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# SHILAP

# REVISTA DE LEPIDOPTEROLOGIA

**Madrid**
**2017**

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# *SHILAP REVISTA DE LEPIDOPTEROLOGIA*

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# Borboletas em Floresta Estacional Semidecidual e Campos do Bioma Pampa, Brasil (Lepidoptera: Papilionoidea)

J. M. Silva, K. Gawlinski, M. Moscoso, M. P. V. Zurschimiten, S. K. Cunha, E. J. E. Silva & F. R. M. Garcia

**Resumo**

O Bioma Pampa ainda permanece em grande parte pouco conhecido, o que pode ser uma das principais causas de ameaça a sua biodiversidade. Visando contribuir para o conhecimento das borboletas na região, foi realizado um inventário em Floresta Estacional Semidecidual e Campos do Bioma Pampa em Morro Redondo e Capão do Leão, Sudeste do Rio Grande do Sul, Brasil. As coletas foram realizadas mensalmente através do uso de redes entomológicas, entre outubro de 2012 a junho de 2013. Totalizando 540 horas-rede foram registrados 3.065 indivíduos distribuídos em 154 espécies e seis famílias de borboletas. Destes, 54% correspondem à Nymphalidae, 33% Hesperiidae, 5% Pieridae, 4% Lycaenidae, 2% Papilionidae e 2% Riodinidae. Hesperiidae foi a família mais rica seguida de Nymphalidae, com *Tegosa claudina* (Eschscholtz, 1821) sendo a espécie mais abundante. Quatro espécies são novos registros para a região.
PALAVRAS CHAVE: Lepidoptera, Papilionoidea, diversidade, inventário, Brasil.

**Butterflies in Seasonal Semi-deciduous Forest and Fields in Brazilian Grassland Biome (Lepidoptera: Papilionoidea)**

**Abstract**

The Brazilian Grassland Biome comprises ecosystems which harbor unique flora and fauna for the country. It remains largely unknown, which can be a major cause of threat to biodiversity. To contribute to the knowledge of butterflies in the region, an inventory was conducted for Seasonal Semideciduous Forest and Fields of Pampa Biome in Morro Redondo and Capão do Leão, Southeast of Rio Grande do Sul, Brazil. Sampling was carried out monthly by using entomological nets from October 2012 to June 2013. Totalizing 540 net-hours, 3,065 individuals belonging to 154 species and six families of butterflies have been recorded. Of these, 54% correspond to Nymphalidae, 33% to Hesperiidae, 5% to Pieridae, 4% to Lycaenidae, 2% to Papilionidae and 2% to Riodinidae. Hesperiidae was the richest family followed by Nymphalidae, with *Tegosa claudina* (Eschscholtz, 1821) being the most abundant species. Four species are new records for the region.
KEY WORDS: Lepidoptera, Papilionoidea, diversity, inventory, Brazil.

**Mariposas de los bosques semicaducifolios estacionales y campos del Bioma de la Pampa, Brasil (Lepidoptera: Papilionoidea)**

**Resumen**

El brasileño Bioma de la Pampa comprende ecosistemas que dan refugio a flora y faunas únicas para el país. Son en gran parte desconocidos, que puede ser una causa muy importante de la amenaza para

biodiversidad. Para colaborar en los conocimientos de mariposas en la región, un inventario fue dirigido para el bosque de semicaducifolios estacionales y campos del Bioma de la Pampa en Morro Redondo y Capão do Leão, sudeste de Rio Grande do Sul, Brasil. La muestra fue realizada mensualmente usando redes de entomológicas de octubre de 2012 a junio de 2013. Totalizando 540 horas-red, 3.065 ejemplares que pertenecen a 154 especies y seis familias de mariposas han sido registradas. De éstos, el 54 % corresponden a Nymphalidae, 33 % a Hesperiidae, 5 % a Pieridae, 4 % a Lycaenidae, 2 % a Papilionidae y 2 % a Riodinidae. Los Hesperiidae era la familia más abundante seguida por los Nymphalidae, siendo la especie más abundante *Tegosa claudina* (Eschscholtz, 1821). Se registran cuatro nuevas especies para la región.

PALABRAS CLAVE: Lepidoptera, Papilionoidea, diversidad, inventario, Brasil.

## Introdução

No Brasil, o Bioma Pampa ocupa aproximadamente 63% do Estado do Rio Grande do Sul (IBGE, 2004). Sua vegetação apresenta predomínio de campos, entremeados por capões de mata, matas ciliares e banhados. A região é composta por ecossistemas que abrigam uma boa riqueza de espécies animais e vegetais, possuindo aspectos de fauna e flora únicos no país, ainda não completamente conhecidos pela ciência (MMA, 2002). No entanto, com o avanço de atividades como a agricultura e silvicultura, este bioma tem sofrido intensas alterações em sua paisagem (CORDEIRO & HASENACK, 2009).

A realização de inventários é uma importante estratégia para a obtenção de informações essenciais que fundamentam estudos e práticas conservacionistas, tais como: avaliação, monitoramento e definição de áreas prioritárias para a conservação. Os adultos de borboletas se destacam em trabalhos com este intuito, pois são diversos, respondem com rapidez a alterações no ambiente e são relativamente fáceis de amostrar e identificar (FREITAS *et al.,* 2005). Além disso, são conspícuos e carismáticos, o que permite que também sejam utilizados como espécies bandeira ou guarda-chuva (NEW, 1997).

No Sudeste do Rio Grande do Sul, as borboletas foram historicamente bem inventariadas através de diferentes metodologias e esforços amostrais. No século passado, sem relatos precisos sobre métodos de amostragem, foram registradas borboletas para os atuais municípios de Pelotas, Capão do Leão e Morro Redondo (BIEZANKO & FREITAS, 1938; BIEZANKO, 1949, 1958, 1959, 1960a, 1960b, 1963; BIEZANKO & MIELKE, 1973). KRÜGER & SILVA (2003) revisando materiais de coleções e realizando coletas a campo, atualizaram os dados de Papilionoidea para estas mesmas localidades. PAZ *et al.* (2008), acrescentando os dados de suas coletas à esta lista, registraram Nymphalidae, Papilionidae e Pieridae para Caçapava e Canguçu. Mais recente, através de metodologia específica para borboletas frugivoras, foram registrados Nymphalidae para o Capão do Leão (SILVA *et al.,* 2013).

Segundo SANTOS *et al.* (2008), o Rio Grande do Sul possui baixa prioridade em levantamentos da fauna de borboletas, pois é um dos estados brasileiros mais amostrados. Porém, muitos destes trabalhos apresentam informações desatualizadas e incompletas, além de focarem em grupos e regiões específicas. Poucos são os inventários que abrangem a fauna em áreas de Campos e Floresta Estacional Semidecidual. Estes ambientes formam um mosaico de mata e campo, sendo um valoroso refúgio de vida que tem sofrido diversas e constantes pressões antrópicas nos últimos anos, e apesar de serem áreas importantes para a manutenção da biodiversidade local, são os menos representados quanto a sua proteção (CORDEIRO & HASENACK, 2009; OVERBECK *et al*., 2009).

O Bioma Pampa ainda é em grande parte pouco conhecido, inclusive no que se refere à fauna de borboletas, sobre a qual muitos locais permanecem carentes de trabalhos (MORAIS *et al*., 2007; MARCHIORI *et al*., 2014). Muito se tem focado em reservas e zonas de alta diversidade, o que pode estar prejudicando outras áreas em potencial, que por serem desconhecidas não são valorizadas e sofrem constantes ameaças. Sendo o desconhecimento uma das principais causas da degradação dos ecossistemas naturais, listas de espécies se tornam urgentes. Desta forma, o presente estudo teve por

objetivo inventariar as borboletas em áreas de Floresta Estacional Semidecidual e de Campos no Bioma Pampa, Sudeste do Rio Grande do Sul, Brasil.

## Material e Métodos

O trabalho foi realizado em três áreas, duas localizadas no município de Morro Redondo e uma em Capão do Leão, Sudeste do Rio Grande o Sul (31º 43' 05.85"S e 52º 41' 45.42"W, 31º 43' 41.80"S e 52º 41' 28.10"W, 31º 48' 58"S e 52º 25' 55"W) (Figura 1). Encontram-se nas regiões geomorfológicas da Encosta do Sudeste e da Planície Costeira, respectivamente. Pertencem ao Bioma Pampa e se localizam nas fisionomias da Floresta Estacional Semidecidual e na transição entre esta e as Formações Pioneiras (VELOSO *et al.,* 1991). O clima é Cfa (mesotérmico, sempre úmido, com verões quentes) de acordo com a classificação de Köppen (MORENO, 1961).


**Figura 1.–** Localização dos municípios de Morro Redondo e Capão do Leão no extremo Sul do Brasil, onde foram realizadas as coletas de borboletas entre outubro de 2012 a junho de 2013.

As amostragens ocorreram mensalmente entre outubro de 2012 e junho de 2013, por quatro coletores utilizando redes entomológicas. Foi delimitada uma trilha por área, as quais foram percorridas com esforço amostral padronizado, 2h 30min pela manhã e 2h 30min pela tarde, no período entre 8h 30min e 16h 30min. Espécimes de fácil identificação no campo foram marcados numericamente através de caneta permanente, fotografados e liberados. Para cada indivíduo

avistado foram registrados a espécie, data, turno e área de coleta. Indivíduos de identificação incerta e exemplares testemunhos foram coletados e encaminhados ao Museu Entomológico Ceslau Biezanko da Universidade Federal de Pelotas, onde foram montados, identificados e depositados.

A identificação das espécies foi realizada com base no padrão morfológico, por comparação com o material disposto na coleção do museu mencionado, de bibliografia especializada (CANALS, 2000, 2003, D'ABRERA, 1984) e da consulta a especialistas. A nomenclatura e sistemática foi atualizada segundo LAMAS (2004). Os trabalhos consultados para a confirmação dos novos registros foram: BIEZANKO (1949, 1958, 1959, 1960a, 1960b, 1963); BIEZANKO & FREITAS (1938); BIEZANKO & MIELKE (1973); BIEZANKO *et al.* (1978); KRÜGER & SILVA (2003); PAZ *et al.* (2008) e SILVA *et al.* (2013).

A partir da identificação dos espécimes foram obtidas a composição, riqueza e abundância das borboletas registradas nas três áreas. O esforço amostral foi calculado multiplicando-se o número de coletores pelas horas-rede. Para avaliar a suficiência amostral foi construído um gráfico cumulativo de espécies através do software Past versão 2.17 (HAMMER *et al.,* 2001). Foram consideradas singletons as espécies que apresentaram apenas um indivíduo, abundantes as dez com o maior número de indivíduos e dominantes as espécies em que a frequência relativa foi maior que 10%.

**Resultados e Discussão**

Totalizando 540 horas-rede de amostragem, foram registrados 3.065 indivíduos distribuídos em 154 espécies e seis famílias de borboletas para a Floresta Estacional Semidecidual e os Campos do Bioma Pampa no Rio Grande do Sul, Brasil (Tabela 1). Apesar do grande esforço amostral, a curva de acúmulo de espécies obtida continua em ascensão, indicando que muitas espécies ainda estão por ser amostradas (Figura 2). De fato, os números encontrados estão longe dos registros históricos documentados para a região, o que será discutido mais adiante.

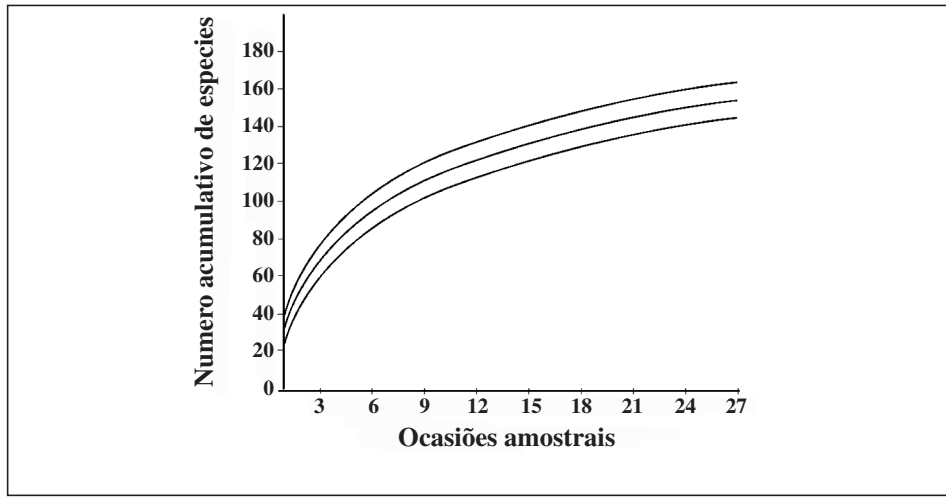


**Figura 2.–** Número acumulado de espécies de borboletas amostradas para a Floresta Estacional Semidecidual e os Campos do Bioma Pampa no Extremo Sul do Brasil, entre outubro de 2012 a junho de 2013. Intervalos de confiança de 95%.

No total de indivíduos mensurados, Nymphalidae é a família mais abundante, seguida de Hesperiidae, Pieridae, Lycaenidae, Papilionidae e Riodinidae (Figura 3). Outros trabalhos relatam esta predominância de Nymphalidae em diferentes ambientes do Rio Grande do Sul (DESSUY & MORAIS, 2007; MORAIS *et al.,* 2012). A abundância de Nymphalidae pode estar relacionada ao fato dela ser uma das famílias de borboletas mais diversificadas em termos de hábito e morfologia, apresentando o maior número de espécies conhecidas e sendo encontrada em todas as regiões tropicais e subtropicais do mundo (LAMAS, 2004).

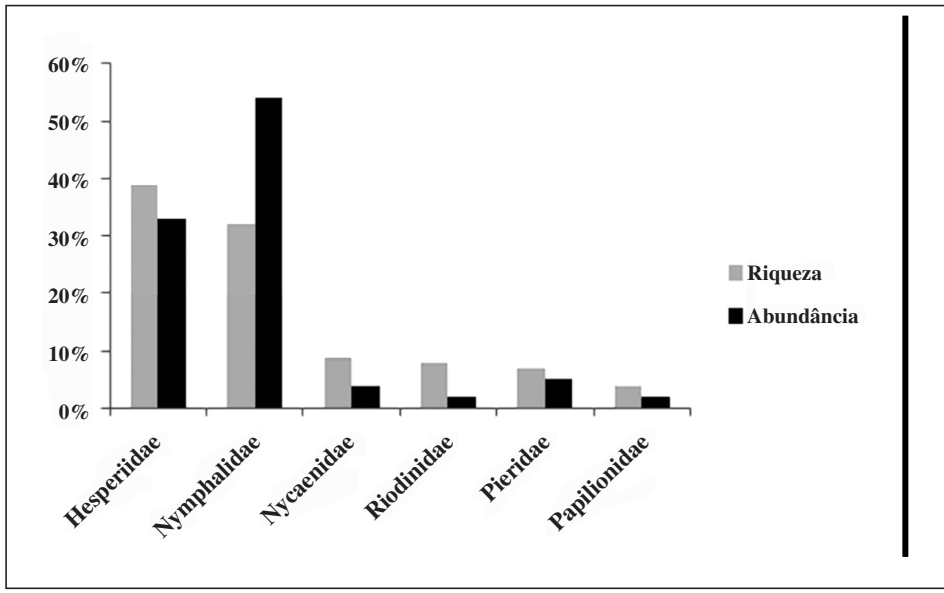


**Figura 3.–** Riqueza e abundância relativa das famílias de borboletas amostradas para a Floresta Estacional Semidecidual e os Campos do Bioma Pampa no Extremo Sul do Brasil, entre outubro de 2012 a junho de 2013.

As espécies mais abundantes foram: *Tegosa claudina* (Eschscholtz, 1821) (8%), *Pyrgus orcus* (Stoll, 1780) (6%), *Urbanus simplicius* (Stoll, 1790) (5%), *Hermeuptychia* sp. (4%), *Yphthimoides celmis* (Godart, 1824) (4%), *Paryphthimoides eous* (Butler, 1867) (3%), *Dryas iulia alcionea* (Cramer, 1779) (3%), *Actinote carycina* Jordan, 1913 (3%), *Ortilia orthia* (Hewitson, 1864) (3%) e *Agraulis vanillae maculosa* (Stichel, 1908) (3%). Nenhuma se mostrou dominante (>10%). As espécies *T. claudina*, *P. orcus*, *Hermeuptychia* sp. e *D. iulia alcionea* estão entre as dez espécies mais abundantes no Rio Grande do Sul (MORAIS *et al.,* 2007). Segundo os mesmos autores, juntas elas representam em torno de 20% das borboletas amostradas no Estado. *T. claudina* é encontrada em ambientes abertos como campos e beira de matos, podendo formar agregações o que foi observado durante o estudo.

São novos registros para o Sudeste do Rio Grande do Sul: *Emesis lupina melancholica* Stichel, 1916, *Synargis paulistina* (Stichel, 1910) (Riodinidae), *Nicolaea cupa* (Druce, 1907) (Lycaenidae) e *Philaethria wernickei* (Röber, 1906) (Nymphalidae). É surpreendente que esta última não tenha sido registrada antes, pois se trata de uma espécie grande, bastante vistosa e de uma família bem conhecida. Já as três primeiras pertencem a famílias compostas por espécies de tamanho pequeno, algumas pouco atraentes, sendo sua captura, manuseio e identificação relativamente difícil

(BROWN JR. & FREITAS, 1999). Motivos pelos quais estes grupos estão entre os menos amostrados, sendo subamostrados ou nem mesmo considerados em muitos trabalhos (FRANCINI *et al.,* 2011).

Segundo ISERHARD *et al.* (2010), *S. paulistina* foi recentemente registrada pela primeira vez no Rio Grande do Sul para a Floresta Nacional de São Francisco de Paula. Entretanto já havia sido mencionada para a região missioneira através de sua sinonímia *Synargis phillone enimanga* (Seitz, 1917) (BIEZANKO & MIELKE, 1973). ISERHARD *et al.* (2010) também citam *E. lupina melancholica* para a região. *N. cupa* foi registrada pela primeira vez no estado para o Norte da Planície Costeira (BELLAVER *et al.,* 2012). Lycaenidae e Riodinidae estão entre as famílias que apresentam a maior expectativa em relação ao acréscimo de espécies no Rio Grande do Sul (ISERHARD & ROMANOWSKI, 2004). Segundo MORAIS *et al.* (2007), em torno de 13% a 26% destas famílias esperam registro.

Outras espécies que merecem destaque são as singletons, que correspondem a 17% do total de espécies amostradas: três Riodinidae que representam 23% desta família, três Lycaenidae (21%), 12 Hesperiidae (20%), duas Pieridae (18%), uma Papilionidae (17%) e seis Nymphalidae (12%). Muitas espécies de Hesperiidae, Riodinidae e Lycaenidae são naturalmente raras (BROWN JR. & FREITAS, 2000). Porém, não é comum para as demais famílias, onde a maioria das espécies analisadas neste estudo é normalmente abundante, principalmente em ambientes abertos. Apenas *Zischkaia pacarus* (Godart, 1824), *Ascia monuste* (Linnaeus, 1764) e *Hypanartia lethe* (Fabricius, 1793) também foram consideradas escassas na região por outros autores (BIEZANKO, 1949, 1958, 1960a, 1960b).

Hesperiidae foi a família mais rica, seguida de Nymphalidae, Lycaenidae, Riodinidae, Pieridae e Papilionidae. De acordo com ROSA *et al.* (2011), espécies pertencentes à Hesperiidae são difíceis de capturar, visto que apresentam tamanho relativamente pequeno e voo rápido, sendo o acréscimo de espécies lento. Por isso apenas em trabalhos com um bom esforço amostral sua riqueza é evidenciada. A representatividade das famílias alcançada neste estudo condiz com a ordenação encontrada em diferentes ambientes do Brasil, principalmente no que se refere à Floresta Estacional Semidecidual (FRANCINI *et al.,* 2011). Também se aproxima bastante das proporções gerais relatadas para o estado e região sudeste deste (Tabela 2).

**Tabela 2.–** Representatividade das famílias de borboletas para diferentes localidades no Extremo Sul do Brasil.

| | Presente Estudo | Região Sudeste | Rio Grande do Sul |
|---|---|---|---|
| **Hesperiidae** | 39% | 48% | 37% |
| **Nymphalidae** | 32% | 27% | 29% |
| **Lycaenidae** | 17% | 15% | 23% |
| **Pieridae** | 7% | 7% | 7% |
| **Papilionidae** | 4% | 3% | 4% |

Riqueza relativa de espécies por família de borboletas amostradas em Floresta Estacional Semidecidual e Campos no Bioma Pampa extremo Sul do Brasil, entre outubro de 2012 e junho de 2013 (Presente Estudo). BIEZANKO & FREITAS, 1938; BIEZANKO, 1949, 1958, 1959, 1960a, 1960b; BIEZANKO & MIELKE (1973); KRÜGER & SILVA (2003); PAZ, ROMANOWSKI & MORAIS (2008); SILVA *et al*. (2013) (Região Sudeste), MORAIS *et al*. (2007) (Rio Grande do Sul). *Riodinidae incluído dentro de Lycaenidae.

Para a região Centro-Norte do Rio Grande do Sul, os trabalhos tem registrado uma alta riqueza de espécies. Na Mata Atlântica, RITTER *et al.* (2011) através de 108h/rede mencionam 125 espécies, ISERHARD & ROMANOWSKI (2004) e ISERHARD *et al.* (2010) para o mesmo ambiente com 238 h/rede constaram 292 espécies e com 674 h/rede 277 espécies respectivamente. Na Floresta Estacional Decidual DESSUY & MORAIS (2007) em 135 h/rede encontraram 145 espécies e SACKIS & MORAIS (2008) com 113 h/rede obtiveram 89 espécies. Estes resultados

podem ser atribuídos a particularidades dos ambientes analisados, principalmente no que se refere à vegetação e sua heterogeneidade. A Mata Atlântica propriamente dita é considerada um dos biomas mais ricos do mundo (MMA, 2002).

Para o Sudoeste do Bioma Pampa em áreas de Mata Ciliar e Campanha, MARCHIORI & ROMANOWSKI (2006a) com esforço de 300 h/rede, registraram 97 espécies. Para a mesma região em Mata Ciliar e Campos, ROSA *et al.* (2011) com um esforço de 99 h/rede inventariaram 46 espécies. Os dados apresentados nestes trabalhos se aproximam mais do presente estudo, incluindo composição de espécies, sendo possível que com um esforço superior obtivessem resultados mais similares.

Somando os dados dos trabalhos realizados no Sudeste do Rio Grande do Sul, são registradas aproximadamente 421 espécies de borboletas. Deste total, apenas 90 (40%) Papilionoidea e 60 (30%) Hesperiidae são relatadas neste estudo, esta diferença nos valores de riqueza pode ser atribuída aos diferentes esforços amostrais. Pois a informação obtida para a região provém de compilação de dados, ou seja, é uma visão em ampla escala dos ambientes estudados, oriunda de diferentes esforços amostrais. Mas também pode estar relacionada às intensas alterações de paisagem que a região tem sofrido nos últimos anos, em decorrência de atividades como a agricultura e silvicultura ou a própria urbanização (CORDEIRO & HASENACK, 2009), fatores já citado por PAZ *et al.* (2008). A perda de habitats naturais está entre as principais ameaças à biodiversidade das borboletas (CASAGRANDE & MIELKE, 1995; BROWN JR., 1996; CASAGRANDE *et al.,* 1998).

A acelerada degradação dos ecossistemas naturais tem salientado a necessidade de maiores esforços para o conhecimento da sua biodiversidade. Inventários, mesmo que rápidos, ainda são ferramentas cruciais para a obtenção de importantes informações acerca de um determinado ambiente (MARCHIORI & ROMANOWSKI, 2006b). Os resultados aqui apresentados são uma amostra peculiar das comunidades de borboletas que ocorrem em áreas de Floresta Estacional Semidecidual e Campos do Bioma Pampa, Extremo Sul do Brasil. Também levantam muitas questões acerca da riqueza local e nos alertam sobre a possível ausência de muitas espécies com relação aos dados históricos. Neste caso, um melhor acompanhamento da área se faz necessário.

**Tabela 1.–** Borboletas amostradas em Floresta Estacional Semidecidual e Campos do Bioma Pampa no extremo Sul do Brasil, entre outubro de 2012 e junho de 2013. (S) número de espécies, (#) singleton, (*) novo registro para o Sudeste do Rio Grande do Sul.

| **Família/Espécie** | |
|---|---|
| **HESPERIIDAE (S=60)** | *Lucida lucia* (Capronnier, 1874)# |
| **Hesperiinae (S=27)** | *Lucida ranesus* (Schaus, 1902) |
| | *Nyctelius nyctelius* (Latreille, 1824)# |
| *Ancyloxypha nitedula* (Burmeister, 1878)# | *Panoquina* sp.# |
| *Anthoptus epictetus* (Fabricius, 1793) | *Perichares aurina* Evans, 1955 |
| *Callimormus interpunctata* (Plötz, 1884) | *Polites vibex catilina* (Plötz, 1886) |
| *Callimormus rivera* (Plötz, 1882) | *Quadrus u-lucida* (Plötz, 1884)# |
| *Conga chydaea* (Butler, 1877) | *Sodalia coler* (Schaus, 1902) |
| *Conga iheringii* (Mabille, 1891) | *Synale hylaspes* (Stoll, 1781) |
| *Conga zela* (Plötz, 1883) | *Vettius diana* (Plötz, 1886)# |
| *Corticea obscura* Mielke, 1969 | *Wallengrenia premnas* (Wallengren, 1860) |
| *Cumbre triumviralis* (Hayward, 1939)# | *Zariaspes mys* (Hübner, 1808) |
| *Cymaenes distigma* (Plötz, 1882)# | *Zenis jebus* (Plötz, 1882)# |
| *Cymaenes gisca* Evans, 1955 | |
| *Cymaenes odilia* (Burmeister, 1878) | **Pyrginae (S=28)** |
| *Cymaenes tripunctus theogenis* (Capronnier, 1874) | |
| *Hylephila phyleus* (Drury, 1773) | *Achlyodes busirus rioja* Evans, 1953 |

*Achlyodes mithridates thraso* (Hübner, 1807)
*Antigonus liborius areta* Evans, 1953
*Astraptes elorus* (Hewitson, 1867)
*Astraptes fulgerator* (Walch, 1775)
*Autochton integrifascia* (Mabille, 1891)
*Autochton zarex* (Hübner, 1818)
*Carrhenes canescens pallida* Röber, 1925
*Celaenorrhinus similis* Hayward, 1933
*Chioides catillus* (Cramer, 1779)
*Epargyreus tmolis* (Burmeister, 1875)
*Gorgythion begga* (Prittwitz, 1868)
*Gorgythion beggina escalophoides* Evans, 1953
*Heliopetes arsalte* (Linnaeus, 1758)
*Heliopetes omrina* (Butler, 1870)
*Heliopetes laviana* (Hewitson, 1868)
*Milanion leucaspis* (Mabille, 1878)
*Pellicia costimacula* Herrich-Schäffer, 1870#
*Pyrgus orcynoides* (Giacomelli, 1928)
*Pyrgus orcus* (Stoll, 1780)
*Staphylus* sp.
*Urbanus albimargo* (Mabille, 1876)
*Urbanus dorantes* (Stoll, 1790)
*Urbanus esta* Evans, 1952
*Urbanus simplicius* (Stoll, 1790)
*Urbanus teleus* (Hübner, 1821)
*Urbanus zagorus* (Plötz, 1880)
*Xenophanes tryxus* (Stoll, 1780)

**Pyrrhopyginae (S=5)**

*Elbella hegesippe* (Mabille & Boullet, 1908)#
*Elbella mariae* (Bell, 1931)
*Myscelus amystis epigona* (Hewitson, 1867)#
*Mysoria barcastus barta* Evans, 1951
*Sarbia damippe* Mabille & Boullet, 1908

**LYCAENIDAE (S=14)**
**Theclinae (S=14)**

*Arawacus meliboeus* (Fabricius, 1793)
*Atlides cosa* (Hewitson, 1867)#
*Calycopis caulonia* (Hewitson, 1877)
*Cyanophrys herodotus* (Fabricius, 1793)
*Evenus latreillii* (Hewitson, 1865)
*Laothus phydela* (Hewitson, 1867)
*Nicolaea cupa* (H. H. Druce, 1907)*
*Parrhasius orgia* (Hewitson, 1867)
*Rekoa palegon* (Cramer, 1780)
*Strymon bazochii* (Godart, 1824)
*Strymon eurytulus* (Hübner, 1819)
*Strymon* sp.#
*Theritas triquetra* (Hewitson, 1865)
*Ziegleria ceromia* (Hewitson, 1877)#

**NYMPHALIDAE (S=50)**
**Libytheinae (S=1)**

*Libytheana carinenta* (Cramer, 1777)

**Danainae (S=2)**

*Danaus erippus* (Cramer, 1775)
*Danaus gilipus* (Cramer, 1775)

**Morphinae (S=2)**

*Caligo martia* (Godart, 1824)
*Morpho epistrophus catenaria* (Perry, 1811)

**Charaxinae (S=2)**

*Memphis* sp.
*Zaretys* sp.#

**Biblidinae (S=4)**

*Biblis hyperia* (Cramer, 1779)
*Diaethria candrena* (Godart, 1824)
*Eunica eburnea* Fruhstorfer, 1907
*Haematera pyrame* (Hübner, 1819)

**Apaturinae (S=2)**

*Doxocopa kallina* (Staudinger, 1886)
*Doxocopa laurentia* (Godart, 1824)

**Limenitidinae (S=4)**

*Adelpha mythra* (Godart, 1824)
*Adelpha syma* (Godart, 1824)
*Adelpha thessalia indefecta* Fruhstorfer, 1913
*Adelpha zea* (Hewitson, 1850)

**Heliconiinae (S=12)**

*Actinote carycina* Jordan, 1913
*Actinote discrepans* d'Almeida, 1958#
*Actinote mamita elena* Hall, 1921
*Actinote melanisans* Oberthür, 1917
*Actinote pellenea* Hübner, 1821
*Actinote thalia pyrrha* (Fabricius, 1775)
*Agraulis vanillae maculosa* (Stichel, 1908)
*Dione juno* (Cramer, 1779)
*Dryas iulia alcionea* (Cramer, 1779)
*Euptoieta hortensia* (Blanchard, 1852)
*Heliconius eratho phyllis* (Fabricius, 1775)
*Philaethria wernickei* (Röber, 1906)*#

**Satyrinae (S=10)**

*Capronnieria galesus* (Godart, 1824)
*Hermeuptychia* sp.
*Moneuptychia paeon* (Godart, 1824)
*Moneuptychia soter* (Butler, 1877)
*Paryphthimoides eous* (Butler, 1867)
*Paryphthimoides poltys* (Prittwitz, 1824)
*Praepedaliodes phanias* (Hewitson, 1862)
*Yphthimoides celmis* (Godart, 1824)
*Yphthimoides* sp.#
*Zischkaia pacarus* (Godart, 1824)#

**Nymphalinae (S=11)**

*Anartia amathea roeselia* (Eschscholtz, 1821)
*Hypanartia bella* (Fabricius, 1793)
*Hypanartia lethe* (Fabricius, 1793)#
*Junonia evarete* (Cramer, 1779)
*Ortilia ithra* (W. F. Kirby, 1900)
*Ortilia orthia* (Hewitson, 1864)
*Siproeta epaphus trayja* Hübner, 1823
*Siproeta stelenes meridionalis* (Fruhstorfer, 1909)
*Tegosa claudina* (Eschscholtz, 1821)
*Tegosa orobia* (Hewitson, 1864)
*Vanessa braziliensis* (Moore, 1883)

**PAPILIONIDAE (S=6)**
**Papilioninae (S=6)**

*Battus polydamas* (Linnaeus, 1758)#
*Heraclides anchisiades* capys (Hübner, 1809)
*Heraclides astyalus* (Godart, 1819)
*Heraclides hectorides* (Esper, 1794)
*Heraclides thoas brasiliensis* (Rothschild & Jordan, 1906)
*Mimoides lysithous eupatorion* (Lucas, 1859)

**PIERIDAE (S=11)**
**Coliadinae (S=7)**

*Colias lesbia* (Fabricius, 1775)
*Eurema albula sinoe* (Godart, 1819)
*Eurema deva* (Doubleday, 1847)
*Eurema elathea flavescens* (Chavannes, 1850)#
*Phoebis neocypris* (Hübner, 1823)
*Phoebis philea* (Linnaeus, 1763)
*Rhabdodryas trite banksi* (Breyer, 1939)

**Pierinae (S=4)**

*Ascia monuste* (Linnaeus, 1764)#
*Hesperocharis paranensis* Schaus, 1898
*Pereute antodyca* (Boisduval, 1836)
*Theochila maenacte* (Boisduval, 1836)

**RIODINIDAE (S=13)**
**Euselasiinae (S=2)**

*Euselasia eucerus* (Hewitson, 1872)
*Euselasia hygenius occulta* Stichel, 1919

**Riodininae (S=11)**

*Aricoris montana* (Schneider, 1937)
*Calephelis nilus* (C. Felder & R. Felder, 1861)
*Caria plutargus* (Fabricius, 1793)
*Chalodeta theodora* (C. Felder & R. Felder, 1862)#
*Emesis lupina melancholica* Stichel, 1916*
*Emesis mandana* (Cramer, 1780)
*Emesis russula* Stichel, 1910
*Pirascca sagaris phrygiana* (Stichel, 1916)
*Riodina lysippoides* Berg, 1882#
*Synargis paulistina* (Stichel, 1910)*
*Theope thestias* Hewitson, 1860#

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# *Eana argentana* (Clerck, 1759) en la Sierra de Ancares, Lugo, Galicia (España) (Lepidoptera: Tortricidae)

J. J. Pino-Pérez & R. Pino-Pérez

**Resumen**

Se cita por primera vez *Eana argentana* (Clerck, 1759) para Galicia, España, y se describe la vegetación en la que se encontró.
PALABRAS CLAVE: Lepidoptera, Tortricidae, *Eana argentana*, Galicia, España.

*Eana argentana* **(Clerck, 1759) in the Sierra de Ancares, Lugo, Galicia (Spain) (Lepidoptera: Tortricidae)**

**Abstract**

First record of *Eana argentana* (Clerck, 1759) from Galicia, Spain. We describe the vegetation in which it was found.
KEY WORDS: Lepidoptera, Tortricidae, *Eana argentana*, Galicia, Spain.

## Introducción

En la Península Ibérica se han citado 483 especies de Tortricidae (VIVES MORENO, 2014). La tribu Cnephasiini tiene registradas 150 especies Paleárticas, de las cuales 76, son específicamente europeas (RAZOWSKI, 2002).

*Eana argentana* (Clerck, 1759) es una especie Holártico-boreal (KUZNETSOV & MIKKOLA, 1991), con más de 1.600 registros en Gbif (disponible en http://www.gbif.org/species/174666) y que en particular habita en el paleártico desde la Península Ibérica hasta el extremo oriental de Siberia. La subespecie *argentana* está presente en la región paleártica, la India y Norteamérica (OBRAZTSOV, 1962).

Según RAZOWSKI (2002), en el sur de Europa sólo ocupa zonas montañosas, pero en latitudes más altas y frías puede habitar incluso áreas costeras soleadas (RYRHOLM & OHLSSON, 2003), prados húmedos o zonas de tundra a baja altitud (KOZLOV & KULLBERG, 2008).

En Rumanía vuela entre junio y agosto en prados en los que es frecuente durante el día entre los 1.300-1.900 m (POPESCU-GORJ, 1995); véase también a menor altitud (DINCĂ & GOIA, 2005). En Macedonia se ha encontrado en el Parque Nacional de Mavrovo entre julio y agosto en un el rango de altitudes de 2.080-2.180 m (HUEMER *et al*., 2011). En la zona de los Urales es poco común en los claros de los bosques mixtos o decíduos (ANIKIN e*t al*., 2006), incluso a una altitud de 500 m en julio (TREMATERRA, 2010); según BILDZILYA *et al*. (2002), en los montes Altai (Rusia) aparece en los prados de las laderas insoladas que están protegidos del viento. En todo caso no parece común en buena parte de su distribución.

En la Península Ibérica, las citas de la especie se remontan al siglo XIX (STAUNDIGER & WOC-

KE, 1871; SEEBOLD, 1889), y aparece en trabajos tempranos del siglo XX como KENNEL (1910) o KAUTZ (1928). Y por eso AGENJO (1955, 1967) ya la menciona en sus catálogos. Algunas referencias más modernas son los trabajos de DE PRINS (1982), DERRA & HACKER (1982) y BAIXERAS (1989). Con los datos bibliográficos y el material depositado en los museos, la especie parece estar restringida fundamentalmente a los Pirineos oscense y catalán, algunas zonas del norte peninsular, como Vizcaya y zonas relativamente altas al sur peninsular, como Sierra Nevada. Parece estar ausente de las islas Baleares y de Portugal.

En Galicia apenas hay menciones sobre Tortricidae y o bien son sobre alguna especie común, (*Grapholitha succedana* en MENDES, 1914), o sobre especies que forman plagas como la *Cydia pomonella* (GONZÁLEZ DE ANDRÉS, 1934), o bien las ocho especies mencionadas del Parque Nacional de las Islas Atlánticas de Monteagudo en Cíes, Ons y Sálvora (HIERNAUX *et al*., 2010), o aún la forestal, *Agapeta zoegana* de Cecebre (FERNÁNDEZ, 2011).

Citamos aquí por primera vez para Galicia a esta especie de la zona cacuminal de la Sierra de Ancares, desprovista de arbolado con prados insolados y expuestos. Zona de relativa altitud y latitud en la Península Ibérica que confirma la preferencia de esta especie por enclaves fríos. Esta cita corresponde con toda probabilidad a la población más occidental de Europa continental.

