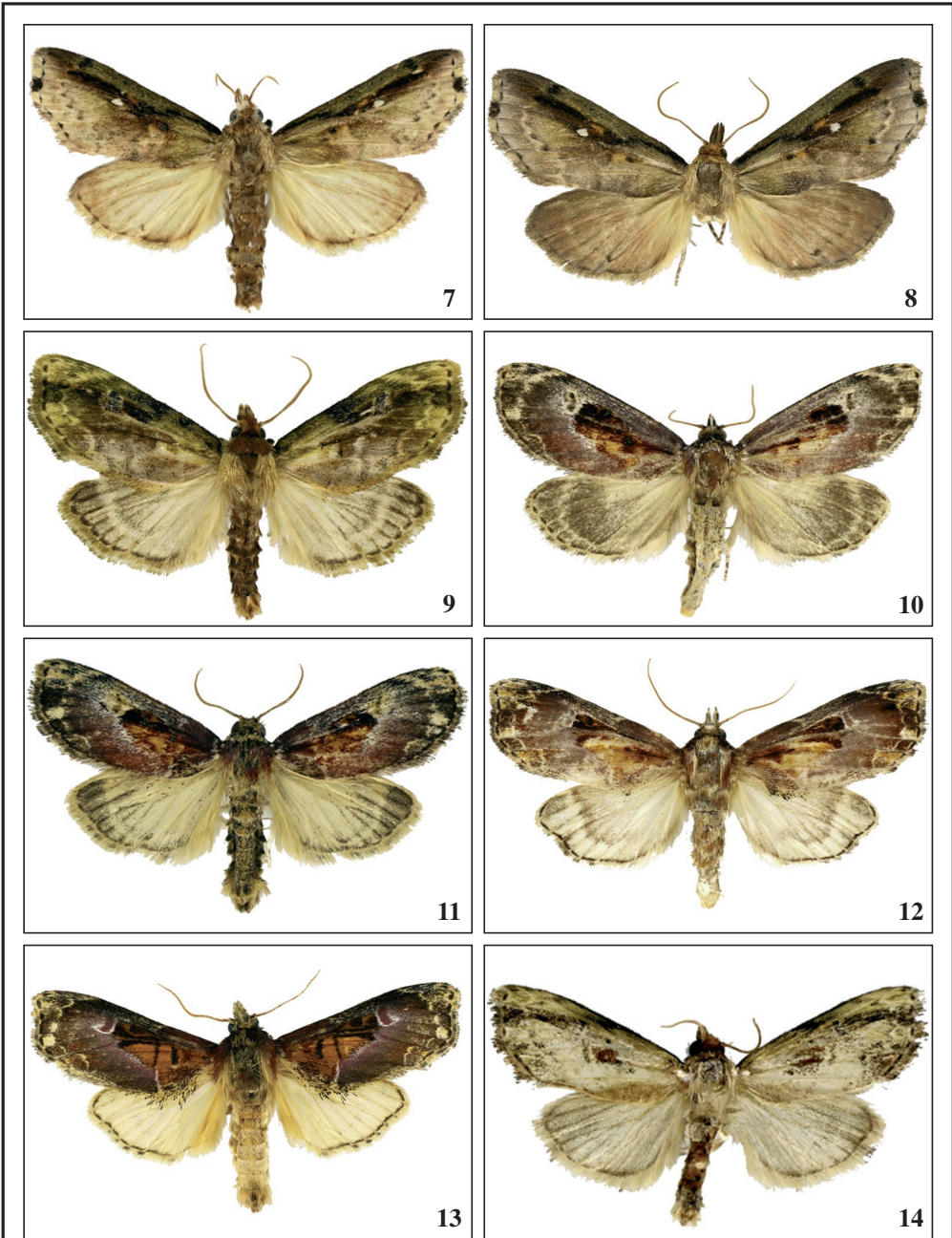
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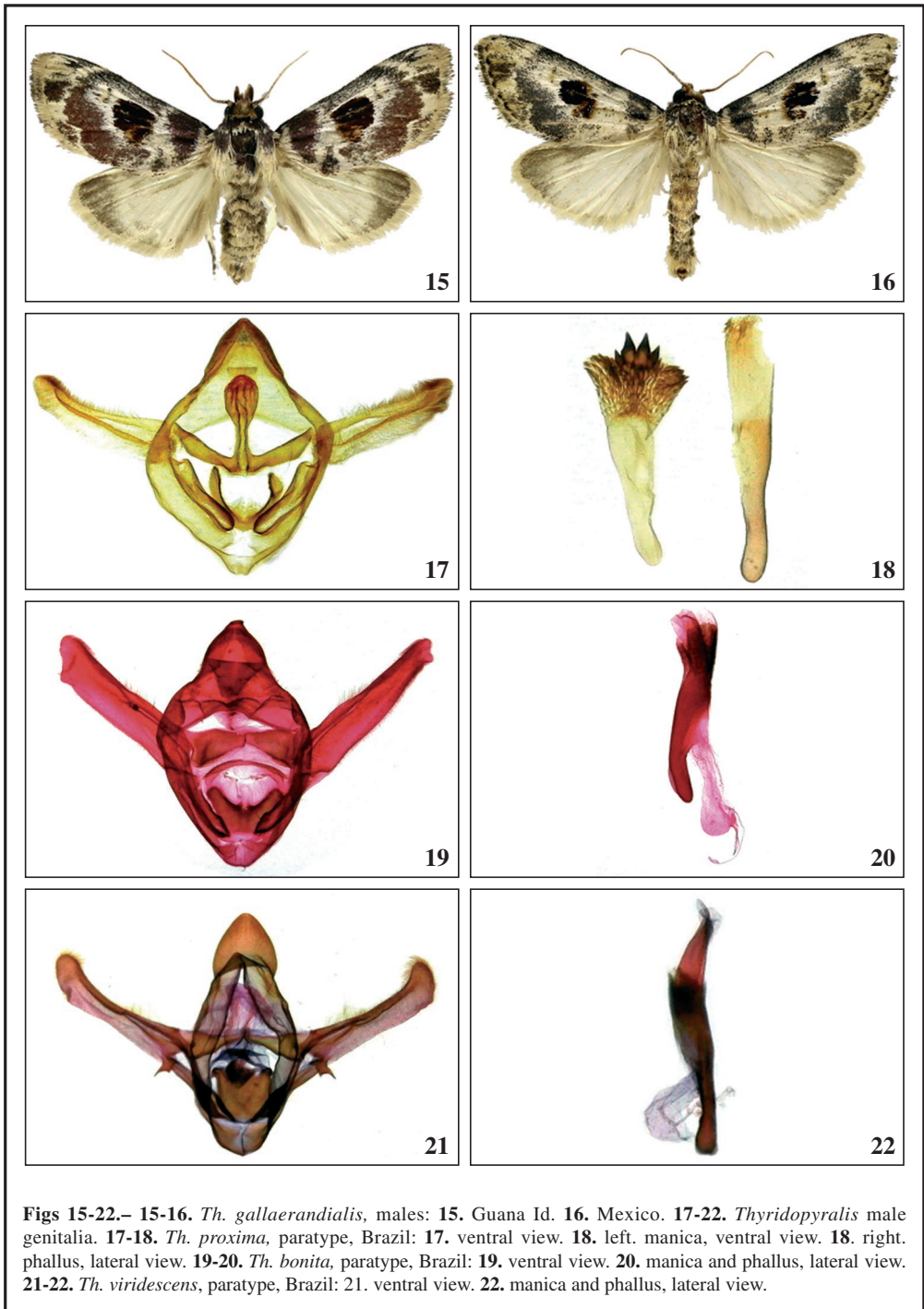
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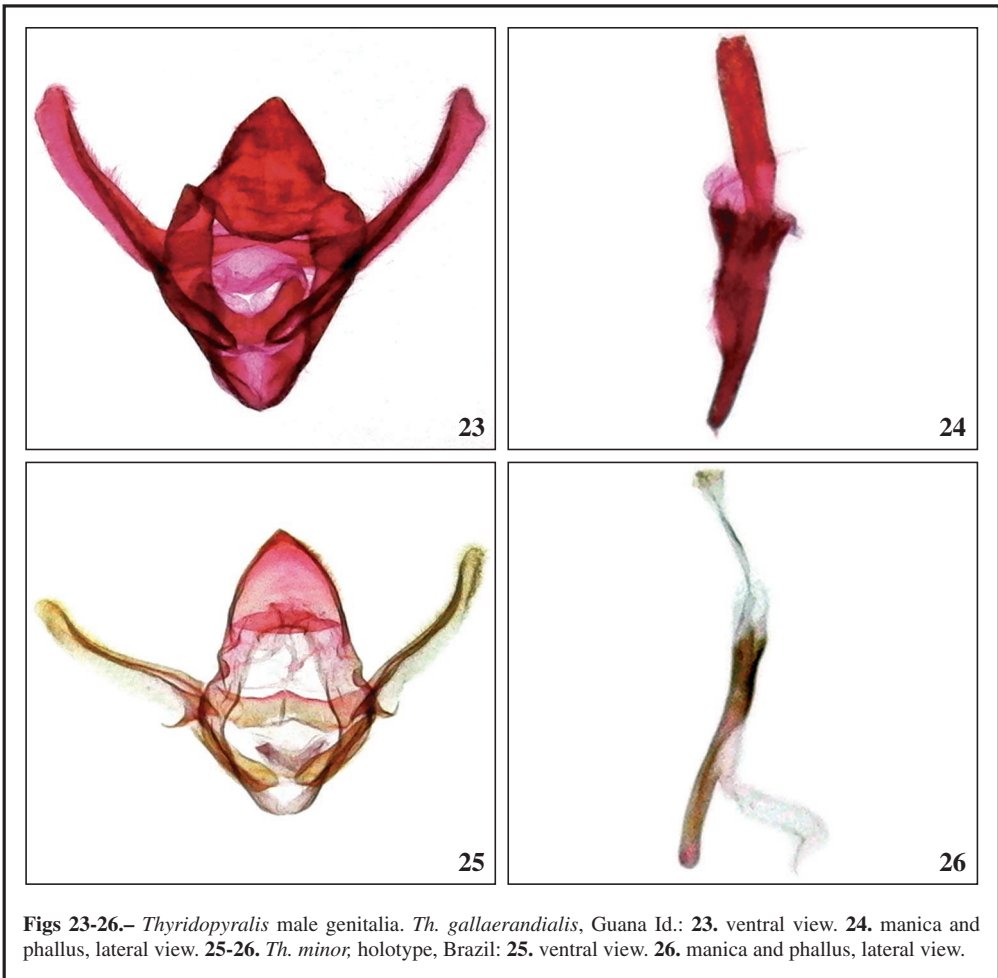
Figs 2-6.– *Thyridopyralis* genitalia, Brazil. **2-5.** *Th. leucophthalma*, paratype, ventral view. **3.** manica, ventral view. **4.** phallus, lateral view. **5.** female, ventral view. **6.** *Th. proxima*, female paratype, ventral view.