Material estudiado: ESPAÑA, Lugo, Cervantes, Piornedo, Sierra de Ancares, cima del Mustallar, 20-VII-2013, 1 ♂, Lou-Arthr 40108, UTM 29TPH7628843379, 1.924 m; 1 ♂, Lou-Arthr 40109, UTM 29TPH7634843367, 1.926, J. J. Pino-Pérez & R. Pino-Pérez leg.

Aparte de otros ejemplares volando tanto en la parte de León como en la de Lugo, ambos machos levantaron el vuelo al ser molestados entre las 14.15' y las 14.20', en un día soleado, en los alrededores de la cima del Mustallar. Dieron cortos vuelos antes de posarse a unos 10 m. Los especímenes estaban en el cervunal de la cumbre donde se extiende como gramínea de mayor tamaño, *Festuca paniculata*. En estos prados de la cumbre están diseminadas pequeñas manchas del brezal de *Genistello tridentati-Ericetum aragonensis* facies *Calluna vulgaris*. En los alrededores hay teselas de la serie climatófila subalpina orocantábrica silicícola del *Junipero nanae-Vaccinieto uliginosi* (FERNÁNDEZ PRIETO *et al*., 1987), que da paso en las zonas más húmedas a un cervunal y a los prados de *Festuca paniculata spadicea*. En los caminos y calveros, en las zonas más erosionadas del área cacuminal aparecen pastos psicroxerófilos del *Teesdaliopsis confertae-Festucetum summilusitanicae* (SILVA-PANDO, 1994).

Los ejemplares capturados son inusualmente grandes, 28.3 mm (Lou-Arthr 40148) y 29.4 mm (Lou-Arthr 40149), es decir, con generalidad, tienen un 20% más de tamaño que el indicado por RAZOWSKI (2002) para la especie. Pero, por otro lado, sus genitalias son similares a la representada por el mismo autor (op. cit. 151, lámina 24). Las hembras parecen tener preferencia por el prado cacuminal más o menos laxo de la *Festuca paniculata*. Aunque Razowski menciona que las larvas se alimentan de gramíneas, algún autor afirma que además de *Poa pratensis* lo hace de coníferas como *Larix leptolepis* (YASUDA, 1972), o que es polífaga (ANIKIN *et al.*, 2006).

Las diferencias morfológicas apuntadas permiten aventurar que acaso estemos ante un morfotipo específico que precisa un análisis genético detallado, sobre todo si a ello añadimos que se trata de una población en el borde de la amplísima distribución de esta especie polífaga.

Hasta donde hemos muestreado, el área ocupada por la especie en la Sierra de Ancares, tanto en la parte leonesa como en la lucense, es exigua, de unas 50 hectáreas No obstante, en Galicia, podría aparecer en cualquiera de los picos de las sierras orientales por encima de los 1.700 m, como poblaciones finícolas de su distribución occidental europea. Sin embargo, aunque hemos prospectado habitualmente, tanto en Trevinca como en Manzaneda a esas altitudes y superiores, nunca, hasta ahora, ha aparecido, ni a la luz de 250 W de vapor de mercurio que parece no atraerla, ni en los transectos diurnos. Más difícil se antoja su presencia en el Courel, dadas las características de la Sierra y su menor altitud general.

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# Bionomics of *Comadia redtenbacheri* (Hammerschmidt, 1847) (Lepidoptera: Cossidae)

C. Llanderal-Cázares, R. Castro-Torres & K. Miranda-Perkins

**Abstract**

Boring insects feed on the internal tissues of their hosts, and their activity is detected only after a severe damage to the host has occurred; therefore, studying their biology in the wild is difficult. The objective of the study was to complement knowledge about the biology, ecology and taxonomic position of *Comadia redtenbacheri* (Hammerschmidt, 1847), an agave borer with a long lifecycle. Laboratory observations were made on life stages obtained from larvae collected in Hidalgo, Mexico, which were induced to pupate in tubes with vermiculite and soil. Emerged adults were placed in cloth bags where they mated and laid eggs. Larvae that emerged from these eggs were raised on an artificial diet. Field observations were made in some localities of the State of Mexico; for this, external leaves and rhizomes of *Agave* plants were examined to look for eggs and larvae. Eggs and larvae were found in *Agave salmiana* Otto ex Salm-Dyck and *Agave applanata* Lem. ex Jacobi. Eggs are brown; they are found mainly at the base of external leaves. Neonate larvae bore a hole in the chorion and feed on it for a few days; they are gregarious and migrate towards the rhizome as they mature; last instar larvae are aposematic and release a volatile odoriferous secretion; their development is not uniform and can last more than a year. Pupation takes place in a silken cocoon under the soil. Adults are nocturnal; female calling starts one hour after the start of the scotophase, and can last until 5:30 am; oviposition happens a few hours after mating. The parasitoids *Lisonnota fascipennis* Townes, 1978 (Hymenoptera: Ichneumonidae), and *Acantholespesia texana* (Aldrich & Webber, 1924) (Diptera: Tachinidae) and fungal and bacterial pathogens are commonly found in larvae. Predators of larvae and adults include ants, rodents and birds.
KEY WORDS: Lepidoptera, Cossidae, *Agave*, ecology, life cycle, nomenclature, Mexico.

**Bionomía de *Comadia redtenbacheri* (Hammerschmidt, 1847) (Lepidoptera: Cossidae)**

**Resumen**

Los insectos barrenadores se alimentan de los tejidos internos de su hospedero, y su actividad es detectada sólo hasta que existe un gran daño en el hospedero, lo que complica su estudio en la naturaleza. El objetivo del estudio fue complementar el conocimiento de la biología, ecología y taxonomía de *Comadia redtenbacheri* (Hammerschmidt, 1847), un barrenador de *Agaves* con un ciclo de vida largo. Las observaciones en laboratorio se hicieron a partir de diferentes estados biológicos obtenidos de larvas colectadas en Hidalgo, México, las cuales se indujeron a pupar en tubos con vermiculita y suelo; los adultos emergidos se colocaban en bolsas de tela donde se apareaban y ovipositaban; las larvas obtenidas se criaron en dieta artificial. Las observaciones en campo se hicieron en diferentes localidades del Estado de México; para esto, se revisaron las pencas y rizomas de *Agave* para buscar larvas y huevos. Se encontraron huevos y larvas en *Agave salmiana* Otto ex Salm-Dyck y *Agave applanata* Lem. ex Jacobi. Los huevos son cafés; se encuentran principalmente en la base de pencas externas secas. Las larvas neonatas perforan el corion y permanecen alimentándose de él por algunos días; son gregarias y migran hacia el rizoma a medida que maduran; los últimos instares son aposemáticos y liberan una secreción odorífera volátil. La pupación ocurre en un capullo de seda bajo el suelo. Los adultos son nocturnos; la hembra inicia el llamado una hora después del inicio de

la escotofase y éste se puede prolongar hasta las 5:30 horas am; la oviposición se da algunas horas después del apareamiento. Los parasitoides *Lisonnota fascipennis* Townes, 1978 (Hymenoptera: Ichneumonidae) y *Acantholespesia texana* (Aldrich & Webber, 1924) (Diptera: Tachinidae), y varios hongos y bacterias patógenas se encuentran en las larvas. Los depredadores de larvas y adultos son hormigas, roedores y aves.
PALABRAS CLAVE: Lepidoptera, Cossidae, *Agave*, ecología, ciclo de vida, nomenclatura, México.

## Introduction

Boring insects feed on the internal tissues of their hosts, and their activity is detected only after serious damage has occurred, which makes their study difficult (NIELSEN, 1981); moreover, the adults are rarely observed, except when they are reared on their hosts or collected with light traps (DREES *et al.*, 2008). *Comadia redtenbacheri* (Hammerschmidt, 1847) is an edible insect that bores into *Agave* plants during its larval stage. Its life cycle lasts a year or more, but the adults live only between three and five days (LLANDERAL *et al.*, 2007). In the original description of the species, HAMMERSCHMIDT (1847) mentions that its development could last up to 12 months like in other species of Cossidae. Studies about its biology, life cycle and ecology are scarce, probably due to the complexity and time necessary to obtain results, as it is the case in other lepidopteran borers.

Most edible insects are collected from the wild, and the impact that their overexploitation has on the vegetation, fauna and ecology is unknown. Several measures have been proposed for their conservation, like the development of protocols for their protection and the use of flagship species to preserve their habitats, because unregulated collection from the wild, loss of habitat and an increase of their demand have become a threat to their survival (YEN, 2009). Efforts have been made in some countries to rear those insects as a starting point for their conservation and management, but it is vital to take into account the biology, distribution and population dynamics of the species (YEN, 2012; VAN HUIS *et al.*, 2013), as well as the knowledge from local people (KUHNLEIN & RECEVEUR, 1996; PAOLETTI & DREON, 2005). Due to this, the objective of the study was to complement knowledge about the biology and ecology of the *Agave* red worm.

## Materials and methods

The observations of larvae from the third to the seventh instar were made on specimens collected from 2012 to 2015 in *Agave* plants in the state of Hidalgo, Mexico. Larvae with a weight of <0.3 g were kept in leaves of *Agave salmiana* Otto ex Salm-Dyck (Agavaceae) cut in pieces of approximately 5-9 cm wide, which were changed every time fungi were observed growing on the surface. Larvae with a weight of ≥0.3 g were placed in plastic trays with tubes half-filled with soil to allow them to dig and pupate. The technique is described in detail in MIRANDA-PERKINS *et al.* (2013). From these specimens we obtained pupae, adults, eggs and first and second instar larvae. When the adults emerged, they were transferred to cloth bags, which allow air circulation, to let them mate and oviposit. The eggs were collected two or three times a week, and they were placed in Petri dishes covered with Agribón® (Polymer Group Inc., Charlotte, NC). Newly-hatched larvae were placed in rearing trays of 32 cavities (C - D International, Pitman, NJ) where they were reared on artificial diet for lepidopterans (Southland Products Inc®, Lake Village, AR).

To study larvae in their natural habitat, several *Agave* plants were inspected in the municipalities Santiago Zacualuca (19º 42’ 07.8” N, 98º 54’ 58.3” W) and Hueypoxtla (20º 00’ 45’’ N, 99º 02’ 34’’ W), in the State of Mexico. The external leaves were separated to look for eggs and larvae; afterwards, the whole plant was dug out and the rhizomes inspected. If larvae were found, the plant was collected and taken to the laboratory for further analysis.

To observe the external surface of the eggs and antennae, these were fixed in 3% glutaraldehyde for 24 h and washed three times with 0.1 M Sorensen’s phosphate buffer at a pH of 7.2, placing the samples in the buffer for five minutes at each change. Afterwards, the tissues were dehydrated in ascending concentrations of ethanol; first they were placed in solutions of 30, 40, 50, 60 and 70%

ethanol for 45 min at each concentration and then they were placed in 80, 90, 100 and 100% ethanol for 1 h at each concentration. The specimens were critical-point dried in $CO_2$, mounted on SEM stubs on an adhesive carbon tape, and sputter-coated with gold (Ion Sputter JFC-1100, Jeol, Japan). The observations were made with a SEM microscope model JSM-6390 (Jeol, Japan).

The images were taken with a digital Single Lens Reflex camera (D7000, Nikon, Japan), and the images were processed with Adobe Photoshop CC (v. 14.0, Adobe Systems Inc.).

## Results and discussion

The first description of the species was made by HAMMERSCHMIDT (1847), who classifies this insect as *Zeuzera* (*Cossus*) *redtenbacheri*. After that, in 1870 in his work "Insectos del maguey", BLÁSQUEZ (1870) names the species *Bombyx agavis*, without realizing that it had already been described. DYAR (1910) reclassifies it as *Hypopta chilodora* from a few specimens collected in central Mexico. ANCONA (1931) renames *H. chilodora* as *Hypopta agavis*, but DYAR (1937) decides both species are synonyms of *Hypopta redtenbacheri*. BROWN (1975) makes an ample revision of the genus *Comadia* and considers that the morphology of *H. redtenbacheri* fits the genus *Comadia*, and thus reclassifies it as *Comadia redtenbacheri*. In the extensive revision of Cossidae, SCHOORL (1990) validates the taxonomic and phylogenetic position of the insect after comparing the morphological characters of a large number of genera. More recently, CASTRO-TORRES & LLANDERAL-CÁZARES (2016) confirm that the morphological characteristics make this insect part of the genus *Comadia*.

The larvae were found in *A. salmiana* and in plants of the complex *Agave applanata* Lemaire ex Jacobi, a species that had not been reported as host of the *Agave* red worm, and that is used as a source of fiber and as an ornamental plant (Fig. 1a). *A. applanata* is medium-sized; the leaves are broad, rigid, lanceolate and blue-green in color; the lateral thorns are prominent, dark and slightly curved at the margins; the apical thorns are long and rigid; the rhizome is softer than *A. salmiana*, which may make it easier for the the larvae to exit the tissue after they are fully mature. The only reported hosts for the species are in the genus *Agave* Linnaeus, especially *A. salmiana*, *Agave atrovirens* Karwin and *Agave mapisaga* Trelease (RAMOS-ELORDUY *et al.*, 2011). It is interesting to note that many species of *Agave*, if not all, have bundles of raphides in their tissues as a means of defense (WATTENDORF, 1976; ISHII, 1991; BLUNDEN, *et al*, 2008), so we believe that the larvae of *C. redtenbacheri* must have anatomical or biochemical adaptations, or even symbiotic relationships with microorganisms that allow them to feed on these plants.

### Life cycle and ecology

Egg: They are white, about 12 mm long. The surface of the chorion shows a reticulated pattern that gives them a rough aspect. The female lays the eggs in masses, and covers them with a brown secretion from the accessory glands, which are prominent and with a reservoir to store the secretion (Fig. 1b) (RAMÍREZ-CRUZ & LLANDERAL-CÁZARES, 2015). The secretion has a porous appearance under Scanning Electron Microscopy (Figs. 1c, 1d). The number of eggs laid may appear to be related to the number of males that are in contact with the female (MIRANDA-PERKINS *et al.*, 2016)

The aggregation of eggs has been considered as a response to the structure of the host plant, and in butterflies it seems to be related to the aposematic coloration of some of the development stages and to the gregarious behavior of the larvae. In some lepidopterans, it has been determined that oviposition in masses, especially when these are formed by several layers, protects the eggs from desiccation, cannibalism and predation of neonate larvae, and increases the hatching rate compared with eggs laid singly; in other species it could be a strategy of the females to save time and energy when searching for oviposition sites (STAMP, 1980; CLARK & FAETH, 1998; FIGUEIREDO *et al.*, 2016). In laboratory at room temperature, eggs hatch after two months on average. During this time, some lose humidity and

collapse, but become hydrated after being sprayed with water. When the larvae are about to hatch, the dark heads of the larvae can be seen through the chorion. In the field the eggs are found mainly on plants with a height of around 60 cm, from the first week of January until May. The eggs are laid on the base of the external leaves, often on dry ones, but that remain moist enough at the base; these leaves can be easily separated from the inner leaves, and they show frequently some degree of decomposition. As with other borers, the preferred hosts are those that show certain degree of weakening, and thus can be considered as secondary invaders (NIELSEN, 1981). The color and the texture of the eggs resemble those of dry leaves, which could help with the camouflage, as can be seen in Fig. 1b. When the females do not mate, they still lay between a couple of eggs to more than 40, all which are unviable. Some females lay their eggs on plants that have already been infested in previous cycles.

Larva: Newly-hatched larvae are approximately 2 mm long. The head is partially retracted into the thorax, and the body is slightly flattened dorsoventrally. The first instars are white, and from the third or fourth instar they start to acquire a pinkish coloration that progressively intensifies until an intense red tone is reached (Fig. 1e). A distinctive characteristic of the larvae is the presence of a dark thorn on the dorsum of the tenth abdominal segment (DAMPF, 1927; CASTRO-TORRES & LLANDERAL-CÁZARES, 2015).

Neonate larvae use their mandibles to bore a hole in the chorion, and afterwards they knit a silken net that protects them. The silk gives the eggs a cottony appearance. After hatching, the larvae remain under the silk for two or three days feeding on the chorion; when most of the larvae have hatched, they bore through the leaf and enter it as a group. The leaves with larvae in this stadium are dark at the base and with a decaying appearance, but their odor is similar to that of mature compost.

All the instars of the larvae are gregarious, and according to STAMP (1980), the gregarious behavior of phytophagous insects is the result of the oviposition in masses. From the first instar, the larvae can build silken tunnels through which they move as a group; this is similar to other species like *Yponomeuta cagnagellus* (Hübner, [1813]) (Lepidoptera: Yponomeutidae), a gregarious lepidopteran whose larvae follow trails of silken threads by touch to orient themselves and find their congeners, although chemical cues may also be involved (ROESSING, 1989). As the *Agave* red worm larvae grow, they migrate to the rhizome, where they can molt up to six times and reach 4 cm in length. Although BLÁSQUEZ (1870) and ANCONA (1931) mention between three and four molts, HERNÁNDEZ-LIVERA *et al*. (2005) reported seven instars. The development of the larvae is not uniform, and in the same plant larvae in different development stages can be found. This is similar to what was observed by DELGADO-TEJEDA (personal communication) after artificially infesting plants with first instar larvae, and then isolating the plants with cloth screens; after checking the rhizomes the next year, she found larvae of different sizes and even pupae. Due to this we think that the duration of the larval stage in this species is variable, ranging from eight months to more than 12, as in other species of *Comadia* (RIVERS, 1897). The molting behavior has never been observed in the field; in the laboratory, the larvae that are about to molt exit the piece of leaf, remain almost motionless for a day or two until they molt, and then introduce themselves again into the leaf. As they grow, the coloration becomes more intense and they start secreting a characteristic odor that remains on the surfaces that are in contact with the larvae. The aposematic coloration in the larval stage seems to be common to several species of Cossidae belonging to subfamilies as diverse as Cossinae, Zeuzerinae and Chilecomadiinae (sensu Schoorl) (CARTER, 1984; OLIVARES & ANGULO, 1992; ZONG *et al.*, 2006; TIAN *et al.*, 2010; VEERANNA & REMADEVI, 2011), but while in *C. redtenbacheri* the color appears progressively and in the fully developed larvae it is the most intense, in some other species of the family the color appears at the beginning of the larval stage and disappears towards the last instars. The variation of the coloration could be correlated with the period where the insects are more exposed to predators; in this species that period occurs when the mature larvae go out of the rhizome in large numbers to find a place to pupate (BLÁSQUEZ, 1870; DAMPF, 1931). The bright colors of several species have been considered as a defensive mechanism (PINHEIRO *et al.*, 2015). Some aposematic species are also gregarious, which makes their presence more obvious and emphasizes their defenses, thus dissuading predation (GAGLIARDO & GUILFORD, 1993); however, from an evolutionary point

of view, aposematism and gregarism may not be interdependent (RUXTON & SHERRATT, 2006). The larvae of some cossids also secrete a mixture of volatile fatty acids of relatively high molecular weights, which may serve a defensive function (TRAVE *et al.*, 1960; BERGMANN *et al.*, 2007). During September and October, the larvae go out of the rhizome and dig into the soil to a depth of 3 cm. There they build a cocoon with silk and particles of the substrate (Fig. 1f). The larvae curve themselves either dorsally, ventrally, or laterally.

Pupa: They are adecticous and obtect, where the mandibles are immobile and the appendages are adhered to the body. At the beginning they are white, and they get a creamy hue as they mature, until a dark brown is reached towards the emergence of the adults. The head has two black chitinous projections, one on the vertex and the other near the clypeal region. The abdomen presents several rows of spines on the pleural and dorsal region. The number of rows of spines can be used to distinguish the sexes (CASTRO-TORRES & LLANDERAL-CÁZARES, 2016). Males can also be separated from females by the presence of a pair of tubercles present on the ventral surface of the ninth abdominal segment (Fig. 1g, 1h).

After forming the cocoon, the larvae stay inside for five months and a half on average, but they remain as larvae for up to half of that period, as prepupae for up to 1.5 months, and as pupae for about a month (MIRANDA-PERKINS *et al.*, 2013). The larval stage inside the cocoon is easily reactivated in the presence of light. During the prepupal stage they start losing color until they reach a creamy white hue. The pupae make a hole in the cocoon and emerge from the substrate with the aid of the chitinous projections on the head and the rows of spines. The last abdominal segment often remains in the substrate, which gives the adult a point of support. In laboratory, adults emerge during the whole day, but mainly in the afternoon.

Adult: They exhibit a cryptic coloration; they are light brown with rows of dark brown scales together with whitish scales (Fig. 2a). The thorax is covered by a number of filiform scales. Males are dark; the antennae are bipectinate (Fig. 2b) and the body length is about 1.3 cm. Females are paler than males; the antennae are serrate (Fig. 2c) and the body length is 1.6 cm on average.

Pheromone emission and mating happen the first or second day after emergence. Females start calling about an hour after the start of the scotophase, and they can continue until 5:30 am uninterruptedly. This is different to what LLANDERAL-CÁZARES *et al*. (2007) report; they mention that the calling period extends only until 23:00. The difference may be the presence of light, which can affect the calling behavior (DELISLE & MCNEIL, 1986). SOLOMON & NEEL (1972) mention that males of *Prionoxystus robiniae* (Peck, 1818) (Lepidoptera: Cossidae) can respond to the calling between midday and dusk, but they mainly respond during the afternoon. During the calling, the female extends the last abdominal segments and the ovipositor (Fig. 2d) and sometimes it moves rhythmically, which according to SOLOMON *et al*. (1972), serves to regulate the release and dispersion of the sexual pheromone in *P. robiniae*. Mating can occur at any time during the night. Females emerge with most of the oocytes ready to be fertilized and oviposited in a few hours, which is similar to other lepidopterans with short adult lifespans and non-feeding adults (CHAPMAN, 2013). The weight of the ovaries could explain the fact that females are not as mobile as males. Males are able to fly shortly after their emergence. SOLOMON & NEEL (1972) observed something similar in *P. robiniae*. In this species, females remain on the host plant, about a meter from the site of their emergence, while males exhibit a rapid flight in zigzag.

Oviposition takes place a few hours after mating and starts with a searching behavior where the female repeatedly probes the surface with the ovipositor until it finds a suitable site, which normally includes crevices or rough textures. In cloth bags, oviposition occurs mainly between tighter folds, or between the coxae or wings of dead individuals. If the ovipositor of a female during the searching behavior was gently pressed between the folds of the bag, the female immediately stopped searching and started ovipositing; when the folds were released, the female started the searching behavior again. This shows that a mechanical stimulus alone is enough to trigger oviposition. At the tip of the ovipositor there are several types of trichoid sensilla, which have been associated to mechanoreception, that probably are important to find suitable substrates for oviposition. Females can lay 33 eggs on

average, although some females can lay more than 160. Although eggs can be laid singly, most of them are laid in masses. According to HEBERT (1983), this behavior occurs in species with non-feeding adults because it helps the individuals save energy and use it to lay eggs. RAMÍREZ-CRUZ & LLANDERAL-CÁZARES (2015) report that the average potential fecundity (APF) in this species is 104; however, the number of eggs laid was less than 50% of the APF on average. The huge difference between APF and real fecundity is influenced by female size, the balance between oviposited eggs and their size (LAMBERT, 2008), and the quality of host plants in pro-ovigenic species (AWMACK & LEATHER, 2002). In our study, the larvae were extracted from their host plant and forced to pupate probably before they were fully developed, which may have diminished the nutrients available to the adults; therefore, it is necessary to analyze the real fecundity in adults that emerge from larvae that had pupated naturally. In laboratory, adults emerge from March to May, which is similar to what BROWN (1975) reported for Texas, but in the field the flight period goes from December to May (JIMÉNEZ-VÁSQUEZ & LLANDERAL-CÁZARES, 2015: 38).

### Natural enemies

Parasitoids: The larvae are parasitized by *Lisonnota fascipennis* Townes (Hymenoptera: Ichneumonidae) (Fig. 2e, 2f) and *Acantholespesia texana* (Aldrich & Webber) (Diptera: Tachinidae) (Fig. 2g). A single larva can carry a single ichneumonid larva and up to five tachinids. In laboratory, *L. fascipennis* emerges from the cocoons from March to May, but in the field, parasitized larvae from fourth to sixth instar were found in August and September. Parasitized larvae can bear small brown spots with a small perforation that marks the point of entrance of the ovipositor of *L. fascipennis*, generally on the back of the body (ZETINA *et al.*, 2009; ZETINA *et al.*, 2012; ZETINA & LLANDERAL, 2014). Larvae and pupae of moths are the main hosts of Ichneumonidae, which are specific in several cases. The parasitoids can oviposit inside, on or near their hosts and the immature stages develop as endoparasites, with the life cycles of both organisms interrelated (NICHOLLS, 2008). The stage where parasitization of the *Agave* red worm larvae takes place and how the larvae are found by *L. fascipennis* females remain unknown. Some ichneumonid species that parasitize subterranean pupae have a hardened cuticle that allows them to move through the soil (THOMAS & ELMES, 1993). The adults of *A. texana* emerge from the cocoons of *C. redtenbacheri*. In specimens collected in the field, ZETINA *et al*. (2012) found fifth and sixth instar larvae of *C. redtenbacheri* parasitized by the dipteran in August and September, and the adult dipterans in November and December. Most female tachinids lay their eggs on the surface of the integument of their host, and newly hatched larvae bore through the cuticle and enter the body cavity. Once inside, the parasitoid larvae connect their spiracles to the entrance hole or to the tracheal trunks. After the third instar, the larvae exit the body of the host and form a cylindrical puparium that breaks through the anterior pole during the emergence of the adult (O'HARA, 2008; CHAPMAN, 2013). Lesions caused by *A. texana* can be found in any part of the body of the host, and they consist of a brown, tunnel-shaped melanized structure with a conspicuous hole caused by the entrance of the parasitoid. When the parasitoid larvae are in the last instar, the tissues of the host have already been completely consumed (ZETINA & LLANDERAL, 2014).

Microorganisms: Most of the larvae that were placed in plastic trays died. In some cases it was due to infection by *Beauveria bassiana* (Balsamo) Vuillemin (Fungi: Hypomycetes); this fungus hardens the tissues of the host and covers the integument with white mycelium. Other individuals were infected by bacteria, which produce wet rots and foul odor in the hosts. MIRANDA-PERKINS *et al.* (2013) reported that *B. bassiana* can infect up to 39.6% of the larvae still active inside the cocoons in laboratory. ZETINA & LLANDERAL (2014) observed that infections by bacteria, viruses and fungi cause changes in the color and consistence of the body of the host (Fig. 2i). HERNÁNDEZ-FLORES *et al*. (2015) found nine genera of bacteria associated with *C. redtenbacheri*, none of which were pathogenic to insects or humans.

Predators: All the stages of the insect are predated by ants, rodents and birds. The latter can find the cocoons that are below the ground, and destroy the prepupae, but they do not feed on them, possibly

due to the volatile compounds that the larvae secrete (Fig. 2h); however, the adults are easily spotted and devoured when they are resting on the leaves of the *Agave*. It is possible that the larvae are protected by their aposematic coloration and their secretion, while the adults rely on their camouflage to escape predation. The adults of some Cossidae produce a clicking sound when they flex their wings before flying, and this may be a defensive strategy against predators (MINET & SURLYKKE, 2003), but this behavior has not been observed in *C. redtenbacheri*.

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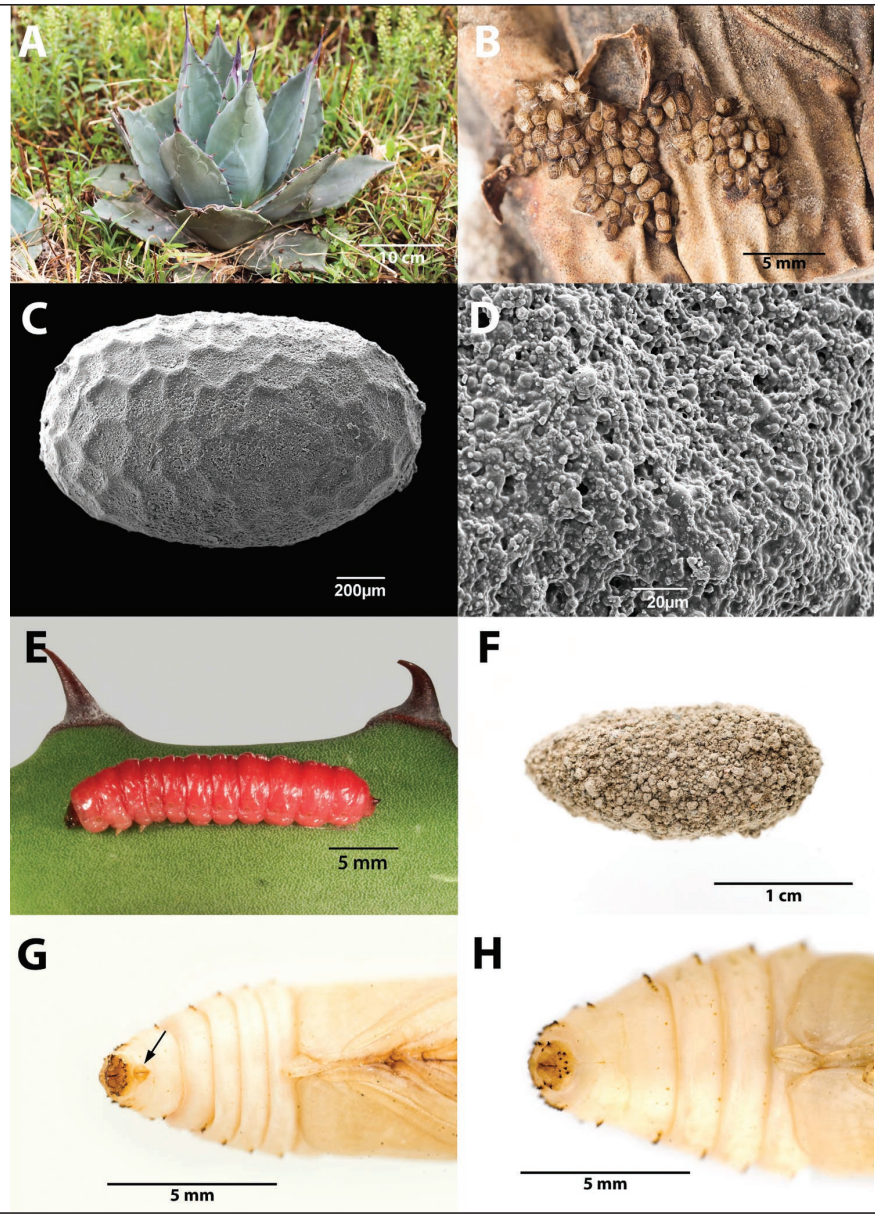


**Fig. 1.– A.** *Agave applanata*. **B.** Eggs of *Comadia redtenbacheri* on a dry leaf. **C.** SEM of the egg of *Comadia redtenbacheri* covered by a secretion from the accessory glands. **D.** Detail of the secretion of the accessory glands. **E.** Mature larva of *Comadia redtenbacheri.* **F.** Cocoon of *Comadia redtenbacheri*. **G.** Distal segments of a male pupa of *Comadia redtenbacheri* showing small tubercles (arrow). **H.** Distal segments of a female pupa of *Comadia redtenbacheri*. No tubercles are present.

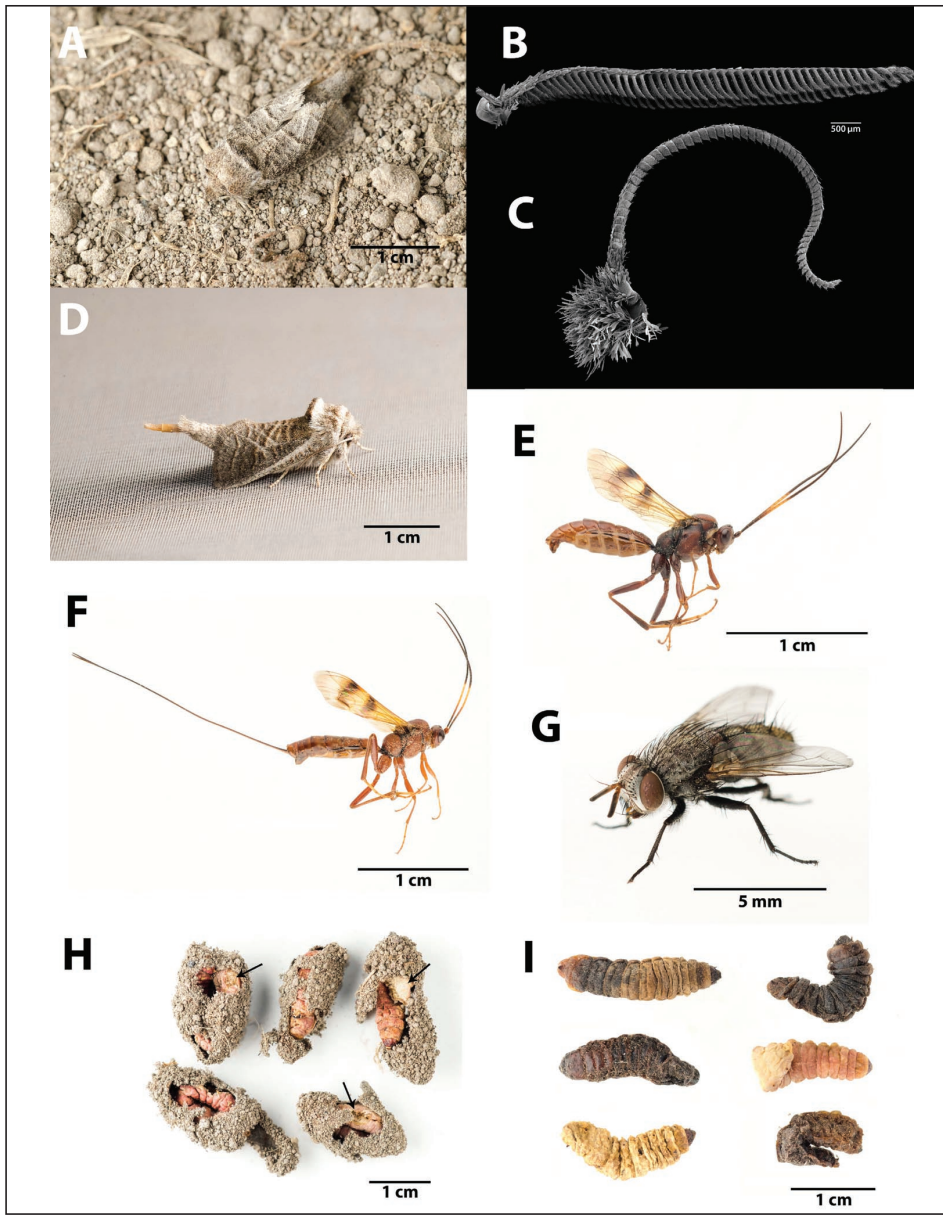


**Fig. 2.– A.** Female *Comadia redtenbacheri* on the soil. **B.** Antenna of the male of *Comadia redtenbacheri*. **C.** Antenna of the female of *Comadia redtenbacheri*. **D.** Female of *Comadia redtenbacheri* calling. **E.** Male of *Lisonnota fascipennis*. **F.** Female of *Lisonnota fascipennis*. **G.** Female of *Acantholespesia texana*. **H.** Larvae and cocoons of *Comadia redtenbacheri* dug out and pecked by birds. The larvae were damaged by the birds (arrows) and later died of desiccation. **I.** Larvae of *Comadia redtenbacheri* exhibiting symptoms of several unknown pathogens.

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

**Solicitud de autorización para recoger Lepidoptera con fines científicos en España**

Las solicitudes cumplirán las siguientes condiciones:

**1.–** Estar al día en el pago de la cuota anual de la Sociedad, antes de solicitar los permisos.

**2.–** Enviar una carta al Secretario General de SHILAP con todos los datos personales, incluyendo nombre, apellidos, dirección, DNI o número de pasaporte, número de teléfono con código del país y prefijo, y/o correo electrónico. Estos datos serán enviados al Secretario General con un mínimo de 45 días de antelación al período de captura previsto.

**3.–** Se detallará el área donde se desea capturar el material (provincia y / o Comunidad Autónoma), el período de tiempo (días, meses o todo el año); procedimiento de captura que se desea emplear (manga entomológica, grupo electrógeno, etc.), material que se desea recoger (especies, géneros, familias, y/o superfamilias), y cualquier otro dato que se desee añadir.

**4.–** Todos los socios de SHILAP que soliciten estos permisos para recoger Lepidoptera en España con fines científicos, se incluirán en el Proyecto de Investigación Científica creado por la Sociedad y denominado: *"Faúnula Lepidopterológica Ibérica, Baleárica y de la región Macaronésica"*.

**5.–** Con el fin de contribuir con este Proyecto Científico, se ruega remitan a SHILAP, **o una copia por correo electrónico (e-mail) con el listado del material recogido en EXCEL,** (sólo en este formato, por favor) indicando la Familia, Subfamilia, Tribu, nombre de la especie (género, especie, autor y año), localidad, coordenadas UTM (1 X 1) o GPS, provincia, fecha de captura, colector y número de machos y hembras capturados (**sólo 5 ejemplares por taxón y localidad, máximo**). Por favor utilice sólo el "*Catálogo sistemático y sinonímico de los Lepidoptera de la Península Ibérica, de Ceuta, de Melilla y de las islas Azores, Baleares, Canarias, Madeira y Salvajes (Insecta: Lepidoptera)*" (A. VIVES MORENO, 2014)". Esta lista es necesaria para este Proyecto Científico de SHILAP y para nuevas autorizaciones.

**6.– Es obligatorio publicar en** *SHILAP Revta. lepid.,* las nuevas especies o subespecies que se descubran y remitir a SHILAP **una parte del material TIPO**, para su posterior incorporación a la colección de Lepidoptera del Museo Nacional de Ciencias Naturales en Madrid, España.

**7.–** Se recuerda a todos los socios la obligación de estar autorizados para recoger Lepidoptera, con fines científicos, en España.

**8.–** Conocer los fines científicos de SHILAP y comprometerse a pagar los gastos de participación en este Proyecto Científico, que la Junta Directiva considere en cada momento y que será comunicado con antelación.

**Application for permits to collect Lepidoptera in Spain for scientific purposes**

Applications must abide by the following conditions:

**1.–** The Society's annual fee must be paid before applying for the permits.

**2.–** A letter applying for the permit has to be addressed to the General Secretary of SHILAP, including name, surname, address, ID card number or Passport number, telephone number with country code and prefix, and/or e-mail address. These data must reach the General Secretary at least 45 days in advance of the foreseen collecting activity.

**3.–** The collecting area to be visited by the applicant should also be detailed (province and / or Autonomous Community), expected dates (days, months, or the whole year), collecting method (entomological net, generator, etc.), taxonomical groups of interest to be collected (species, genera, families and/or superfamilies); any other data the applicant wishes to add.

**4.–** All members of SHILAP who apply for these permits to collect Lepidoptera in Spain with scientific purposes, will be included in the Scientific Investigation Project created by the Society and called: *"Lepidopterological Fauna of the Iberian Peninsula, Balearic Islands and Macaronesian region"* .

**5.–** In order to contribute to this Scientific Project, it is requested to send to SHILAP, **either a copy by electronic mail (e-mail) with the listing of the material picked up in EXCEL** (only in this format, please), indicating the Family, Subfamily, Tribe, name of the species (genera, species, author's name and year), town, UTM (1 X 1) or GPS coordinates, province, dates of capture, collector and numbers of males and females captured (**only 5 specimens per taxon and locality, maximum**). Please use only the "*Catálogo sistemático y sinonímico de los Lepidoptera de la Península Ibérica, de Ceuta, de Melilla y de las islas Azores, Baleares, Canarias, Madeira y Salvajes (Insecta: Lepidoptera)* (A. VIVES MORENO, 2014)". This list is necessary for this Scientific Project of SHILAP and for new authorizations.

**6.– It's obligatory to publish in** *SHILAP Revta. lepid*., the new species or subspecies that are discovered and to remit to SHILAP **a part of the TYPE material**, for later incorporation into the Lepidoptera Collection of the National Museum of Natural Sciences in Madrid, Spain.

**7.–** All members are kindly reminded of the obligation to be duly authorized for collecting Lepidoptera, with scientific purposes, in Spain.

**8.–** To know about the scientific aims of SHILAP and to commit to pay the expenses of participation in this Scientific Project, that the Board of Directors considers at any given moment and that will be communicated in advance.

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# Four new *Coleophora* Hübner, 1822 species from the Iberian Peninsula (Lepidoptera: Coleophoridae)

J. Tabell

**Abstract**

Four new *Coleophora* Hübner, 1822 species, *C. septembra* Tabell, sp. n., *C. tigris* Tabell, sp. n., *C. aragonensis* Tabell, sp. n. and *C. forcipata* Tabell, sp. n. are described from the Iberian Peninsula. Habitus of the adults and the genitalia are illustrated. DNA barcodes are presented and compared to those of close relatives.
KEY WORDS: Lepidoptera, Coleophoridae, *Coleophora*, new species, Iberian Peninsula.

**Cuatro nuevas especies de *Coleophora* Hübner, 1822 de la Península Ibérica (Lepidoptera: Coleophoridae)**

**Resumen**

Se describen de la Península Ibérica cuatro nuevas especies de *Coleophora* Hübner, 1822, *C. septembra* Tabell, sp. n., *C. tigris* Tabell, sp. n., *C. aragonensis* Tabell, sp. n. and *C. forcipata* Tabell, sp. n. Se ilustran los adultos y genitalia. Se presenta el código de barras DNA y se compara con los de parientes próximos.
PALABRAS CLAVE: Lepidoptera, Coleophoridae, *Coleophora*, nuevas especies, Península Ibérica.

## Introduction

The Lepidoptera genus *Coleophora* Hübner, 1822 is well represented in the Iberian Peninsula with over 250 different species (available from http://www.faunaeur.org/). A remarkable portion of these taxa are considered endemic to this area. In the last century new species from this region were described especially by Toll (e.g. TOLL, 1960), and later by Glaser and Baldizzone (e.g. GLASER, 1981; BALDIZZONE, 1987; VIVES MORENO, 1987). The collecting trips made by Glaser and van der Wolf in the 1970-90's indicated that the Spanish Coleophoridae fauna is still insufficiently known. However, over the last 15 years no more than three new *Coleophora* taxa (plus two *Ischnophanes* Meyrick, 1891 taxa) have been described from the Iberian Peninsula, namely *C. lusitanica* Baldizzone & Corley, 2004, *C. luteochrella* Baldizzone & Tabell, 2009 and *C. alacanta* Tabell, 2013 (BALDIZZONE & CORLEY, 2004; BALDIZZONE & TABELL, 2009; TABELL, 2013). Recent expeditions to Spain, carried out by Jari Junnilainen, Timo & Kari Nupponen and the author have produced rich material of Coleophoridae, including several so far unknown species. In this article four new species of Coleophoridae are described from the Iberian Peninsula, namely *Coleophora septembra* Tabell, sp. n., *Coleophora tigris* sp. n., *Coleophora aragonensis* Tabell, sp. n. and *Coleophora forcipata* Tabell, sp. n.

Tissue samples (dried legs) from the specimens of these four new taxa were shipped to the Canadian Centre for DNA Barcoding in Guelph for DNA sequence analysis. On the same occasion

several samples of closely related species were also sent for barcoding. The barcoding results are discussed under Molecular diagnosis of each new species. Details of the barcoded specimens and their photographs are available through the following dataset (available from http://dx.doi.org/10.5883/DS-COLSEP).

Type specimens are deposited in the collections of MZH (Helsinki, Finland), A. Vives (MNCN, Madrid, Spain), M. Corley (Faringdon, England), J. Junnilainen (Vantaa, Finland), T. & K. Nupponen (Espoo, Finland) and J. Tabell (Hartola, Finland).

**Abbreviations:**

MZH = Finnish Museum of Natural History, University of Helsinki, Finland
MNCN = Museo Nacional de Ciencias Naturales, Madrid, Spain

***Coleophora septembra* Tabell, sp. n.**
Barcode Index Number: BOLD:AAV8014

Holotype ♂ (GP 4895 J. Tabell, DNA sample 21983 Lepid. Phyl.), SPAIN, Granada, Sierra Nevada, Puerto de la Ragua 4.5 km S, 1780 m, 23-IX-2012, J. Tabell leg., coll. MZH.

Paratypes (14 ♂♂, 13 ♀♀): 6 ♂♂: (GP 5260 J. Tabell), 9 ♀♀ (GP 4943 J. Tabell, DNA sample 21984 Lepid. Phyl.; GP 5261 J. Tabell) same collecting data as in holotype, colls. A. Vives / MNCN and Tabell; 1 ♂ (Gen. prep. 3145 J. Tabell), SPAIN, Granada, Sierra Nevada 1400 m, Granada 15 km SE, 30-IX-1997, T. Nupponen leg., coll. T. & K. Nupponen; 1 ♂ (Gen. prep. 4180 J. Tabell, DNA sample 20095 Lepid. Phyl.), Spain, Aragón, Teruel, Albarracín, 5 km W, 13-IX-2004, K. Nupponen leg., coll. T. & K. Nupponen; 4 ♀♀ (GP 5251 J. Tabell), SPAIN, Castilla y León, prov. Ávila, Guisando 5 km NW, Sierra de Gredos, 1150-1400 m, 19-IX-2012, T. Nupponen leg., colls. T. & K. Nupponen and Tabell; 4 ♂♂ (GP 5249, 5262 J. Tabell), PORTUGAL, Trás-os-Montes, Montalegre, Mourilhe, 15-IX-1973, P. Grotenfelt leg., colls. MZH and Tabell; 1 ♂, PORTUGAL, Beira Alta, Lamego, 19-IX-1973, P. Grotenfelt leg., coll. MZH; 1 ♂ (Gen. prep. 1999), PORTUGAL, Beça, Boticas, Trás-os-Montes, 22-IX-2003, leg. M. Corley, coll. Corley.

Paratypes are deposited in the collections of MZH (Helsinki, Finland), A. Vives (MNCN, Madrid, Spain), J. Tabell (Hartola, Finland), M. Corley (Faringdon, England) and T. & K. Nupponen (Espoo, Finland).

Diagnosis: According to the external appearance and the genitalia structures *C. septembra* Tabell, sp. n. belongs to the *C. onobrychiella* Zeller, 1849 species group. The moths of this species group are usually yellowish brown with light costal line, and most species cannot be safely determined without examining the genitalia. The genitalia of *C. septembra* are similar to those of *C. genistae* Stainton, 1857, *C. saturatella* Stainton, 1850 and *C. trifariella* Zeller, 1849, but differ by a more acute-tipped sacculus in the male genitalia. The female genitalia display only minor separating details, above all the more conical sterigma.

Molecular diagnosis: Three specimens of *C. septembra* were successfully sequenced, resulting in a 658 bp, full-length barcode fragment for two specimens, and a fragment of 636 bp for one specimen. The DNA barcodes were compared to those of six closely related species (*C. cyrneogenistae* Varenne & Nel, 2014, *C. genistae*, *C. kahaourella* Toll, 1957, *C. saturatella*, *C. svenssoni* Baldizzone, 1985, *C. trifariella*). The results reveal a distinct divergence between *C. septembra* and the other barcoded taxa (Fig. 1). Among these species the mean interspecific divergences varies from 5.24 % to 10.01%, and the closest neighbour for *C. septembra* is *C. kahaourella* (Table 1). Consequently, the results support the status of *C. septembra* as a distinct species.

Description (Fig. 3): Wingspan 11-14.5 mm. Head white, tinged with pale brown. Antenna white, annulated with brown. Scape with pale brown or pale ochreous elongate scales, not forming a long tuft. Labial palp pale brown, whitish below, second article 1.5 x longer than third article. Thorax white with pale ochreous median line; tegula pale ochreous. Forewing ochreous brown, dorsal half slightly paler,

stripes white; costal stripe narrow, from base to near apex, median stripe narrow, from base to 2/5, dorsal stripe distinct only at base, outer margin sparsely with white scales. Costal fringe white, towards apex pale brown, dorsal fringe pale brownish grey. Hindwing pale grey, fringe brownish grey. Abdomen brownish grey, lustrous.

**Table 1.–** Interspecific mean K2P divergences (>600 bp) based on the analysis of COI gene. Maximum intraspecific variations in diagonal grey cells. The number of examined specimens in parenthesis.

| | *C. septembra* | *C. cyrneogenistae* | *C. genistae* | *C. kahaourella* | *C. saturatella* | *C. svenssoni* | *C. trifariella* |
|---|---|---|---|---|---|---|---|
| *C. septembra* (3) | 0.8 | 9.68 | 6.73 | 5.24 | 7.75 | 7.75 | 8.26 |
| *C. cyrneogenistae* (2) | 9.68 | 0.61 | 10.01 | 8.13 | 9.59 | 9.87 | 8.34 |
| *C. genistae* (3) | 6.73 | 10.01 | 0 | 6.73 | 5.97 | 6.48 | 6.66 |
| *C. kahaourella* (2) | 5.24 | 8.13 | 6.73 | 0.15 | 7.08 | 6.41 | 6.72 |
| *C. saturatella* (1) | 7.75 | 9.59 | 5.97 | 7.08 | N | 7.31 | 5.77 |
| *C. svenssoni* (3 ) | 7.75 | 9.87 | 6.48 | 6.41 | 7.31 | 0.15 | 7.47 |
| C. *trifariella* (1) | 8.26 | 8.34 | 6.66 | 6.72 | 5.77 | 7.47 | N |

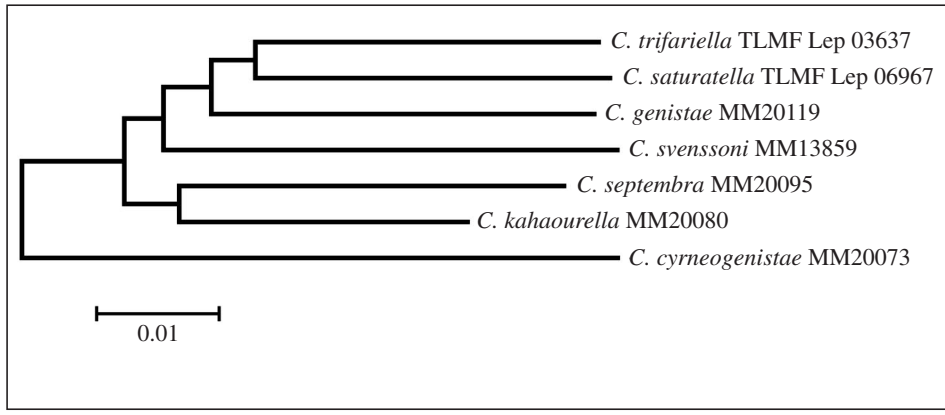


**Fig. 1.**– Neighbour joining tree of *C. septembra* Tabell, sp. n. and adjacent species based on sequences of COI gene (658 bp) (Figure: Marko Mutanen).

Abdominal structures (Figs. 10, 13) No posterior lateral struts. Transverse strut slightly convex, proximal margin straight, evenly sclerotized, distal margin constricted medially. Tergal sclerites 3 x longer than wide, covered with 45-55 conical spines (3rd tergum).

Male genitalia (Figs. 7-9): Gnathos knob large, transversely oval. Tegumen rather broad, hourglass-shaped, pedunculi short. Transtilla short, triangular. Cucullus elongate, moderately narrow. Valvula triangular, outer margin well delineated. Sacculus chitinized; ventral margin convex, terminating in acute protuberance; dorsal margin concave. Phallotheca conical, slightly arched, dorsally sclerotized tube. Vesica transparent, with several curved long cornuti grouped in three bundles.

Female genitalia (Figs. 11-12): Papillae anales oval, covered with longish bristles. Tergum 8 trapezoid, well sclerotized, anteriorly bilobate, caudal margin convex. Anterior apophyses slightly longer than sterigma, posterior apophyses twice as long as anterior ones. Sterigma trapezoid, laterally broadly membranous; proximal margin straight; caudal margin rounded, lined with several long bristles, medial excavation wide and deep, lined with few short bristles. Ostium bursae wide, U-shaped, situated at anterior half of sterigma. Antrum chalice-shaped, distal margin broadly and

strongly chitinized, median lamina broad. Spinulate section of ductus bursae long, coiled once; median lamina extended beyond spinulate section, coiled; anterior section transparent, narrow, at level of ductus seminalis several small spinules. Corpus bursae round with one leaf-like signum.

Bionomy: All specimens have been captured in September by light (8 W and 20 W fluorescent tubes). Biology is unknown.

Distribution: So far the new taxon is known from Portugal (northern provinces of Beira Alta and Trás-os-Montes e Alto Douro) and Spain (provinces of Granada and Teruel).

Derivation of name: The specific name refers to the flight period of adults in September.

***Coleophora tigris* Tabell, sp. n**
Barcode Index Number: BOLD:ACT0660

Holotype ♂ (DNA sample 23600 Lepid. Phyl.), SPAIN, Granada, Motril, 7.5 km N, 100 m, N36.81134 W3.54550, 10-IV-2014, J. Tabell leg., coll. MZH.

Paratypes (15 ♂♂, 3 ♀♀): 10 ♂♂ (GP 5218 JT), 2 ♀♀ (GP 5220 J. Tabell; DNA sample 23601 Lepid. Phyl.), same collecting data as in holotype, colls. A. Vives / MNCN and Tabell; 1 ♂ (DNA sample 23599 Lepid. Phyl.), SPAIN, Granada, Sierra Nevada, 1420 m, Juviles, 3 km W, 8-VI-2010, J. Tabell leg., coll. Tabell; 4 ♂♂ (GP 5155 J. Tabell), 1 ♀ (GP 5156 J. Tabell, DNA sample 23649 Lepid. Phyl.), SPAIN, Granada, Motril, 10 km N, 23-IV-2001, J. Junnilainen leg., colls. Junnilainen and Tabell.

Diagnosis: *Coleophora tigris* Tabell, sp. n. is a moderately small moth, characterized by white-yellow-brown-striped wing-pattern. Externally it resembles *C. brunneosignata* Toll, 1944, but the dark scales on forewing are more suffused than in *C. brunneosignata* and other species of *C. vulnerariae* species group. The genitalia of *C. tigris* resemble those of *C. glaseri* Toll, 1961, *C. turbatella* Toll, 1944 and *C. marcarolensis* Baldizzone, 2004. The main distinquishing characters in the male genitalia are the larger gnathos knob and apical tooth on sacculus in *C. tigris*, and the shape of cornuti (longer than in *C. turbatella* and *C. marcarolensis*, similar with *C. glaseri*). In the female genitalia the separating details are the shape of sterigma (in *C. turbatella* and *C. glaseri* narrower than in *C. tigris*, in *C. marcarolensis* similar to *C. tigris*) and the length of spinulate section of ductus bursae (in *C. marcarolensis* shorter, in *C. turbatella* and *C. glaseri* longer than in *C. tigris*).

Molecular diagnosis: Four specimens of *C. tigris* sp. nov. were sequenced successfully, resulting in 658 bp (n=2), 636 bp and 565 bp barcode fragments. The resultant sequences display 0.36 % maximum intraspecific variation. The DNA barcodes were compared to those of three closely related taxa belonging to the *C. vulnerariae* species group (*C. brunneosignata*, *C. marcarolensis* and *C. turbatella*). The results reveal a distinct, 6.38-10.54 % divergence between the species (Table 2). So far there exist no barcodes in BOLD for morphologically closely related species *C. glaseri.*

**Table 2.–** Interspecific mean K2P divergences (>600 bp) based on the analysis of COI gene. Maximum intraspecific variations in diagonal grey cells. The number of examined specimens in parenthesis.

| | *tigris* | *brunneosignata* | *marcarolensis* | *turbatella* |
|---|---|---|---|---|
| *tigris* (4) | 0.36 | 8.77 | 6.96 | 8.58 |
| *brunneosignata* (3) | 8.77 | 0.46 | 9.86 | 10.54 |
| *marcarolensis* (1) | 6.96 | 9.86 | N | 6.38 |
| *turbatella* (5) | 8.58 | 10.54 | 6.38 | 1.0 |

Description (Fig. 4): Wingspan 12.5-15 mm, female 10-12 mm. Head white, medially pale ochreous to pale brown. Antenna white, annulated with brown. Scape white, below shortly tufted by

white and pale brown scales. Labial palp whitish, second article 1.5 x longer than third article. Thorax white, medially mixed with yellow and pale brown, tegula white, mixed with pale brown. Forewing yellow with a narrow white costal stripe to 5/6 and four dark brown stripes; one below costal stripe from base to apex, extended apically; two medial stripes fused basally, longer upper stripe to near apex, lower to tornus; one dorsal stripe; medial and dorsal stripes mixed with white scales forming short lines. Costal fringe dark brown, dorsal fringe slightly paler. Hindwing pale brownish grey, fringe pale brown. Abdomen yellowish brown, lustrous.

Male genitalia (Figs. 14-16): Gnathos knob crescent-shaped, lower margin concave, arms long and narrow. Tegumen long, slightly conical, pedunculus short. Transtilla wedge-shaped, upcurved. Costa concave. Cucullus narrow and long, apically slightly broader. Valvula well sclerotized, covered with bristles, ventral margin strongly sclerotized. Phallotheca conical tube, dorsally arched and strongly sclerotized. Sacculus short, strongly sclerotized, margin rounded; characterized by a darkly sclerotized subapical tooth; apical part densely covered with bristles of different size. Vesica membranous, with an annulus and weekly sclerotized, long and curved cornutus.

Female genitalia (Figs. 18-19): Papillae anales oval, sparsely covered with long and short bristles. Tergum 8 lightly sclerotized, anteriorly bilobate. Anterior apophyses 1.25x longer than sterigma, posterior apophyses almost twice as long as anterior ones. Sterigma trapezoid, laterally membranous, apical fifth covered with bristles; proximal margin straight; caudal margin rounded, medial excavation wide and deep, lined with few stud-shaped bristles. Ostium bursae wide, U-shaped, situated at anterior half of sterigma. Antrum chaliced, median lamina caudally broad, extended into antrum. Spinulate section of ductus bursae 3.5x longer than sterigma, curved, lamina extended beyond spinulate section, twisted; anterior section transparent, straight. Corpus bursae oval with one leaf-like signum, spine broad, base with a pair of small nodules.

Abdominal structures (Figs. 17, 20): Latero-posterior bar absent. Transverse bar broad, convex, proximal edge clearly sclerotized only medially, distal edge evenly sclerotized. Tergal sclerite about 3x longer than wide, covered with 35 conical spines (3rd tergum).

Biology: Early stages unknown.

Distribution: So far known from three localities in southern Spain, province Granada, at an altitude between 100 m and 1420 m.

Derivation of name: The specific name refers to a tiger (*Panthera tigris*), considering to its coloration.

### *Coleophora aragonensis* Tabell, sp. n.

Barcode Index Number: BOLD:ACF3723

Holotype ♂ (GP 4680 J. Tabell), SPAIN, Aragón, prov. Teruel, Teruel 9 km NNE, Villalba Baja, 960-1030 m, 13-VI-2008, K. Nupponen leg., coll. T. & K. Nupponen (holotype currently deposited in collection of Nupponen can be borrowed through MZH).

Paratypes (13 ♂♂, 2 ♀♀): 1 ♀ (GP 4676 J. Tabell) same data as in holotype; 6 ♂♂ same locality as in holotype, but 27-IV-2009, T. & K. Nupponen leg., colls. T. & K. Nupponen and Tabell; 1 ♀ same data as in holotype, but 970 m, 17-V-2007, coll. T. & K. Nupponen; 4 ♂♂ (DNA sample 16502 Lepid. Phyl.), SPAIN, Aragón, prov. Zaragoza, Los Monegros, Caspe 7 km N, 18-V-2004, J. Junnilainen leg., coll. Junnilainen; 3 ♂♂ (Gen. prep. 3748 J. Tabell, DNA sample 16501 Lepid. Phyl.; Gen. prep. 3834 J. Tabell), SPAIN, Aragón, prov. Zaragoza, Los Monegros, Gelsa, 10 km NW, 21-V-2004, J. Junnilainen leg., colls. A. Vives / MNCN, Junnilainen and Tabell.

Diagnosis: Externally *C. aragonensis* Tabell, sp. n. is similar to several smallish, striped pale brown Coleophoridae moths. Examination of the genitalia is required for confident determination. According to the genitalia structures the new taxon is most close to *C. sarehma* Toll, 1957, the distribution range of which extends from the Canary Islands to Iran and Turkey, through the northern African countries (BALDIZZONE *et al.,* 2006). Another close relative is *C. scabrida* Toll, 1959, a species widely distributed in Europe (BALDIZZONE *et al*., 2006). In *C. aragonensis* the

lateral margin of sacculus is swollen and more serrated, cucullus is narrower and the apical tooth of phallotheca larger. In *C. scabrida* the dorsal protuberance is acute-tipped and the lower phallotheca rod strongly swollen. In the female genitalia the main distinguishing characters are shape of the sterigma (rectangular in *C. aragonensis* and *C. scabrida*, conical in *C. sarehma*), length and width of the antrum (short and broad in *C. aragonensis*, long and broad in *C. scabrida*, long and narrow in *C. sarehma*), and length of spinulate section of ductus bursae (in *C. aragonensis* and *C. sarehma* longer than antrum, in *C. scabrida* shorter than antrum).

Molecular diagnosis: Samples of two specimens of *C. aragonensis* were sent for barcoding. Both samples were sequenced successfully, resulting in full 658 bp barcode fragments. The DNA barcodes were compared to that of *C. sarehma* (n=1), showing 1.99 % interspecific divergence (no intraspecific variation). This distance gap is congruent with the obvious morphological differences and supports the status of *C. aragonensis* as a distinct species.

Description (Fig. 5): Wingspan 12.5-13 mm. Head pale brown, whitish laterally. Antenna white, annulated with dark brown. Scape brown, not tufted. Labial palp whitish, outer surface of second article brown, second article 1.5 x longer than third article. Thorax pale brown mixed with white. Forewing mottled, pale brown with creamy white indistinctly edged longitudinal stripes and scattered dark brown scales; costal stripe from base to 2/3. Costal fringe creamy white, dorsal fringe pale brown, apically paler. Hindwing pale brown, fringe pale brown, apically paler. Abdomen pale grey, slightly lustrous.

Abdominal structures (Figs. 24, 27) No posterior lateral struts. Transverse strut slightly convex, proximal margin broad, distal margin medially bulged. Tergal sclerites 4 x longer than wide, covered with 20-25 conical spines (3rd tergum).

Male genitalia (Figs. 21-23): Gnathos knob elongate, arms short. Tegumen rectangular, short, pedunculi longer than tegumen, basally bulged. Transtilla wedge-shaped. Costa basally bulged, cucullus elongate, moderately narrow, basally constricted. Valvula narrower than cucullus, ventral margin evenly rounded. Sacculus well chitinized; ventral margin oblique, almost straight, obtuse-angled; lateral margin shallowly serrated, convex, ending in robust and inwards curved protuberance exceeding costa. Phallotheca rods narrow, divergent, lower rod (lateral aspect) longer with robust apical triangular tooth. Vesica rather short, ventrally slightly chitinized, with two to three cornuti in tight cluster.

Female genitalia (Figs. 25-26): Papillae anales elongate, narrow, covered with longish bristles. Anterior apophyses slightly longer than sterigma, posterior apophyses twice as long as anterior ones. Sterigma transverse, almost twice as wide as long, in proximal portion two curved oblique wrinkles; proximal margin rounded, medially deeply concave; caudal margin almost straight, broadly more strongly chitinized, sparsely lined with long bristles, medial excavation 1/5 x width of sterigma. Ostium bursae V-shaped, situated medially on sterigma. Antrum chalice-shaped, longer than sterigma, about 1/3 x width of sterigma, curved, posterior third strongly chitinised, in anterior half elongate sclerotization. Spinulate section of ductus bursae 3 x longer than sterigma, semicircular, twisted, median lamina present, spinules small; middle section coiled, darkly sclerotized; anterior section transparent. Corpus bursae oval with one leaf-like signum.

Bionomy: The larval case and host plant are unknown. The habitats are xerothermic calcareous slopes with sparse vegetation (e.g. *Thymus* and *Helianthemum*) (Fig. 2).

Distribution: So far the new taxon is known from three localities in the Spanish provinces of Teruel and Zaragoza.

Derivation of name: The specific name refers to the region of Aragon, where the collecting sites of *C. aragonensis* are located.

***Coleophora forcipata* Tabell, sp. n.**
Barcode Index Number: BOLD:ACT4012

Holotype ♂ (GP 4681 J. Tabell, DNA sample 23645 Lepid. Phyl.), SPAIN, Aragón, prov.

**Fig. 2.–** Type locality of *C. aragonensis* Tabell, sp. n. and *C. forcipata* Tabell, sp. n. in Teruel, Spain (Photo: Kari Nupponen).

Teruel, Teruel 9 km NNE, Villalba Baja, 960-1030 m, 13-VI-2008, K. Nupponen leg., coll. T. & K. Nupponen (holotype currently deposited in collection of Nupponen can be borrowed through MZH).

Paratypes (10 ♂♂, 4 ♀♀), 6 ♂♂, 4 ♀♀ (GP 5099 J. Tabell, DNA sample 23646 Lepid. Phyl; GP 5263 J. Tabell; GP 5413 J. Tabell): same collecting locality as in holotype, but 1000 m, 13-IX-2007, T. Nupponen leg., colls. A. Vives / MNCN, T. & K. Nupponen and Tabell; 2 ♂♂, SPAIN, Aragón, prov. Zaragoza, Los Monegros, Gelsa 8 km NE, 270 m, 11-IX-2007, T. Nupponen leg., coll. T. & K. Nupponen; 1 ♂ same collecting data, but 12-IX-2007, coll. Tabell; 1 ♂, SPAIN, Castilla y León, prov. Zamora, Zamora 6 km W, 14-IX-2007, T. Nupponen leg., coll. T. & K. Nupponen.

Diagnosis: *C. forcipata* Tabell, sp. n is a middle-sized species, and on account of typical coloration, viz. light brown forewing with white longitudinal stripes and dark scales, a secure determination requires the scrutiny of genitalia structures. According to the genitalia of both sexes *C. forcipata* belongs to the *C. dianthivora* species group and is most closely related to *C. agenjoi* Toll, 1960, a species known from Spain (BALDIZZONE *et al*., 2006) and Portugal (CORLEY *et al*., 2011). In the male genitalia a large fork-shaped appendix of the lower phallotheca rod readily distinguishes *C. forcipata* from *C. agenjoi* and the other relatives, e.g. *C. riffelensis* Rebel, 1913. In general, the shape of phallotheca rods is the most valuable genitalic character in separating

different taxa of the *C. dianthivora* species group. In the female genitalia of *C. forcipata* shape of the sterigma with medial opening is unique.

Molecular diagnosis: Samples of two specimens of *C. forcipata* were sent for barcoding. Both samples were sequenced successfully, resulting in full 658 bp barcode fragments. The barcodes display 0.15 % intraspecific variation, whereas the interspecific divergence between *C. forcipata* and *C. riffelensis* is 3.87 %. So far there exist barcodes neither for the morphologically most closely related species *C. agenjoi*, nor for its numerous Asian relatives in BOLD. Consequently, the usage of existing barcodes as a taxonomical tool in *C. dianthivora* species group is not very useful.

Description (Fig. 6): Wingspan 14-17 mm. Antenna white, unringed or indistinctly annulated with pale brown. Scape whitish, not tufted. Labial palp pale brown mixed with whitish, second article 1.5 x longer than third article. Thorax pale brown mixed with white. Forewing mottled, pale brown with white longitudinal stripes and scattered blackish scales; costal stripe from base to 4/5, median stripe from base to apex, joined with a stripe along fold, dorsal stripe from base to apex; in apical area three indistinctly edged short stripes. Fringe white mixed pale brown along costal margin, at dorsal margin pale brown, tipped whitish. Hindwing pale greyish brown, fringe pale brown, tipped whitish. Abdomen light grey, slightly lustrous.

Abdominal structures (Figs. 31, 34): No posterior lateral struts. Transverse strut slightly convex, both margins broadly sclerotized. Tergal sclerites 4 x longer than wide, covered with 25 conical spines (3rd tergum).

Male genitalia (Figs. 28-30): Gnathos knob elongate, narrow. Tegumen hourglass-shaped, pedunculi slightly bulged. Transtilla arrowhead-shaped, upwards oblique. Costa deeply concave, cucullus rounded. Valvula small, outer margin well delineated, densely outlined with small bristles, ventral margin evenly rounded. Sacculus broad, thickly sclerotized; ventral and lateral margins unevenly curved, ending in robust and inwards curved digitate protuberance exceeding costa; dorsal margin almost parallel with lateral margin, with one small tooth. Phallotheca rods curved, upper rod (lateral aspect) twice as long as lower rod, gradually thinning towards apex; lower rod broad, ending in fork-shaped formation, its lower branch twice longer than upper branch. Vesica rather short, two distally arched small cornuti grouped together.

Female genitalia (Figs. 32-33): Papillae anales elongate, narrow, covered with longish bristles. Anterior apophyses slightly shorter than sterigma, posterior apophyses twice as long as sterigma. Sterigma markedly sclerotized, with large medial opening, apical fifth covered with bristles; proximal margin slightly convex, caudal margin rounded; medial excavation short, conical, lined with few bristles. Ostium bursae broadly U-shaped. Antrum as long as sterigma, sack-shaped, lateral edges more strongly sclerotized. Spinulate section of ductus bursae twice longer than sterigma, with median lamina, followed by large, sclerotized coil; anterior section gradually widening into oval corpus bursae. Signum leaf-shaped, spine short.

Bionomy: The larval case and host plant are unknown. The habitats are xerothermic calcareous slopes with sparse vegetation (e.g. *Thymus* and *Helianthemum*) (Fig. 2).

Distribution: *C. forcipata* is known from three Spanish provinces, Teruel, Zamora and Zaragoza.

Derivation of name: The specific name refers to the fork-shaped tip of the lower phallotheca rod in the male genitalia.

**Acknowledgements**

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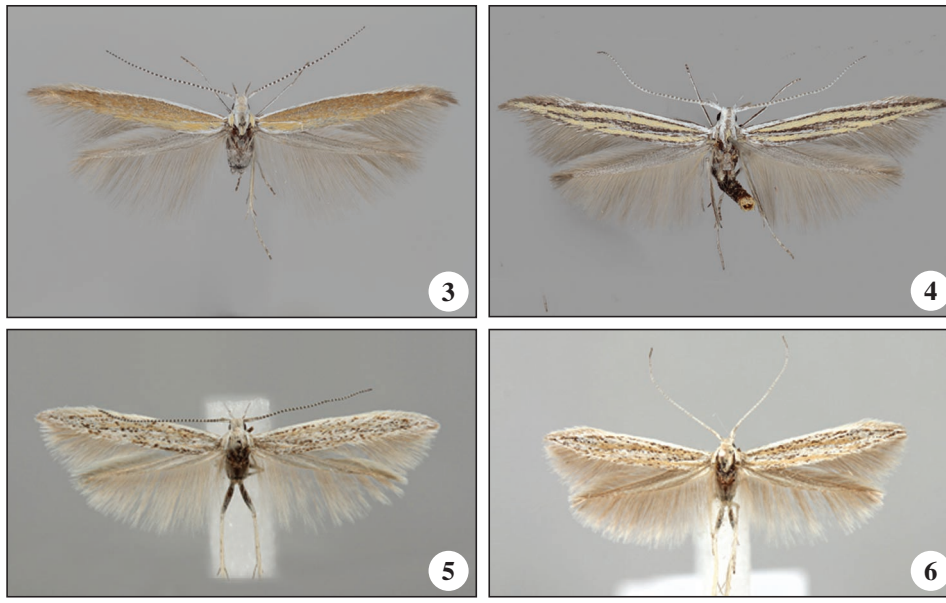


**Figs. 3-6.**– Adults: **3.** *C. septembra* Tabell, sp. n., male paratype, Spain, Sierra Nevada. **4.** *C. tigris* Tabell, sp. n., male paratype, Spain, Granada (Photos: Juha Tyllinen). **5.** *C. aragonensis* Tabell, sp. n., holotype, Spain, Aragon. **6.** *C. forcipata* Tabell, sp. n., holotype, Spain, Teruel (Photos: Reijo Siloaho).