Figs 7-14.– *Thyridopyralis* adults. 7-8. *Th. leucophthalma*, Brazil: 7. male holotype. 8. female paratype. 9-14. *Thyridopyralis* adults 9. *Th. viridescens*, male holotype, Brazil. 10-12. *Th. proxima*, Brazil: 10, 12, female paratypes. 11. male holotype. 13. *Th. bonita*, male holotype, Brazil. 14. *Th. minor*, male holotype, Brazil.



Figs 15-22.– 15-16. *Th. gallaerandialis*, males: 15. Guana Id. 16. Mexico. 17-22. *Thyridopyralis* male genitalia. 17-18. *Th. proxima*, paratype, Brazil: 17. ventral view. 18. left. manica, ventral view. 18. right. phallus, lateral view. 19-20. *Th. bonita*, paratype, Brazil: 19. ventral view. 20. manica and phallus, lateral view. 21-22. *Th. viridescens*, paratype, Brazil: 21. ventral view. 22. manica and phallus, lateral view.



NOTICIAS GENERALES / GENERAL NEWS

SHILAP REVISTA DE LEPIDOPTEROLOGÍA, RENEVA LA EXCELENCIA 2021-2022 / SHILAP REVISTA DE LEPIDOPTEROLOGIA, RENOVATES THE EXCELLENCE 2021- 2022.– 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 2021. Después de este arduo proceso, la resolución definitiva de la convocatoria establece que *SHILAP Revista de lepidopterología* ha logrado superar los indicadores de calidad y ha obtenido la certificación de FECYT que selecciona y califica nuestra publicación como **EXCELENTE**. / *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 2021. After this complicated process, the final finding establishes that SHILAP Revista de lepidopterología has passed the indicators of quality and obtained the certificate of FECYT that selects and qualifies our publication as EXCELLENT.*– **DETALLES / DETAILS:** SHILAP, Apartado de correos, 331, E-28010 Madrid, ESPAÑA / SPAIN (E-mail: avives1954@outlook.es).

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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:

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Papilionoidea inventory of the Sempre Vivas National Park, Minas Gerais State, southeastern Brazil (Insecta: Lepidoptera)

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Abstract

This paper provides a preliminary inventory of the Lepidoptera from the Sempre Vivas National Park, a mountain area (1200 to 1400 m a.s.l.) that combines savannas (Cerrado) and open rocky montane fields (campos rupestres) in the north-central region of Minas Gerais, Brazil. Collections were made by active search using nets and Van Someren-Rydon bait traps in two periods: one from 2010 to 2011 (10 sampling days) and the other from 2018 to 2019 (20 sampling days). A total of 1181 individuals of 238 species were sampled, distributed in 18 subfamilies of six Lepidoptera families. Noteworthy were the records of *Rhetus belphegor* (Westwood, [1851] (Riodinidae), *Magnastigma julia* (Lycaenidae), and *Strymon ohausi* (Spitz, 1933) (Lycaenidae), species included in the Brazilian Red List of threatened Lepidoptera. Five species endemic to the Cerrado biome were reported, namely *Cogia cerradicola* (Mielke, 1967) (Hesperiidae), *Parides bunichus diodorus* (Hopffer, 1866) (Papilionidae), *Nhambikuara cerradensis* Freitas, Barbosa & Zacca, 2018, *Ypthimoides cipoensis* Freitas, 2004 (Nymphalidae), and *Sertania jaibensis* (Callaghan & Soares, 2001) (Riodinidae). Although preliminary, the information presented here is important for the management of the Sempre Vivas National Park and contributes to a crucial body of data to support actions for the conservation of the Cerrado biome in Brazil.

KEY WORDS: Insecta, Lepidoptera, Papilionoidea, Cerrado, Hesperiidae, Nymphalidae, Bait traps, Brazil.

Inventário de Papilionoidea do Parque Nacional Sempre Vivas, Estado de Minas Gerais, sudeste do Brasil (Insecta: Lepidoptera)

Resumo

O presente trabalho apresenta um inventário preliminar das Lepidoptera do Parque Nacional das Sempre Vivas, uma área montanhosa (1200 to 1400 m de altitude) que combina vegetação de Cerrado e de campos rupestres na região centro-norte de Minas Gerais, Brasil. As coletas foram feitas com busca ativa usando redes e com armadilhas atrativas modelo Van Someren-Rydon, em dois períodos distintos: entre 2010 e 2011 (dez dias de amostragem), e entre 2018 e 2019 (20 dias de amostragem). Foram coletados 1181 indivíduos de 238 espécies, distribuídas em 18 subfamílias de seis famílias de Lepidoptera. Destaca-se o registro das espécies *Rhetus belphegor* (Westwood, [1851]) (Riodinidae), *Magnastigma julia* e *Strymon ohausi* (Spitz, 1933) (ambas Lycaenidae), todas na lista das ameaçadas de extinção do Brasil. Adicionalmente, foram registradas cinco espécies endêmicas do Bioma Cerrado, a saber: *Cogia cerradicola* (Mielke, 1967) (Hesperiidae), *Parides bunichus diodorus* (Hopffer, 1866) (Papilionidae), *Nhambikuara cerradensis* Freitas, Barbosa & Zacca, 2018, *Ypthimoides cipoensis* Freitas, 2004 (Nymphalidae) e *Sertania jaibensis* (Callaghan & Soares, 2001) (Riodinidae). Apesar de preliminar, as informações

aqui apresentadas são importantes não apenas para a gestão do Parque, mas também irão contribuir para formar um corpo de dados crucial para subsidiar ações de conservação do Bioma Cerrado no Brasil.

PALAVRAS-CHAVE: Insecta, Lepidoptera, Papilionoidea, Cerrado, Hesperidae, Nymphalidae, armadilhas atrativas, Brasil.

Inventario de Papilionoidea del Parque Nacional Sempre Vivas, Estado de Minas Gerais, sudeste de Brasil (Insecta: Lepidoptera)

Resumen

Este trabajo presenta un inventario preliminar de los Lepidoptera del Parque Nacional Sempre Vivas, un área de montaña (1.200 a 1.400 m s.n.m.) que combina sabanas (Cerrado) y campos rocosos abiertos de montaña (campos rupestres) en la región centro-norte de Minas Gerais, Brasil. Las recolecciones se realizaron mediante búsqueda activa con redes y trampas de cebo Van Someren-Rydon en dos periodos: uno de 2010 a 2011 (10 días de muestreo) y otro de 2018 a 2019 (20 días de muestreo). Se muestrearon 1.181 individuos de 238 especies, distribuidos en 18 subfamilias de seis familias de Lepidoptera. Destacan los registros de *Rhetus belphegor* (Westwood, [1851]) (Riodinidae), *Magnastigma julia* (Lycaenidae) y *Strymon ohausi* (Spitz, 1933) (Lycaenidae), especies incluidas en la Lista Roja de mariposas amenazadas de Brasil. Se reportaron cinco especies endémicas del bioma del Cerrado: *Cogia cerradicola* (Mielke, 1967) (Hesperidae), *Parides bunichus diodorus* (Hopffer, 1866) (Papilionidae), *Nhambikuara cerradensis* Freitas, Barbosa & Zacca, 2018, *Ypthimoides cipoensis* Freitas, 2004 (Nymphalidae) y *Sertania jaibensis* (Callaghan & Soares, 2001) (Riodinidae). Aunque preliminar, la información presentada aquí es importante para la gestión del Parque Nacional Sempre Vivas y contribuye a un cuerpo de datos crucial para apoyar las acciones de conservación del bioma del Cerrado en Brasil.

PALABRAS CLAVE: Insecta, Lepidoptera, Papilionoidea, Cerrado, Hesperidae, Nymphalidae, trampas de cebo, Brasil.

Introduction

Neotropical Cerrado savannas cover extensive areas in northeastern Brazil, where they intermix with Caatinga dry forests, extending obliquely toward the southwest until reaching the boundaries of Pantanal and Chaco and, thereby, dividing two large, forested biomes, the Amazon and the Atlantic Forest (OLIVEIRA & MARQUIS, 2002). This region is considered an important biodiversity hotspot for combining a high rate of endemism and threats (MYERS *et al.*, 2000). The area of Cerrado savannas has decreased in recent decades as a result of policies that prioritize the expansion of agricultural frontiers in Brazil (OLIVEIRA-FILHO, 2006; OLIVEIRA-FILHO & RATTER, 2002). Thus, effective public policies aiming at the conservation of Cerrado remnants are urgently needed to maintain biodiversity and, consequently, preserve ecosystem services (KLINK & MACHADO, 2005; STRASSBURG *et al.*, 2017). For the proposal of new conservation actions and monitoring strategies, it is necessary to obtain information on Cerrado species, their geographical distributions and temporal patterns, and the ecology and natural history of groups occupying preserved Cerrado areas (BROWN & GIFFORD, 2002; CAVALCANTI & JOLY, 2002; PINHEIRO *et al.*, 2010).

Biological inventories, that is, complete and well-represented lists of local species, are fundamental to the knowledge of the geographic distribution of organisms and development of environmental agendas, including conservation priorities and management programs (SANTOS *et al.*, 2008; SILVEIRA *et al.*, 2010). Insect inventories are prioritized because of the ecological relevance of these organisms to terrestrial and aquatic ecosystems. Insects are involved in several ecological processes, such as pollination, suppression of plant species through herbivory, predation of other insects and animals, and nutrient cycling; furthermore, insects are important components of virtually all food webs (MORSE, 1971; BARBOLA *et al.*, 2007; POTTS *et al.*, 2016; SCHOWALTER *et al.*, 2018). Given such a close relationship with other organisms, several insect groups are used as indicators of

anthropogenic disturbances (i.e., biological indicators), particularly Lepidoptera (BROWN, 1991; FREITAS *et al.*, 2003; FREITAS *et al.*, 2006).