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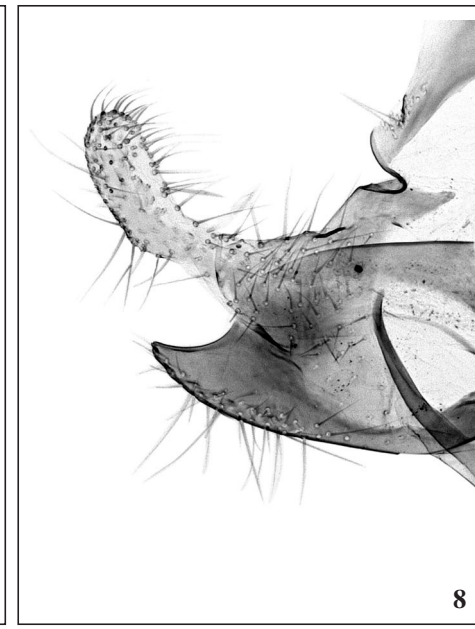
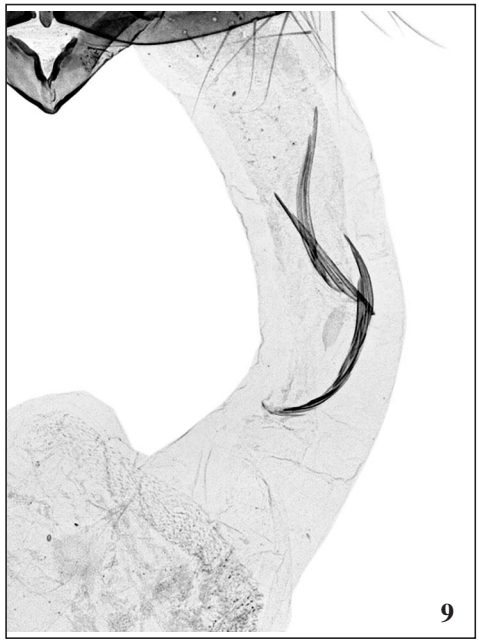
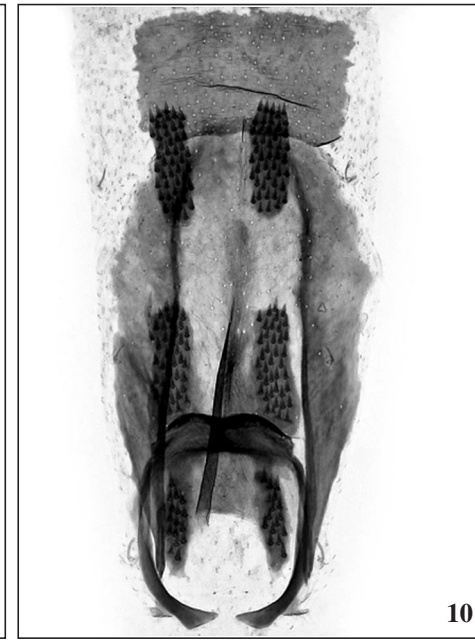
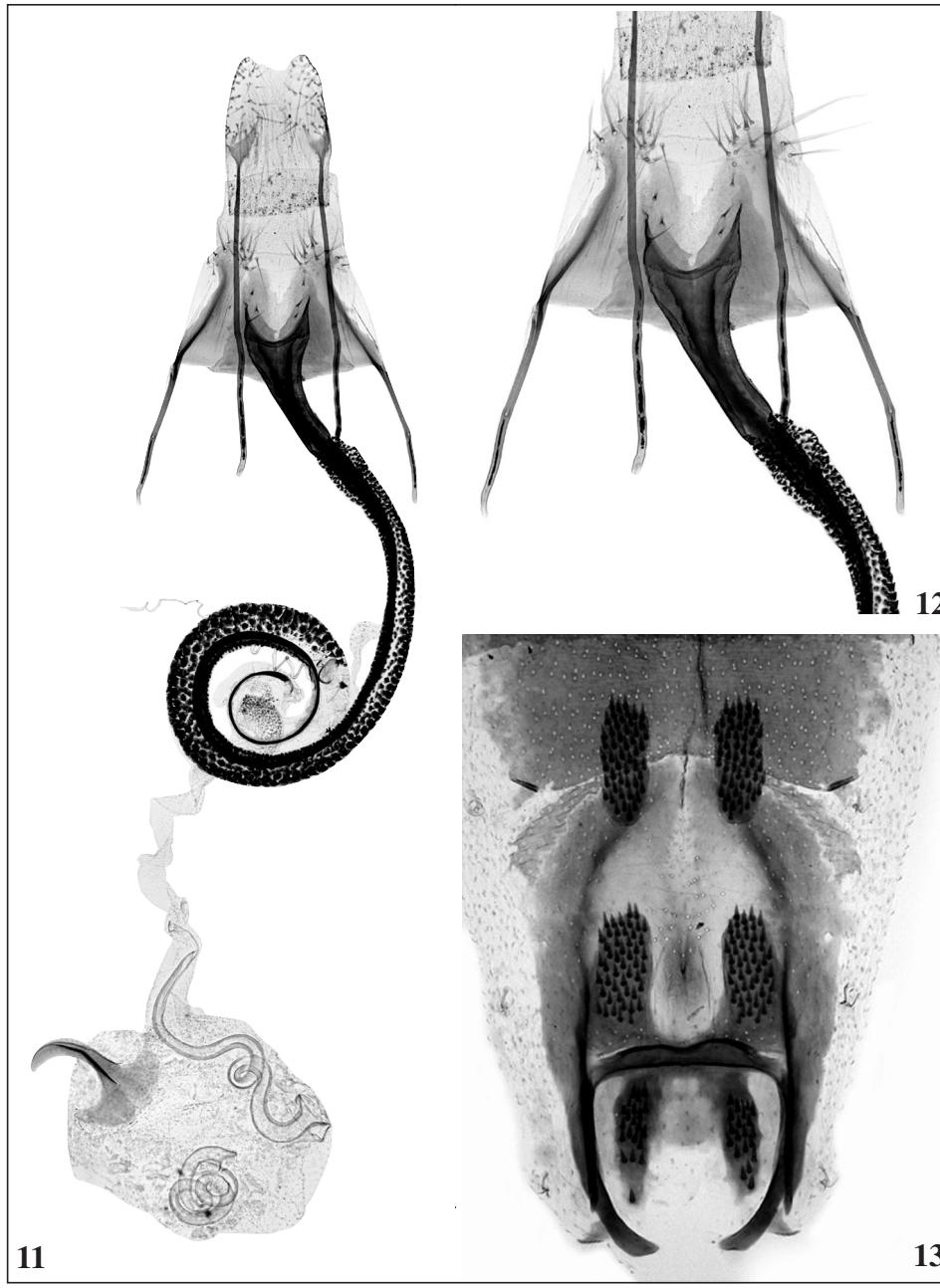


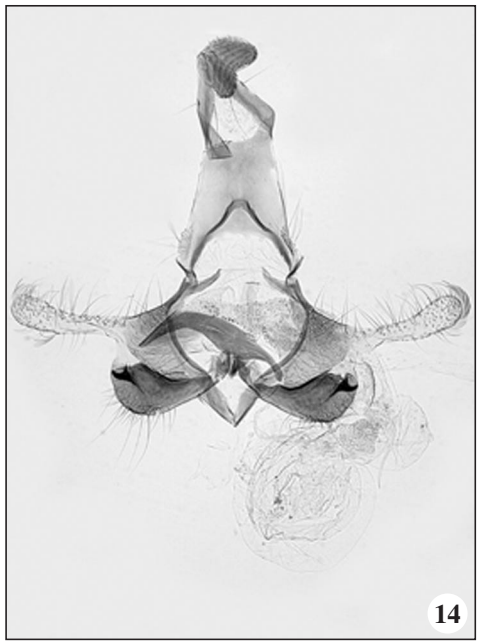



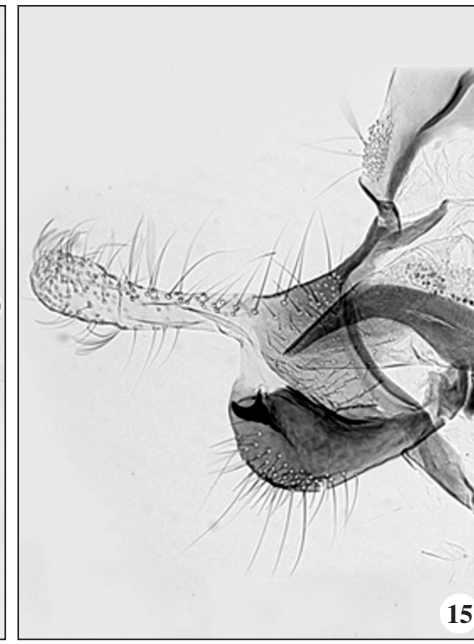




**Figs. 7-10.**– *C. septembra* Tabell, sp. n.: **7.** Male genitalia, holotype (GP 4895 J. Tabell), Spain, Sierra Nevada. **8.** Cucullus and sacculus enlarged. **9.** Cornuti enlarged. (Photos: Reijo Siloaho). **10.** Abdomen (Photo: Bo Wikström).

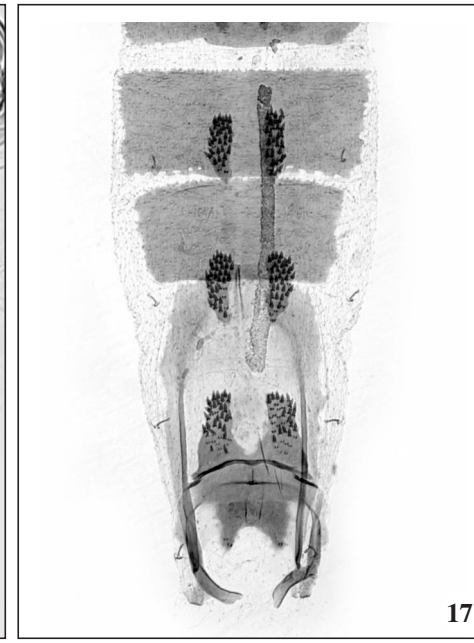



**Figs. 11-13.**– *C. septembra* Tabell, sp. n.: **11.** Female genitalia, paratype (GP 4943 J. Tabell), Spain, Sierra Nevada. **12.** Sterigma enlarged (Photos: Reijo Siloaho). **13.** Abdomen (Photo: Bo Wikström).

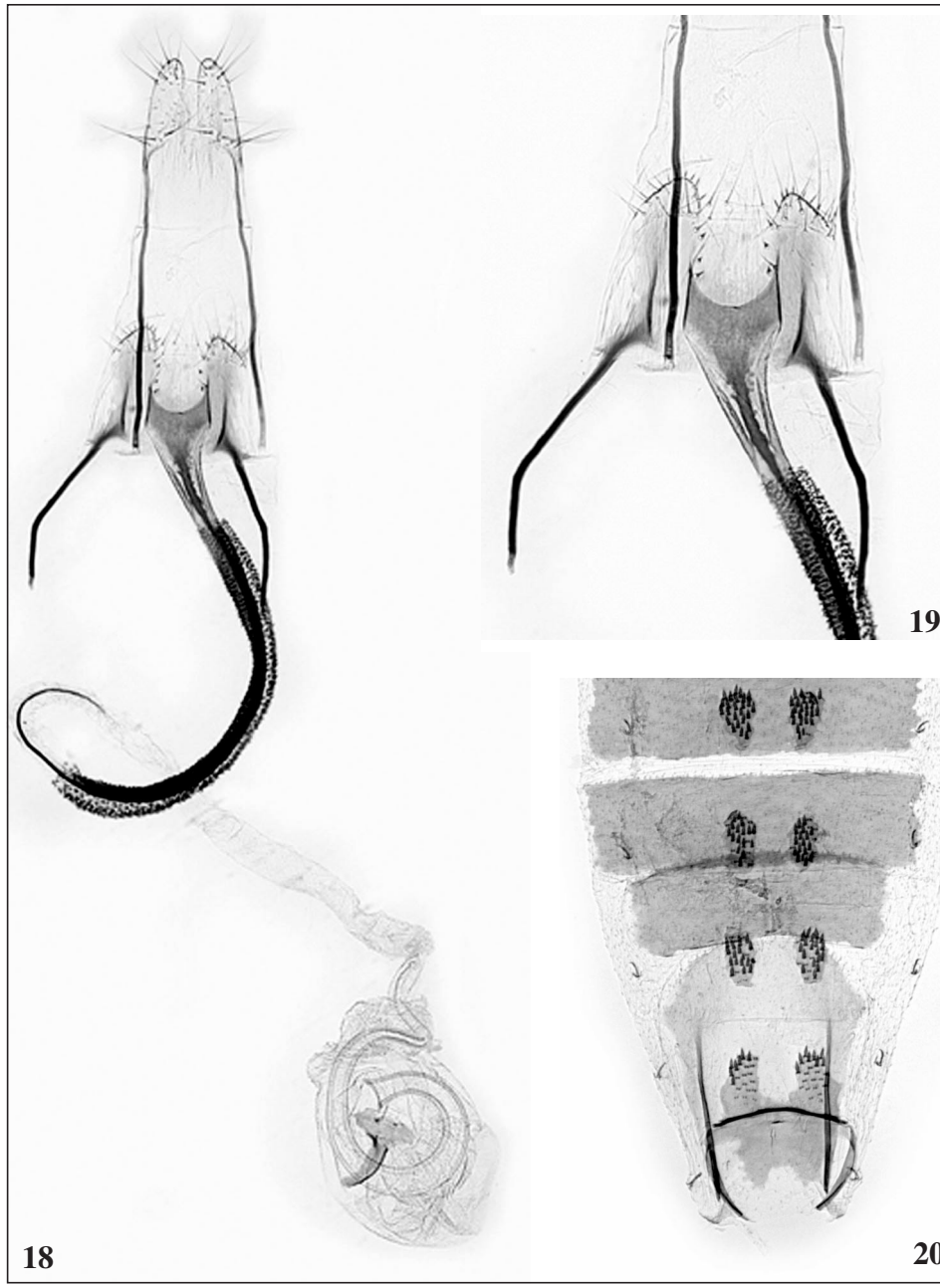


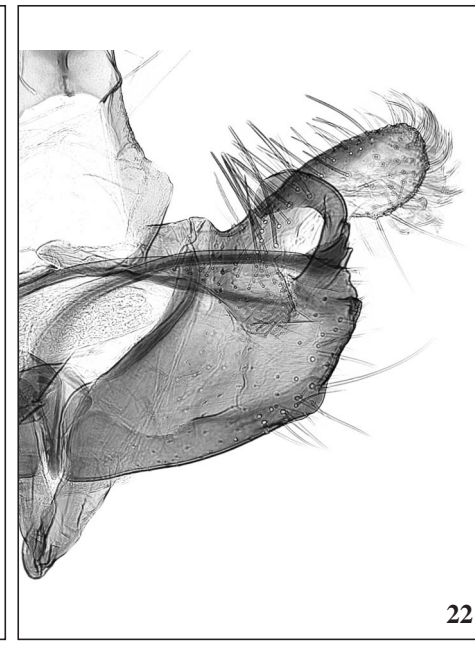





**Figs. 14-17.**– *C. tigris* Tabell, sp. n.: **14.** Male genitalia, paratype (GP 5218 J. Tabell), Spain, Granada. **15.** Cucullus and sacculus enlarged. **16.** Cornuti enlarged. **17.** Abdomen (Photos: Pasi Sihvonen).

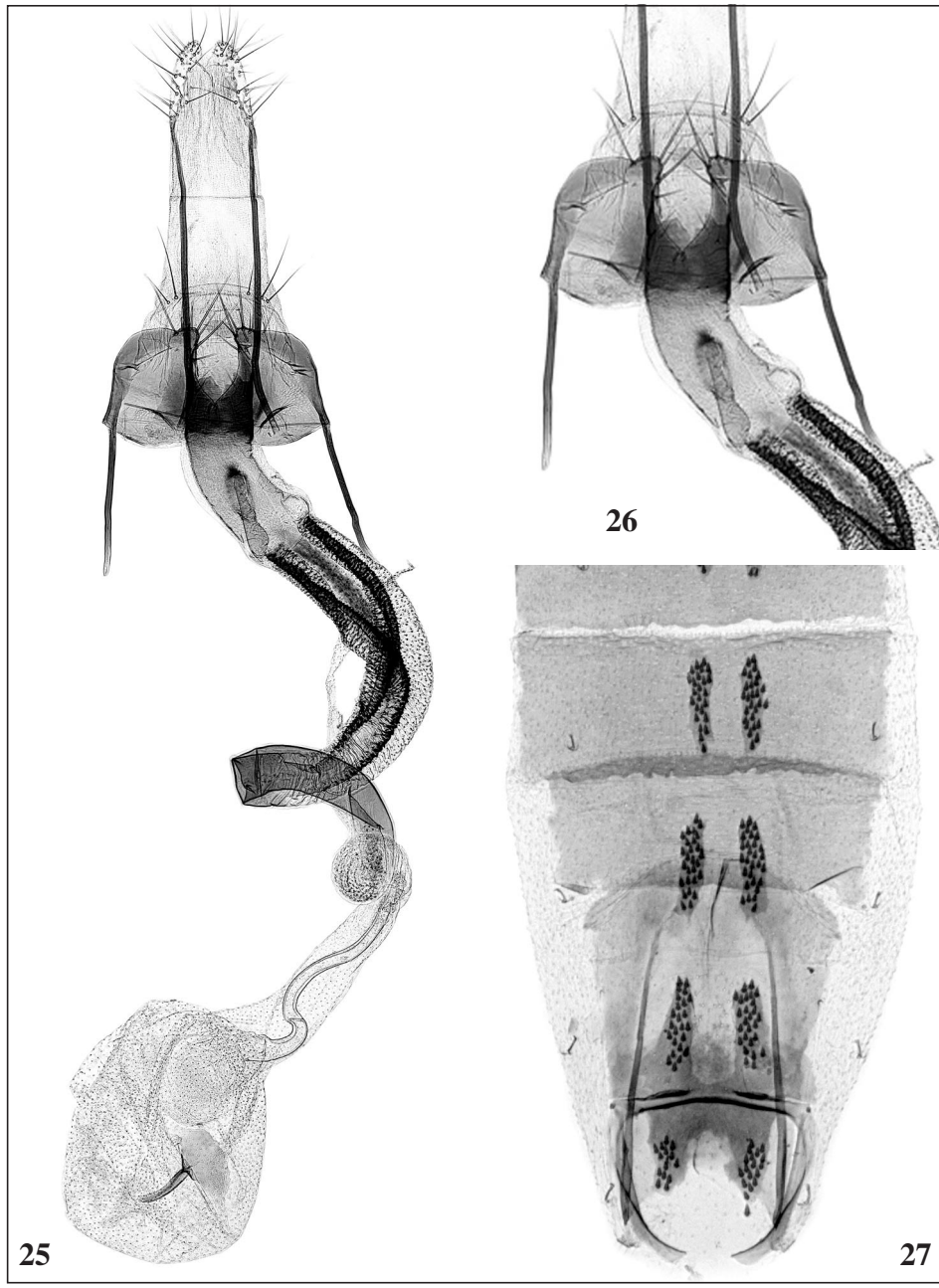



**Figs. 18-20.**– *C. tigris* Tabell, sp. n.: **18.** Female genitalia, paratype (GP 5220 J. Tabell), Spain, Granada. **19.** Sterigma enlarged. **20.** Abdomen (Photos: Pasi Sihvonen).

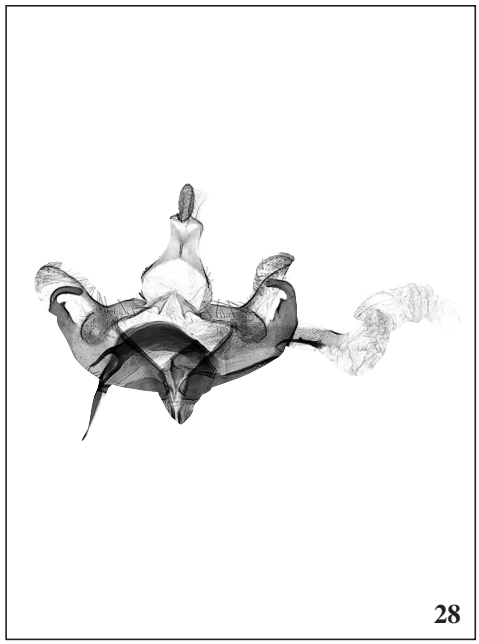



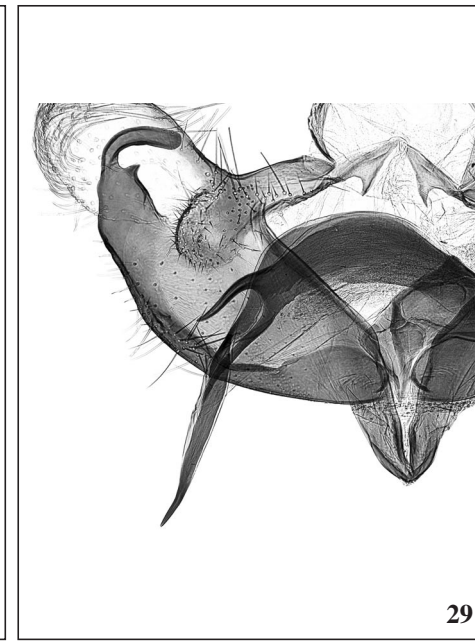


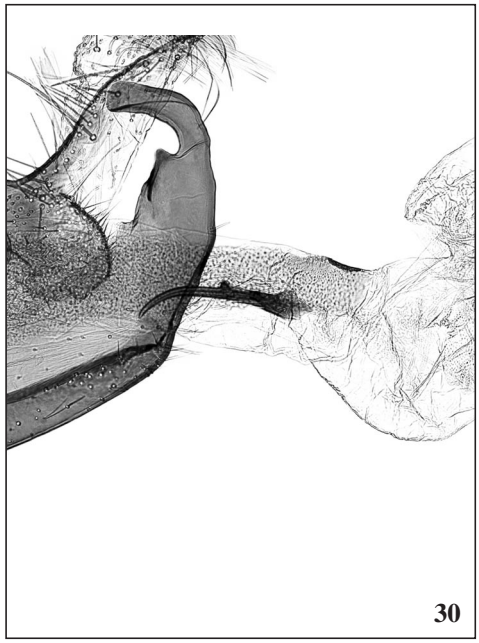

**Figs. 21-24.**– *C. aragonensis* Tabell, sp. n.: **21.** Male genitalia, holotype (GP 4680 J. Tabell), Spain, Teruel). **22.** Cucullus and sacculus enlarged. **23.** Cornuti enlarged. **24.** Abdomen (Photos: Reijo Siloaho).

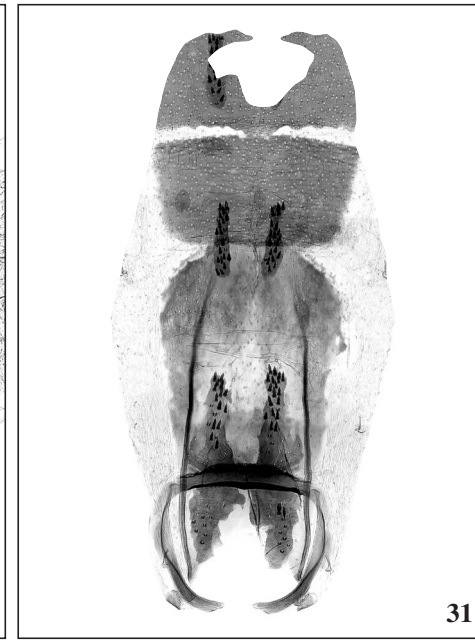



**Figs. 25-27.**– *C. aragonensis* Tabell, sp. n.: **25.** Female genitalia, paratype (GP 4676 J. Tabell), Spain, Teruel). **26.** Sterigma enlarged (Photos: Reijo Siloaho). **27.** Abdomen (Photo: Pasi Sihvonen).

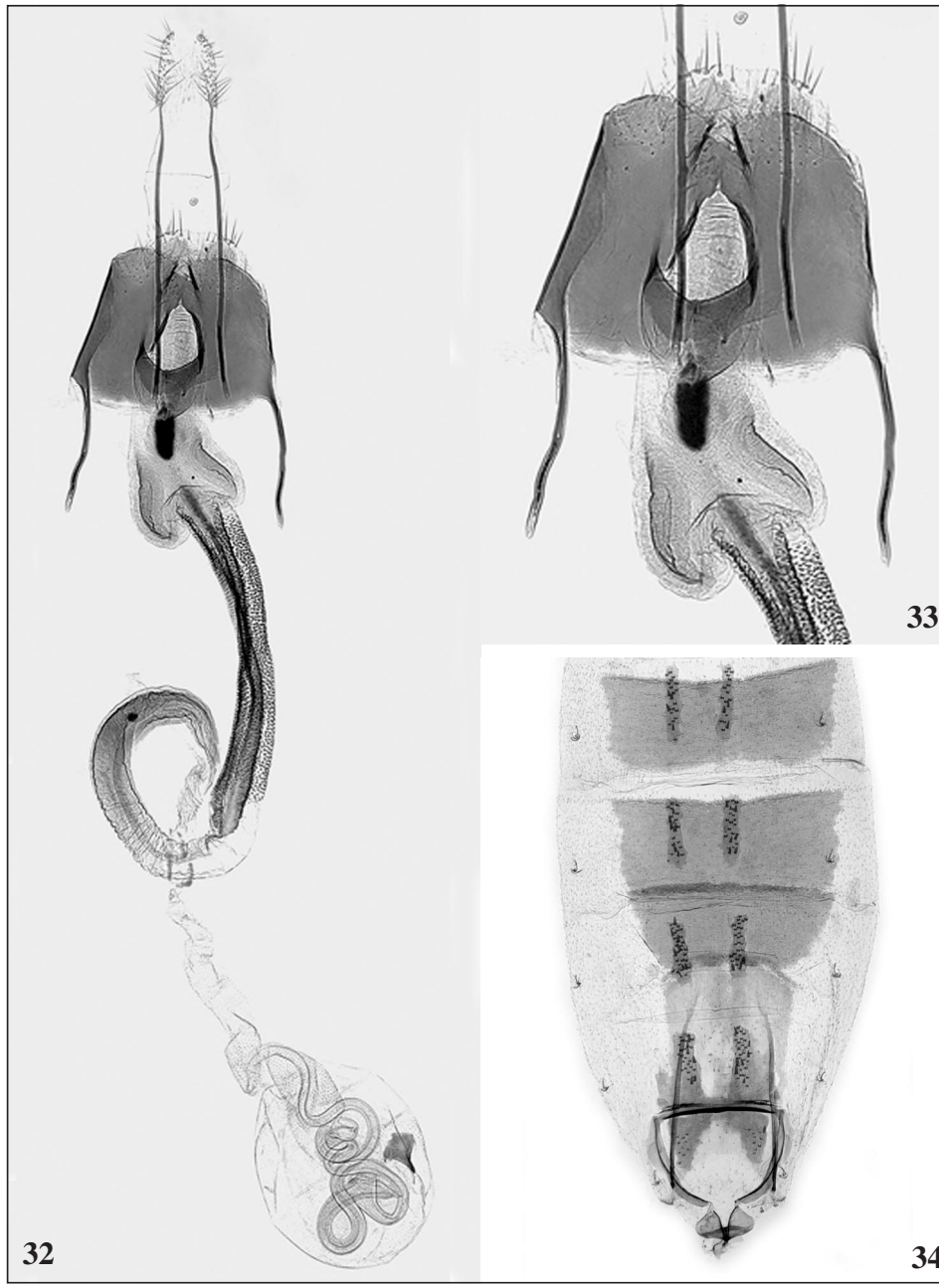



**Figs. 28-31.**– *C. forcipata* Tabell, sp. n.: **28.** Male genitalia, holotype (GP 4681 J. Tabell), Spain, Teruel. **29.** Cucullus and sacculus enlarged. **30.** Cornuti enlarged. **31.** Abdomen (Photos: Reijo Siloaho).




**Figs. 32-34.**– *C. forcipata* Tabell, sp. N .: **32.** Female genitalia, paratype (GP 5413 J. Tabell), Spain, Teruel). **33.** Sterigma enlarged. **34.** Abdomen (Photos: Pasi Sihvonen).

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# First record of *Dysschema sacrifica* (Hübner, [1831]) on Soybean (*Glycine max* (L.) Merr) (Lepidoptera: Erebidae, Arctiinae)

E. González & H. M. Beccacece

**Abstract**

The presence of *Dysschema sacrifica* (Hübner, [1831]) on soybean (*Glycine max* (L.) Merr) is reported for the first time. Larvae of this species were found consuming soybean leaves in soybean fields in Córdoba province, Argentina, and were able to complete their life cycle. Characteristics of adults and larvae are provided for rapid identification in the field. Due to the widespread distribution of this species within the region where soybean is more intensively cultivated in South America, we conclude that *D. sacrifica* is a potential soybean pest. Further studies on infestation frequency, damage levels and control by natural enemies are needed.
KEY WORDS: Lepidoptera, Erebidae, Arctiidae, *Dysschema sacrifica*, soybean, pest, Argentina.

**Primer registro de *Dysschema sacrifica* (Hübner, [1831]) en soja (*Glycine max* (L.) Merr) (Lepidoptera: Erebidae, Arctiinae)**

**Resumen**

Se reporta por primera vez la presencia de *Dysschema sacrifica* (Hübner, [1831]) en soja (*Glycine max* (L.) Merr). Larvas de esta especie fueron encontradas comiendo hojas de esta planta de soja en cultivos de la provincia de Córdoba, Argentina, las que pudieron completar su ciclo biológico. Se provee características de adultos y larvas para una rápida identificación en el campo. Debido a la gran distribución de esta especie en la región donde la soja es más intensamente cultivada en Sudamérica, nosotros concluimos que *D. sacrifica* es una potencial plaga de soja. Se requieren futuros estudios que evalúen la frecuencia de infestación, niveles de daño y control por enemigos naturales.
PALABRAS CLAVE: Lepidoptera, Erebidae, Arctiidae, *Dysschema sacrifica*, soja, plaga, Argentina.

## Introduction

The legume family is the third largest family within the Angiospermae and represents the second economically most important plant family after Poaceae. Soybean, also known as soya (*Glycine max* (L.) Merr) is one of the most important crops within this family (LEFF *et al.*, 2004). It is native to East Asia and the main producers are the United States, Brazil, Argentina, China and India (FORECAST USDA, 2016). In Argentina, soybean represented half of the cultivated surface in 2006 (AIZEN *et al.*, 2009) and 86.5% of the total soybean production corresponds to the Pampean region, situated in the center-east of Argentina (PIASTRELLINI *et al*., 2015).

Although soybean is an exotic plant, the crop has been established in different locations and with increasing areas for many uses. Many arthropods species in the American continent gradually adapted to the crop, sometimes causing considerable damage or becoming pests (CARRARO-FORMENTINI *et al*., 2015). According to a review, several arthropod herbivores that feed on soybean across the globe were identified and, particularly, 70 species of lepidopteran larvae were reported to produce damages by different

feeding strategies like leaf eaters, leaf-rollers, borers, pod eaters and cutworms (FICHETTI *et al*., 2013; CARRARO-FORMENTINI *et al*., 2015). The accurate identification of the species that feed on crops is extremely important for proper management and to avoid economic losses (CARRARO-FORMENTINI *et al.*, 2015). This study reported for the first time a species of Lepidoptera that feeds on soybean leaves.

## Materials and methods

Recently, during field sampling of soybean arthropods, in two of twelve fields (March 15th and April 14th, 2016) within Santa Maria department, Córdoba province, Argentina (Fig. 1) lepidopteran larvae were observed feeding on leaves of soybean. Larvae and leaves of soybean were collected and transported to the laboratory. The larvae were reared to adulthood for determination. Both soybean fields were adjacent to fragments of Chaco forest.

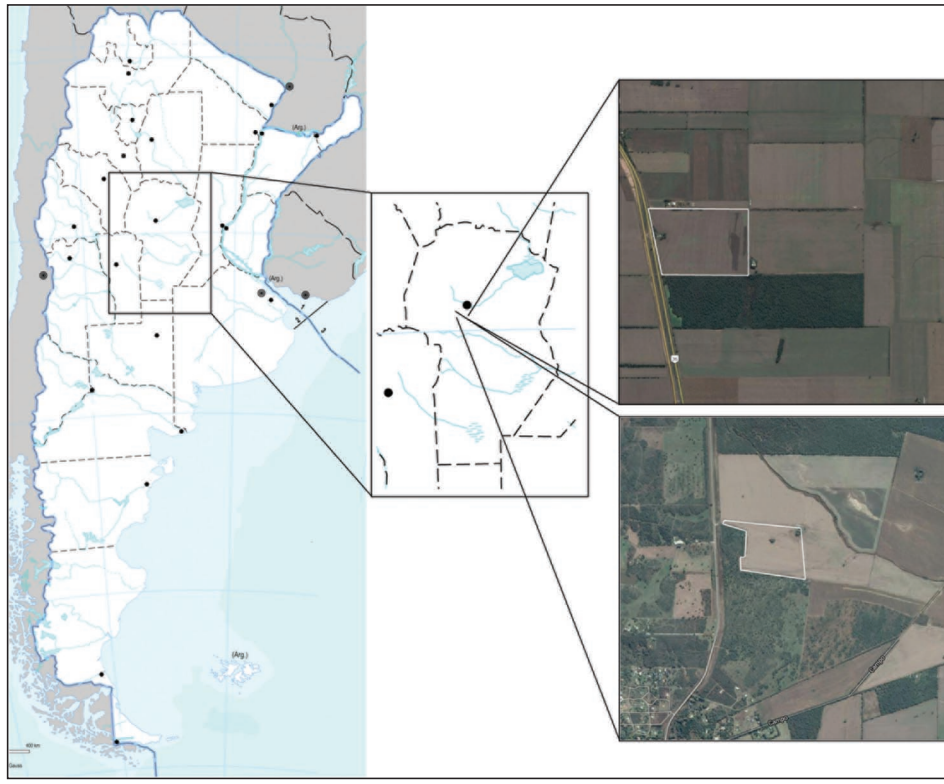

**Fig. 1**.– Maps showing the location were *D. sacrifica* larvae were observed. Soybean fields where larvae were found are highlighted in white.

## Results and discussion

The larvae collected belong to *Dysschema sacrifica* (Hübner, [1831]). The larvae ate leaves, causing an important defoliation. Life cycle of the species was completed consuming soybean, therefore *Glycine max* can be considered as an alternative feeding source for immature stages. There are three previous

reports of the subfamily Arctiinae, commonly named tiger moths, feeding on soybean leaves (CARRARO-FORMENTINI *et al.*, 2015) (Table I).

**Table I.–** Species of Arctiinae (Lepidoptera: Erebidae) reported on *Glycine max* crops. * = new report. The reference column refers to the number of the references in text.

| Genus / species | Frequency on soybean | Geographical distribution | Reference |
|---|---|---|---|
| *Aloa moorei* (Snell.) | Sporadic | India, Pakistan | SINGH *et al.*, 1990 |
| *Estigmene acrea* (Dry.) | Sporadic | Canada to south of Central America | MARRERO-ARTABE *et al.*, 2013 |
| *Dysschema sacrifica* (Hb.)* | Potential | South America | |
| *Paracles cajetani* (Rothsch.) | Sporadic | Uruguay | CARRARO-FORMENTINI *et al.,* 2015 |
| *Paracles vulpina* (Hb.) | Sporadic | Argentina | CARRARO-FORMENTINI *et al.,* 2015 |
| *Spilarctia casigneta* (Koll.) | Sporadic | North Pakistan, Himalaya, Nepal, Bhutan | NEUPANE & SHRESTHA, 2015 |
| *Spilarctia dalbergiae* Mre. | Potential | Himalayas | TIWARI & KASHYAP, 1990 |
| *Spilarctia obliqua* Wlk. | Frequent | South East Afghanistan, North Pakistan, India, Bhutan, Bangladesh, Burma | BISWAS, 2013 |
| *Spilosoma virginica* (F.) | Frequent | North America (introduced in South America) | CARRARO-FORMENTINI *et al.,* 2015 |

*D. sacrifica* has a wide distribution in South America, and is usually present in open and/or disturbed areas (BOURQUIN, 1945). It is present from Northern Brazil to the centre of Argentina, also occurring in Peru, Paraguay, Bolivia and Uruguay. Previous studies showed that immature stages have polyphagous habits, feeding on different plant families, mostly herbaceous plants (BOURQUIN, 1945; PASTRANA, 2004; FONSECA *et al.*, 2014) (Table II). Furthermore, larvae can feed on different hosts plants during their larval stages and complete their life cycle without problems (PASTRANA, 2004). Field observations during sampling of this study revealed that larvae were also found on forest remnants close to the soybean crops, feeding on native herbaceous plants. The profound changes on Cordoba´s natural habitats over the last decades have led to deforestation and forest fragmentation (ZAK *et al.*, 2004), mainly for agricultural expansion due to an increase in soybean cultivated surface (ZAK *et al.*, 2008). A recent study found that insects move intensely between forest fragments and soybean crops (GONZÁLEZ *et al.*, 2016), which suggests that *D. sacrifica* can be leaving forest patches occasionally to feed on soybean.

The complete life cycle of *D. sacrifica* was previously studied (BOURQUIN, 1945). Nonetheless, we mention some characteristics for quick identification of the species in the field. The adults of this species are medium sized, with females bigger than males (wingspan of males: 41.5-42mm, females: 49-52mm). The identification of the adults is not difficult due to their color pattern, the forewings are brownish dark with a white cross-like mark. There is also sexual dichromatism, since hindwings in females are darker than males. The final larval instar has a size of approximately 45 mm and the dominant coloration is greenish yellow with longitudinal black lines, verrucae are metallic blue and reddish brown bearing black and white setae, head and thorax legs are shiny black. (Fig. 2).

We suggest that producers should control their crops in future soybean campaigns in order to develop an early response. Also, more research is needed to determine the areas where *D. sacrifica* feeds on soybean and if damages are economically significant. Moreover, since it is a native species, it is likely that natural enemies are attacking all life stages, so this should also be considered in future studies. A large number of predators and parasitoids move between natural and cultivated habitats (GONZÁLEZ *et al.,* 2016) and more species are found near forest fragments and in landscapes with high forest cover

(GONZÁLEZ *et al.,* 2015). Therefore, populations of this moth could be naturally controlled in the sampled fields.

**Table II**.– Host plants of *Dysschema sacrifica.* *= new host plant here reported.

| **Family** | **Genus** | **species** |
|---|---|---|
| Amaranthaceae | *Amaranthus* | *hybridus* ssp. *cruentus* (L.) Thell |
| | *Amaranthus* | *hybridus* L. ssp. *hybridus* |
| **Asteraceae** | *Artemisia* | *absinthium* |
| | *Austroeupatorium* | *inulifolium* (Kunth) R. M. King & H. Rob. |
| | *Bidens* | sp. |
| | *Chromolaena* | *odorata* (L.) R. M. King & H. Rob. |
| | *Chrysanthemum* | spp. |
| | *Eremanthus* | *erythropappus* (DC.) MacLeish |
| | *Helianthus* | *annuus* L. |
| | *Lactuca* | *sativa* L. |
| | *Senecio* | *brasiliensis* (Spreng.) Less. |
| | *Taraxacum* | *officinale* F. H. Wigg. |
| | *Vernonanthura* | *phosphorica* (Vell.) H. Rob. |
| **Fabaceae** | *Glycine* | *max* (L.) Merr.* |
| **Mirtaceae** | *Eucalyptus* | spp. |
| **Nyctaginaceae** | *Pisonia* | *zapallo* Griseb. |
| **Urticaceae** | *Boehmeria* | *caudata* (Poir.) Bonpl. |

## Conclusions

Soybean (*Glycine max* (L.) Merr) is registered as a new host plant for the tiger moth *D. sacrifica*. The species has a wide distribution that coincides with the region were soybean is more intensively cultivated in South America, which makes it a potential pest of this crop. More studies are needed to understand how frequently this species attacks soybean plants, the damage in produces and how natural enemies can be used to control it.