Despite the growing knowledge of Brazilian Lepidoptera, inventories of Cerrado areas are still local, sparse, and underrepresented, mostly concentrated in the Central-West and Highlands (see BROWN & MIELKE 1967 a, b; BROWN & MIELKE 1968; PINHEIRO & ORTIZ 1992; EMERY *et al.*, 2006; PINHEIRO & EMERY, 2006). Thus, there is a lack of information about butterflies occurring in southern Cerrado, transition zones between biomes, and elevated regions, in which Cerrado vegetation is replaced by natural, open, rocky montane vegetation, known locally as campo rupestre (see SOARES *et al.*, 1999; GOZZI *et al.*, 2012; NERY *et al.*, 2014; PIRES *et al.*, 2018; HENRIQUES *et al.*, 2019; SOLDATI *et al.*, 2019; FREITAS *et al.*, 2021a). This survey provides an inventory of butterflies occurring in the Sempre Vivas National Park (SVNP), an area covered by Cerrado and campo rupestre vegetation in the north-central region of Minas Gerais State, Brazil.

Material and methods

The study was carried out in the Sempre Vivas National Park (SVNP) (17°55'S 43°47'W), a reserve that encompasses areas in the municipalities of Diamantina, Olhos D'Água, Bocaiúva, and Buenópolis, north-central Minas Gerais State, southeastern Brazil. The SVNP is located in the Serra do Espinhaço and extends over an area of approximately 124,156 ha, covered by a mosaic of different phytophysiognomies, such as riparian forest, seasonal semideciduous forest, several Cerrado physiognomies (such as Cerrado savannas *sensu stricto*, arboreal formations such as cerradão, and open vegetation such as campo limpo), and a high representation of campo rupestre. The climate is humid subtropical with dry winters and temperate summers (Cwb in the Köppen climate classification) (ÁLVARES *et al.*, 2014). Altitudes range from 1200 to 1400 m a.s.l., and the annual precipitation is between 1300 and 1600 mm (ÁLVARES *et al.*, 2014).

Samplings took place at 10 sampling sites over two periods: (1) two expeditions of five consecutive days each in April 2010 and May 2011 and (2) four expeditions of five consecutive days each in October 2018 and January, February, and March 2019 (Table I). Samplings were carried out between 9:00 a.m. and 5:00 p.m. (about 8 h of sampling effort per day) by active search using entomological nets, according to the protocols proposed by BROWN (1972), FREITAS *et al.* (2003), and FREITAS *et al.* (2021b), totaling 240 h of sampling effort over the two periods. Additionally, baited traps (Van Someren-Rydon traps) were used to attract fruit-feeding butterflies, following a protocol adapted from FREITAS *et al.* (2014). Ten traps were placed 20 m away from each other in areas of open vegetation, forest, and forest edges and left in the field for five consecutive days per expedition, totaling 480 h of sampling effort per trap. The bait used was a mixture of fermented banana and sugarcane juice, prepared 48 h before sampling. Collections were restricted to individuals whose identification in the field was difficult or doubtful, in which case the collected specimens were taken to the laboratory for later identification and deposited in zoological collections. Species identification was carried out by authors with experience in the field, supported by specialized literature and comparisons with the illustrated list on the webpage "Butterflies of America" (WARREN *et al.*, 2016) and specimens previously identified and deposited in museums. The classification used follows the checklist published by LAMAS (2004), modified according to WARREN *et al.* (2009), CONG *et al.* (2019), LI *et al.* (2019), and ZHANG *et al.* (2019) for HesperIIDae; SERAPHIM *et al.* (2018) for Riodinidae; WAHLBERG *et al.* (2009) for Nymphalidae; and ZACCA *et al.* (2018) for Euptychiina. Collection, storage, and preparation procedures were performed according to FREITAS *et al.* (2021c). Six families of diurnal butterflies were sampled (family Hedyliidae was not included). Collected specimens were deposited in one of the following three scientific collections: (1) Coleção Zoológica do Museu de Diversidade Biológica da Universidade Estadual de Campinas (ZUEC), Campinas, São Paulo, Brazil; (2) Centro Nacional de Pesquisa e Conservação da Biodiversidade do Cerrado e Caatinga do Instituto Chico Mendes de Conservação da Biodiversidade (CECAT), Brasília, Distrito Federal,

Brazil; or (3) Coleção do Laboratório de Zoologia, do Instituto Federal de Educação, Ciências e Tecnologia do Sul de Minas (CBVS), Campus Inconfidentes, Inconfidentes, Minas Gerais, Brazil.

Table I.– Sampling sites, coordinates, and phytophysiognomies where butterfly individuals were collected in the Sempre Vivas National Park, Minas Gerais, southeastern Brazil.

Locality	Geographical coordinates	Phytophysiognomies
Base	17.917200°S 43.786910°W	Campo limpo and riparian forest
Baliza	17.889685°S 43.731034°W	Campo limpo and riparian forest
Cachoeira Santa Rita	17.95820°S 43.93301°W	Cerrado, cerrado sensu stricto, and riparian forest
Córrego do Durão	17.882715°S 43.837921°W	Cerrado, cerrado sensu stricto, and riparian forest
Nhacica	17.846020°S 43.763150°W	Campo rupestre and campo limpo
Os Felipe	17.906360°S 43.709300°W	Campo rupestre, cerrado sensu stricto, and riparian forest
Rio Jequitaiá	17.889999°S 43.805292°W	Cerrado sensu stricto, campo limpo and riparian forest
Rio Jequitinhonha	16.502936°S 41.026484°W	Cerrado and riparian forest
Rio Preto	17.929697°S 43.809616°W	Campo rupestre, cerrado sensu stricto, campo limpo, and riparian forest
Rio Tamanduá	17.972718°S 43.779833°W	Cerrado and riparian forest

Results

A total of 1181 individuals belonging to 238 species were collected/recorded, distributed in six families of Lepidoptera (Appendix I). The family with the highest species richness was HesperIIDae, with 73 species (30.7%), followed by Nymphalidae ($n = 65$, 27.3%), Lycaenidae ($n = 42$, 17.7%), Riodinidae ($n = 37$, 15.5%), Pieridae ($n = 15$, 6.3%), and Papilionidae ($n = 6$, 2.5%) (Appendix I).

Of the Lepidoptera species inventoried in this study, three are included in the Brazilian Red List of threatened fauna (MMA, 2014): (1) *Magnastigma julia* Nicolay, 1977 (Lycaenidae) (endangered); (2) *Strymon ohausi* (Spitz, 1933) (Lycaenidae) (endangered); and (3) *Rhetus belphegor* (Westwood, 1851) (Riodinidae) (critically endangered). At least five species are endemic to the Cerrado biome: (1) *Cogia cerradicola* (Mielke, 1967) (HesperIIDae); (2) *Parides bunichus didorus* (Hopffer, 1865) (Papilionidae); (3) *Nhambikuara cerradensis* Freitas, Barbosa & Zacca, 2018 (Nymphalidae); (4) *Ypthimoides cipoensis* Freitas, 2004 (Nymphalidae); and (5) *Sertania jaibensis* (Callaghan & Soares, 2001) (Riodinidae).

Discussion

Although species richness was relatively low in the SVNP compared with other Neotropical sites (see BROWN 2005 and the discussion below), the present list can be considered representative of the SVNP Lepidoptera assemblage for the following reasons: (1) expeditions were well spaced in time, including periods characteristically known to have high species richness in the region and occurrence of univoltine species (see BROWN, 1972), (2) the team was composed of researchers

with vast experience in butterfly inventories, and (3) the richness of HesperIIDae species was greater than that of Nymphalidae species, a characteristic also observed in complete inventories of Lepidoptera in the Atlantic Forest and Cerrado (FRANCINI *et al.*, 2011; ISERHARD *et al.*, 2017). In summary, although many additions of species are expected in all six families represented here, this list may adequately represent richness patterns of the SVNP Rhopalocera assemblage.

Inventories in forested biomes, such as the Atlantic Forest and Amazon, generally comprise more than 500 species (e. g., BROWN JR. & FREITAS, 2002; BROWN, 2005; MIELKE *et al.*, 2010; FRANCINI *et al.*, 2011; BELTRAMI *et al.*, 2014; GARCIA-SALIK *et al.*, 2014; FREITAS *et al.*, 2016), as do inventories carried out in central Cerrado areas (EMERY *et al.*, 2006; MIELKE *et al.*, 2008). The species richness recorded here is comparable to that obtained in relatively well-sampled areas of southern Cerrado (CASAGRANDE *et al.*, 2012), sites in ecotone with the Atlantic Forest (also known as transition zones) (BROWN & MIELKE, 1968; SOLDATI *et al.*, 2019), and in similar areas of campo rupestre (PIRES *et al.*, 2018; HENRIQUES *et al.*, 2019). Some groups were clearly undersampled, and their richness would likely increase with some additional visits. For example, the subfamily Ithomiini (Nymphalidae: Danainae) had only three sampled species, but, according to other lists from the Cerrado, this number could increase to 15 or more. A good strategy is to visit riparian forests during the dry season, when Ithomiini species can usually be found in large groups in humid, shaded environments. Other poorly sampled groups were two genera of the family Nymphalidae, *Adelpha* (Limnitiidae) and *Actinote* (Heliconiinae), both with only one sampled species. These two genera are usually represented by eight or more species in similar habitats; the number of sampled species could increase with additional visits in March and April.