## Acknowledgments

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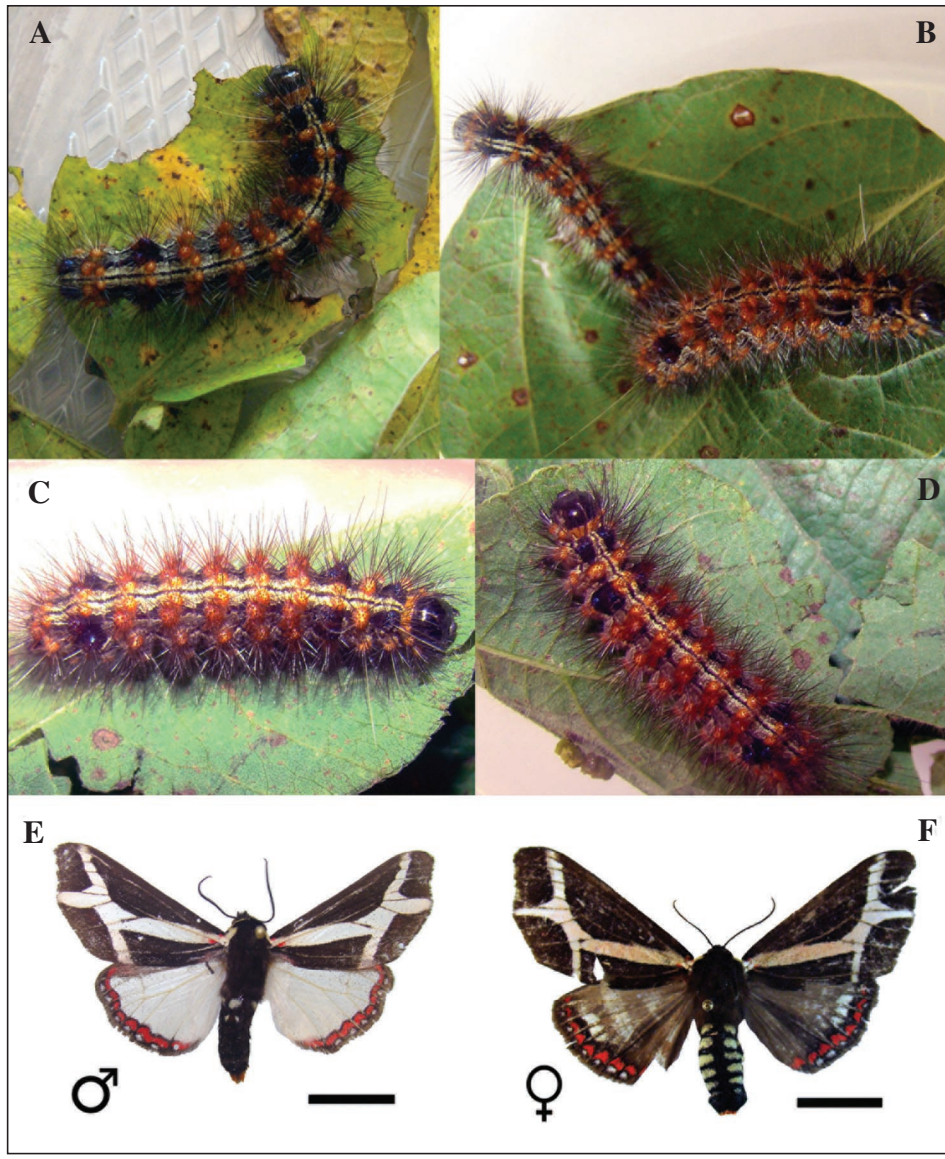


**Fig. 2.–** Photographs of *D. sacrifica.* A-D: Final larval stage feeding on soybean leaves. E: Adult male. F: adult female.

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# Notes on the *Scythris punctivittella* species-group, with description of a new species from Morocco (Lepidoptera: Scythrididae)

K. Nupponen & J. Tabell

**Abstract**

*Scythris bengti* Nupponen & Tabell, sp. n. is described from Morocco. A pair of the new taxon, belonging to the *punctivittella* species-group, was collected in the High Atlas Mountains in late June, 2016. The external appearance and genitalia of both sexes of the new species are illustrated. The previously unknown male of *S. atlasensis* Bengtsson, 1997 was discovered in the same site near the type locality of the taxon, and its genitalia are illustrated.
KEY WORDS: Lepidoptera, Scythrididae, new species, High Atlas Mountains, Morocco.

**Notas sobre el grupo de especies de *Scythris punctivittella*, con descripción de una nueva especie de Marruecos (Lepidoptera: Scythrididae)**

**Resumen**

Se describe de Marruecos *Scythris bengti* Nupponen & Tabell, sp. n. Un par del nuevo taxón perteneciente al grupo de especies de *punctivittella*, fue capturado de las montañas del Alto Atlas el pasado junio de 2016. De la nueva especie, se ilustra la apariencia externa y la genitalia de ambos sexos. El hasta ahora desconocido macho de *S. atlasensis* Bengtsson, 1997, fue descubierto en el mismo sito cerca de la localidad tipo del taxón y se ilustra su genitalia.
PALABRAS CLAVE: Lepidoptera, Scythrididae, nueva especie, Alto Atlas, Marruecos.

## Introduction

The *Scythris punctivittella* species-group was established by BENGTSSON (1997), who included eight species in it. Subsequently one further species of the group was described (PASSERIN d'ENTRÈVES & ROGGERO, 2004). Thus, the *punctivittella* group consists of nine species to date, as follows: *Scythris albostriata* Hannemann, 1962; *S. apicistrigella* (Staudinger, 1871); *S. atlasensis* Bengtsson, 1997; *S. confluens* (Staudinger, 1871); *S. cycladeae* Jäckh, 1978; *S. emichi* (Anker, 1870); *S. landryi* (Passerin d'Entrèves & Roggero, 2004); *S. punctivittella* (Costa, [1836]); *S. trinacriae* Passerin d'Entrèves, 1984. The species are distributed in the Mediterranean range, with a single exception, *S. emichi*, which is known from Central East Europe and Latvia (BENGTSSON, 1997) along the steppe belt eastwards to South Ural (NUPPONEN *et al.,* 2000) and the Baikal region (NUPPONEN, 2003). Two of the species are known from North Africa: *S. atlasensis* from Morocco, and *S. landryi* from Tunisia.

## Material and methods

During an expedition to Morocco in 2016, Jukka Tabell collected a few interesting scythridids. Two of the taxa revealed they belonged to the *punctivittella* species-group. The single male specimen turned out to be *S. atlasensis*, the male of which was previously unknown, and a pair of the other

species is undescribed. The latter taxon is described and illustrated in the present paper, as are the male genitalia of *S. atlasensis*.

## Descriptions

### *Scythris bengti* Nupponen & Tabell, sp. n.

Type material. Holotype: ♂ (Fig. 1): Morocco, High Atlas Mts., 31.14290° N 7.92223° W, Al Haouz Prov., by Imlil, 1680 m, 30-VI-2016, J. Tabell leg. Genitalia slide: K. Nupponen prep. no. 1/26-IX-2016. In coll. T. & K. Nupponen. Paratype ♀ (Fig. 2): Idem. Genitalia slide: K. Nupponen prep. no. 2/27-IX-2016. In coll. T. & K. Nupponen.

Diagnosis: Externally *S. bengti* Nupponen & Tabell, sp. n. can be confused with several scythridids with a similar forewing pattern. It most resembles five species of the *punctivittella* species-group, viz. *S. apicistrigella* (Staudinger, 1871), *S. confluens* (Staudinger, 1871), *S. punctivittella* (O. G. Costa, [1836]), *S. trinacriae* Passerin d'Entrèves, 1984, and the North African *S. landryi* Passerin d'Entrèves & Roggero, 2004, but may be separated from those by the oblique dash at the cell end.The male genitalia of *S. bengti* are readily separated from those of the other species of the *punctivittella* group by the distally cut-off valva with concave apical margin, and by the shape of asymmetrical sternum VIII. The female genitalia of *S. bengti* are similar to those of *S. atlasensis* Bengtsson, 1997, but differ by smaller medial sclerotization of the sterigma, wrinkled and spinned antrum, and presence of a medioposterior semicircular flap in sternum VII.

Description (Figs. 1-2): Wingspan 13 mm. Head, collar, tegula and thorax dark brown, in male with scattered whitish scales. Neck tuft whitish brown in male, pale brown in female. Antenna dark brown. Haustellum laterally whitish, otherwise brown, paler in female. Labial palp: segment I white in male, pale cream-coloured in female; segments II–III dark brown, more (II) or less (III) mixed with dirty white. Legs dark brown scattered with white, inner surface of femur dirty white. Hindleg tibia with two pairs and midleg tibia with one pair of spurs. Abdomen dorsally dark brown; ventrally in male dirty white mixed with cream and grey scales, in female pale cream-coloured. Forewing dark brown, with faint purplish gloss; white (in male) or pale cream-coloured (in female) streak in fold from base to midwing, and separate oblique dash of same colour at cell end. Hindwing dark brown.

Male genitalia (Figs. 3-4): Uncus subtrapezoid with posterior indentation. Gnathos asymmetrical; basal plate trapezoid and slightly furrowed; distal arm attached laterally to basal plate, a little longer than uncus, bent and evenly tapered, tip pointed. Phallus a very long and slender spiral. Valva moderately long, slightly tapering beyond middle, apically downcurved: tip cut off, rather broad, apical margin concave. Sternum VIII composed of two large and asymmetrical, medio-anteriorly fused plates; one plate roundish, the other one rectangular with sub-oval posterolateral process; between plates a deep median incision; anterior margin concave. Tergum VIII subrectangular, twice wider than high; anterior margin narrowly sclerotized and medially widely concave; posterior margin convex.

Female genitalia (Figs. 5-6): Sterigma consists of three parts: posteriorly a heart-shaped plate; anterior portion bowl-like with elongated posterior corners; at middle an egg-shaped sclerotization. Ostium situated sub-anteriorly at middle. Antrum somewhat sclerotized and distinctly wrinkled, turned 360º at anterior quarter. Sternum VII subrectangular, 0.65 times as high as wide, medioposteriorly with semicircular flap. Apophyses posteriores 1.5 times longer than apophyses anteriores.

Bionomy: The specimens were swept in sunshine in the afternoon. The habitat is a xerotermic montane slope with *Santolina* sp. as a dominant plant (Fig. 10). Immature stages are unknown.

Distribution: Morocco. So far the species is only known from the type locality.

Etymology: The species is named after Bengt Å. Bengtsson, a famous Swedish entomologist, and the author of numerous important articles on Palaearctic and Afrotropical Scythrididae.

Remarks: *Scythris bengti* Nupponen & Tabell sp. n. is assigned to the *punctivittella* species-group. The asymmetrical sternum VIII of *S. bengti* differs considerably from that of the other species of the *punctivittella* group. Despite that, the genitalia of both sexes are typical for the group, as well as the

external appearance of the moth. *S. atlasensis* Bengtsson, 1997 is the closest known relative of *S. bengti*, based on shape of the genitalia of both sexes.

*Scythris atlasensis* Bengtsson, 1997

Material (Fig. 7): Morocco, High Atlas Mts., 31.14290° N 7.92223° W, Al Haouz Prov., by Imlil, 1680 m, 1 ♂, 30-VI-2016, J. Tabell leg. Genitalia slide: K. Nupponen prep. no. 2/26-IX-2016. In coll. T. & K. Nupponen.

Male genitalia (Figs. 8-9): Uncus subtrapezoid with posterior indentation. Gnathos asymmetrical; basal plate subtriangular and slightly furrowed; distal arm attached laterally to basal plate; basal half stout, distal half tapered and bent 90º downwards, tip pointed. Phallus a very long and slender spiral. Valva rather long and narrow, bent, broadened at apical 0.2, apex dorsally elongated. Sternum VIII subrectangular, composed of two symmetrical and anteromedially fused plates, each of them with rather short and broad posterolateral protrusion. Tergum VIII subtrapezoid, anterior corners elongated.

Distribution: Morocco.

Remarks: The moth came to light at night. The habitat is illustrated in Fig. 10. The description of *S. atlasensis* Bengtsson, 1997 is based on two females, and the male was hitherto unknown. The collecting site of the present male is located only 10 km to the south-west of the type locality. Externally *S. atlasensis* is easy to separate from other species of the *punctivittella* species-group by absence of basal streak in the forewings. The male genitalia of *S. atlasensis* are typical for the group. The distally broadened and dorso-apically extended valvae separates the species from the other known taxa of the *punctivittella* species-group.

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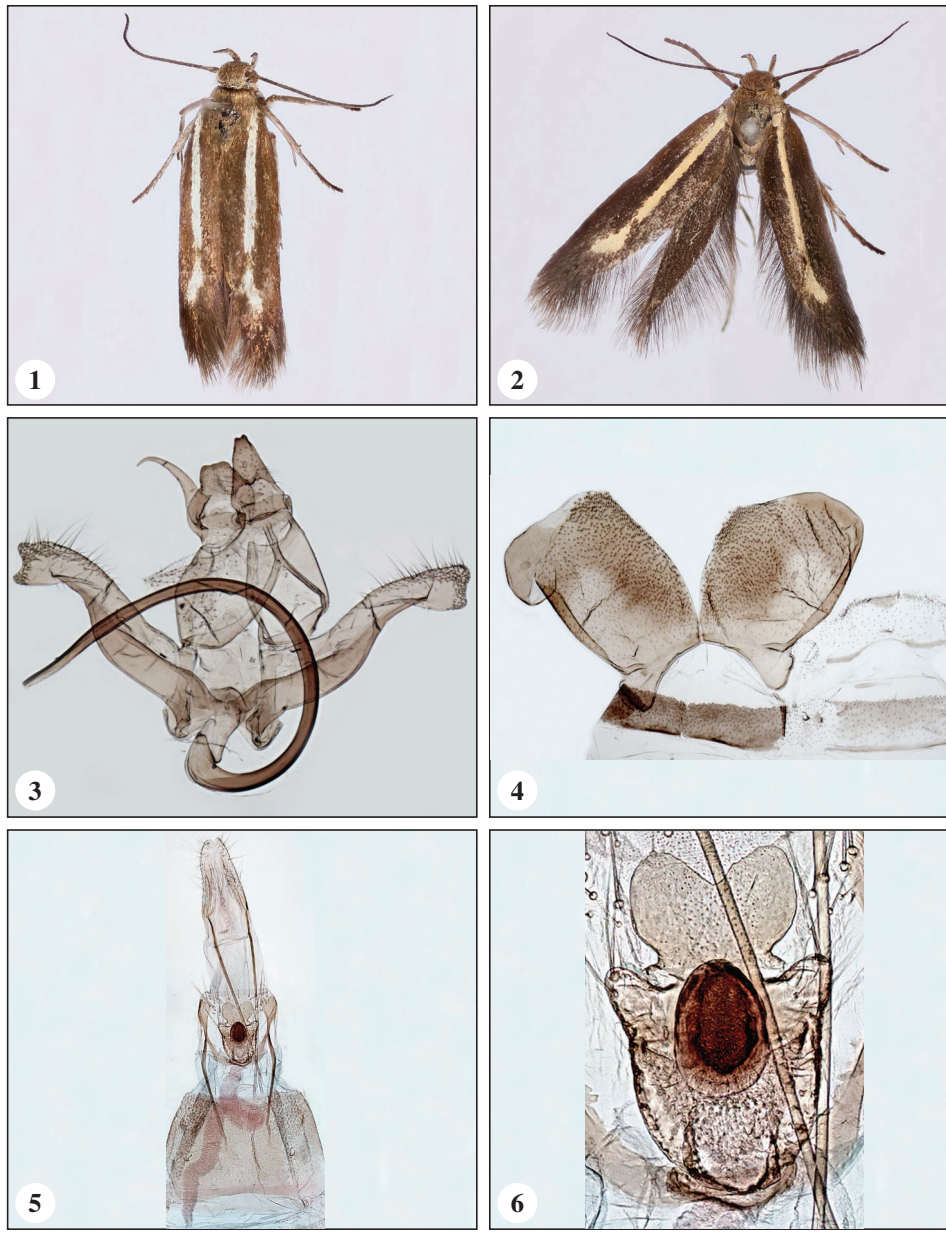


**Figs. 1-6.– 1.** Adult (male, holotype) of *Scythris bengti* Nupponen & Tabell, sp. n.; 2. Adult (female, paratype) of *Scythris bengti* Nupponen & Tabell, sp. n.; **3.** Male genitalia of *Scythris bengti* Nupponen & Tabell, sp. n. (holotype; GP 1/26-IX-2016 KN); 4. Tergum VIII (right) and sternum VIII (left) of *Scythris bengti* Nupponen & Tabell, sp. n. (paratype; GP 1/26-IX-2016 KN); **5.** Female genitalia of *Scythris bengti* Nupponen & Tabell, sp. n. (paratype; GP 2/27-IX-2016 KN); **6.** Sterigma of *Scythris bengti* Nupponen & Tabell, sp. n. (paratype; GP 2/27-IX-2016 KN).





**Figs. 7-10.– 7.** Adult (male) of *Scythris atlasensis* Bengtsson, 1997; **8.** Male genitalia of *Scythris atlasensis* Bengtsson, 1997 (GP 2/26-IX-2016 KN); **9.** Tergum VIII (left) and sternum VIII (right) of *Scythris atlasensis* Bengtsson, 1997 (GP 2/26-IX-2016 KN); **10.** Habitat of *Scythris bengti* Nupponen & Tabell, sp. n. and *S. atlasensis* Bengtsson, 1997: xerotermic montane slope in the High Atlas Mts. (1680 m a.s.l.), Morocco.

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# On species related to *Elachista deceptricula* Staudinger, 1880 with descriptions of three new species (Lepidoptera: Elachistidae)

L. Kaila & K. Nupponen

**Abstract**

The taxonomy of Palearctic *Elachista* species similar to *E. deceptricula* Staudinger, 1880 is revised. Five species are treated: *E. spumella* Caradja, 1920, *E. deceptricula* Staudinger, *Elachista athroa* Kaila, sp. n. from Turkey, *E. conferta* Kaila sp. n. from Spain, and *E. sagara* Kaila sp. n. from Kyrgyzstan. Lectotype is designated for *E. spumella* Caradja. These species are assigned to the *Elachista dispilella* complex sensu Kaila in *Elachista* subgenera *Aphelosetia*. The *E. dispilella* complex now comprises 24 species.
KEY WORDS: Lepidoptera, Elachistinae, *Aphelosetia*, *Elachista dispilella* group, *Elachista dispilella* complex, new species, taxonomy.

**Sobre las especies relativas a *Elachista deceptricula* Staudinger, 1880 con descripción de tres nuevas especies (Lepidoptera: Elachistidae)**

**Resumen**

Se revisa la taxonomía de las especies Paleárticas de *Elachista* similares a *E. deceptricula* Staudinger, 1880. Se tratan cinco especies: *E. spumella* Caradja, 1920, *E. deceptricula* Staudinger, *Elachista athroa* Kaila, sp. n. de Turquía, *E. conferta* Kaila sp. n. de España y *E. sagara* Kaila sp. n. de Kirguizistán. Se designa el Lectotipo para *E. spumella* Caradja. Estas especies son asignadas al complejo de *Elachista dispilella* sensu Kaila en *Elachista* subgénero *Aphelosetia*. El complejo *E. dispilella* comprende ahora 24 especies.
PALABRAS CLAVE: Lepidoptera, Elachistinae, *Aphelosetia*, grupo *Elachista dispilella*, complejo *Elachista dispilella*, nuevas especies, taxonomía.

## Introduction

The *Elachista dispilella* s. l. group comprises species of *Elachista* (*Aphelosetia*) (Elachistidae) generally characterized by white or pale yellowish - greyish forewing, either unicolorous or having two dark spots or an irregular scattering of dark grey or brown scales on forewing as the sole pattern (TRAUGOTT-OLSEN, 1988, 1990, 1992). In the genitalia, members of the *E. dispilella* group are characterized by a narrow valva with an elongate cucullus, the phallus without a caecum, and the basal opening posteriorly oriented in the male genitalia. The papillae anales of the females have ventrally a basal swelling (see KAILA, 1999, 2012 and KAILA & SUGISIMA, 2011 and KAILA *et al*. (2015) for definition and characterization). TRAUGOTT-OLSEN (1988, 1990, 1992) defined three species complexes within the *E. dispilella* group, and a number of taxa were left pending further grouping. The system of Traugott-Olsen was later proven not straightworward (KAILA *et al*., 2015, KAILA, 2015), and two of these complexes, i.e. *E. triseriatella* and *E. dispunctella* complexes were merged by KAILA (2015). Nor is it possible to delineate unequivocally the *E. dispilella* complexes (KAILA *et al.*, 2015).

Nevertheless, these groupings serve well an orientation in this species-rich group of superficially similar species.

In this paper species that can be associated with *Elachista deceptricula* Staudinger, 1880 are treated. This conglomerate appears not to be 'natural' as a separate group, as all these species could also be placed in the *E. dispilella* complex as defined by TRAUGOTT-OLSEN (1990) even though he did not do so. That convention was also followed by KAILA *et al.* (2015). The species here associated with each other are characterized by a straight, needle-shaped cornutus, often basally with another short one. They also have a large, round or wide gnathos unusual to the *E. dispilella* complex (but see *E. cornuta* Parenti, 1981 and *E. sitibunda* Kaila, 2015). In the absence of any real separating traits the five species treated in the present paper are merged to the *E. dispilella* complex which now comprises the following 24 species:

***E. athroa* Kaila, sp. n.**
*E. bazaensis* Traugott-Olsen, 1990
*E. bigorrensis* Traugott-Olsen, 1990
*E. bruuni* Traugott-Olsen, 1990
***E. conferta* Kaila, sp. n.**
*E. cornuta* Parenti, 1981
*E. curonensis* Traugott-Olsen, 1990
*E. deceptricula* Staudinger, 1880
*E. dispilella* Zeller, 1839
*E. distigmatella* Frey, 1859
*E. festucicolella* Zeller, 1853
*E. filicornella* Kaila, 1992
*E. flavescens* Parenti, 1981
*E. implana* Kaila, 2015
*E. laterotis* Kaila, 2015
*E. levasi* Sruoga, 1998
*E. nitidulella* (Herrich-Schäffer, 1855)
*E. ripai* Kaila, 2015
***E. sagara* Kaila, sp. n.**
*E. sitibunda* Kaila, 2015
*E. spumella* Caradja, 1920
*E. teruelensis* Traugott-Olsen, 1990
*E. turkensis* Traugott-Olsen, 1990
*E. vartianae* Parenti, 1981

## Material and methods

Specimens were examined from the following collections:

Bucharest Natural History Museum, Romania (L. Rákosy)
MNCN National Museum of Natural Sciences, Madrid, Spain (A. Vives)
MZH Finnish Museum of Natural History, Zoology Unit, University of Helsinki, Finland (L. Kaila)
ZMUC Natural History Museum of Denmark, Copenhagen, Denmark (O. Karsholt)
Personal collections of Olexey Bidzilya (Kiev, Ukraine), Jari Junnilainen (Vantaa, Finland), Jari Kaitila (Vantaa, Finland), Kari and Timo Nupponen (Espoo, Finland), Zdenko Tokár (Šală, Slovak Republic) and Bo Wikström (Nummela, Finland).

Terminology of anatomical structures follows TRAUGOTT-OLSEN & NIELSEN (1977), KAILA (1997, 1999), and KAILA & SUGISIMA (2011). The names of new species are nomina in apposition. Characterization of collecting sites in southern Ural region are given in JUNNILAINEN *et al*. (2010)

and KAILA *et al.* (2003). The barcode distance analysis was performed using Kimura 2 Parameter model and kalign alignment.

*Elachista spumella* Caradja, 1920 (Figs. 4-6, 12, 13, 20)

*Elachista spumella* Caradja, 1920: 155

Material studied: Type material. Lectotype ♂, here validated: labelled verbatim: Uralsk 15-V-07 [handwritten, white]; LECTOTYPE *Elachista spumella* Car. DES. ♂ Dr. A. Popescu-Gorj [white with red margin]; PREP. GENITALE ♂ 708 U. PARENTI 1974 [red]; LectoTYPUS *Elachista* ♂ *spumella* Car. Teste U: PARENTI 1974 [red] (in Bucharest Natural History Museum, Romania) (examined).

Other material: AUSTRIA: Hundsheim, Hexenberg, 14-VII-2011, 1 ♂, J. Tabell leg. (MZH). HUNGARY: 20 km E Kecskemet nr. Kerekegyhaza vill., 18-VII-2006, 1 ♂, T. Nupponen leg. (L. Kaila prep. 4702, Coll. Nupponen); Csakbereny Bucka-Hegy, 1-V-2003, 1 ♂, L. Srnka leg. (Coll. Tokár). KAZAKHSTAN: [USSR] 43º 24' N 75º 2' E, Dzhambulskaya obl, 70 km NNE Frunze [now Bishkek], 950 m, rocky slope, 19-VII-1990, ad luc., 3 ♂♂, 1 ♀, L. Kaila & K. Mikkola leg., L. Kaila prep. 496, 5044 (MZH). RUSSIA: S. Ural, Cheliabinsk obl., Arkaim, 22-23-VII-1998, 3 ♂♂, 19-V-2004, 1 ♂, K. Nupponen leg.; Orenburg obl., Chalk Hills, 6-VI-1998, 1 ♂, T. & K. Nupponen leg., 3-7-VII-1998, 2 ♂♂, J. Junnilainen leg.; Bashkiria, Kandrykul, 30-V-2001, 1 ♂, 1 ♀, K. Nupponen leg.; Orenburg obl., Kidriasovo, 28-29-V-1998, 13 ♂♂, J. Junnilainen leg., 2 ♂♂, T. & K. Nupponen leg., L. Kaila prep. 3410; Cheliabinsk obl., Kizilskoye, 27-V-1998, 3 ♂♂, J. Junnilainen leg., 8 ♂♂, 1 ♀, T. & K. Nupponen leg., 26-VII-2000, 2 ♂♂, T. Nupponen leg.; Cheliabinsk obl., Moskovo, 26-V-1998, 3 ♂♂, J. Junnilainen leg., L. Kaila prep. 3123, DNA sample 21327 Lepid. Phyl., 11-12-VII-1998, 3 ♂♂, 1 ♀, 2-VI-2004, 4 ♂♂, K. Nupponen leg.; Orenburg obl., Kuvandyk, 19-VII-1998, 2 ♂♂, K. Nupponen leg.; Orenburg obl., Verbljushka, 30-V-12-VI-1998, 2 ♂♂, J. Junnilainen leg., 30-V-1998, 1 ♂, 14-16-VII-1998, 5 ♂♂, T. & K. Nupponen leg., 13-V-1999, 1 ♂, 28-VI-2003, 2 ♀♀, K. Nupponen leg., DNA sample 21328 Lepid. Phyl.; Orenburg obl., 40 km W Orsk, nr. Guberlja vill., 20-V-2004, 4 ♂♂, 1 ♀, K. Nupponen leg.; Volgograd obl., nr. Olhovka vill., 16-18-V-2005, 4 ♂♂, K. Nupponen leg., L. Kaila prep. 4833 (Coll. Junnilainen, Nupponen, MZH). Ul'yanovsk obl., Vasil'evka, Novospasskoe distr., 130 km S Ul'yanovsk, 53º 05' N 48º 07' E, 17-19-VII-1999, 1 ♂, V. V. Zolotuhin leg.; Beketovka, Veshkayma distr., 130 km W Ul'yanovsk, 11-13-VII-1998, 2 ♂♂, A & V. B. Isajev leg.; Akulovka, Nikolaevka distr., 150 km SWS Ul'yanovsk, limestone steppe, 53º 06' N 47º 29' E, 5-8-VI-2000, 5 ♂♂, 3 ♀♀, V. V. Zolotuhin & V. B. Isajeva leg., L. Kaila prep. 6055, 6056, DNA sample 21332 Lepid. Phyl.; Vjazovka, Radishchevo distr., 160 km S Ul'yanovsk, 52º 53' N 48º 26' E, 3-VI-1993, 1 ♂, 29-V-2000, 2 ♀♀, V. V. Zolotuhin leg., L. Kaila prep. 4134 (MZH); SW Altai, Katun valley, 10 km W. Katanda, 6-8-VII-1983, 7 ♂♂, Exp. Mikkola, Hippa & Jalava leg., L. Kaila prep. 357, 358, 459, 460 (MZH); SW Altai, Katun valley, 51º 35' N 85º 55' E, 10 km SE Ust-Sema village, 23-VI-2000, 2 ♀♀, T. & K. Nupponen leg., DNA sample 21316 Lepid. Phyl. (Coll. Nupponen, MZH); Tuva Rep. 50º 44' N 93º 08' E, 1000 m, E. Tannu-Ola Mts, Irbitei reg., stony steppe slopes, 13-16-VI-1995, 15 ♂♂, 1 ♀, J. Jalava & J. Kullberg leg., L. Kaila prep. 1665, 1675, 1679, 1681, 2209, 3980, DNA sample 21330 Lepid. Phyl. (MZH). UKRAINE: Crimea, Karadag, 3-VII-1989, 1 ♂, Yu. Budashkin leg., L. Kaila prep. 3427 (MZH); Kamennie Mogilnyi, 14-19-VII-1994, 2 ♂♂, 1 ♀, A. Bidzilya leg. & Coll.; Tsernomorskiiy zapovednik, Ivano-Frankvskiy, 24-V-2000, 1 ♂, E. Rutjan leg. (Coll. Bidzilya).

Diagnosis: *Elachista spumella* is an externally variable species, both in size (wingspan varying from 7 to 12 mm) and in forewing coloration that varies from nearly snowy white, creamy to pale ochreous, sometimes with scattered brown scales. Such specimens resemble, e.g., *E. arenbergeri* Traugott-Olsen (cf. KAILA *et al.*, 2015) and *E. rutjani* Kaila (cf. KAILA, 2011) neither of which, however, possess the plical or discal spots on the forewing. Usually a moth of the general *dispilella* group habitus can be suspected to be *E. spumella* by the somewhat narrower forewing shape as compared to most others. Juxta lobes are either devoid of setae, or sometimes with one seta laterally, on a swelling of varying size, yet never as conspicuous as in *E. laterotis* Kaila, 2015 (cf. KAILA *et al.*, 2015). These species are readily separated by the shape of the cornutus, which is small and inconspicuous in *E. laterotis.* The most characteristic trait in the male genitalia of *E. spumella* is indeed

the very long and narrow, spiniform cornutus which is almost half the length of the phallus. The female genitalia are generally similar to several other members of the *E. dispilella* complex, but the very large and broad signum is characteristic.

Barcode data (n= 9). Maximum intraspecific variation 1.23 %; distance to the closest relative *E. conferta* Kaila, sp. n., 2.7 %.

Distribution: Austria, Hungary, Kazakhstan, Russia (European part, Siberia, Tuva), Ukraine.

Biology: SZÖCS (1981) reports *Festuca vaginata* Walldst. & Kit. ex Willd. (Poaceae) as a host plant. The species prefers xerothermic habitats, and is common in steppes from East Europe to southern Siberia.

Remarks: Even though widespread and common in eastern Europe eastwards to S. Siberia and Tuva, this species has remained not well known. This is likely due to that, to our knowledge, it has only once been illustrated in literature (BIDZILYA *et al*., 2016).

*Elachista deceptricula* Staudinger, 1880 (Figs. 7, 8, 14, 21)

*Elachista deceptricula* Staudinger, 1880: 409. Type locality: Turkey: Amasia, Caraman (Staudinger 1880: 409. Lectotype ♂ designated by Nielsen & Traugott-Olsen (1978), in ZMHB, illustrated by Nielsen & Traugott-Olsen (1978) (not examined).

Material studied: BULGARIA: Kresna, 7-V-2014, 1 ♂, J.-P. Kaitila leg., L. Kaila prep. 6050 (Coll. Kaitila); Sandansko Pole, 41.597300º N 23.225308º E, 23-IV-2014, 6 ♂♂, 1 ♀, J.-P. Kaitila leg., L. Kaila prep. 6050, 6051, 6054 (Coll. Kaitila (MZH)); 5 km N Sandanski, 15-VI-1-VII-2009, 1 ♂, N. Savenkov leg., Lepid Phyl. 22122 (Coll. H. Roweck); Sandanski, Drag Dallas, 41.597247º N 23.224926º E, 1-12-VIII-2013, 45 exx., N. Ryrholm & B. Wikström leg., L. Kaila prep. 5800, 6052 (Coll. Wikström, MZH); Struma river valley, Ilindentsi, 500 m, 29-IV-2013, 18 ♂♂, J. Junnilainen leg., L. Kaila prep. 6061 (Coll. Junnilainen, 1 ♂ in MZH). GREECE: Lakonia, Palaeopanagia, 12 km S. Sparti, 350 m, 23-VII-1998, 1 ♂, B. Skule & D. Nilsson leg. (L. Kaila prep. 4683, ZMUC); Makedonia, Kastoria, 11-X-2014, 2 ♂♂, T. Nupponen leg., L. Kaila prep. 6049 (Coll. Nupponen, MZH); Makedonia, Kozani, 23-24-V-2003, 1 ♂, J.-P. Kaitila leg., L. Kaila prep. 4137 (MZH); Makedonia, 15 km W Kozani, Metamorfosi, 22-V-2003 1 ♂ J.-P. Kaitila leg. (L. Kaila 3942), 1 ♂, J. Junnilainen leg. (L. Kaila prep. 6048 (Coll. Junnilainen); Delfi, 22-IV-2006, 3 ♂♂, J. Junnilainen leg.; Kozani environs, 26-IV-2006, 3 ♂♂, 3 ♀♀, 21-24-V-2003, 2 ♂♂, 3 ♀♀, J. Junnilainen leg., L. Kaila prep. 6053 (Coll. Junnilainen, MZH); Sterea Ellada, 10 km NW Arachova, Mt. Parnassos, 1350 m, 7-8-VI-2006, 2 ♂♂, J. Junnilainen leg., DNA sample 5418 Lepid. Phyl. (Coll. Junnilainen, MZH). TURKEY: prov. Konya, Aksehir 30 km SW, Sultan Daglari Mts., 1200 m, 6-7-V-1996, 2 ♂♂, 19-20-V-1997, 6 ♂♂, 1 ♀, K. Nupponen & J. Junnilainen leg., L. Kaila prep. 2485, 4726, 6057, 6058, DNA sample 21325 Lepid. Phyl. (Coll. Junnilainen, Nupponen, MZH); prov. Konya, 35 km SW Aksehir, Cetince, 1200 m, 9-13-V-2000, 23 ♂♂, 3 ♀♀, J. Junnilainen leg., L. Kaila prep. 4727, 6047, 6060, DNA sample 21322 Lepid. Phyl., (5 ♂♂, 2 ♀♀ in ZMH); prov. Kayseri, Incesu, 1100 m, 28-VII-1996, 1 ♂, Stovgaard leg. (L. Kaila prep. 4326, ZMUC); Cappadokia, Ürgüp, 19-21-VII-1998, 4 ♂♂, J. Junnilainen leg. (L. Kaila prep. 4734, 6045, 6062); 5 km NE Aksaray, 19-V-2005, 2 ♂♂, J. Junnilainen leg. & Coll; Cappadokia, 5 km S Urgüp, 18-V-2005, 2 ♂♂, J. Junnilainen leg., L. Kaila prep. 5046, 6059 (MZH, Coll. J. Junnilainen); Cappadokia, Mustafapasa, 17-V-2005, 1 ♂, J. Junnilainen leg., L. Kaila prep. 6046 (MZH).

Diagnosis: *E. deceptricula* is a chalky or creamy white species, usually with pronounced plical and discal spots, and forewing costa narrowly dark grey up to the middle of wing length. It is relatively broad-winged and usually large. However, size varies, apparently at least to some extent geographically. Specimens from the Balkan tend to be smaller than those in Turkey (variation in wingspan 9.5-13 mm). In male genitalia, the length of phallus is equal to, or up to 1.2 times as long as valva. Juxta lobes are devoid of setae. Identification of *E. deceptricula* from the closely related *E. athroa* sp. n. is explained under the diagnosis of *E. athroa.* The female genitalia of *E. deceptricula* are similar to most of the other species of the *E. dispilella* complex, having a narrow colliculum; ductus seminalis incepted with a distance from it, and with a sclerotized broadening in the ductus bursae close to inception to corpus bursae. From most of the other species it is distinguishable by the short signum.

Barcode data. Barcode data (n= 13). Maximum intraspecific variation 0.92 %; distance to the closest relative *E. spumella* 4.36 %.

Biology: Larval host plant unknown. The species inhabits various kinds of xerothermic slopes, preferably calcareous sites.

Distribution: Bulgaria, Greece, Turkey, Ukraine.

Remarks: NIELSEN & TRAUGOTT-OLSEN (1978) designated the lectotype of *E. deceptricula* Staudinger, kept in the Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung (Germany, Berlin). The detailed description and illustrations of the lectotype specimen by NIELSEN & TRAUGOTT-OLSEN (1978) makes the identity of the species straightforward.

### ***Elachista athroa*** **Kaila, sp. n. (**Figs. 9, 15)

Material studied: Type material. Holotype ♂: TURKEY, prov. Konya, 38º 11' N 31º 14' E, Sultan Daglari Mts., 30 km SW Aksehir, 1200 m, 19-V-1997, K. Nupponen & J. Junnilainen leg., L. Kaila prep. 3022, DNA sample 25503 Lepid. Phyl. (Coll. Junnilainen) (examined).

Diagnosis: *E. athroa* closely resembles *E. deceptricula.* The single known specimen is large-sized with faint plical and discal spots. Usually the wing markings are quite distinctive in *E. deceptricula.* However, both the size and the level of brightness of wing markings vary in *E. deceptricula*, and these traits of *E. athroa* fall, although as extreme, within the variation observed in *E. deceptricula.* The male genitalia of these species differ as follows: the spinose knob of gnathos is square in *E. athroa*, broader than long, often kidney-shaped in *E. deceptricula*; the juxta lobes are distolaterally produced in *E. athroa,* rounded in *E. deceptricula.* The digitate process is broader in *E. athroa* than in *E. deceptricula*. This character may, however, be distorted depending on the pressure applied during genital slide preparation. This phenomenon was controlled during the preparation of an excessive number of slide mounts of *E. deceptricula.* Uncus lobes of *E. athroa* are somewhat longer than those of *E. deceptricula*.

Description: Wingspan 13.5 mm. Length of labial palpus equal to diameter of head; chalky white, second segment fuscous below. Head, neck tuft, tegula and thorax creamy white; scape and pedicel of antenna suffused with ochreous grey, pecten pale brown; flagellum dark grey. Foreleg leaden grey, mid- and hindlegs inwards pale ochreous, outwards grey, spurs somewhat darker. Forewing creamy white, costa narrowly grey from base to middle of wing length; small, elongate, grey spot in the middle of wing length at fold, another similar spot at distal 2/3 of forewing in the middle. Fringe concolorous with ground colour except along dorsal margin pale grey. Hindwing grey, fringe creamy white. Underside of wings grey with concolorous fringe, except along apex of forewing creamy white.