Finally, it is worth noting that, although richness was not very high, three threatened species were recorded in the SVNP, namely *M. julia*, *S. ohausi*, and *R. belphegor*, all associated with open formations of Cerrado and campo rupestre (FREITAS & MARINI-FILHO, 2011; KAMINSKI *et al.*, 2015; ICMBio, 2018). By contrast, no threatened species were identified in the Baixada Santista region, São Paulo State, where more than 500 species were recorded (FRANCINI *et al.*, 2011). Furthermore, some endemic species of the Cerrado were recorded, such as *Sertania jaibensis*, which was previously observed in only two localities (CALLAGHAN & SOARES, 2001; KAMINSKI *et al.*, 2017). The Serra do Espinhaço region is very peculiar and important to several fauna and flora species, extending over a small area (compared to the Cerrado as a whole) from Minas Gerais to Bahia States. Thus, we highlight the importance of preserved areas in unique landscapes such as campo rupestre in the SVNP. This area, belonging to the Cerrado domain, preserves and maintains various populations of endangered and endemic species in Brazil, representing a crucial and singular ecosystem to the biodiversity of Brazilian elevated regions.

Taxonomic composition

As previously mentioned, the SVNP list reflects the richness distribution of Brazilian species lists, with HesperIIDae being more represented than Nymphalidae (BROWN & FREITAS, 1999). Such a family composition is evidence that the inventory constituted a representative sampling effort (FRANCINI *et al.*, 2011). This is due to the fact that Nymphalidae has a greater proportion of species that are common and easily detectable, leading to a high accumulation of species in the first expeditions. By contrast, HesperIIDae, Lycaenidae, and Riodinidae show a slower rate of species accumulation, given that these individuals are generally furtive and low in abundance (BROWN & FREITAS, 2000; ISERHARD *et al.*, 2013, 2017a). Thus, these groups demand greater collection effort and time to obtain a well-represented inventory (e.g., BROWN & FREITAS, 2000: Table 3; LAMAS *et al.*, 2021). Inventories carried out with low sampling efforts tend to show greater Nymphalidae than HesperIIDae richness, although local richness is usually greater in the latter family.

A second pattern observed here was the relative proportions of Lycaenidae and Riodinidae.

Previous studies suggested that Lycaenidae predominate over Riodinidae in colder sites of the Atlantic Forest, including southern localities and highlands (ISERHARD & ROMANOWSKI, 2004; ISERHARD *et al.*, 2010; BELLAYER *et al.*, 2012). Riodinidae, by contrast, is more frequent than Lycaenidae in lowlands, northern regions, and the interior of the Atlantic Forest (FRANCINI *et al.*, 2011). Therefore, the SVNP inventory, carried out in a mountainous region with elevations of up to 1600 m a.s.l., is in accordance with this pattern, given that Lycaenidae was better represented than Riodinidae. The reasons for this pattern are unknown; however, warmer climates seem to favor sampling of the latter in relation to the former. According to BROWN (2005), several Amazon sites, including some that exhibit the highest butterfly species richness, follow this pattern, with reports of a significant positive relationship between Riodinidae richness and mean annual temperature. In the current study, the difference in richness between the two families was small, but it is expected that with more collections, the relative proportion between Lycaenidae and Riodinidae may change.

Conclusion

Given the importance of knowledge about Neotropical Lepidoptera, the inclusion of well-represented inventories is crucial to cover the lack of information on the occurrence and distribution of Lepidoptera in Brazil. This study represents an important contribution to such knowledge, including Lepidoptera that occur in montane sites within the Cerrado biome, where savannas are replaced by campo rupestre. In general, these habitats are spatially restricted and extremely sensitive to human disturbances and climate change, in addition to harboring several endemic and endangered species. Thus, knowledge of the diversity of these ecosystems is essential to support future conservation actions, including monitoring and management of protected areas (as in the present case), and to identify and propose priority areas for conservation. This survey has great relevance and is in accordance with the aims proposed by the National Plan for the Conservation of Threatened Lepidoptera, a great effort involving several researchers and the ICMBio Environmental Agency to increase the knowledge of Lepidoptera in all Brazilian biomes. Thus, this list holds valuable information not only for the management of the SVNP but also, combined with other campo rupestre inventories, for the consolidation of a more robust body of information to support actions aimed at the conservation of Cerrado biodiversity in Brazil.

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BIBLIOGRAPHY

- ALVARES, C. A., STAPE, J. L., SENTELHAS, P. C., GONÇALVES, J. L. M. & SPAROVEK, G., 2014.– Köppen's climate classification map for Brazil.– *Meteorologische Zeitschrift*, **22**(6): 711-728.
- BARBOLA, I. F., NASCIMENTO, E. A. & MILLÉO, J. A., 2007.– Fauna de insetos dos Campos Gerais.– *In* M. S. MELO, R. S. MORO & G. B. GUIMARÃES. *Patrimônio natural dos Campos Gerais do Paraná*: 230 pp. Editora UEPG, Ponta Grossa.
- BELLAVER, J. M., ISERHARD, C. A., SANTOS J. P., SILVA, A. K., TORRES, M., SIEWERT, R. R., MOSER, A. & ROMANOWSKI, H. P., 2012.– Butterflies (Lepidoptera: Papilionoidea and Hesperioidea) from Swamp forests and Restinga forests at the southern Brazilian Coastal Plain.– *Biota Neotropica*, **12**(4): 181-190.
- BELTRAMI, L. C. C., MIELKE, O. H. H., CASAGRANDE, M. M. & CARNEIRO, E., 2014.– The Hesperioidea and Papilionoidea (Lepidoptera) of São Luiz Do Purunã, Balsa Nova, Paraná State, Brazil.– *Tropical Lepidoptera Research*, **24**(1): 30-36.
- BROWN JR., K. S., 1972.– Maximizing daily butterfly counts.– *Journal of the Lepidopterists' Society*, **26**: 183-196.
- BROWN JR., K. S., 2005.– Geological, evolutionary and ecological bases of the diversification of Neotropical butterflies: implications for conservation.– *In* E. BERMINGHAM, E., C. W. DICK & C. MORITZ. *Tropical rainforests: Past, Present and Future*: 672 pp. University of Chicago Press, Chicago.
- BROWN JR., K. S. & FREITAS, A. V. L., 1999.– Lepidoptera.– *In* C. A. JOLY & C. E. M. BICUDO. *Biodiversidade do Estado de São Paulo, Brasil: Síntese do Conhecimento ao Final do Século XX*.– *In* C. R. F. BRANDÃO & E. M. CANCELLO. *5. Invertebrados terrestres*: 279 pp. FAPESP, São Paulo.
- BROWN JR., K. S. & FREITAS, A. V. L., 2000.– Atlantic Forest butterflies: indicators for landscape conservation.– *Biotropica*, **32**: 934-956.
- BROWN JR, K. S. & FREITAS, A. V. L., 2002.– Diversidade biológica no Alto Juruá: avaliação, causas e manutenção.– *In* M. C. CUNHA & M. B. ALMEIDA. *Enciclopédia da floresta: O alto Juruá: práticas e conhecimentos das populações*: 735 pp. Companhia das Letras, São Paulo.
- BROWN JR, K. S. & GIFFORD, D. R., 2002.– Lepidoptera in the Cerrado Landscape and the Conservation of Vegetation, Soil, and Topographical Mosaics.– *In* P. S. OLIVEIRA & R. J. MARQUIS. *The Cerrados of Brazil: Ecology and natural history of a neotropical savana*: 656 pp. Columbia University Press, New York.
- BROWN JR, K. S., 1991.– Conservation of Neotropical environments: insects as indicators.– *In* N. M. COLLINS & J. A. THOMAS. *The conservation of insects and their habitats*: 468 pp. Royal Entomological Society Symposium XV. Academic Press, London.
- BROWN JR., K. S. & MIELKE, O. H. H., 1967a.– Lepidoptera of the central Brazil plateau: I. Preliminary list of Rhopalocera: Introduction, Nymphalidae, Libytheidae.– *Journal of the Lepidopterists' Society*, **21**: 77-106.
- BROWN JR., K. S. & MIELKE, O. H. H., 1967b.– Lepidoptera of the central Brazil plateau: II. Preliminary list of Rhopalocera: Lycaenidae, Pieridae, Papilionidae, Hesperidae.– *Journal of the Lepidopterists' Society*, **21**: 145-168.
- BROWN JR., K. S. & MIELKE, O. H. H., 1968.– Lepidoptera of the central Brazil plateau: III. Partialist for the Belo Horizonte area, showing the character of the southeastern "blend zone".– *Journal of the Lepidopterists' Society*, **22**: 147-157.
- CALLAGHAN, C. J. & SOARES, A., 2001.– A review of the Cinericiiformes section of the genus *Audre* Hemming and the description of a new subspecies (Riodinidae).– *Revista Brasileira de Zoologia*, **18**(3): 755-763.
- CASAGRANDE, M. M., DOLIBAINA, D. R., CARNEIRO, E., DIAS, F. M. S., LEITE, L. A. R. & MIELKE, O. H. H., 2012.– Borboletas (Hesperioidea e Papilionoidea) de Jaguaiaíva, Paraná, Brasil: Inventário em um enclave de cerrado meridional.– *In* O. T. B. CARPANEZZI & J. B. CAMPOS. *Coletânea de Pesquisas. Parques Estaduais de Vila Velha, Cerrado e Guartelá*: 374 pp. Instituto Ambiental do Paraná, Curitiba.
- CAVALCANTI, R. B. & JOLY, C. A., 2002.– 18. Biodiversity and Conservation Priorities in the Cerrado Region.– *In* P. S. OLIVEIRA & R. J. MARQUIS. *The Cerrados of Brazil: Ecology and natural history of a neotropical savana*: 656 pp. Columbia University Press, New York.
- CONG, Q., ZHANG, J., SHEN, J. & GRISHIN, N. V., 2019.– Fifty new genera of Hesperidae (Lepidoptera).– *Insecta Mundi*, **0731**: 1-56.
- EMERY, E. O., BROWN JR, K. S. & PINHEIRO, C. E. G., 2006.– As borboletas (Lepidoptera, Papilionoidea) do Distrito Federal, Brasil.– *Revista Brasileira de Entomologia*, **50**(1): 85-92.
- FRANCINI, R. B., DUARTE, M., MIELKE, O. H. H., CALDAS, A. & FREITAS, A. V. L., 2011.– Butterflies (Lepidoptera, Papilionoidea and Hesperioidea) of the "Baixada Santista" region, coastal São Paulo, southeastern Brazil.– *Revista Brasileira de Entomologia*, **55**(1): 55-68.
- FREITAS, A. V. L., BROWN JR., K. S., MIELKE, O. H. H., SANTOS, J. P. & VASCONCELLOS-NETO, J.,

- 2016.– Borboletas da Reserva Natural Vale, Linhares/ES.– In S. G. ROLIM, L. F. T. MENEZES & A. C. SRBEK-ARAÚJO. *Floresta Atlântica de Tabuleiro: Diversidade e Endemismos na Reserva Natural Vale*: 496 pp. Editora Rupestre, Belo Horizonte.
- FREITAS, A. V. L., FRANCINI, R. B. & BROWN JR., K. S., 2003.– Insetos como indicadores ambientais.– In L. CULLEN JR., R. RUDRAN & C. VALLADARES-PÁDUA. *Métodos de estudos em biologia da conservação e manejo da vida silvestre*: 665 p. Editora da Universidade Federal do Paraná/Fundação O Boticário de Proteção à Natureza, Curitiba.
- FREITAS, A. V. L., ISERHARD, C., SANTOS, J. P., CARREIRA, J. Y. O., RIBEIRO, D. B., MELO, D. H. A., ROSA, A. H. B., MARINI-FILHO, O. J., ACCACIO, G. M. & UEHARA-PRADO, M., 2014.– Studies with butterfly bait traps: an overview.– *Revista Colombiana de Entomologia*, **40**: 203-212.
- FREITAS, A. V. L., LEAL, I. R., UEHARA-PRADO, M. & IANNUZZI, L., 2006.– Insetos como indicadores de conservação da paisagem.– In C. F. D. ROCHA, H. G. BERGALLO, M. VAN SLUYS & M. A. S. ALVES. *Biologia da conservação: essências*: 582 pp. UERJ, Rio de Janeiro.
- FREITAS, A. V. L. & MARINI-FILHO, O. J., 2011.– Plano de ação nacional para a conservação dos lepidópteros ameaçados de extinção.– *Série Espécies Ameaçadas*, **13**: 124 pp. ICMBio, Brasília.
- FREITAS, A. V. L., MUNIZ, D. G., CARREIRA, J. Y. O. & OLIVEIRA, P. S., 2021a.– Fruit-Feeding Butterfly Assemblages in a Neotropical Savanna: Assessing Phenological Patterns Using Baited Traps.– *The Journal of the Lepidopterists' Society*, **75**(2): 88-103.
- FREITAS, A. V., SANTOS, J. P., ROSA, A. H., ISERHARD, C. A., RICHTER, A., SIEWERT, R. R., GUERATTO, P. E., CARREIRA, J. Y. O. & LOURENÇO, G. M., 2021b.– Sampling Methods for Butterflies (Lepidoptera).– In J. C. SANTOS & G. W. FERNANDES. *Measuring Arthropod Biodiversity*: 600 pp. Springer, Cham.
- FREITAS, A. V. L., ZACCA, T., BARBOSA, E. P., SHIRAI, L. T., SERAPHIM, N., AGUIAR, T. M. C. & CARREIRA, J. Y. O., 2021c.– *Guia de práticas para coleta, preservação e montagem de material coletado em campo. Laboratório de Ecologia e Sistemática de Borboletas (LABBOR) e Laboratório de Pesquisas em Lepidoptera (LaPeL). Campinas - Rio de Janeiro*. Available from em http://www2.ib.unicamp.br/labor/site/?page_id=2211 (Acesso 10 de março de 2021).
- GARCIA-SALIK, L. M., CARNEIRO, E., DOLIBAINA, D. R., DIAS, F. M. S., RIBEIRO-LEITE, L. A., CASAGRANDE, M. M. & MIELKE, O. H. H., 2014.– Borboletas da estação ecológica do Caiuá, Diamante do Norte, Paraná, Brasil (Lepidoptera: Hesperioidea & Papilionoidea).– *SHILAP Revista de lepidopterologia*, **42**(166): 265-280.
- GOZZI, M. R., BEIRÃO, M. V., MEDEIROS, L. R., NEVES, F. S. & FAGUNDES, M., 2012.– Borboletas frugívoras em uma região de transição entre cerrado sensu stricto e caatinga no norte de Minas Gerais, Brasil.– *MG Biota*, **4**: 25-37.
- HENRIQUES, N. R., BEIRÃO, M. V., BRASIL, E. & CORNELLISEN, T., 2019.– Butterflies (Lepidoptera: Papilionoidea) from the campos rupestres, of São José, Minas Gerais, Brasil.– *Biota Neotropica*, **19**(3): 1-9.
- ICMBIO. Instituto Chico Mendes de Conservação da Biodiversidade. 2018 - *Livro Vermelho da Fauna Brasileira Ameaçada de Extinção: Invertebrados*, **7**: 726 pp. ICMBio, Brasília.
- ISERHARD, C. A., BROWN, K. S. & FREITAS, A. V. L., 2013.– Maximized sampling of butterflies to detect temporal changes in tropical communities.– *Journal of Insect Conservation*, **17**(3): 615-622.
- ISERHARD, C. A., QUADROS, M. T., ROMANOWSKI, H. P. & MENDONÇA-JR, M. S., 2010.– Occurrence of butterflies (Lepidoptera: Papilionoidea and Hesperioidea) in different habitats at the Araucaria Moist Forest and the Grasslands in the Basaltic Highlands in Southern Brazil.– *Biota Neotropica*, **10**(1): 1-13.
- ISERHARD, C. A. & ROMANOWSKI, H. P., 2004.– Butterfly species list (Lepidoptera, Papilionoidea and Hesperioidea) in a region at valley of Maquiné river, Rio Grande do Sul State, Brazil.– *Revista Brasileira de Zoologia*, **21**(3): 649-662.
- ISERHARD, C. A., ROMANOWSKI, H. P., RICHTER, A. & MENDONÇA-JR, M. S., 2017b.– Monitoring Temporal Variation to Assess Changes in the Structure of Subtropical Atlantic Forest Butterfly Communities.– *Environmental Entomology*, **46**(4): 804-813.
- ISERHARD, C. A., UEHARA-PRADO, M., MARINI-FILHO, O. J., DUARTE, M. & FREITAS, A. V. L., 2017a.– Fauna da Mata Atlântica: Lepidoptera - Borboletas.– In E. L. A. MONTEIRO-FILHO & C. E. CONTE. *Revisões em Zoologia - Mata Atlântica*: 490 pp. Editora UFPR, Curitiba.
- KAMINSKI, L. A., SOARES, G. R., SERAPHIM, N., WAHLBERG N., MARINI-FILHO, O. J. & FREITAS, A. V. L., 2015.– Natural history and systematic position of *Rhetus belphegor* (n. comb.) (Lepidoptera: Riodinidae), an endangered butterfly with narrow distribution in Southeast Brazil.– *Journal of Insect Conservation*, **19**(6): 1141-1151.
- KAMINSKI, L. A., CALLAGHAN, C. J., SERAPHIM, N., MAGALDI, L. M., VOLKMANN, L. & FREITAS, A.

- V. L., 2017.– *Sertania* gen. nov., a new genus of butterflies (Lepidoptera: Riodinidae) from the South American dry diagonal.– *Zootaxa*, **4312**(1): 165-179.
- LI, W., CONG, Q., SHEN, J., ZHANG, J., HALLWACHS, W., JANZEN, D. H. & GRISHIN, N. V., 2019.– Genomes of skipper butterflies reveal extensive convergence of wing patterns.– *Proceedings of the National Academy of Sciences*, **116**(13): 6232-6237.
- LINK, C. A. & MACHADO, R. B., 2005.– A conservação do Cerrado brasileiro.– *Megadiversidade*, **1**(1): 147-155.
- LAMAS, G., 2004.– Checklist: Part 4A. Hesperioidea-Papilionoidea.– In J. B. HEPPNER. *Atlas of Neotropical Lepidoptera*: 439 pp. Association for Tropical Lepidoptera, Gainesville.
- LAMAS, G., MCINNIS, M. L., BUSBY, R. C. & ROBBINS, R. K., 2021.– The lycaenid butterfly fauna (Lepidoptera) of Cosñipata, Peru: annotated checklist, elevational patterns, and rarity.– *Insecta Mundi*, **0861**: 1-34.
- MIELKE, O. H. H., CARNEIRO, E. S. & CASAGRANDE, M. M., 2010.– Lepidopterofauna (Papilionoidea e Hesperioidea) do Parque Estadual do Chandless e arredores, Acre, Brasil.– *Biota Neotropica*, **10**: 285-300.
- MIELKE, O. H. H., EMERY, E. D. O. & PINHEIRO, C. E. G., 2008.– As borboletas Hesperíidae (Lepidoptera, Hesperioidea) do Distrito Federal, Brasil.– *Revista Brasileira de Entomologia*, **52**(2): 283-288.
- MMA, Ministério do Meio Ambiente, 2014.– *Fauna Brasileira Ameaçada de Extinção*. Portaria nº 444, de 17 de dezembro de 2014.
- MORSE, H. D., 1971.– The insectivorous bird as an adaptive strategy.– *Annual Review of Ecology and Systematics*, **2**(1): 177-200.
- MYERS, N., MITTERMEIER, R. A., MITTERMEIER, C. G., FONSECA, G. A. & KENT, J., 2000.– Biodiversity hotspots for conservation priorities.– *Nature*, **403**(6772): 853-858.
- NERY, I., CARVALHO, N. & PAPROCKI, H., 2014.– Checklist of butterflies (Insecta: Lepidoptera) from Serra do Intendente State Park-Minas Gerais, Brasil.– *Biodiversity data Journal*, **2**: 1-23.
- OLIVEIRA-FILHO, A. T., 2006.– Definição e delimitação de domínios e subdomínios das paisagens naturais do estado de Minas Gerais.– In J. R., SCOLFORO & L. M. T. CARVALHO. *Mapeamento e Inventário da Flora e dos Reflorestamentos de Minas Gerais*: 288 pp. Lavras, UFLA.
- OLIVEIRA-FILHO, A. T. & RATTER, J. A., 2002.– Vegetation physiognomies and the woody flora of the cerrado biome.– In P. S. OLIVEIRA & R. J. MARQUIS. *The Cerrados of Brazil: Ecology and natural history of a neotropical savana*: 656 pp. Columbia University Press, New York.
- OLIVEIRA, P. S. & MARQUIS R. J., 2002.– *The Cerrados of Brazil: Ecology and natural history of a neotropical savana*: 656 pp. Columbia University Press, New York.
- PINHEIRO, C. E. G. & EMERY, E. O., 2006.– The butterflies (Lepidoptera: Papilionoidea and Hesperioidea) of the Environmental Protection Zone/APA do Gama e Cabeça de Veado, Distrito Federal, Brasil.– *Biota Neotropica*, **6**: 1-15.
- PINHEIRO, C. E. G., MALINOV, I. K., EMERY, E. O. & SCHMIDT, K., 2010.– Endemismos e conservação de borboletas (Lepidoptera: Papilionoidea e Hesperioidea) no bioma Cerrado.– In I. R. DINIZ, J. M. FILHO, M., R. B. MACHADO & R. B. CAVALCANTI. *Cerrado: conhecimento científico quantitativo como subsídio para as ações de conservação*: 496 pp. Thesaurus, Brasília.
- PINHEIRO, C. E. G. & ORTIZ, J. V. C., 1992.– Communities of Fruit-Feeding Butterflies along a vegetation gradiente in Central Brasil.– *Journal of Biogeography*, **19**: 505-511.
- PIRES, A. C. V., BEIRÃO, M. V., FERNANDES, G. W., OLIVEIRA, I. F. PEREIRA, G. C. N., SILVA, V. D., MIELKE, O. H. H. & DUARTE, M., 2018.– Checklist of butterflies from the rupestrian grasslands of Serra do Cipó, Minas Gerais, Brasil (Lepidoptera: Papilionoidea).– *SHILAP Revista de lepidopterologia*, **46**(181): 5-17.
- POTTS, S. G., IMPERATRIZ-FONSECA, V. L., NGO, H. T., AIZEN, M. A., BIESMEIJER, J. C., BREEZE, T. D., DICKS, L. V., GARIBALDI, L. A., HILL, R., SETTELE, J. & VANBERGEN, A. J., 2016.– Safeguarding pollinators and their values to human well-being.– *Nature*, **540**: 220-229.
- SANTOS, E. C., MIELKE, O. H. H. & CASAGRANDE, M. M., 2008.– Butterfly inventories in Brazil: the state of the art and the priority-areas model for research aiming at conservation.– *Natureza & Conservação*, **6**(2): 176-198.
- SCHOWALTER, T. D., NORIEGA, J. A. & TSCHARNTKE, T., 2018.– Insect effects on ecosystem services - introduction.– *Basic and Applied Ecology*, **26**: 1-7.
- SERAPHIM, N., KAMINSKI, L. A., DEVRIES, P. J., PENZ, C., CALLAGHAN, C., WAHLBERG, N., SILVABRANDÃO, K. L. & FREITAS, A. V. L., 2018.– Molecular phylogeny and higher systematics of the metalmark butterflies (Lepidoptera: Riodinidae).– *Systematic Entomology*, **43**(2): 407-425.
- SILVEIRA, L. F., BEISIEGEL, B. M., CURCIO, F. F., VALDUJO, P. H., DIXO, M., VERDADE, V. K., MATTOX,