Male genitalia: Uncus lobes 1.5 times as long as broad, distally with a few setae; distally rounded, lateral margin slightly convex. Spinose knob of gnathos large, square. Valva 1.5 times as long as tegumen + uncus, 4.5 times as long as broad at its broadest point; straight; cucullus elongate, as broad as valva in the middle, distally rounded. Juxta lobes distolaterally produced, devoid of setae. Digitate process broad, tongue-shaped, length 1/5 of the length of valva. Phallus 1.1 times as long as valva, evenly weakly bent; apex reinforced, shortly blunt at tip; basal opening posteriorly oriented, caecum absent; length of cornutus 0.3 the length of phallus, consisting of short and broad basal lobe and long and stout, weakly bent spine.

Female: Unknown.

Barcode data: Barcoding of the single known specimen unsuccessful.

Biology: Unknown. The holotype came to light just before sunrise. The habitat is a steep and xerothermic chalk slope exposed to the south (Fig. 1). At the site the species occurs sympatrically with *E. deceptricula*.

Distribution: Only known from the type locality in central Turkey.

### ***Elachista* (*Aphelosetia*) *conferta*** **Kaila, sp. n. (**Figs. 10, 16, 17)

Material studied: Type material. Holotype ♂: SPAIN, prov. Granada, 10 km NE Baza, 700 m,

37.56361º N 2.70921º W, 13-IV-2014 at 8.00-8.20 a.m., J. Tabell leg., L. Kaila prep. 6037 (MZH). Paratypes (9 ♂♂): SPAIN, prov. Tarragona, 2 km S. Bonastre, 140 m, 26-III-2011, 1 ♂, J. Tabell leg., DNA sample 16590 Lepid. Phyl. (MZH); SPAIN, prov. Aragón, Sastago, 4-V-2005, 1 ♂, J. Junnilainen leg., L. Kaila prep. 5880 (Coll. Junnilainen); SPAIN, prov. Aragón, Caspe, 6-V-2005, 1 ♂, J. Junnilainen leg., J. Tabell prep. 4577, DNA sample 21411 Lepid. Phyl. (Coll. Junnilainen); Spain 41º 21' 42" N 00º 17' 19" E, prov. Aragón, Mequinenza env., 14-VII-2010, 1 ♂, Z. Tokár leg., L. Kaila prep. 5921 (Coll. Tokár); SPAIN, prov. Castellón de la Plana, Sierra Wespadan, 2 km NW Eslida, 400 m, 1-V-1997, 2 ♂♂, P. Skou leg., L. Kaila prep. 4679, 5900 (ZMUC and MNCN); SPAIN, prov. Huesca, 8 km S. of Candasnos, Barranco de Valcuerna, 175 m, 13-14-IX-2002, 1 ♂, P. Skou leg. (ZMUC); Same locality with coordinates 41º 26' 01" N 00º 04' 24" E, 5-VII-2002, 1 ♂, B. Skule leg., L. Kaila prep. 4304 (ZMUC); SPAIN, prov. Alicante, 4 km E of Aspe, by Río Vilalopo, 300 m, 24-V-1998, 1 ♂, P. Skou leg., L. Kaila prep. 4673 (ZMUC).

Diagnosis: *E. conferta* closest resembles *E. sagara* sp. n. The flagellum of the antenna is dark grey in *E. conferta,* brass-colored in *E. sagara*. The forewing of *E. conferta* displays plical and discal spots, while *E. sagara* is unicolorous. Their male genitalia differ by the shape of the uncus lobes: they are distolaterally almost rounded in *E. conferta*, with distinct distolateral corner in *E. sagara.* The cornutus of *E. conferta* consists of a broad, semi-cylindrical basal plate and one almost straight spine with variably sclerotized, smooth lateral lobe. The cornutus of *E. sagara* is otherwise similar, but slightly shorter, and the spine has many wrinkles.

Description: Wingspan 8-11 mm. Labial palpus 0.8 times diameter of head, porrect, third segment ascending; underside to varying extent fuscous, base of third segment usually chalky white; upperside white or faintly ochreous. Head, neck tuft, thorax, scape and pedicel of antenna varying from white to pale ochreous, depending on the general coloration of the specimen. Flagellum varying from dark brown with faint paler annulation to unicolorous dark grey. Foreleg leaden grey, mid- and hindlegs pale ochreous. Forewing ground colour varying from white to pale ochreous, in fresh specimens scales with pale brown tips; elongate spot in the middle of wing length at fold, another similar spot at 2/3 wing length in the middle of wing. Scales concolorous with ground colour. Hindwing lustrous, silvery to pale grey, fringe either concolorous or pale brass-colored. Underside of wings dark grey, fringe on forewing costa ochreous, otherwise white.

Male genitalia: Uncus lobes 1.5 times as long as wide; distolaterally with a few setae. Apex almost rounded, slightly produced distolaterally, lateral margin straight. Spinose knob of gnathos slightly broader than long, otherwise rounded but anterior margin straight or slightly concave. Valva 1.5 times as long as tegumen + uncus, 4.5 times as long as broad at its broadest point; sacculus somewhat dilated, cucullus broader than median part of valva, elongate, distally rounded. Juxta lobes devoid of setae, rounded or a little extended in distolateral direction. Digitate process rather narrow, setose, slightly bent, length ⁄ of the length of valva. Phallus as long as valva, broad, evenly weakly bent, apex reinforced, shortly blunt at the very tip; basal opening posteriorly oriented, caecum absent; cornutus ⁄ the length of phallus, consisting of broad, semi-cylindrical basal plate and one almost straight spine with variably sclerotized, smooth lateral lobe.

Female. Unknown.

Barcode data (n= 2): Maximum intraspecific variation 0 %; distance to the closest relative *E. sagara* 2.11 %.

Biology: The holotype has been collected by net at dawn, at a temperature of +5 C; most others, if not all, have been obtained by UV light during night. All collecting sites are at low elevation highest site is at 700 m a.s.l. A typical habitat is gypsum soil with sparse vegetation, typically with *Gypsophila*, *Salsola* and *Artemisia*. The species has also been collected in low vegetation grass-shrubland (J. Tabell, pers. comm.). Even though only 10 specimens are currently known, their collection dates span from March, April, May, and July to September. Apparently the species is at least bivoltine.

Distribution: Spain.

Remarks: The record of a specimen resembling *E. deceptricula* from Spain by PARENTI & DOMÍNGUEZ (1995) is probably referable to *E. conferta* sp. n.

***Elachista sagara* Kaila, sp. n.** (Figs. 11, 18, 19)

Material studied. Type material: Holotype ♂: KYRGYZSTAN, Trans-Alai Mts., 3010 m a.s.l., 39º 22' 45.5" N 72º 16' 30.7" E, Altyn-Dara River Valley, 27-VII-2010, K. Nupponen & R. Haverinen leg., L. Kaila prep. 5912, DNA sample 21333 Lepid. Phyl. (Coll. Nupponen). Paratypes (5 ♂♂): 4 ♂♂ with same collecting data as in holotype, L. Kaila prep. 5333; DNA samples 22546, 22549, 22555, 22628 Lepid. Phyl. (Coll. Nupponen, MZH); KYRGYZSTAN, Alai Mts., 3500 m a.s.l., 39º 40' 57.3" N 72º 32' 00.7" E, near Kashka-Suu village, 22-VII-2010, 1 ♂, K. Nupponen & R. Haverinen leg., L. Kaila prep. 5333 (Coll. Nupponen).

Diagnosis: *E. sagara* closest resembles *E. conferta.* Their separation is explained under the diagnosis of *E. conferta.*

Description: Wingspan 10-12.5 mm. Labial palpus 0.8 times diameter of head, slightly ascending, underside to varying extent fuscous, upperside white. Head, neck tuft, thorax, scape and pedicel of antenna chalky white; flagellum brass-colored, unicolorous. Foreleg leaden grey, mid- and hindlegs pale ochreous, spurs and tarsal articles grey especially in midleg. Forewing unicolorous, chalky white. Fringe concolorous. Hindwing lustrous, silvery to pale grey, fringe either concolorous or pale brass-colored. Underside of forewing grey, fringe white; underside of hindwing varying from white to pale grey, fringe concolorous.

Male genitalia: Uncus lobes 1.5 times as long as wide; distolaterally with a few setae; apex distolaterally produced with sharp apex, lateral margin straight. Spinose knob of gnathos rounded, anterior margin straight or weakly concave. Valva 1.5 times as long as tegumen + uncus, 5 times as long as broad at its broadest point; sacculus somewhat dilated, cucullus hardly broader than median part of valva, elongate, distally rounded. Juxta lobes devoid of setae, rounded. Digitate process rather narrow, setose, straight, length⁄ of the length of valva. Phallus slightly shorter than or as long as valva, evenly bent, apex reinforced; basal opening posteriorly oriented, caecum absent; cornutus 1/5 the length of phallus, consisting of broad, semi-cylindrical basal plate and almost straight, broad, multiply wrinkled spine.

Barcode data (n=5): Maximum intraspecific variation 0 %; distance to the closest relative *E. conferta* 2.11%.

Biology: Unknown. The moths were collected by netting at daylight. The species inhabits dry montane steppes at high altitudes (Figs. 2-3).

Distribution: Only known from a restricted area in the Alai and Trans-Alai Mts. in southern Kyrgyzstan.

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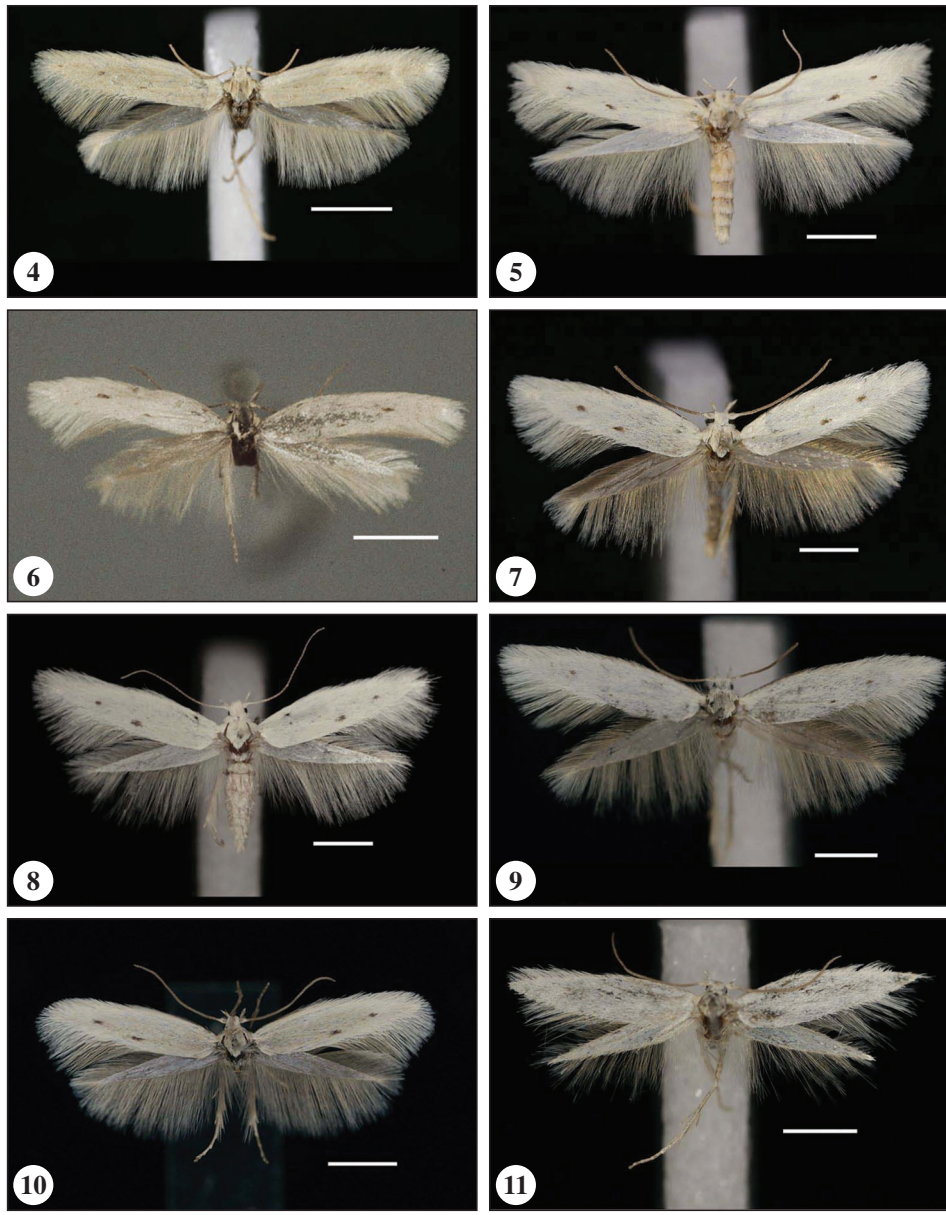
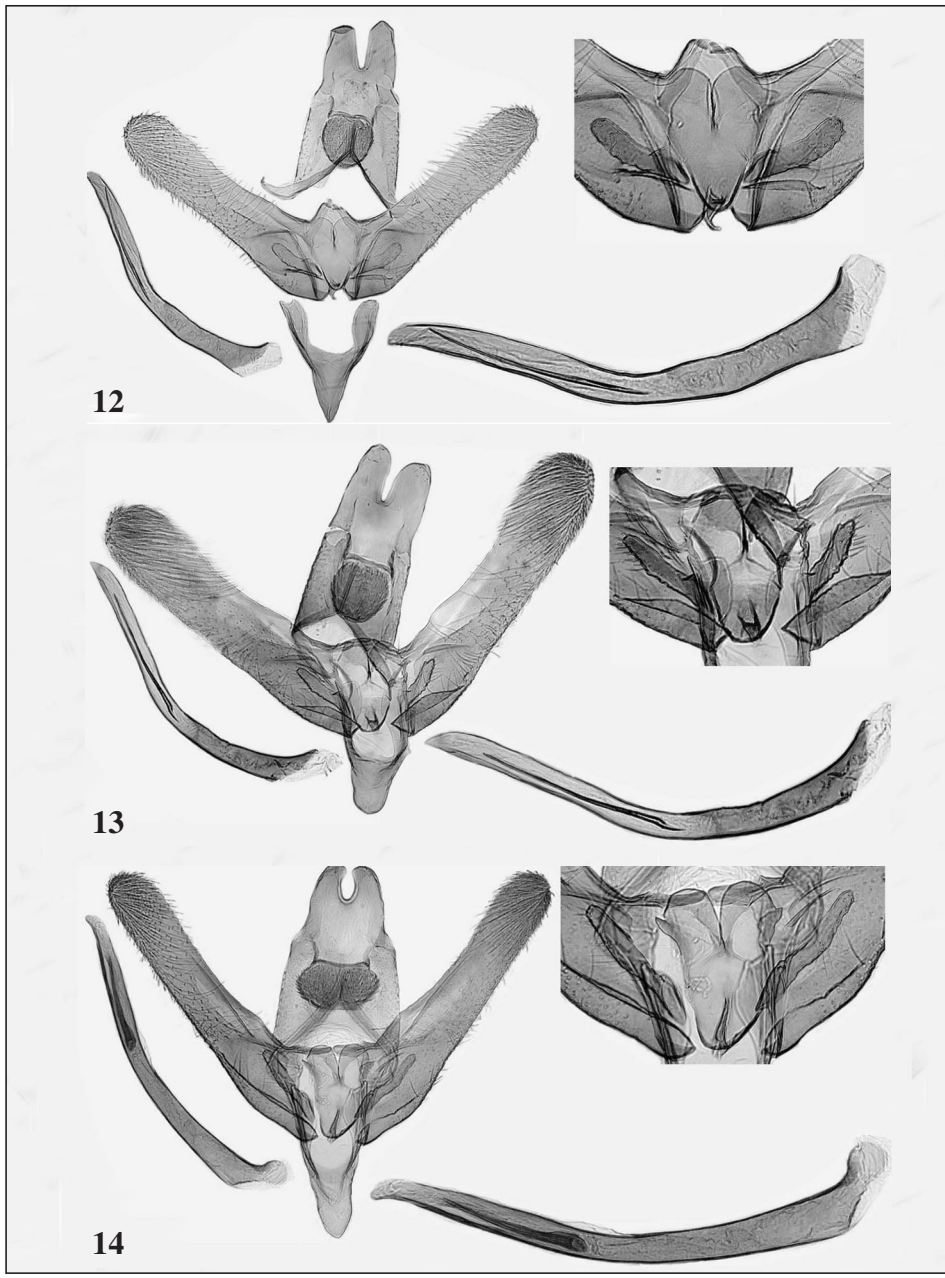
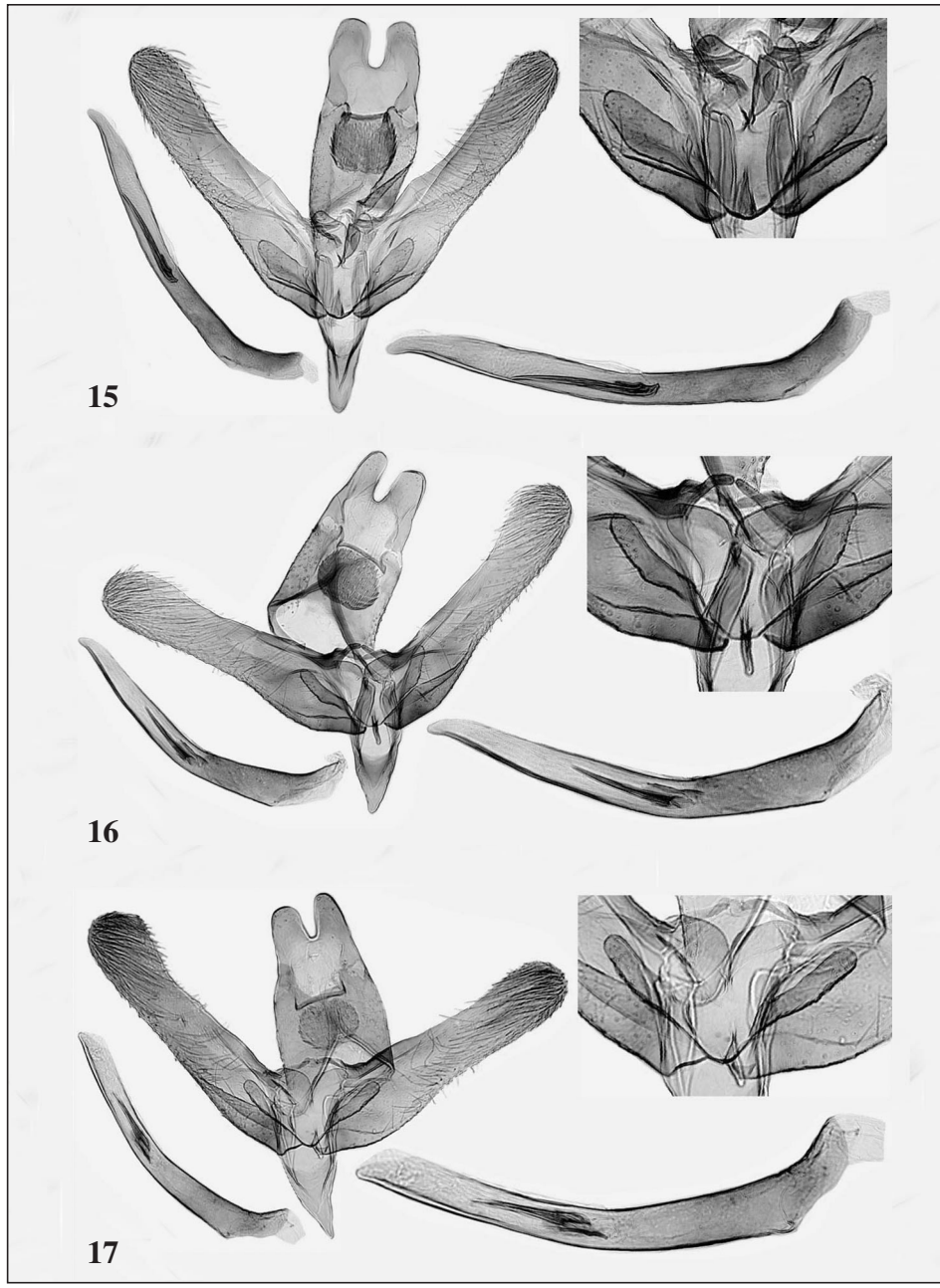
**Figs. 1-3.– 1.** Habitat of *Elachista athroa* Kaila, sp. n.: chalk slope in Sultan Daglari Mts. (1200 m a.s.l.), Central Turkey. **2.** Habitat of *Elachista sagara* Kaila, sp. n.: montane steppe in Altyn-Dara Valley, Trans-Alai Mts. (3010 m a.s.l.), Kyrgyzstan. **3.** Habitat of *Elachista sagara* Kaila, sp. n.: montane steppe by Kashka-Suu village, Alai Mts. (3500 m a.s.l.), Kyrgyzstan. (Photos K. Nupponen).



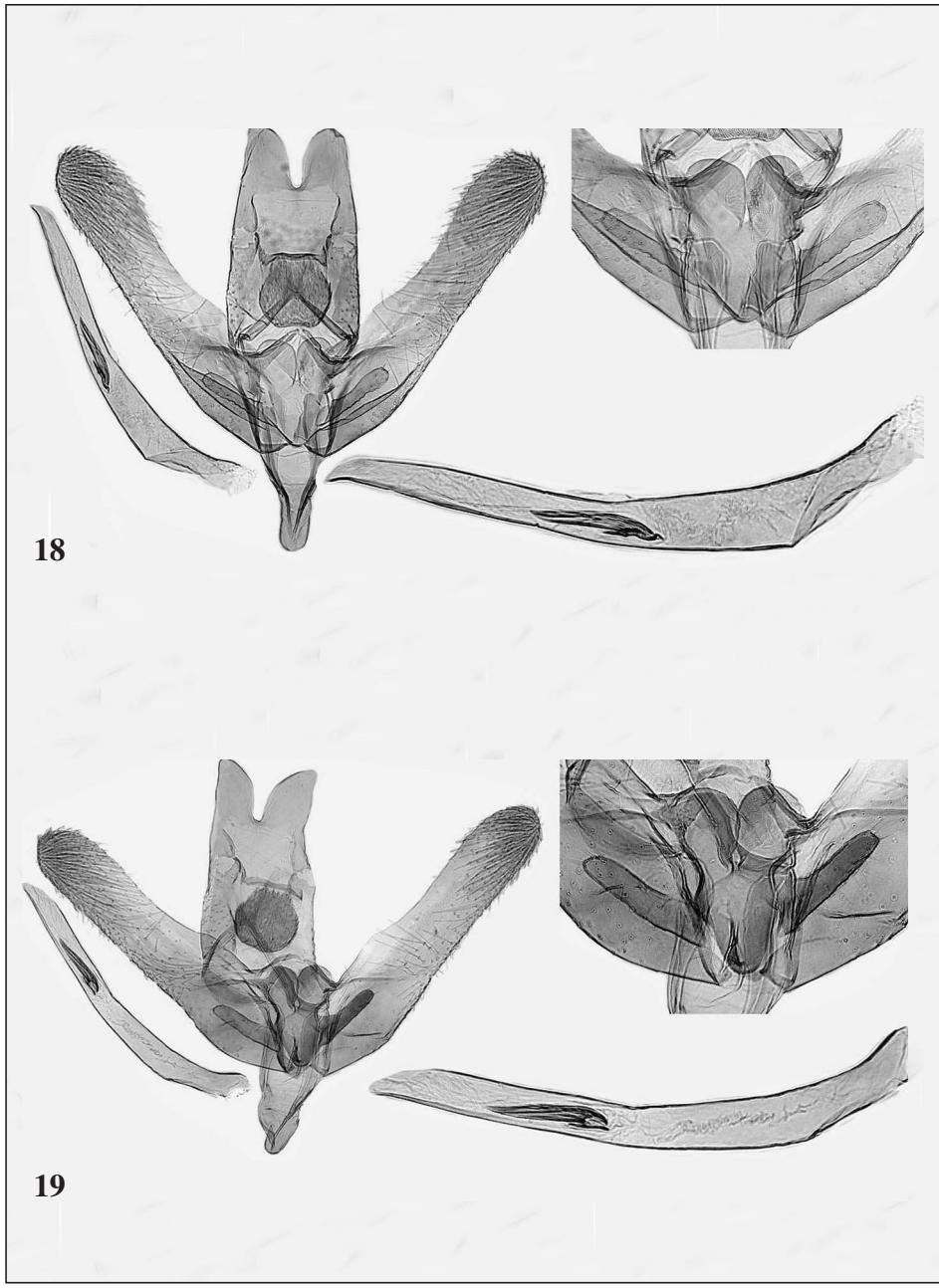

**Figs. 4-11.–** Adults of *Elachista* spp. **4.** *E. spumella* Caradja, male (Russia, Volgograd distr.). **5.** *E. spumella* Caradja, female (Russia, Altai Mts., Katun valley). **6.** *E. spumella* Caradja, lectotype male (Russia, Uralsk). **7.** *E. deceptricula* Staudinger, male (Turkey, prov. Konya, Aksehir). **8.** *E. deceptricula* Staudinger, female (Turkey, Aksehir). **9.** *E. athroa* Kaila, sp. n., holotype, male. **10.** *E. conferta* Kaila, sp. n., holotype, male, **11.** *E. sagara* Kaila, sp. n., holotype, male.



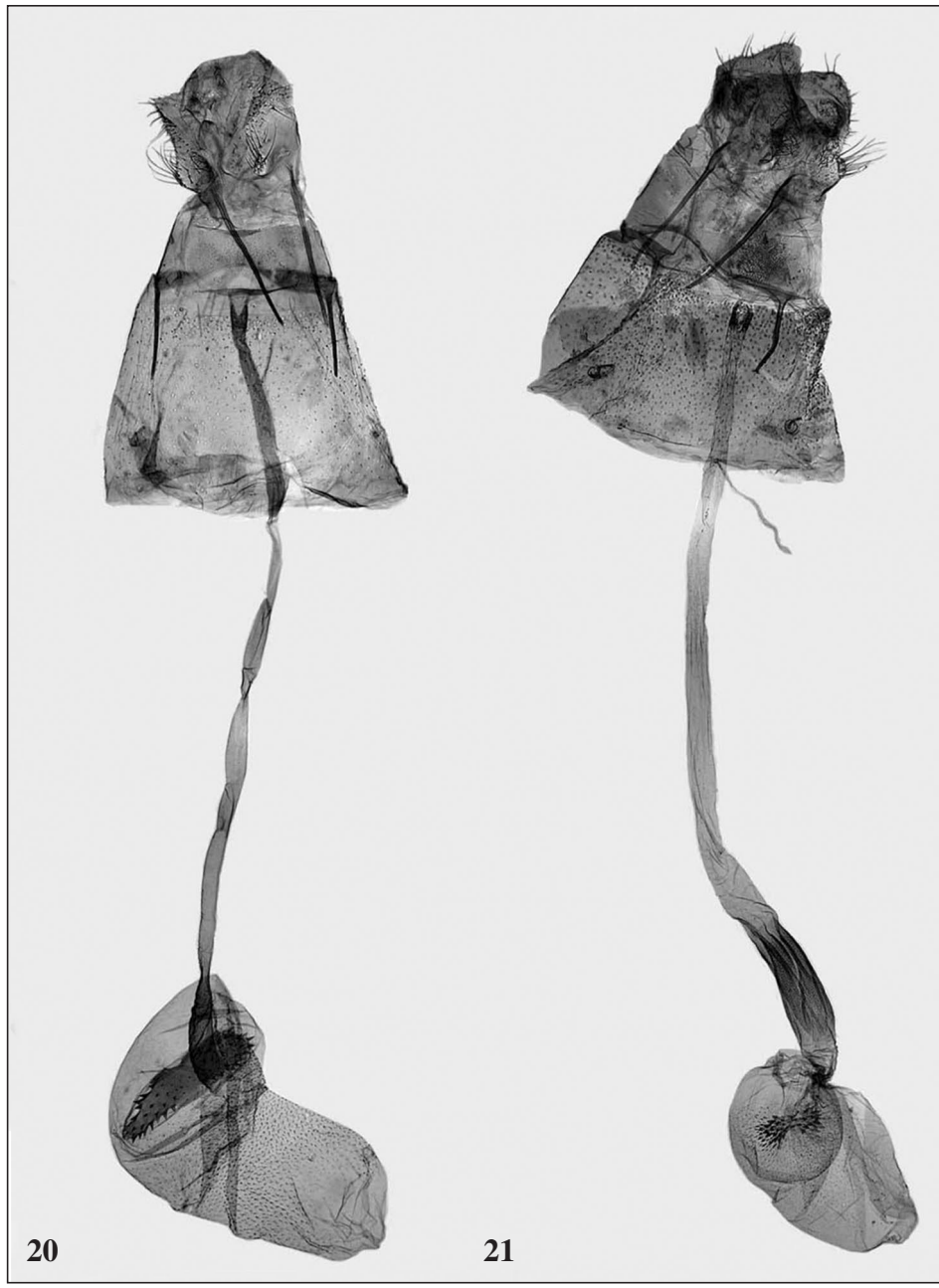

**Figs. 12-14.–** Male genitalia of *Elachista* spp. **12.** *E. spumella* Caradja, lectotype male (Russia, Uralsk), U. Parenti prep. 708. **13.** *E. spumella* Caradja, L. Kaila prep. 3123 (Russia, S. Ural). **14.** *E. deceptricula* Staudinger, L. Kaila prep. 2485 (Turkey, prov. Konya, Aksehir).




**Figs. 15-17.–** Male genitalia of *Elachista* spp. **15.** *E. athroa* Kaila, sp. n., holotype, L. Kaila prep. 3022. **16.** *E. conferta* Kaila, sp. n., holotype, L. Kaila prep. 6037. **17.** *E. conferta* Kaila, sp. n., paratype, L. Kaila prep. 4673.




**Figs. 18-19.–** Male genitalia of *Elachista sagara* Kaila, sp. n. **18.** Holotype, L. Kaila prep. 5192. **19.** Paratype, L. Kaila prep. 5333.




**Figs. 20-21.–** Female genitalia of *Elachista* spp. **20.** *E. spumella* Caradja, L. Kaila prep. 6055 (Russia, Ulyanovsk), **21.** *E. deceptricula* Staudinger, L. Kaila prep. 6053 (Greece, Kozani environs).

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# Nuevos datos sobre la presencia de *Idaea sylvestraria* (Hübner, [1799] 1796) en España (Lepidoptera: Geometridae, Sterrhinae)

J. J. Guerrero, R. M. Rubio, M. Garre & A. S. Ortiz

**Resumen**

Una nueva captura del Geometridae *Idaea sylvestraria* (Hübner, [1799] 1796) en Galicia permite confirmar la presencia de la especie en España. Se aportan algunas características sobre su biología.
PALABRAS CLAVE: Lepidoptera, Geometridae, Sterrhinae, *Idaea sylvestraria*, Galicia, España.

**New data on the presence of *Idaea sylvestraria* (Hübner, [1799] 1796) in Spain (Lepidoptera: Geometridae, Sterrhinae)**

**Abstract**

A new record of the Geometridae *Idaea sylvestraria* (Hübner, [1799] 1796) in Galicia confirms its presence in Spain. In this paper some biological data are highlighted.
KEY WORDS: Lepidoptera, Geometridae, Sterrhinae, *Idaea sylvestraria* Galicia, Spain.

## Introducción

*Idaea sylvestraria* (Hübner, [1799] 1796) es un geométrido de la subfamilia Sterrhinae de distribución euroasiática que se conoce en el sur de Europa, concretamente, de los Apeninos, Balcanes y centro y sureste de Francia (HAUSMANN, 2001). En España la especie fue citada reiteradamente en Cataluña por CUNÍ i MARTORELL (1874), aunque DANTART (2000) decide no incluirla en el catálogo de los Geometridae de Cataluña debido a que no ha sido capturada posteriormente, por lo que consideró que dichas citas podían deberse a un error de identificación con *Idaea straminata* (Borkhausen, 1794). Posteriormente, PÉREZ-ALONSO (1979) la cita en la localidad asturiana de Viella y SÁNCHEZ-EGUIALDE (1999) en la localidad navarra de Tudela, mientras que CIFUENTES *et al.* (2003) la mencionan en Madrid según una cita de GÓMEZ DE AIZPÚRUA (1974). REDONDO *et al.* (2009) indican que la mayoría de estos datos no han podido comprobarse, a excepción de la captura de J. Gastón en el Puerto del Páramo de Masa, en la provincia de Burgos.

La presente nota aporta un nuevo dato sobre la presencia de *Idea sylvestraria* en España, lo que permite confirmar su rango de distribución y las características del hábitat que ocupa en las latitudes europeas meridionales.

## Material y métodos

La captura se realizó con una trampa de luz actínica tipo Heath de 15 vatios, como parte de los

muestreos realizados en toda la Península Ibérica para obtener ejemplares para la secuenciación del gen COI (citocromo oxidasa I), dentro del proyecto del Plan Nacional I+D+I (2008-2011).

El adulto de la especie estudiada se muestra en la figura 1A mientras que la genitalia masculina se muestran en las figuras 1B (andropigio) y 1C (aedeagus). La tinción se ha realizado con fucsina de Ziehl (fucsina básica, alcohol absoluto y agua fenicada) con lavado posterior en alcohol de 95º (YÉLAMOS, 1994).

El material estudiado se encuentra depositado en la colección del Laboratorio de Biología Animal del Departamento de Zoología y Antropología Física de la Universidad de Murcia.

Material estudiado: LUGO, Degrada, Albergue de Ancares, (42º 82' 05.85" N - 6º 92' 24.76" O), 1.360 m, 1 ♂, 25-VI-2011 (J. J. Guerrero leg.).

## Discusión

En Europa la especie presenta un comportamiento univoltino desde mediados de junio a mediados de agosto y, ocasionalmente, bivoltino de principios de junio hasta principios de septiembre. La especie habita desde el nivel del mar hasta 1.300 m de altitud, en zonas de suelos pobres en nutrientes donde abundan plantas de los géneros *Calluna* o *Thymus*, aunque se comporta como oligófaga sobre diferentes plantas: *Calluna vulgaris*, *Artemisia campestris*, *Thymus serpyllum*, *Genista tinctoria*, *Chenopodium* spp., *Vaccinium* spp., etc. También se ha citado en espacios abiertos secos, brezales, estepas y dunas, o húmedos como zonas pantanosas (HAUSMANN, 2001). Tanto la cita del Puerto del Páramo de Masa, como el material estudiado en el Albergue de Ancares, han sido realizadas por encima de los 1.000 m de altitud, donde se puede encontrar una masa arbustiva que se alterna con zonas de prado de montaña, que sirve de pasto al ganado en la primavera y verano, rodeada por algunas formaciones arbóreas aisladas. La flora más abundante en el entorno de la estación de muestreo son el brezo (*Erica* spp.), piorno (*Cytissus* spp.), brecina (*Calluna* spp.) y tomillo (*Thymus* spp.), plantas nutricias de las orugas de la especie, mientras que los árboles de los alrededores son robles (*Quercus* spp.), serbal de los cazadores (*Sorbus* spp.), arces (*Acer* spp.), abedules (*Betula* spp.) y acebos (*Ilex aquifolium*).

## Agradecimiento

Al personal del Centro de Interpretación de los Ancares por facilitarnos el acceso a las instalaciones para poder llevar a cabo los muestreos. A la Dirección General de Conservación de la Naturaleza de Galicia, por las facilidades ofrecidas para el desarrollo del trabajo mediante la concesión de los correspondientes permisos para capturas científicas. A Pablo Valero por su labor fotográfica en este trabajo. Este estudio ha sido financiado con el proyecto del Plan Nacional I+D+I (2008-2011) titulado *Barcoding y taxonomía basada en el ADN de coleópteros carábidos y tenebriónidos, lepidópteros noctuidos e himenópteros ápidos de la península ibérica (Insecta, Coleoptera, Lepidoptera Noctuidae e Hymenoptera Apidae)* y la Fundación Séneca (Ref. 19908/GERM/15) de Murcia.