- G. M. T. & CUNNINGHAM, P. T. M., 2010.– Para que servem os inventários de fauna?– *Estudos avançados*, **24**(68): 173-207.
- SOARES, A., JÚLIO, C. E. A., CAETANO, C. A., TANGERINI, N., FARIA, A. C. & COSTA, J. E., 1998.– Lista da Lepidopterofauna diurna da região da Calha do Rio São Francisco, Estado de Minas Gerais, Municípios de Itacarambi, Jaíba, Manga e Matias Cardoso.– *Boletim do Museu Nacional, n. s., Zoologia*, **402**: 1-11.
- SOLDATI, D., SILVEIRA, F. A. D. & SILVA, A. R. M., 2019.– Butterfly fauna (Lepidoptera, Papilionoidea) in a heterogeneous area between two biodiversity hotspots in Minas Gerais, Brasil.– *Papéis Avulsos de Zoologia*, **59**: 1-9.
- STRASSBURG, B. B. N., BROOKS, T., FELTRAN-BARBIERI, R., IRIBARREM, A., CROUZEILLES, R., LOYOLA, R., LATAWIEC, A. E., OLIVEIRA FILHO, F. J. B., SCARAMUZZA, C. A. M., SCARANO, F. R., SOARES-FILHO, B. & BALMFORD, A., 2017.– Moment of truth for the Cerrado hotspot.– *Nature Ecology & Evolution*, **1**: 13-15.
- WAHLBERG, N., LENEVEU, J., KODANDARAMAIAH, U., PEÑA, C., NYLIN, S., FREITAS, A. V. L. & BROWER, A. V. Z., 2009.– Nymphalid butterflies diversify following near demise at the Cretaceous/Tertiary boundary.– *Proceedings of the Royal Society of London. Biological Science*, **276**: 4295-4302.
- WARREN, A. D., DAVIS, K. J., STANGELAND, E. M., PELHAM, J. P., WILLMOTT, K. R. & GRISHIN, N. V., 2016.– *Illustrated Lists of American Butterflies*.– Available from em <http://www.butterfliesofamerica.com> (Acesso em 01 de julho de 2020).
- WARREN, A. D., OGAWA, J. R. & BROWER, A. V. Z., 2009.– Revised classification of the family Hesperidae (Lepidoptera: Hesperioidea) based on combined molecular and morphological data.– *Systematic Entomology*, **34**: 467-523.
- ZACCA, T., BARBOSA, E. P. & FREITAS, A. V. L., 2018.– *Euptychiina Species Checklist*.– Available from em https://www2.ib.unicamp.br/labor/site/?page_id=1020 (Acesso em julho de 2020).
- ZHANG, J., CONG, Q., SHEN, J., BROCKMANN, E. & GRISHIN, N. V., 2019.– Genomes reveal drastic and recurrent phenotypic divergence in firetip skipper butterflies (Hesperiidae: Pyrrhopyginae).– *Proceedings of the Royal Society B*, **286**(1903): 1-6.

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Appendix I.– List of Papilionoidea species recorded in the Sempre Vivas National Park, Minas Gerais, southeastern Brazil. The total number of species in each taxon is indicated in parentheses.

- HESPERIIDAE (73)
 PYRRHOPYGINAE (10)
Elbella sp.
Mimoniades (Mahotis) versicolor (Latreille, [1824])
Mysoria (Mysoria) barcastus barta Evans, 1951
Mysoria (Sarbia) damippe Mabilille & Boulet, 1908
Mysoria (Sarbia) xanthippe (Latreille, [1824])
Mysoria (Sarbiens) catomelaena Mabilille & Boulet, 1908
Passova polemon (Hopffer, 1874)
Pyrrhopyge charybdis Westwood, 1852
Pyrrhopyge pelota Plötz, 1879
Pyrrhopyge sp.
 EUDAMINAE (15)
Autochton (Autochton) integrifascia (Mabilille, 1891)
Autochton (Autochton) itylus Hübner, 1823
Autochton (Autochton) neis (Geyer, 1832)
Cecropterus (Murgaria) barra Evans, 1952
Cecropterus (Thorybes) dorantes (Stoll, [1790])
Chioides catillus (Cramer, 1779)
Cogia calchas (Herrich-Schäffer, 1869)
Cogia cerradicola (O. Mielke, 1967)
Cogia grandis Riley, 1921
Spicauda cindra Evans, 1952
Spicauda simplicius (Stoll, [1790])
Spicauda teleus (Hübner, 1821)
Udranomia spitzii (Hayward, 1942)
Urbanus (Urbanus) proteus (Linnaeus, 1758)
Urbanus (Urbanus) velinus (Plötz, 1880)
 HESPERIINAE (27)
Callimormus saturnus (Herrich-Schäffer, 1869)
Cobalopsis sp.
Cymaenes uruba uruba (Plötz, 1886)
Cymaenes warreni (Weeks, 1901)
Euphyes cherra Evans, 1955
Hedone vibex catilina (Plötz, 1886)
Hylephila phyleus (Drury, 1773)
Justinia kora (Hewitson, 1877)
Miltomiges cinnamomea (Herrich-Schäffer, 1869)
Mnaseas bicolor inca Bell, 1930
Morys subgrisea subgrisea (Mabilille, 1898)
Mucia scitula (Hayward, 1951)
Orthos sp.
Panoquina peraea (Hewitson, 1866)
Pompeius amblyspila (Mabilille, 1898)
Quasimellana mielkei Burns, 1994
Rufocumbre eberti (Evans, 1955)
Synale elana (Plötz, 1882)
Synale metella (Plötz, 1882)
Veadda veadeira O. Mielke, 1968
Vehilius inca (Scudder, 1872)
Vernia dares (Plötz, 1883)
Vidius nostra Evans, 1955
Vidius similis O. Mielke, 1980
Vidius spitzii O. Mielke, 1967
Wallengrenia otho clavus (Erichson, [1849])
Xeniades chalestra (Hewitson, 1866)
 PYRGINAE (21)
Anastrus ulpianus Poey, 1832
Anisochoria minorella Mabilille, 1898
Burnsius orcus (Stoll, 1780)
Chiothion asychis autander (Mabilille, 1891)
Chiothion basigutta (Plötz, 1884)
Cycloglypha thrasibulus (Fabricius, 1793)
Gesta (Gesta) gesta (Herrich-Schäffer, 1863)
Gorythion begga (Prittwitz, 1868)
Eantis mithridates thraso (Hübner, [1807])
Helias phalaenoides palpalis (Latreille, [1824])
Heliopetes (Heliopetes) arsalte (Linnaeus, 1758)
Heliopetes (Heliopetes) orbiger (Mabilille, 1888)
Heliopetes (Leucoscirtes) libra Evans, 1944
Heliopetes (Leucoscirtes) omrina (A. Butler, 1870)
Incisus incisus (Mabilille, 1878)
Pellicia dimidiata zamia Plötz, 1882
Timochares trifasciata (Hewitson, 1868)
Timochreon doria (Plötz, 1884)
Viola violella (Mabilille, 1898)
Zopyrion evenor Godman, 1901
Zopyrion reticulata Hayward, 1942
 LYCAENIDAE (42)
 POLYOMMATINAE (2)
Hemiargus hanno (Stoll, [1790])
Leptotes cassius (Cramer, 1775)
 THECLINAE (40)
Allosmaitia strophius (Godart, [1824])
Arawacus binangula (Schaus, 1902)
Arawacus ellida (Hewitson, 1867)
Arawacus tarania (Hewitson, 1868)
Atlides rustan (Stoll, [1790])
Badecla badaca (Hewitson, 1868)
Bistonina mantica (H. Druce, 1907)
Calycopis caulonia (Hewitson, 1877)
Chlorostymon telea (Hewitson, 1868)
Cyanophrys sp.
Eroria tella (Schaus, 1902)
Magnastigma hirsuta (Prittwitz, 1865)
Magnastigma julia Nicolay, 1977
Ministrymon azia (Hewitson, 1873)
Nicolaea cauter (H. Druce, 1907)
Nicolaea laconia (Hewitson, 1868)
Nicolaea socia (Hewitson, 1868)
Ostrinotes empusa (Hewitson, 1867)
Paiwarria aphaca (Hewitson, 1867)
Parrhasius polibetes (Stoll, 1781)