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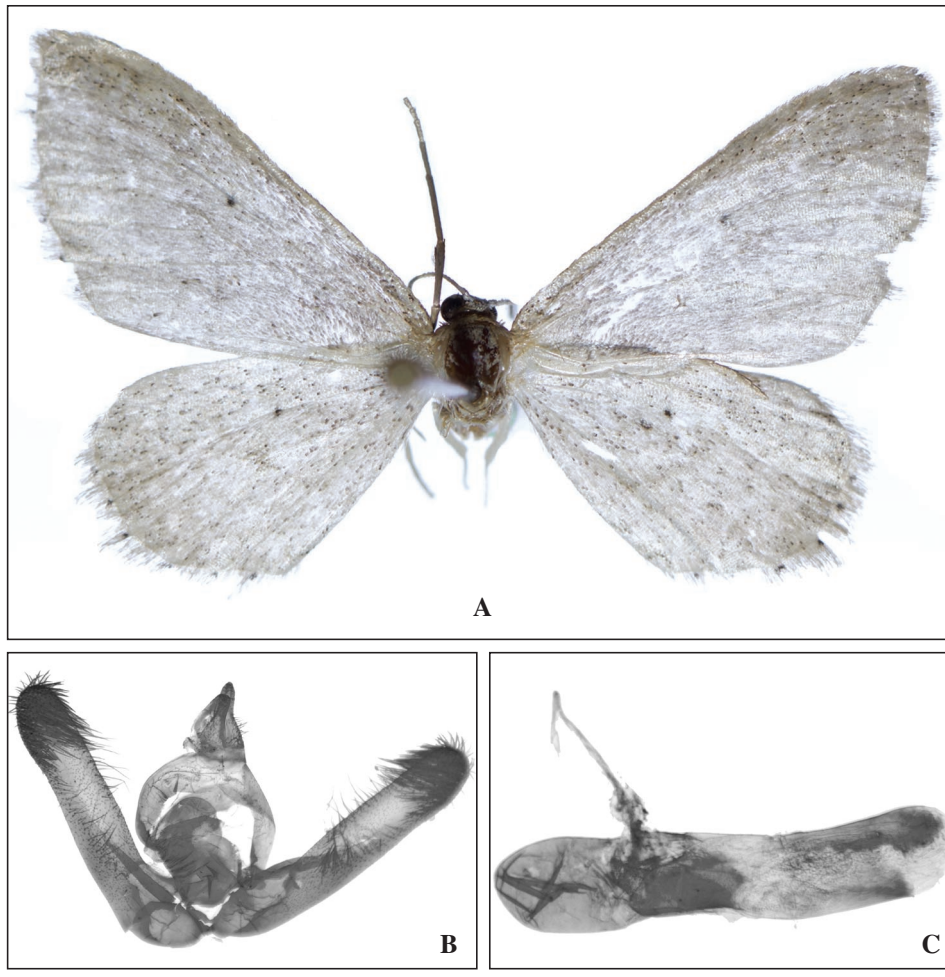


**Figura 1.–** *Idaea sylvestraria* (Hübner, [1799]): 1A. Adulto; 1B. Andropigio; 1C. Aedeagus.

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# Long term survey of the butterfly fauna of Curitiba, Paraná, Brazil: How does a scientific collection gather local biodiversity information? (Lepidoptera: Papilionoidea)

J. H. Pérez, F. G. Gaviria-Ortiz, W. I. G. Santos, E. Carneiro, O. H. H. Mielke & M. M. Casagrande

**Abstract**

Butterfly species lists are commonly published aiming to describe local or regional diversity, thus being primordial tools for subsiding nature preservation and management. However, tropical lands usually lack this kind of information. Inventories of megadiverse organisms, such as butterflies, usually require long term studies to detect a substantial fraction of species present in certain location. Through biological collections in scientific institutions it is possible to preserve a considerate amount of biodiversity information, which is not available in the literature, but can promote studies over time. Aiming at supplementing the knowledge on butterfly diversity in Curitiba, Paraná, Brazil, and to demonstrate how a scientific collection accumulates such information from the nearby surroundings, this study lists all species of butterflies recorded in the city since 1938. Since then, 554 species were recorded. Although there have been large sampling efforts since the 60s, 45 species were only recorded in the last decade. Species lists published in 1938, 1995, 2011 and 2015 contributed to a considerable fraction of species records and monitoring, but species richness observed in each study is usually low (less than 1/3 of all historical records). Therefore, the long term deposition of specimens gathered in a single collection evidences that Curitiba harbors a distinct higher number of species, though new records are still frequent. Taking into account that long term surveys of megadiverse insects offer a more complete analysis of their biological diversity, studies measuring diversity impacts, such as urban sprawl, must include historical data whenever available.
KEY WORDS: Lepidoptera, Papilionoidea, conservation, species richness, urban ecosystems, Atlantic Forest, Brazil.

**Muestreo general, a largo plazo, de la fauna de mariposas de Curitiba, Paraná, Brasil: ¿Cómo se recoge la información de biodiversidad de una colección científica local? (Lepidoptera: Papilionoidea)**

**Resumen**

Los listados de mariposas se publican normalmente aspirando a describir la diversidad local o regional, siendo, por tanto, herramientas primordiales para subvencionar la conservación y su gestión. Los inventarios de organismos mega o superdiversos, como las mariposas, requieren habitualmente estudios a largo plazo para detectar una fracción significativa de las especies presentes en una localidad. Sin embargo, las regiones tropicales carecen, generalmente, de esta clase de información. A través de colecciones biológicas en las instituciones científicas es posible mantener una considerable información de biodiversidad, que no se dispone en la literatura, pero puede promover estudios con el tiempo. Teniendo como objetivo complementar los conocimientos sobre la diversidad de mariposa en Curitiba, Paraná, Brasil y demostrar cómo una colección científica acumula tal información de los entornos cercanos desde entonces, este estudio recoge una lista, todas las especies de mariposas registradas en la ciudad desde 1938, desde entonces, se han registrado 554. Aunque ha habido grandes esfuerzos de muestreos desde el los 60, 45 especies sólo

fueron registradas en la última década. Las listas de especies se publicadas en 1938, 1995, 2011 y 2015 han aportando los registros de una fracción considerable de especies, pero la riqueza de especies observadas en cada estudio resulta usualmente baja (menos de 1/3 de todos los archivos históricos). Por lo tanto, el depósito a largo plazo de los especímenes en una sola colección, muestra claramente que Curitiba da refugio a un mayor número de especies, donde los nuevos registros todavía son frecuentes. Teniendo en cuenta que los muestreos a largo plazo de insectos megadiversos ofrecen un análisis más completo de su diversidad biológica, aquellos estudios que midan los impactos sobre la diversidad, como por ejemplo la aglomeración urbana, deben incluir los datos históricos disponibles.
PALABRAS CLAVE: Lepidoptera, Papilionoidea, conservación, riqueza de especies, ecosistema urbano, Bosque Atlántico, Brasil.

## Introduction

Butterflies are recognized as the most common invertebrates used as bioindicators, given their sensitive to landscape changes from different types of anthropic disturbances (WOOD & GILLMAN, 1998; KITCHING *et al.,* 2000; BROWN & FREITAS, 2000; SUMMERVILLE & CRIST, 2001; UEHARA-PRADO& RIBEIRO, 2012), besides being easy to sample and to identify (DEVRIES *et al.,* 1997; KITCHING *et al.,* 2000). Therefore, there are several studies listing butterfly species aiming to quantify local or regional diversity (BROWN, 1991; KREMEN *et al.,* 1993; KREMEN, 1994). On the other hand, basic information of butterfly diversity, distribution, and population dynamics are still scarce in tropical region (BROWN & FREITAS, 1999; UEHARA-PRADO *et al.*, 2004; SANTOS *et al.,* 2008).

Thus, considering that butterfly diversity surveys can support several aspects of conservation manegement (BROWN & FREITAS, 1999; DOLIBAINA *et al.,* 2011), two main sources are of particular interes: published inventories, and biological collections. In this context, biological collections stands out because data can be used to evaluate space and time changes (FATTORINI, 2013), besides holding voucher material as demanded by the scientific method. Brazilian entomological collections are among the most significant from South America, in terms of Neotropical representatives, with a wide number of collections all over the country, products of different projects and expeditions done during several decades. In terms of Lepidoptera, the Museu Nacional and Instituto Oswaldo Cruz (Rio de Janeiro), Museu de Zoologia de São Paulo (São Paulo) and the Departamento de Zoologia, Universidade Federal do Paraná (Paraná), hold the largest collections from the Neotropical fauna (MARINONI, 2010).

The orgin of specimens deposited in these collections is of course biased by locations within the Brazilian territory and by sites easily accessible to collectors (MARINONI, 2010). Butterfly species lists in Brazil, for example, are more common closer to the biggest metropoles and research centers (SANTOS *et al*., 2008). These sites may regard most records from butterfly diversity in Brazil, but still historical studies on how this information accumulates trough time are scarce. Curitiba is an example of a city where some butterfly species lists were produced (BIEZANKO, 1938; MIELKE, 1995; BONFANTTI, *et al*., 2011; PEREIRA *et al*., 2015), most of them depositing vouchers in a single collection located in the city. However, no study has investigated and compared historical variations in butterfly records gathered in species lists and random collects. This study's main objective was to rank butterfly species, based on records from Brazilian biological collections, and demonstrate, through this study model, how scientific collections accumulate and preserve biodiversity knowledge, especially on the megadiverse groups.

## Material and Methods

### Study area

Curitiba (25º 25' 40"S, 49º 16' 23"W), Paraná, Brazil, has 432.7 km$^2$ and is at approximately 930 m of altitude. The city is located in a Cfb type region, with a humid mesothermal climate, without a dry season, with cool summers, and winters with frequent frost and occasional snowfall (IPPUC, 2012).

Average annual temperature is of 16.4 C and rainfall of 1600 mm/year. Nowaday, the landscape of Curitiba is predominatly urbanized, but the original vegetation was characterized by fragments of mixed ombrophilous forest, isolated by a matrix of grassland. Currently, the city still presents some green areas (HILDEBRAND, 2001), but the matrix is urbanized. Its current vegetation cover is estimated in 129945000 $m^2$ (around 5% of its territory), composed of 22 parks, 454 public squares, 55 lakes, and four private reserves (VIEIRA & BIONDI, 2008; IPPUC, 2012; GRISE *et al*., 2016).

### Data collection

A data matrix was built from the specimens deposited in the Coleção Entomológica Padre Jesus Santiago Moure, Departamento de Zoologia (DZUP), Universidade Federal do Paraná (UFPR), the private collection of Olaf H. H. Mielke, Curitiba, Paraná, compared to the names listed in previous survey data (BIEZANKO, 1938; MIELKE, 1995; BONFANTTI *et al*., 2011; PEREIRA *et al*., 2015). The specimens were identified through comparisons with specimens previously identified in the DZUP collection, through the use of specialized literature, or were identified / confirmed by specialists. Taxonomical nomenclature for Papilionoidea follows LAMAS (2004) and for Hesperioiidea follows O. MIELKE (2005). Records of all surveyed species are deposited in the DZUP.

## Results and discussion

According to data obtained from surveys done in Curitiba and in the DZUP, there are 554 species recorded in the city, belonging to six families, 25 subfamilies, and 320 genera (Table I). The family with highest species richness was Hesperiidae 237 ssp. (42.8%), followed by Nymphalidae 161 ssp. (29%), Lycaenidae 68 ssp. (12.27%), Riodinidae 44 ssp. (7.94%), Pieridae 32 ssp. (5.78%) and Papilionidae 12 spp. (2.17%) (Figure 1).

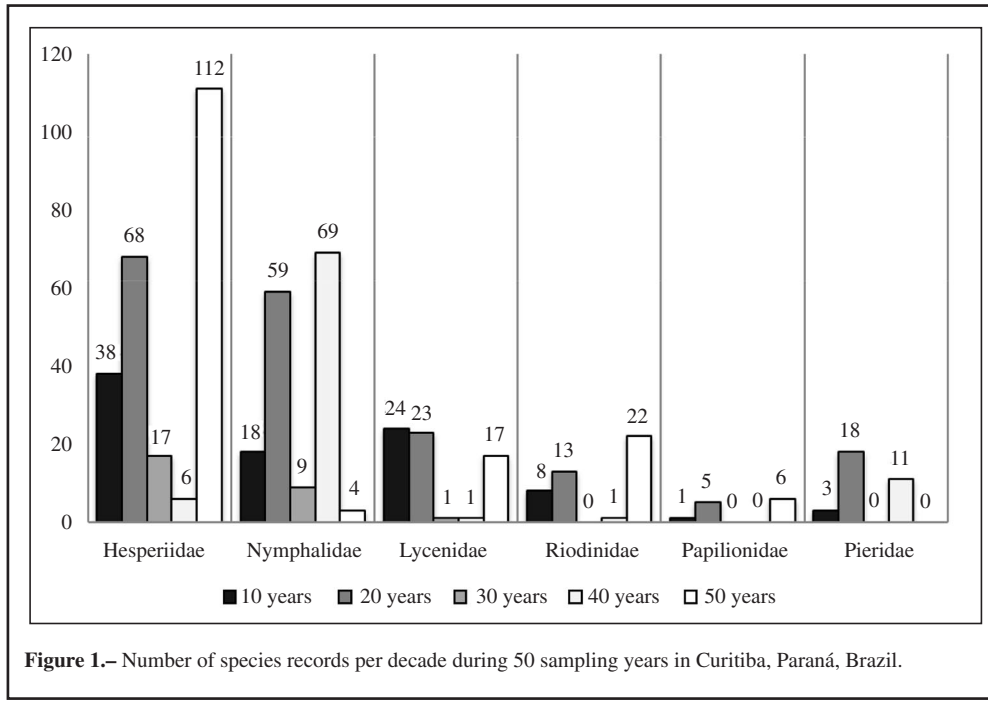


**Figure 1.–** Number of species records per decade during 50 sampling years in Curitiba, Paraná, Brazil.

BIEZANKO (1938) presented the first list with 24 species of butterflies and, after approximately five decades without updates, MIELKE (1995) published a new list with 498 species, using the same collection to gather butterfly records, but adding additional municipalities on Curitiba surroundings. From those, 446 species were confirmed to occur within Curitiba limits. Since than, recent studies on different urban parks of Curitiba, from 2010 and onward (BONFANTTI *et al*., 2011; PEREIRA *et al*., 2015), ocassionally added more records (Figure 2).

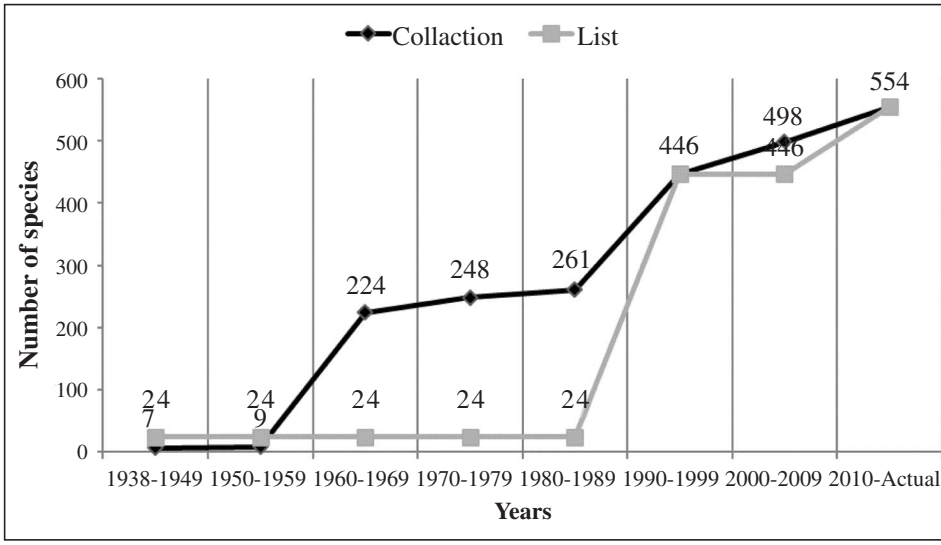


**Figure 2.–** Historical records of Lepidoptera species based on the entomological collection (DZUP) and species lists from Curitiba, Paraná, Brazil.

The number of species represents 17.1 % of the butterfly richness that is estimated to occur in Brazil. It is more than what was recorded in other city surveys in Paraná (e.g. Jaguariaíva, 226 spp., Diamante do Norte, 379 spp., Foz do Iguaçú, 106 spp. (Hesperiidae), Maringá, 106 spp., Balsa Nova, 432 spp and Palmito-Paranagua, 200 spp. (MIELKE, 1968; ALMEIDA *et al*., 1986; CASAGRANDE *et al*., 2012; BELTRAMI *et al*., 2014; GARCIA-SALIK *et al*., 2014; LEVISKI *et al*., 2016). However, studies with similar sampling efforts, and additional data from collections, presented species number closer or superior to the ones recorded for Curitiba (DOLIBAINA *et al*., 2011; MIELKE *et al*., 2012). These differences in the number of species are obviouly related to sampling effort and number of localities sampled in these municipalities (DOLIBAINA *et al*., 2011; RITTER *et al*., 2011; BOGIANI *et al*., 2012; BELLAVER *et al*., 2012). Furthermore, we should emphizize that such differences might also be influenced by the presence of a nearby scientific collection. Besides the use of specimens deposited in local collections, the surveys available for Curitiba, Guarapuava and Ponta Grossa count with the active participation of collectors such as Hipólito Schneider and Felipe Justus, who founded the first Lepidoptera collections of the state (DOLIBAINA *et al*., 2011; MIELKE *et al*., 2012). As demonstrated by FATTORINI (2013), the sampling effort of amateurs often surpasses those of scientists in biological collections of renowned historical importance, contributing as an important legacy to local collections, biodiversity and science awareness.

The lepidopterofauna of Curitiba was sampled with different efforts since 1938, as expected

for any museum data. There are several factors that contribute to maximize or minimize specimen deposition during certain periods. The 90s, as an example, was especially important for the publication of species lists for Curitiba and neighbouring cities (MIELKE, 1995), as mentioned before. Until then, there was only BIEZANKO (1938) list (24 spp.) as a published reference. Besides the available information from a long historical period, new records are constantly deposited, reflecting the complexity of sampling high diverse groups, such as butterflies.

From September / 2015 until March / 2016, 45 new records for Curitiba were added: Hesperiidae (17), Lycaenidae (13), Nymphalidae (11) and Riodinidae (4) (Table I). Families such as Hesperiidae and Nymphalidae are commonly reported as the most representative in Neotropical surveys (BROWN & FREITAS, 2000; SANTOS *et al*., 2008), although the percentual number of species for each family depends on the sampling effort employed (ISERHARD *et al*., 2013). In short surveys, with low sampling effort or systematic collectings, Nymphalidae usually exhibits the highest number of recorded species (MARCHIORI & ROMANOWSKI, 2006; DESSUY & MORAIS, 2007; LEMES *et al*., 2008; PAZ *et al*., 2008; PEREIRA *et al*., 2015). Nevertheless, long term record additions are expected to show a disproportional increase in the number of species of Hesperiidae (FRANCINI *et al*., 2011; ISERHARD *et al*., 2013; THIELE *et al*., 2014), which is currently corroborated by the high number of recent records for the family, even after four decades of sampling efforts. Thus, the high number of Hesperiidae species recorded in a survey can be considered a good indicator of the total butterfly species richness in a region (MIELKE *et al*., 2008). Similarly, Riodinidae and Lycaenidae species numbers also tend to increase disproportionally to Nymphalidae although their richness is expected to be lower in temperate regions (BROWN & FREITAS, 2000; UEHARA-PRADO *et al*., 2007; SANTOS *et al*., 2008; SIEWERT *et al*., 2014).

One of the great advantages of exploring historical data is the possibility of monitoring the presence/absence of species over time. Some of these species are particularly important to conservation strategies, such as the endangered and endemic *Pampasatyrus glaucope* (C. Felder & R. Felder, 1867). This species has disappeared from the Curitiba records after 47 years (DZ 24.474, DZUP), even though it was relatively common in grassland habitats within the city (pers. obs.). Currently, the urban matrix replaced all grasslands habitats previously present in Curitiba. Additionaly, *Cyanophrys bertha* (Jones, 1912) and *Symmachia arion* (C. Felder & R. Felder, 1865) were also included in red lists of threatened fauna but, for different reasons. These species are represented only by sparse records in the national scientific collections. Thus, their disappearance from the collection records might be an artefact of the difficulty of detecting them in nature.

Therefore, the continuous development of butterfly species lists is of extreme relevance to planning conservation strategies in diferente kind of habitats. In highly degraded areas, such as urbans places, the addition of historical records permits current species distribution to be more precicely determined as a fator of antropogenic disturbance. Thus, conservation practices could also be applied based on local assemblage trends and its habitats preferences (BROWN & FREITAS, 1999, 2000; SUMMERVILLE & CRIST, 2001). We expect that the presente species list to influence future ecological and conservation studies in Curitiba, besides contributing to circusncribing the original distribution of the Neotropical Lepidoptera.

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**Table I.–** Species list of Papilionoidea in Curitiba, Paraná, Brazil. (*) new records in the period from IX-2015 and III-2016. All subspecies names are ommited when typonomial.

HESPERIIDAE

EUDAMINAE

*Aguna asander* (Hewitson, 1867)
*Aguna megaeles* (Mabille, 1888) *
*Astraptes alardus* (Stoll, 1790)
*Astraptes aulus* (Plötz, 1881)
*Astraptes creteus siges* (Mabille, 1903) *
*Astraptes elorus* (Hewitson, 1867)
*Astraptes enotrus* (Stoll, 1781) *
*Astraptes erycina* (Plötz, 1881)
*Astraptes fulgerator* (Walch, 1775)
*Astraptes naxos* (Hewitson, 1867)
*Astraptes talus* (Cramer, 1777)
*Autochton integrifascia* (Mabille, 1891)
*Autochton zarex* (Hübner, 1818)
*Chioides catillus* (Cramer, 1779)
*Epargyreus socus pseudexadeus* Westwood, 1852
*Oechydrus chersis evelinda* (Butler, 1870)
*Phanus australis* L. Miller, 1965
*Phocides charon* (Felder & Felder, 1867)
*Phocides pialia* (Hewitson, 1857)
*Phocides polybius phanias* (Burmeister, 1880)
*Polygonus leo pallida* Röber, 1925
*Polygonus savigny* (Latreille, [1824])
*Polythrix octomaculata* (Sepp, [1844])
*Proteides mercurius* (Fabricius, 1787)
*Telemiades vespasius* (Fabricius, 1793)
*Typhedanus stylites* (Herrich-Schäffer, 1869)
*Urbanus albimargo rica* Evans, 1952
*Urbanus dorantes* (Stoll, 1790)
*Urbanus esma* Evans, 1952 *
*Urbanus esta* Evans, 1952
*Urbanus procne* (Plötz, 1880)
*Urbanus proteus* (Linnaeus, 1758)
*Urbanus simplicius* (Stoll, 1790) *
*Urbanus teleus* Hübner, 1821
*Urbanus zagorus* (Plötz, 1880)

HESPERIINAE

*Alera furcata* Mabille, 1891
*Anatrytone perfida* (Möschler, 1879)
*Ancyloxypha nitedula* (Burmeister, 1878)
*Anthoptus epictetus* (Fabricius, 1793)
*Arita arita* (Schaus, 1902) *
*Arita polistion* (Schaus, 1902)
*Arotis derasa brunnea* (Mielke, 1972)
*Artines satyr* Evans, 1955
*Caligulana caligula* (Schaus, 1902)
*Callimormus interpunctata* (Plötz, 1884)
*Callimormus rivera* (Plötz, 1882)
*Calpodes ethlius* (Stoll, 1782)
*Cantha ivea* Evans, 1955
*Cobalopsis hazarma* (Hewitson, 1877)
*Cobalopsis miaba* (Schaus, 1902)
*Cobalopsis nero* (Herrich-Schäffer, 1869)
*Cobalopsis vorgia* (Schaus, 1902)
*Cobalus virbius hersilia* (Plötz, 1882)
*Conga chydaea* (Butler, 1877)
*Conga iheringii* (Mabille, 1891)
*Conga immaculata* (Bell, 1930)
*Conga urqua* (Schaus, 1902)
*Conga zela* (Plötz, 1883)
*Copaeodes jean favor* Evans, 1955
*Corticea corticea* (Plötz, 1882)
*Corticea immocerinus* (Hayward, 1934)
*Corticea lysias potex* Evans, 1955
*Corticea noctis* (Plötz, 1882)
*Corticea oblinita* (Mabille, 1891)
*Corticea obscura* Mielke, 1969
*Corticea* sp.
*Cumbre cumbre* (Schaus, 1902)
*Cumbre* sp.
*Cyclosma altama* (Schaus, 1902)
*Cymaenes campestris* Mielke, 1980
*Cymaenes distigma* (Plötz, 1882)
*Cymaenes gisca* Evans, 1955
*Cymaenes lepta* (Hayward, 1939)
*Cymaenes odilia* (Burmeister, 1878)
*Cymaenes perloides* (Plötz, 1882)
*Cymaenes tripunctata* (Latreille, [1824])
*Cynea melius* (Geyer, 1832)
*Cynea trimaculata* (Hërrich-Schäffer, 1869)
*Decinea lucifer* (Hübner, [1831])
*Euphyes cherra* Evans, 1955
*Euphyes fumata* Mielke, 1972
*Euphyes leptosema* (Mabille, 1891)
*Euphyes subferrugineus biezankoi* Mielke, 1972
*Eutychide physcella* (Hewitson, 1866)
*Gallio carasta* (Schaus, 1902) *
*Ginungagapus ranesus* (Schaus, 1902)
*Ginungagapus schmithi* (Bell, 1930)
*Hansa devergens hydra* Evans, 1955
*Hylephila phyleus* (Drury, 1773)
*Igapophilus rufus* Mielke, 1980
*Justinia kora* (Hewitson, 1877)
*Lamponia lamponia* (Hewitson, 1876)
*Lerema duroca lenta* Evans, 1955
*Lerodea eufala* (Edwards, 1869)
*Libra aligula decia* (Hayward, 1948)
*Lucida lucia* (Capronnier, 1874)
*Lycas argentea* (Hewitson, 1866)
*Lycas godart* (Latreille, [1824])
*Lychnuchoides ozias* (Hewitson, 1878)
*Lychnuchus celsus* (Fabricius, 1793)

*Metron oropa* (Hewitson, 1877)
*Miltomiges cinnamomea* (Herrich-Schäffer, 1869)
*Mnasilus allubita* (Butler, 1870) *
*Mnasitheus nella* Evans, 1955 *
*Mnasitheus ritans* (Schaus, 1902)
*Moeris seth* Carneiro, Mielke & Casagrande, 2015
*Molla molla* Evans, 1955
*Monca branca* Evans, 1955
*Mucia zygia* (Plötz, 1886)
*Nastra chao* (Mabille, 1898) *
*Nastra lurida* (Herrich-Schäffer, 1869)
*Neoxeniades scipio* (Fabricius, 1793)
*Niconiades caeso* (Mabille, 1891) *
*Niconiades merenda* (Mabille, 1878)
*Nyctelius nyctelius* (Latreille, [1824])
*Orses itea* (Swainson, 1821)
*Orthos orthos hyalinus* (Bell, 1930)
*Panoquina fusina viola* Evans, 1955
*Panoquina hecebolus* (Scudder, 1872)
*Panoquina lucas* (Fabricius, 1793)
*Panoquina ocola* (Edwards, 1863)
*Papias phainis* Godman, 1900
*Parphorus pseudecorus* (Hayward, 1934)
*Perichares philetes aurina* Evans, 1955
*Perichares seneca* (Latreille, [1824])
*Phemiades pohli* (Bell, 1932)
*Pheraeus perpulcher* (Hayward, 1934)
*Polites* sp.
*Polites vibex catilina* (Plötz, 1886)
*Pompeius amblyspila* (Mabille, 1898)
*Pompeius pompeius* (Latreille, [1824])
*Psoralis stacara* (Schaus, 1902)
*Pyrrhopygopsis socrates* (Ménétriés, 1855)
*Quinta cannae* (Herrich-Schäffer, 1869)
*Remella remus* (Fabricius, 1798)
*Saliana longirostris* (Sepp, [1840])
*Saliana saladin catha* Evans, 1955
*Saliana triangularis* (Kaye, 1914)
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*Saturnus reticulata meton* (Mabille, 1891)
*Sodalia argyrospila* (Mabille, 1876)
*Sodalia coler* (Schaus, 1902)
*Sucova sucova* (Schaus, 1902)
*Synale hylaspes* (Stoll, 1781)
*Talides sergestus* (Cramer, 1775)
*Thargella evansi* Biezanko & Mielke, 1973 *
*Thespieus aspernatus* Draudt, 1923
*Thespieus catochra* (Plötz, 1882)
*Thespieus dalman* (Latreille, [1824])
*Thespieus ethemides* (Burmeister, 1878)
*Thespieus jora* Evans, 1955
*Thespieus lutetia* (Hewitson, 1866)
*Thespieus vividus* (Mabille, 1891)
*Thespieus xarina* Hayward, 1948
*Thoon circellata* (Plötz, 1882)
*Thracides cleanthes* (Latreille, [1824])
*Vehilius celeus vetus* Mielke, 1969
*Vehilius clavicula* (Plötz, 1884)
*Vehilius inca* (Scudder, 1872)
*Vettius artona* (Hewitson, 1868)
*Vettius diana* (Plötz, 1886)
*Vettius diversa* (Herrich-Schäffer, 1869)
*Vettius marcus* (Fabricius, 1787)
*Vidius fido* Evans, 1955
*Vidius mictra* Evans, 1955
*Vidius nappa* Evans, 1955
*Vidius similis* Mielke, 1980
*Vidius vidius* (Mabille, 1891)
*Vinius letis* (Plötz, 1883)
*Vinius pulcherrimus* Hayward, 1934
*Virga austrinus* (Hayward, 1934)
*Virga hygrophila* Mielke, 1969
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*Wallengrenia premnas* (Wallengren, 1860)
*Xeniades chalestra corna* Evans, 1955
*Xeniades orchamus* (Cramer, 1777)*
*Zariaspes mys* (Hübner, [1808])
*Zenis jebus jebus* (Plötz, 1882)

HETEROPTERINAE
*Dardarina aspila* Mielke, 1966
*Dardarina castra* Evans, 1955
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PYRGINAE
*Achlyodes busirus rioja* Evans, 1953
*Achlyodes mithridates thraso* (Hübner, [1807])
*Aethilla echina coracina* Butler, 1870
*Anastrus sempiternus simplicior* (Möschler, 1877)
*Anastrus ulpianus* (Poey, 1832) *
*Anisochoria subpicta* Schaus, 1902
*Bolla catharina* (Bell, 1937) *
*Carrhenes canescens pallida* Röber, 1925
*Celaenorrhinus eligius punctiger* (Burmeister, 1878)
*Celaenorrhinus* sp.
*Chiomara asychis autander* (Mabille, 1891)
*Chiomara mithrax* (Möschler, 1879)
*Diaeus lacaena* (Hewitson, 1869)
*Ebrietas anacreon* (Staudinger, 1876)
*Ebrietas infanda* (Butler, 1876) *
*Erynnis funeralis* (Scudder & Burgess, 1870)
*Gindanes brebisson* (Latreille, [1824])
*Gorgythion begga* (Prittwitz, 1868)
*Gorgythion* sp. *
*Helias phalaenoides palpalis* (Latreille, [1824])
*Heliopetes alana* (Reakirt, 1868)
*Heliopetes leucola* (Hewitson, 1868)
*Heliopetes ochroleuca* Zikán, 1938
*Heliopetes omrina* (Butler, 1870)
*Heliopetes purgia* Schaus, 1902

*Milanion leucaspis* (Mabille, 1878)
*Mylon maimon* (Fabricius, 1775)
*Nisoniades bipuncta* (Schaus, 1902)
*Nisoniades brazia* Evans, 1953
*Noctuana diurna* (Butler, 1870) *
*Pellicia vecina* Schaus, 1902
*Polyctor polyctor* (Prittwitz, 1868)
*Pyrgus orcus* (Stoll, 1780)
*Pyrgus orcynoides* (Giacomelli, 1928)
*Pythonides lancea* (Hewitson, 1868)
*Quadrus u-lucida mimus* (Mabille & Boullet, 1917)
*Sostrata bifasciata* (Ménétriés, 1829)
*Staphylus coecatus* (Mabille, 1891)
*Theagenes dichrous* (Mabille, 1878)
*Timochares trifasciata* (Hewitson, 1868)
*Viola minor* (Hayward, 1933)
*Xenophanes tryxus* (Stoll, 1780)
*Zera hyacinthinus servius* (Plötz, 1884)
*Zera tetrastigma erisichthon* (Plötz, 1884)

PYRRHOPYGINAE
*Elbella adonis* (E. Bell, 1931)
*Elbella hegesippe* (Mabille & Boullet, 1908)
*Elbella mariae* (Bell, 1931)
*Granila paseas* (Hewitson, 1857)
*Olafia roscius* (Hopffer, 1874)
*Pseudocroniades machaon* (Westwood, 1852)
*Pyrrhopyge charybdis* Westwood, 1852
*Sarbia antias* (Felder & Felder, 1859)
*Sarbia curitiba* Mielke & Casagrande, 2002
*Sarbia damippe* Mabille & Boullet, 1908
*Sarbia pertyi* (Plötz, 1879)
*Sarbia xanthippe spixii* (Plötz, 1879)

LYCAENIDAE
POLYOMMATINAE
*Hemiargus hanno* (Stoll, 1790)
*Leptotes cassius* (Cramer, 1775)

THECLINAE
*Allosmaitia strophius* (Godart, [1824])
*Arawacus binangula* (Schaus, 1902)
*Arawacus ellida* (Hewitson, 1867)*
*Arawacus meliboeus* (Fabricius, 1793)
*Arawacus tadita* (Hewitson, 1877)
*Arcas ducalis* (Westwood, 1852)
*Arzecla nubilum* (Druce, 1907)
*Arzecla taminella* (Schaus, 1902)
*Atlides cosa* (Hewitson, 1867)
*Aubergina vanessoides* (Prittwitz, 1865)
*Badecla badaca* (Hewitson, 1868)
*Brangas silumena* (Hewitson, 1867)
*Calycopis caulonia* (Hewitson, 1877)
*Celmia uzza* (Hewitson, 1873)*
*Chalybs chloris* (Hewitson, 1877)
*Chlorostrymon simaethis* (Drury, 1773)
*Contrafacia catharina* (Draudt, 1920)
*Contrafacia imma* (Prittwitz, 1865)
*Contrafacia muattina* (Schaus, 1902)
*Cyanophrys acaste* (Prittwitz, 1865)
*Cyanophrys amyntor* (Cramer, 1775)*
*Cyanophrys bertha* (Jones, 1912)
*Cyanophrys herodotus* (Fabricius, 1793)
*Cyanophrys remus* (Hewitson, 1868)
*Dicya dicaea* (Hewitson, 1874)*
*Electrostrymon endymion* (Fabricius, 1775)
*Erora* sp. 1
*Erora* sp. 2
*Kolana ergina* (Hewitson, 1867)*
*Kolana ligurina* (Hewitson, 1874)*
*Laothus phydela* (Hewitson, 1867)
*Magnastigma hirsuta* (Prittwitz, 1865)
*Michaelus jebus* (Godart, 1822)
*Michaelus thordesa* (Hewitson, 1867)
*Ministrymon azia* (Hewitson, 1873)
*Mithras catrea* (Hewitson, 1874)
*Nesiostrymon calchinia* (Hewitson, 1868)
*Nicolaea cupa* (Druce, 1907)*
*Nicolaea torris* (Druce, 1907)
*Nicolaea xorema* (Schaus, 1902)
*Ocaria ocrisia* (Hewitson, 1868)*
*Ocaria thales* (Fabricius, 1793)*
*Olynthus fancia* (Jones, 1912)
*Ostrinotes sophocles* (Fabricius, 1793)*
*Panthiades hebraeus* (Hewitson, 1867)
*Parrhasius orgia* (Hewitson, 1867)
*Parrhasius polibetes* (Stoll, 1781)
*Parrhasius selika* (Hewitson, 1874)
*Rekoa malina* (Hewitson, 1867)
*Strephonota elika* (Hewitson, 1867)
*Strymon bazochii* (Godart, [1824])
*Strymon bubastus* (Stoll, 1780)
*Strymon cardus* (Hewitson, 1874)*
*Strymon cestri* (Reakirt, [1867])
*Strymon crambusa* (Hewitson, 1874)
*Strymon eurytulus* (Hübner, [1819])
*Strymon megarus* (Godart, [1824])*
*Strymon mulucha* (Hewitson, 1867)
*Strymon oreala* (Hewitson, 1868)
*Strymon ziba* (Hewitson, 1868)
*Thereus ortalus* (Godman & Salvin, 1887)
*Theritas chaluma* (Schaus, 1902)
*Theritas deniva* (Hewitson, 1874)
*Theritas triquetra* (Hewitson, 1865)
*Tmolus echion* (Draudt, 1920)
*Ziegleria hesperitis* (Butler & Druce, 1872)*

NYMPHALIDAE
APATURINAE
*Doxocopa laurentia* (Godart, [1824])

*Doxocopa kallina* (Staudinger, 1886)
*Doxocopa zunilda* (Godart, [1824])

BIBLIDINAE
*Biblis hyperia nectanabis* (Fruhstorfer, 1909)
*Callicore pygas eucale* (Fruhstorfer, 1916)
*Catonephele numilia penthia* (Hewitson, 1852)
*Catonephele sabrina* (Hewitson, 1852)
*Cybdelis phaesyla* (Hübner, [1831])
*Diaethria candrena* (Godart, [1824])
*Diaethria eluina* (Hewitson, [1855])
*Diaethria meridionalis* (Bates, 1864)
*Dynamine agacles* (Dalman, 1823)
*Dynamine athemon athemaena* (Hübner, [1824])
*Dynamine myrrhina* (Doubleday, 1849)
*Dynamine postverta* (Cramer, 1779)
*Dynamine tithia* (Hübner, [1823])
*Ectima thecla* (Fabricius, 1796)
*Epiphile huebneri* Hewitson, 1861
*Epiphile orea* (Hübner, [1823])
*Eunica eburnea* Fruhstorfer, 1907
*Haematera pyrame* (Hübner, [1849])
*Hamadryas amphinome* (Linnaeus, 1767)
*Hamadryas epinome* (Felder & Felder, 1867)
*Hamadryas februa* (Hübner, [1823])
*Hamadryas feronia* (Linnaeus,1758)
*Hamadryas fornax* (Hübner, [1823])
*Hamadryas iphthime* (Bates, 1864)
*Marpesia chiron marius* (Cramer, 1779)*
*Marpesia petreus* (Cramer, 1776)
*Myscelia orsis* (Drury, 1772)
*Temenis laothoe meridionalis* Ebert, 1965

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*Blepolenis bassus* (Felder & Felder, 1867)
*Blepolenis batea* (Hübner, [1821])
*Brassolis astyra* Godart, [1824]
*Caligo martia* (Godart, [1824])
*Catoblepia amphirhoe* (Hübner, [1825])
*Dasyophthalma creusa* (Hübner, [1821])*
*Dynastor napoleon* Doubleday, [1849]
*Eryphanis reevesii* (Doubleday, [1849])
*Narope cyllene* Felder & Felder 1859
*Opoptera fruhstorferi* (Röber, 1896)
*Opoptera sulcius* (Staudinger, 1887)
*Opsiphanes invirae amplificatus* Stichel, 1904
*Penetes pamphanis* Doubleday, [1849]

CHARAXINAE
*Archaeoprepona amphimachus pseudomeander* (Fruhstorfer, 1906)
*Archaeoprepona chalciope* (Hübner, [1823])
*Archaeoprepona demophon thalpius* (Hübner, [1814])
*Consul fabius drurii* (Butler, 1874)
*Memphis hirta* (Weymer, 1907)
*Memphis moruus stheno* (Prittwitz, 1865)
*Prepona proschion* Fruhstorfer, 1904
*Zaretis strigosus* (Gmelin, [1790])