- Pseudolycaena marsyas* (Linnaeus, 1758)
Rekoa marius (Lucas, 1857)
Rekoa palegon (Cramer, 1780)
Strymon bubastus (Stoll, 1780)
Strymon cestri (Reakirt, [1867])
Strymon crambusa (Hewitson, 1874)
Strymon lucena (Hewitson, 1868)
Strymon mulucha (Hewitson, 1867)
Strymon ohausi (Spitz, 1933)
Strymon rufofusca (Hewitson, 1877)
Strymon serapio (Godman & Salvin, 1887)
Strymon tegaea (Hewitson, 1868)
Strymon ziba (Hewitson, 1868)
Strymon sp. 1
Strymon sp. 2
Symbiopsis lenitas (H. Druce, 1907)
Thepytus sp.
Thereus sp.
Theritas triquetra (Hewitson, 1865)
Thestius lycabas (Cramer, 1777)
 NYMPHALIDAE (65)
 BIBLIDINAE (11)
Biblis hyperia nectanabis (Fruhstorfer, 1909)
Callicore astarte selima (Guenée, 1872)
Callicore sorana (Godart, [1824])
Dynamine postverta (Cramer, 1779)
Dynamine tithia (Hübner, [1823])
Eunica bechina magnipunctata Talbot, 1928
Eunica cuvieri (Godart, 1819)
Eunica sydonia (Godart, [1824])
Hamadryas februa (Hübner, [1823])
Pyrrhogyra sp.
Temenis laothoe (Cramer, 1777)
 CHARAXINAE (3)
Fountainea ryphea phidile (Geyer, 1837)
Memphis acidalia victoria (H. Druce, 1877)
Zaretis strigosus (Gmelin, [1790])
 DANAINAE (4)
Aeria olena Weymer, 1875
Brevioleria aelia plisthenes (R.F. d' Almeida, 1958)
Danaus gilippus (Cramer, 1775)
Mechanitis polymnia casabranca Haensch, 1905
 HELICONIINAE (9)
Actinote pellenea Hübner, [1821]
Agraulis vanillae maculosa (Stichel, [1908])
Dryas iulia alcionea (Cramer, 1779)
Eueides isabella dianasa (Hübner, [1806])
Euptoieta hegesia meridiania Stichel, 1938
Heliconius besckei (Ménétriés, 1857)
Heliconius erato phyllis (Fabricius, 1775)
Heliconius ethilla narcaea (Godart, 1819)
Philaethria wernickei (Röber, 1906)
 LIMENITIDINAE (1)
Adelpha thoasa gerona (Hewitson, 1867)
 NYMPHALINAE (8)
Anartia jatrophae jatrophae (Linnaeus, 1763)
Eresia lansdorfi (Godart, 1819)
Historis odius dious Lamas, 1995
Junonia evarete (Cramer, 1779)
Ortilia orthia (Hewitson, 1864)
Tegosa claudina (Eschscholtz, 1821)
Telenassa teletusa (Godart, [1824])
Vanessa myrinna (E. Doubleday, 1849)
 SATYRINAE (29)
Caligo illioneus (Cramer, 1775)
Cissia eous (A. Butler, 1867)
Erichthodes narapa (Schaus, 1902)
Godartiana muscosa (A. Butler, 1870)
Hermeuptychia ca. *atalanta* (A. Butler, 1867)
Hermeuptychia gisella (Hayward, 1957)
Hermeuptychia maimoune (A. Butler, 1870)
Morpho anaxibia (Esper, [1801])
Morpho helenor ca. *mielkei* Blandin, 2007
Morpho epistrophus (Fabricius, 1796)
Moneuptychia itapeva Freitas, 2007
Moneuptychia wahlbergi Freitas, Barbosa, Siewert & Mielke, 2015
Nhambikuara cerradensis Freitas, Barbosa & Zacca, 2018
Opsiphanes invirae (Hübner, [1808])
Paryphthimoides sylvina (C. Felder & R. Felder, 1867)
Pharneuptychia ca. *innocentia* sp. 1
Pharneuptychia ca. *innocentia* sp. 2
Pharneuptychia ca. *innocentia* sp. 3
Pharneuptychia ca. *innocentia* sp. 4
Pharneuptychia phares (Godart, [1824])
Praepedaliodes landryi Pycrz & Freitas, 2017
Stegosatyryus ocelloides (Schaus, 1902)
Taygetis laches Fabricius, 1793
Taygetis sp.
Yphthimoides affinis (A. Butler, 1867)
Yphthimoides cipoensis Freitas, 2004
Yphthimoides pacta (Weymer, 1911)
Yphthimoides patricia (Hayward, 1957)
Yphthimoides straminea (A. Butler, 1867)
 PAPILIONIDAE (6)
 PAPILIONINAE (6)
Heraclides thoas brasiliensis (Rothschild & Jordan, 1906)
Mimoides lysithous (Hübner, [1821])
Parides anchises foetterlei (Rothschild & Jordan, 1906)
Parides bunichus diodorus (Hopffer, 1865)
Protesilaus telesilaus (C. Felder & R. Felder, 1864)
Pterourus scamander grayi (Boisduval, 1836)
 PIERIDAE (15)
 COLIADINAE (11)
Anteos clorinde (Godart, [1824])
Anteos menippe (Hübner, [1818])
Eurema albula sinoe (Godart, 1819)
Eurema deva (E. Doubleday, 1847)

- Eurema elathea flavescens* (Chavannes, 1850)
Eurema phiale paula (Röber, 1909)
Leucidia elvina (Godart, 1819)
Phoebis argante (Fabricius, 1775)
Phoebis marcellina (Cramer, 1777)
Pyrisitia leuce (Boisduval, 1836)
Pyrisitia nise tenella (Boisduval, 1836)
 DISMORPHIINAE (1)
Enantia clarissa (Weymer, 1895)
 PIERINAE (3)
Glutophrissa drusilla (Cramer, 1777)
Hesperocharis paranensis Schaus, 1898
Melete lycimnia (Cramer, 1777)
 RIODINIDAE (37)
 NEMEOBIINAE (1)
Euselasia thucydides truncata Callaghan, 2001
 RIODININAE (36)
Adelotypa asemna (Stichel, 1910)
Ancyluris colubra (Saunders, 1859)
Anteros formosus (Cramer, 1777)
Anteros lectabilis Stichel, 1909
Ariconias glaphyra (Westwood, 1851)
Aricoris almironensis (Schweizer & Kay, 1941)
Aricoris caracensis (Callaghan, 2001)
Aricoris tutana (Godart, [1824])
Aricoris sp. 1
Aricoris sp. 2
- Baeotis johannae* Sharpe, 1890
Calephelis brasiliensis McAlpine, 1971
Chalodeta theodora (C. Felder & R. Felder, 1862)
Detritivora gynaea (Godart, [1824])
Emesis diogenia Prittwitz, 1865
Emesis lupina melancholica Stichel, 1916
Juditha sp.
Lemonias stalactioides (A. Butler, 1867)
Lyropteryx tersichore Westwood, 1851
Melanis smithiae (Westwood, 1851)
Melanis xenia (Hewitson, [1853])
Parcella amarynthina (C. Felder & R. Felder, 1865)
Periplacis nitida (A. Butler, 1867)
Phaenochitonina sp.
Rhetus belphegor (Westwood, 1851)
Rhetus periander arthuriana (Sharpe, 1890)
Riodina lycisca (Hewitson, [1853])
Sertania jaibensis (Callaghan & Soares, 2001)
Stalactis phlegia phlegetontia (Perty, 1833)
Stichelia bocchoris (Hewitson, 1876)
Synargis axenus (Hewitson, 1876)
Synargis calyce (C. Felder & R. Felder, 1862)
Theope ca. leucanthe H. Bates, 1868
Theope pieridoides C. Felder & R. Felder, 1865
Zabuella castanea (Prittwitz, 1865)
Zabuella paucipuncta (Spitz, 1930)

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Two new Geometridae for the Maltese islands - *Microloxia herbaria* (Hübner, [1813]) and *Scopula luridata* (Zeller, 1847) (Lepidoptera: Geometridae)

J. Agius

Abstract

Microloxia herbaria (Hübner, [1813]) and *Scopula luridata* (Zeller, 1847) are 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 these new records.

KEY WORDS: Lepidoptera, Geometridae, *Microloxia herbaria*, *Scopula luridata*, Maltese Islands.

**Dos nuevos Geometridae para Malta - *Microloxia herbaria* (Hübner, [1813])
y *Scopula luridata* (Zeller, 1847)
(Lepidoptera: Geometridae)**

Resumen

Microloxia herbaria (Hübner, [1813]) y *Scopula luridata* (Zeller, 1847) se registran por primera vez, para Malta. Se incluye la distribución y hábitat del adulto y larva. Se propone un nombre maltés para estos nuevos registros.

PALABRAS CLAVE: Lepidoptera, Geometridae, *Microloxia herbaria*, *Scopula luridata*, Malta.

Introduction

Geometridae are the second-largest family of Lepidoptera, known to include approximately 24,000 species worldwide (SCOBLE & HAUSMANN, 2007) with 900 species recorded from Europe (HAUSMANN, 2001). In Malta this family is represented by around 75 species (SAMMUT, 2000).

Species in the genus *Microloxia* Warren, 1893 have a deep green ground colour and are relatively small, with the males measuring around 17mm whereas the females measure up to 22 mm. The males have bipectinate antennae whilst the females have dentate antennae. *Microloxia* Warren, 1893 includes six worldwide species and are distributed in Europe, Africa including Madagascar and the Indo-Pacific.

The genus *Scopula* Schrank, 1802 which belongs to the Scopulini Duponchel, 1845 tribe, includes more than 700 worldwide species, with 10 species being mentioned from Malta, however *Scopula* (*Glossotrophia*) *confinaria* (Herrich-Schäffer, 1847), *Scopula* (*Scopula*) *rubiginata* (Hufnagel, 1767), and *Scopula* (*Scopula*) *emutaria* (Hübner, [1809]) have probably been recorded by mistake since these species have never been found in the recent history of Maltese entomology (SAMMUT, 2000) and potentially have been confused with other species.

Material and methods

This material has been collected by the author using a 250 W mercury vapour light and an 18W UV Black light tube and is found in the author's private collection.

Results

Microloxia herbaria (Hübner, [1813])

Material: MALTA, Gozo, Dahlet Qorrot, 1 ♂, 11-VI-2021, at MV light, coll & leg. J. Agius.

Life History: *Microloxia herbaria* (Hübner, [1813]) is found in open grassland of hot coastal plains and rocky steppes. The area from where the specimen was recorded is a valley which leads straight to the sea. The valley has considerable agricultural fields however on the sides it is mainly made up of rocky garigues. The larvae are polyphagous and feed on the flowers of *Helichrysum stoechas* (L.) Moench, *Teucrium polium capitatum* (L.) Arcang, *Vernonia centaureoides* Klatt, and *Artemisia* species. None of these plants are found in the Maltese islands but Gozo is home to *Helichrysum melitense* (Pignatti) Brullo, Lafranco, Pavone & Ronsisvalle, the Maltese everlasting, which is a species of flowering plant in the family Asteraceae and is endemic to Malta, specifically on the island of Gozo. *Helichrysum melitense* is quite common in the area and could potentially be a substitute for *H. stoechas*. Other related plants are *Teucrium fruticans* L. and *T. flavum* L. which are both common whilst *Artemisia arborescens* (Vall.) L. is considered a rare species. However, so far there is no evidence that *Microloxia herbaria* (Hübner, [1813]) is breeding in the Maltese Islands.

Distribution: *Microloxia herbaria* (Hübner, [1813]) is the only species in this *Microloxia* genus which is recorded from Europe and mainly from the Mediterranean basin including Spain, France and Italy. This species is present in neighbouring Tunisia and Sicily (BELLA *et al.*, 2009) too.

Remarks: The species is new to the Maltese lepidopteroфаuna. The author proposes the Maltese name Qejjies tal-Ħxejjex, after a transliteration of the scientific name.

Scopula luridata (Zeller, 1947)

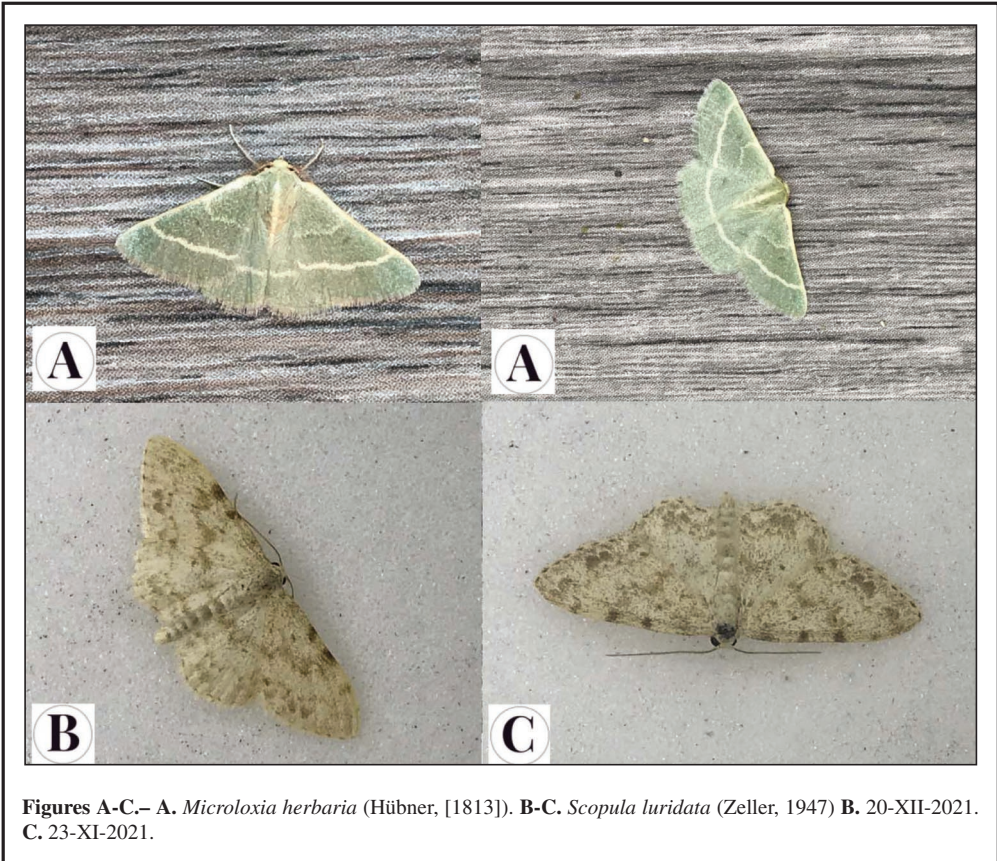
Material: MALTA - Zurrieq, Bassasa, 1 ♀, 04-V-2021, at MV light, coll & leg. J. Agius; Zurrieq, 1 ♀, 16-X-2021, at UV light, coll & leg. J. Agius; Zurrieq, 1 ♂, 20-XI-2021, at UV light, coll & leg. J. Agius; Zurrieq, 1 ♂, 23-XI-2021, at MV light, coll & leg. J. Agius.

Life History: *Scopula luridata* (Zeller, 1947) is found near coasts and xeromontane localities but in Europe it is restricted to lowlands. The Zurrieq, Bassasa area where the first specimen was found is a coastal area whereas the three other specimens were found further inland, but nonetheless, not far away from the coast. The larvae are polyphagous on Solanaceae but have also been recorded feeding on *Silene vulgaris* (Moench.) Garcke (Caryophyllaceae), *Asparagus* (Liliaceae), *Opuntia* (Cactaceae) and *Rosa* (Rosaceae). The first female laid 9 eggs whilst the second female laid 7 eggs. All the eggs of the first female hatched whilst only 5 eggs hatched from those laid by the second female. All the larvae were successfully bred on cultivated roses. *Silene vulgaris* is a scarce species in Malta but sometimes it could be found in sizeable pockets in some localities such as Marsaskala. When fed on roses, the lifecycle of the larvae from egg to adult moth takes 2 months in early summer. Even though no larvae have been found in the wild so far, the fact that 4 specimens including 2 gravid females have been found in a relatively short period of time might be a sign that this species is breeding in Malta. This could have been easily facilitated by the many ornamental roses spread in private and public gardens.

Distribution: *Scopula luridata* (Zeller, 1947) is found in the east Mediterranean including southern Greece and Crete, east Libya, Egypt to Cyprus, southern Turkey, extending to the Arabian Peninsula, Yemen and Somalia, across Iran and western India (HAUSMANN, 2004)

Remarks: The species is new to the Maltese lepidopteroфаuna. The author proposes the Maltese name Skopula Mahmuġa, after a transliteration of the scientific name. With the addition of *Scopula luridata* (Zeller, 1947) to the Maltese lepidopteroфаuna, the *Scopula* species correctly recorded from Malta are:

Scopula (Glossotrophia) asellaria romanaria (Millière, 1869)
Scopula (Scopula) imitaria (Hübner, [1799])
Scopula (Scopula) decolor (Staudinger, 1897)
Scopula (Scopula) marginepunctata (Goeze, 1781)
Scopula (Scopula) minorata (Boisduval, 1833)
Scopula (Scopula) ornata (Scopoli, 1763)
Scopula (Scopula) vigilata (Prout, 1913)
Scopula (Scopula) luridata (Zeller, 1947)



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BIBLIOGRAPHY

BELLA, S., PARENZAN, P. & RUSSO, P., 2008-2009.– I Macrolepidotteri della Riserva Naturale Regionale di Vendicari.– *Entomologica*, **41**(2008-2009): 113-193.
BREHM, G., MURILLO-RAMOS, L., SIHVONEN, P., HAUSMANN, A., SCHMIDT, B. C., ÖUNAP,

- E., MOSER, A., MÖRTTER, R., BOLT, D., BODNER, F., LINDT, A., PARRA, L. E. & WAHLBERG, N., 2019.– New World Geometrid moths (Lepidoptera: Geometridae): Molecular phylogeny, biogeography, taxonomic updates and description of 11 new tribes.– *Arthropod Systematic & Philogeny*, **77**: 457-486.
- HAUSMANN, A., 2001.– Introduction. Archiearinae, Orthostixinae, Desmobathrinae, Alsophilinae, Geometrinae.– *The Geometrid Moths of Europe*, **1**: 282 pp., Apollo Books, Stenstrup.
- HAUSMANN, A., 2004.– Sterrhinae.– *The Geometrid Moths of Europe*, **2**: 600 pp., Apollo Books, Stenstrup.
- SAMMUT, P., 2000.– *Kullana Kulturali. 12 – Il-Lepidoptera*: X + 246 pp. Publikazzjonijiet Indipendenza, Malta.
- SCOBLE, M. J. & HAUSMANN, A., 2007.– Online list of valid and nomenclaturally available names of the Geometridae of the World: Available from <http://www.herbulot.de/globalspecieslist.htm> (accessed 10th June 2020).

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