DANAINAE
*Danaus eresimus plexaure* (Godart, 1819)
*Danaus erippus* (Cramer, 1775)
*Danaus gilippus* (Cramer, 1775)
*Lycorea ilione* (Cramer, 1775)

HELICONIINAE
*Actinote alalia* (Felder & Felder, 1860)
*Actinote carycina* Jordan, 1913
*Actinote dalmeidai* Francini, 1996
*Actinote discrepans* D'Almeida, 1958
*Actinote genitrix* D'Almeida, 1922
*Actinote mamita* (Schaus, 1902)
*Actinote melanisans* Oberthür, 1917
*Actinote parapheles* Jordan, 1913
*Actinote pellenea* Hübner, [1821]
*Actinote pyrrha* (Fabricius, 1775)
*Actinote rhodope* D'Almeida, 1923
*Actinote surima* (Schaus, 1902)
*Agraulis vanillae maculosa* (Stichel, [1908])
*Dione juno* (Cramer, 1779)
*Dryadula phaetusa* (Linnaeus, 1758)
*Dryas iulia alcionea* (Cramer, 1779)
*Eueides aliphera* (Godart, 1819)
*Eueides isabella dianasa* (Hübner, [1806])
*Eueides pavana* Ménétriés, 1857
*Euptoieta claudia hortensia* (Blanchard, 1852)
*Euptoieta hegesia meridiania* Stichel, 1938*
*Heliconius besckei* Ménétriés, 1857
*Heliconius erato phyllis* (Fabricius, 1775)
*Heliconius ethilla narcaea* Godart, 1819
*Heliconius sara apseudes* (Hübner, [1813])
*Philaethria wernickei* (Röber, 1906)

ITHOMIINAE
*Aeria olena* Weymer, 1875*
*Dircenna dero* (Hübner, 1823)
*Episcada carcinia* Schaus, 1902
*Episcada clausina striposis* Haensch, 1909
*Episcada hymenaea* (Prittwitz, 1865)
*Episcada philoclea* (Hewitson, [1855])
*Epityches eupompe* (Geyer, 1832)
*Heterosais edessa* (Hewitson, [1855])
*Hyalenna pascua* (Schaus, 1902)
*Hypothyris euclea laphria* (E. Doubleday, 1847)*
*Hypothyris ninonia daeta* (Boisduval, 1836)*
*Ithomia agnosia zikani* D'Almeida, 1940
*Ithomia drymo* Hübner, 1816
*Mcclungia cymo salonina* (Hewitson, 1855)*
*Mechanitis lysimnia* (Fabricius, 1793)
*Melinaea ludovica paraiya* Reakirt, 1866

*Methona themisto* (Hübner, 1818)
*Oleria aquata* (Weymer, 1875)
*Placidina euryanassa* (Felder & Felder, 1865)
*Pseudoscada erruca* (Hewitson, 1855)
*Pteronymia sylvo* (Geyer, 1832)
*Thyridia psidii cetoides* (Rosenberg & Talbot, 1914)

LIBYTHEINAE
*Libytheana carinenta* (Cramer, 1777)

LIMENITIDINAE
*Adelpha abia* (Hewitson, 1850)
*Adelpha calliphane* Fruhstorfer, 1915
*Adelpha falcipennis* Fruhstorfer, 1915
*Adelpha gavina* Fruhstorfer, 1915
*Adelpha hyas* (Doyère, [1840])
*Adelpha mythra* (Godart, [1824])
*Adelpha poltius* Hall, 1938*
*Adelpha serpa* (Boisduval, 1836)
*Adelpha syma* (Godart, [1824])
*Adelpha thessalia indefecta* Fruhstorfer, 1913
*Adelpha zea* (Hewitson, 1850)

MORPHINAE
*Cytheritis aega* (Hübner, [1822])
*Cytheritis portis* (Hübner, [1821])
*Iphixibia anaxibia* (Esper, [1801])
*Pessonia epistrophus catenaria* (Perry, 1811)

NYMPHALINAE
*Anartia amathea roeselia* (Eschscholtz, 1821)
*Anartia jatrophae* (Linnaeus, 1763)
*Chlosyne lacinia saundersi* (Doubleday, [1847])
*Eresia lansdorfi* (Godart, 1819)
*Hypanartia bella* (Fabricius, 1793)
*Hypanartia lethe* (Fabricius, 1793)
*Junonia evarete* (Cramer, 1779)
*Ortilia ithra* (Kirby, 1990)
*Ortilia orthia* (Hewitson, 1864)
*Ortilia velica* (Hewitson, 1864)
*Siproeta epaphus trayja* Hübner, [1823]
*Tegosa claudina* (Eschscholtz, 1821)
*Tegosa orobia* (Hewitson, 1864)
*Telenassa teletusa* (Godart, [1824])
*Vanessa braziliensis* (Moore, 1883)
*Vanessa carye* (Hübner, [1812])
*Vanessa myrinna* (Doubleday, 1849)

SATYRINAE
*Capronnieria galesus* (Godart, [1824])
*Carminda griseldis* (Weymer, 1911)
*Carminda paeon* (Godart, [1824])
*Erichthodes narapa* (Schaus, 1902)
*Eteona tisiphone* (Boisduval, 1836)
*Euptychoides castrensis* (Schaus, 1902)
*Forsterinaria necys* (Godart, [1824])
*Forsterinaria quantius* (Godart, [1824])
*Godartiana muscosa* (Butler, 1870)
*Hermeuptychia hermes* (Fabricius, 1775)
*Moneuptychia soter* (Butler, 1877)
*Pampasatyrus glaucope* (Felder & Felder, 1867)
*Paryphthimoides eous* (Butler, 1867)*
*Paryphthimoides grimon* (Godart, [1824])*
*Paryphthimoides numeria* (C. Felder & R. Felder, 1867)
*Paryphthimoides phronius* (Godart, [1824])
*Praepedaliodes phanias* (Hewitson, 1862)
*Stegosatyrus ocelloides* (Schaus, 1902)
*Stegosatyrus periphas* (Godart, [1824])
*Taydebis peculiaris* (Butler, 1874)
*Taygetis ypthima* Hübner, [1821]
*Yphthimoides ochracea* (Butler, 1867)
*Yphthimoides ordinaria* Freitas, Kaminski & Mielke 2012*

PAPILIONIDAE
PAPILIONINAE
*Battus polydamas* (Linnaeus, 1758)
*Battus polystictus* (Butler, 1874)
*Heraclides anchisiades capys* (Hübner, [1809])
*Heraclides astyalus* (Godart, 1819)
*Heraclides hectorides* (Esper, 1794)
*Heraclides thoas brasiliensis* (Rothschild & Jordan, 1906)
*Mimoides lysithous* (Hübner, [1821])
*Parides agavus* (Drury, 1793)
*Parides anchises nephalion* (Godart, 1819)
*Parides bunichus* (Hübner, [1821])
*Protesilaus helios* (Rothschild & Jordan, 1906)
*Pterourus scamander grayi* (Boisduval, 1836)

PIERIDAE
COLIADINAE
*Anteos clorinde* (Godart, [1824])
*Anteos menippe* (Hübner, 1818])
*Aphrissa statira* (Cramer, 1777)
*Colias lesbia* (Fabricius, 1775)
*Eurema albula* (Cramer, 1775)
*Eurema arbela* Geyer, 1832
*Eurema deva* (Doubleday, 1847)
*Eurema phiale paula* (Röber, 1909)
*Phoebis argante* (Fabricius, 1775)
*Phoebis neocypris* (Hübner, [1823])
*Phoebis philea* (Linnaeus, 1763)
*Phoebis sennae marcellina* (Cramer, 1777)
*Pyrisitia leuce* (Boisduval, 1836)
*Rhabdodryas trite banski* (Breyer, 1939)

DISMORPHIINAE
*Dismorphia amphione astynome* (Dalman, 1823)

*Dismorphia astyocha* Hübner, [1831]
*Dismorphia melia* (Godart, [1824])
*Dismorphia thermesia* (Godart, 1819)
*Enantia clarissa* (Weymer, 1895)
*Enantia limnorina* (Felder & Felder, 1865)
*Pseudopieris nehemia* (Boisduval, 1836)

PIERINAE
*Archoneas brassolis tereas* (Godart, 1819)
*Ascia monuste orseis* (Godart, 1819)
*Catasticta bithys* (Hübner, [1831])
*Glutophrissa drusilla* (Cramer, 1777)
*Hesperocharis erota* (Lucas, 1852)
*Hesperocharis paranensis* Schaus, 1898
*Leptophobia aripa balidia* (Boisduval, 1836)
*Melete lycimnia petronia* Fruhstorfer, 1907
*Pereute swainsoni* (Gray, 1832)
*Tatochila autodice* (Hübner, 1818)
*Theochila maenacte* (Boisduval, 1836)

RIODINIDAE
EUSELASIINAE
*Euselasia eucerus* (Hewitson, 1872)
*Euselasia hygenius occulta* Stichel, 1919
*Euselasia* sp.

RIODININAE
*Adelotypa sejuncta* (Stichel, 1910)
*Aricoris tutana* (Godart, [1824])
*Barbicornis basilis* Godart, [1824]
*Brachyglenis drymo* (Godman & Salvin, 1886)
*Chalodeta theodora* (Felder & Felder, 1862)
*Charis cadytis* Hewitson, 1866
*Chorinea licursis* (Fabricius, 1775)
*Crocozona croceifasciata* Zikán, 1952
*Dachetola azora* (Godart, [1824])*
*Emesis diogenia* Prittwitz, 1865
*Emesis fatimella* Westwood, 1851
*Emesis mandana* (Cramer, 1780)
*Emesis neemias* Hewitson, 1872
*Emesis ocypore zelotes* Hewitson, 1872
*Emesis russula* Stichel, 1910
*Emesis satema* (Schaus, 1902)
*Eurybia misellivestris* Stichel, 1910
*Eurybia pergaea* (Geyer, 1832)
*Ithomiola nepos* (Fabricius, 1793)
*Lasaia agesilas* (Latreille, [1809])*
*Lasaia incoides* (Schaus, 1902)
*Lemonias ochracea* (Mengel, 1902)
*Melanis smithiae* (Westwood, 1851)
*Mesosemia acuta* Hewitson, 1873*
*Mesosemia friburgensis* Schaus, 1902
*Mesosemia odice* (Godart, [1824])
*Mesosemia rhodia* (Godart, [1824])*
*Monethe alphonsus* (Fabricius, 1793)
*Panara soana* Hewitson, 1875
*Pheles atricolor* (Butler, 1871)
*Pirascca sagaris phrygiana* (Stichel, 1916)
*Rhetus periander eleusinus* Stichel, 1910
*Riodina lycisca* (Hewitson, [1853])
*Stichelia bocchoris* (Hewitson, 1886)
*Stichelia dukenfieldia* (Schaus, 1902)
*Symmachia arion* (Felder & Felder, 1865)
*Synargis paulistina* (Stichel, 1910)
*Synargis phliasus* (Clerck, 1764)
*Synargis regulus* (Fabricius, 1793)
*Syrmatia nyx* (Hübner, 1817)
*Theope thestias* Hewitson, 1860
*Voltinia cebrenia* (Hewitson, [1873])

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# Giant butterfly moths of the Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá, Colombia (Lepidoptera: Castniidae)

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**Abstract**

The Institute of Natural Sciences of Colombia's National University, Bogotá is a repository of objects and organisms that are part of the general and natural history of this megadiverse South American country. During a recent curation of moths deposited in the entomology collection of the museum we came across a small group of giant butterfly-moths (Castniidae). These included eleven taxa in three genera, according to a recent taxonomy of this Neotropical family. Most specimens have detailed collecting information, and with some exceptions, they are in good shape and have been well maintained. We provide herein some historical background about the museum as well as general comments on the Castniid taxa under the museum's care.
KEY WORDS: Lepidoptera, Castniidae, biodiversity, faunistics, Neotropical, Colombia.

**Cástnidos del Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá, Colombia (Lepidoptera: Castniidae)**

**Resumen**

El Instituto de Ciencias Naturales de la Universidad Nacional de Colombia, Bogotá, es un importante depósito de objetos y organismos que forman parte de la historia general y natural de este diverso y gran país Sudamericano. Durante la reciente conservación de polillas depositadas en la colección entomológica del museo, encontramos un pequeño grupo de polillas de taladradores gigantes (Castniidae). Estos incluyen once taxones pertenecientes a tres géneros, de acuerdo a estudios recientes sobre la taxonomía de esta familia Neotropical. La mayoría de los ejemplares presentan información detallada de captura y, salvo algunas excepciones, están en muy buen estado de conservación. En este trabajo presentamos algunos de los fondos históricos y comentarios generales sobre los taxones de Castniidae conservados en este museo.
PALABRAS CLAVE: Lepidoptera, Castniidae, biodiversidad, faunística, Neotropical, Colombia.

## Introduction

The Institute of Natural Sciences (Instituto de Ciencias Naturales, ICN) of the National University of Colombia is the main research center dealing with Flora and Fauna, as well as conservation of natural resources in Colombia. The institution trained researchers who has been generating knowledge about the country's biodiversity and it holds some of the most important scientific collections in Latin-America.

The ICN's collections hold objects, artifacts and specimens; some are up to 16,000 years old and

many are relevant in understanding Colombia's biodiversity and human-environment relationships. Based on their collections, the ICN plans and designs new exploration, as well as research, and allows interaction with investigators worldwide in order to generate publications, scientific and otherwise.

In 1826, General Francisco de Paula Santander (1792-1840), vice-president of Great Colombia (which included what is now Colombia, Ecuador and Venezuela), created the National Academy of Colombia with the aim of developing the country's arts and sciences and collaborating with other institutions (DÍAZ-PIEDRAHITA & VÉLEZ, 1991). By the mid-19th century, after a Central University reform, the Institute of Natural, Physical and Mathematical Sciences was created to include the astronomy observatory, the national chemistry laboratory and the Museum of Natural History of Bogota (ANDRADE-C., 1996).

By 1904, Brother Apolinar María (1867-1949) had arrived in Colombia, becoming one of the most influential naturalists in the country (GONZÁLEZ *et al*., 2013c; SALAZAR, 1999b). Even though the collection he built was lost in the April 1948 fire of Bogotá, his work had already stimulated the study of Lepidoptera and other insect groups in the country during the first half of the 20th century (ANDRADE-C., 1996; GONZÁLEZ *et al*., 2013c).

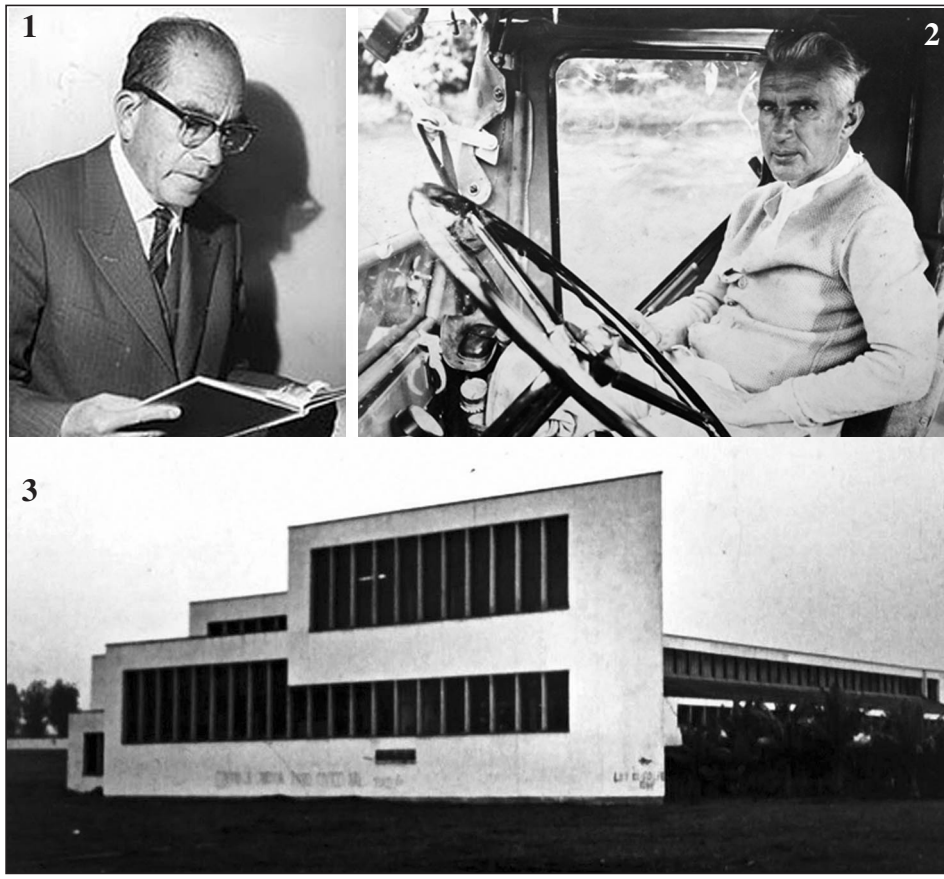
In 1928, Luis María Murillo Quinche (1896-1974) (Fig. 1), one of the pioneers of the study of Colombian insects, was hired as an entomologist by the National Department of Agriculture (ANDRADE-C., 1996). Together with the phytopathologist Ramón Mejía Franco he created a crop health unit which was to become an important department (and later a complex institution) within the National University, formed by both the Institute of Biology of the Economy Ministry and the Institute of Natural Sciences (MURILLO, 1957). These eventually became one single unit thanks to the decisive input of Father Enrique Pérez Arbeláez (1896-1972), the "father of Colombian ecology", and by 1936 the Department of Botany was created, to be later transformed into the Institute of Natural Sciences (ICN) (ANDRADE-C., 1996). The Institute, its collections and personnel were then removed from the building that was holding them which was destined to hold a new college. By 1938, the Natural History Museum was assigned to the ICN, which by 1939 had changed its name to the Botanical Institute. When the German entomologist Leopoldo Richter (1896-1984) (Fig. 2) arrived in Colombia in 1935 after working in Venezuela and Brazil, he immediately became involved with what was to eventually become the entomology section of the ICN in 1939 (RESTREPO-MEJIA, 1985; SALAZAR, 1999b). Richter would become a well-recognized expert in Membracidae (Hemiptera) but also worked with other insect groups (SALAZAR, 1999b). By 1940, the Institute of Natural Sciences (Fig. 3) was re-organized to contain three sections: botany, ornithology and entomology (ANDRADE-C., 1996).

Today, the ICN holds an arthropod collection of over 150,000 insects and some 20,000 arachnids. It is one of the most important museums in the country, not only for the large number of specimens, but also for the wider geographic representation and its historical and scientific value. Among the many lepidopterans contained in this museum, we found a small but interesting collection of giant butterfly moths (Castniidae) collected at several Colombian locations.

Castniidae is a mainly diurnal or crepuscular group of Neotropical moths, containing 88 species (MORAES & DUARTE, 2014). As far as we know 25 species and at least 45 taxa have been reported from Colombia (APOLINAR, 1915, 1945; CONSTANTINO, 1998; GONZÁLEZ *et al*., 2013c; GONZÁLEZ & SALAZAR 2003; HERNÁNDEZ-BAZ *et al*., 2012; LAMAS, 1995; MILLER, 1986, 1995; SALAZAR, 1999a; SALAZAR *et al*., 2013a, 2013b).

The aim of this note is to present the Colombian Castniidae currently under the custody of the ICN. Even though the number of specimens of these moths contained in the ICN is quite small, it is certainly interesting that most have detailed data, thus adding value to their historical importance. In naming the species, we generally follow MILLER (1995) and LAMAS (1995), and for genera we mostly follow MORAES & DUARTE (2014). We have listed the genera phylogenetically after MILLER (1995) and LAMAS (1995), but the species are arranged alphabetically. The name of every species is followed by the information on the labels of the studied specimens. We also include some natural history comments or historical background on the species or some of the specimens

examined. All data found on the labels is presented maintaining the collectors'/curators' writing style. The data is complemented by information added by the authors, which is included within square brackets.




**Figs. 1-3.– 1.** Luis María Murillo Quinche (1896-1974), known as Colombia's "initiator of Entomology." He created the Crop Health Unit, a precursor of the Institute of Natural Sciences of Colombia's (ICN) National University in Bogotá, Colombia. **2.** Leopoldo Richter (1896-1984), artist and entomologist, he worked at the Institute of Natural Sciences, Bogota, from 1939 on, becoming an expert in Membracidae (Hemiptera) and a respected figure in Colombian entomology. **3.** Façade of the Institute of Natural Sciences of Colombia's National University, Bogotá, Colombia, in 1936. (Photos provided by M. Gonzalo Andrade-C.).

**Annotated list of species and label information of the examined specimens**

CASTNIINAE
CASTNIINI

*Amauta cacica angusta* (H. Druce, 1907) (Fig. 4)

Material examined: 1 ♂, Dep[artamen]to de Risaralda, M[unici]pio de Pueblo Rico, Vereda La

Marquina, Alrededores Río Negro, 1770 m.s.n.m. 4-III-[19]92. JAA 1096, ICN-MHN-L 10210, ICN 053808.

Comments: This subspecies was originally described (as *Castnia angusta*) from Ecuador (DRUCE, 1907; LAMAS, 1995; MILLER, 1995), but it has been also reported from Colombia (GONZÁLEZ & SALAZAR, 2003). Information about the biology of the species and its subspecies is scarce, but we at least know that their larvae bore the rhizomes of *Heliconia* (Heliconiaceae) and *Musa* (Musaceae) in neighboring Ecuador causing some economic harm (SUÁREZ-CAPELLO *et al*., 2002; MILLER & SOURAKOV, 2009; GONZÁLEZ *et al*., 2013a).

*Telchin atymnius* (Dalman, 1824)

Material examined: 1 ♂, Tolima, 1800 m, VIII-1946, L. Ritcher; 1 ♂, Risaralde, Mpio. Pueblo rico, Corregimiento Santa Cecília, camino Sta. Cecilia-Pital, 550 m, 21-IX-1991, [col.?]; 1 ♂, Risaralda, Mistrató, Puerto de oro, 30-VI-1992, 1100 m., Col. Gonzalo Andrade-C.; 1 ♂, Valle [del Cauca], Buenaventura, Río Yurumangui Guandal, 28-I-1998, col. F. Riascos; 1 ♂, Santander, Bucaramanga, VII-1969, Col. O Torres; 1 ♀, Nariño, Barbacoas, Altaquer, W. Rio Guiza, 870 m, 1-III-1995, Col. Gonzalo Andrade-C.; 1 ♀, Choco, IV-1998, [Col.?]; 1 ♀, La Esperanza, Cundinamarca, 6-VII-1965, [Col.?].

Comments: This subspecies is found from Colombia to southeastern Brazil along the Orinoco and Amazon River Basins (GONZÁLEZ & SALAZAR, 2003; GONZÁLEZ *et al*., 2010, 2013b) and as with other conspecific subspecies it is known as a pest of *Heliconia* spp. (Heliconiaceae) and most especially of bananas (*Musa* spp.: Musaceae) (GALLEGO, 1946, 1955, 1963; GONZÁLEZ & STÜNING, 2007). The species has been also reported attacking sugarcane (*Saccharum officinarum* L., Poaceae) but this is doubtful (GONZÁLEZ & STÜNING, 2007). Even though *Telchin atymnius* and *T. licus* are clearly two different species (MORAES & DUARTE, 2009) they have been frequently confused. The latter is certainly a known pest of sugarcane (GONZÁLEZ & FERNÁNDEZ-YÉPEZ, 1993; SILVA-BRANDÃO *et al*., 2013) and the species are sympatric in several regions of Central and South America (GONZÁLEZ & COCK, 2004; GONZÁLEZ & STÜNING, 2007). Since *T. atymnius* is somewhat similar to *T. licus*, some authors have misidentified specimens helping to create and spread this error (GONZÁLEZ & COCK, 2004; GONZÁLEZ & STÜNING, 2007).

*Telchin atymnius newmanni* (Houlbert, 1917) (Fig. 5)

Material examined: 1 ♀, Boyacá, Muzo, II-1952, 800 m, *Castnia athymus* [sic], Col. L. Ritcher; 1 ♀, Bucaramanga, Santander, VIII-1951, Col. R. Richter; 1 ♀, Muzo, Boyaca, 5-IV-2006, Col. W. Hass.

Comments: This subspecies was originally described from Panama but can be also found in Colombia, Venezuela and Trinidad where it has been reported as a pest of bananas (*Musa* spp., Musaceae) (GONZÁLEZ & COCK, 2004; GONZÁLEZ & FERNÁNDEZ-YÉPEZ, 1993; GONZÁLEZ *et al*., 2010, 2013b; SANDOVAL *et al*., 2007). Even though it might be confused by some authors with the sympatric and polymorphic *T. licus*, they are easy to separate by the ground color of the wings (dark brown, almost black in most *licus* spp.; brown, with a slight "reddish" hue, in *atymnius newmanni*) and by the clearly defined sub marginal spots in *licus*, which are either lacking or very faint in *atymnius newmanni* (GONZÁLEZ & COCK, 2004; GONZÁLEZ & STÜNING, 2007; MILLER, 1986).

*Telchin diva tricolor* (R. Felder, 1874) (Fig. 6)

Material examined: 2 ♂♂, Muzo, Boyacá, 5-IV-2006, W. Hass. ICN MHN L 30350, ICN 079332.

Comments: The species, perhaps one of the most beautiful Castniidae, is distributed from Mexico right through Central America down to Colombia and Ecuador (GONZÁLEZ *et al*., 2010, 2013a, 2013b; LAMAS, 1995; MILLER, 1995; SALAZAR, 1999a; VINCIGUERRA, 2010). According to LAMAS (1995) four ssp. are known and it seems they are all found in various regions

of Colombia (GONZÁLEZ *et al*., 2010; SALAZAR, 1999a; MILLER, 1995). The specimen at ICN is the spp. *T. diva tricolor*. Even though not much is known about the species and its four sspp., collecting records appear to indicate that they are crepuscular and bivoltine, having flight periods during December-January and July-August (GONZÁLEZ *et al*., 2013a; MILLER, 1986).

*Telchin evalthe* (Fabricius, 1775) (Fig. 10)

Material examined: 1 ♂, Colombia, Meta, Restrepo, Camino Salinas, 800 m, 29-III-1996, ICN MHN L 30352, ICN 079334; 1 ♀, [Colombia], Boyacá, La Carbonera, Santa María, X-2005, [coll.?].

Comments: This species is widely distributed in South America north of the Amazon River, and has been previously reported from Colombia (GONZÁLEZ & SALAZAR, 2003; GONZÁLEZ *et al.*, 2010). Bromeliads (*Bromelia* spp., Bromeliaceae) and Heliconias (*Heliconia* spp.; Heliconiaceae) appear to be their hosts (GONZÁLEZ *et al*., 2010; HOULBERT, 1918; MILLER, 1986; MOSS, 1945).

*Telchin licus* (Drury, 1773) (Fig. 7)

Material examined: 1 ♂, Colombia, Vaupes, camino a Mina la Libertad, rastrojo en parte más baja de la mina, camino a Marulanda, 290 m, 11-VIII-1993, col. G. Fagua; 1 ♂, Putumayo, Municipio, Puerto Leguizamo, Río Caucayá, IX-1944, Col. L. Ritcher; 1 ♀, Colombia, Cundinamarca, Camino de herradura a la Mesa negra, 450-600 m, 9-VIII-1980, Col. C. Bohorquez & L. Cruz; 1 ♀, Colombia, Vaupés, camino a la mina la Libertad, 2 PM, 290 m, 27-VIII-1993, Col. F. Fagua.

Comments: This is a highly variable but certainly one of the most common species of Castniidae found in collections worldwide mainly because of its status as a pest of Sugarcane (*Saccharum officinarum* L., Poaceae) (GONZÁLEZ & COCK, 2004; GONZÁLEZ & FERNÁNDEZ-YÉPEZ, 1993; GONZÁLEZ & STÜNING, 2007; GONZÁLEZ *et al*., 2010; MILLER, 1986; MORAES & DUARTE, 2009; SANDOVAL *et al*., 2007). However, it is also known to attack Bananas (*Musa* spp., Musaceae) and Heliconias (*Heliconia* spp.; Heliconiaceae) (GONZÁLEZ & COCK, 2004; GONZÁLEZ & FERNÁNDEZ-YÉPEZ, 1993; GONZÁLEZ & STÜNING, 2007; GONZÁLEZ *et al*., 2010, 2013a, 2013b; MORAES & DUARTE, 2009; SALAZAR, 1999a; SALAZAR *et al*., 2013a; SILVA-BRANDÃO *et al*., 2013). Several "morphs" exist of *T. licus* creating a complex of more than a few cryptic entities requiring more morphological studies to determine the taxonomy of the group (GONZÁLEZ & COCK, 2004; GONZÁLEZ & STÜNING, 2007; SILVA-BRANDÃO *et al*., 2013). SILVA-BRANDÃO *et al*., (2013) have made a first attempt to molecularly distinguish some of the Brazilian subspecies of *licus*; a similar study is certainly needed for the supposed taxa of this species not only in Colombia, but in other regions of Central and South America.

*Telchin licus magdalena* (Joicey & Talbot, 1925)

Material examined: 1 ♂, Meta, Acacias, IX-1995, 940 m; 1 ♂, Meta, Acacias, IX-1995, 1100 m; 1 ♂, Meta, Acacias, X-1995, 940 m; Colombia, 13 km West of Villavicencio, [Meta], 18-I-1999, Col. G. Nielsen; 1 ♂, Meta, Villavicencio, Camous: Instituto Roberto Franco, 20-IX-1977, Col. O. V. Castaño; 1 ♂, Caquetá, Araracuara, VIII-1951, Col. R. Ritcher.

Comments: This subspecies was originally described by JOICEY & TALBOT (1925) based on a large series (males and females) collected in Villavicencio and Muzo, Colombia. The subspecies seems to be a very well-defined one and it has a wide distribution in the country, however not much is known about its biology, except that like the nominal species it attacks sugarcane (GONZÁLEZ & SALAZAR, 2003; GONZÁLEZ *et al*., 2013a).

## CASTNIINAE
## GAZERINI

*Prometheus ecuadoria truxilla* (Westwood, 1877)

Material examined: 1 ♂, Colombia: Boyacá: Santa María, camino la Almenara, 12-X-2005, 800 m., coll. G. Andrade-C.

Comments: Originally described as *Castnia truxilla*, this is a common ssp. found in the mid-Magdalena region together with other similar taxa (MILLER, 1986; SALAZAR, 1999a; WESTWOOD, 1877). This ssp. is just one of several taxa in a group with large variation in wing patterns and a paucity of specimens for study, further complicating the taxonomy of the group (MILLER, 1986).

*Prometheus polymorpha* (Miller, 2008) (Fig. 9)

Material examined: 1 ♂, Santander, Girón, Finca La Hondureña, 06 42' 20.6" N - 73 06' 34.2" W, 645 m.s.n.m., 25-IX-2007, Col: G. Torres, ICN MHN L 30348, ICN 079330

Comments: This is a beautiful species which is not only multivoltine but highly polymorphic, it seems to be part of a mimetic ring that includes species in the genera *Heliconius* (Nymphalidae), *Lycorea* (Danaidae), *Dysschema* and *Pericopis* (Erebidae) (MILLER, 2008). MILLER (2008) lists a large type series with several phenotypes. A melanic specimen collected in the mid-Magdalena region in the eastern cordillera has been also seen by the authors.

*Prometheus simulans* (Boisduval, [1875]) (Fig. 8)

Material examined: 1 ♂, Alto Río Opon, Santander, 800 m, I-[19]49, [Col.?], ICN MHN L 29418, ICN 053795; 1 ♂,. Colombia. Amazonas. Resguardo Indígena Nocuya de Villa Azul. Comunidad de Peña Roja. Medio Río Caquetá. 150 m. Jameo. 9 am soleado. 19-VIII-1999. Col. R. Gómez & F. Moreno.

Comments: Described (as *Gazera simulans*) by BOISDUVAL (1875) from a female collected in Colombia. The species is also distributed in neighboring Venezuela (GONZÁLEZ, 1997). This is a highly variable species and several subspecies have been reported in the country (GONZÁLEZ, 1997; SALAZAR, 1999a; SALAZAR *et al*., 2013b). They all resemble butterflies in the genus *Melinaea* Hübner (Nymphalidae) which are also phenotypically variable (HERNÁNDEZ-BAZ *et al*., 2012).

*Prometheus zagraea* (R. Felder, 1874)

Material examined: 1 ♂, Río Sanza, III-[19]56, L. Richter.

Comments: This is another species common in the mid-Magdalena region but also present in other areas of Colombia, as well as Panama and Costa Rica (GONZÁLEZ *et al*., 2010; SALAZAR *et al*., 2013b; VÉLEZ & SALAZAR, 1991). However, not much is known about the species, although an association with *Aechmea magdalenae* (André) André ex Baker (Bromeliaceae) has been suggested and it is possibly a member of a mimetic ring that might include several *Heliconius* spp. (Nymphalidae), as well as *Lycorea halia* (Hübner, [1816]) (Danainae), as models (GONZÁLEZ *et al*., 2010; MILLER, 1986).

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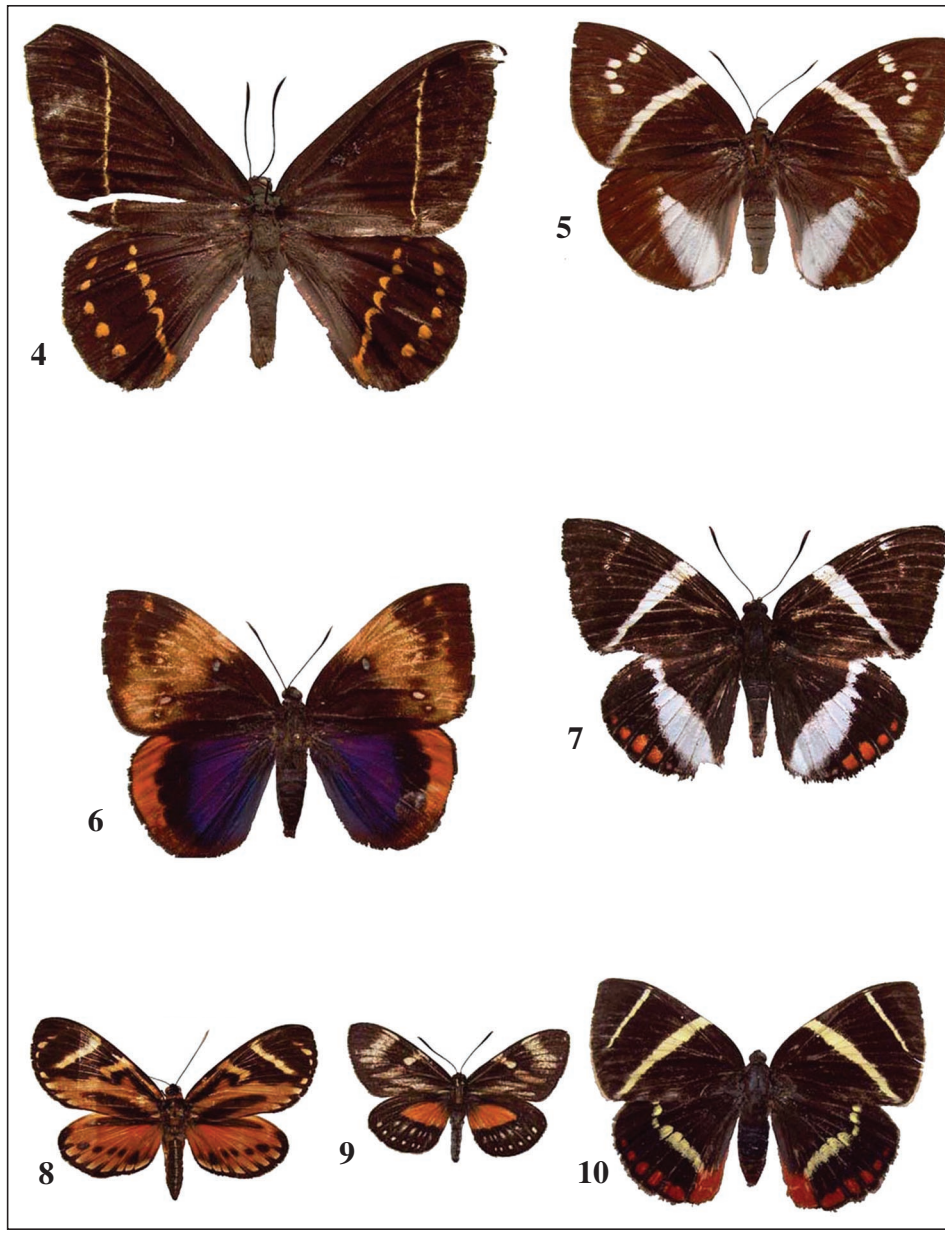


**Figures 4-10:** Selected Colombian Castniidae from the insect collection at the Institute of Natural Sciences of Colombia's National University, Bogotá, Colombia. **4.** *Amauta cacica angusta*, nr. Río Negro, Risaralda; **5.** *Telchin atymnius newmanni*, Boyacá, Muzo; **6.** *Telchin diva tricolor*, Boyacá, Muzo; **7.** *Telchin licus*, nr. La Libertad, Vaupés; **8.** *Prometheus simulans*, Río Opon, Santander; **9.** *Prometheus polymorpha*, Girón, Santander; **10.** *Telchin evalthe*, Restrepo, Meta. (Photos: F. Hernández-Baz).

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# Embryonic death as a probable reason for the collapse of population densities in *Lymantria dispar* (Linnaeus, 1758) (Lepidoptera: Erebidae, Lymantriinae)

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**Abstract**

For the first time the causes of mass death of embryos in a population of *Lymantria dispar* (Linnaeus, 1758) with biochemical and molecular methods are investigated. In this study egg masses were collected in the territory of Russia from two populations, with low (the West Siberian population) and high (Trans-Ural) density and analyzed. Spring hatching of larvae from the eggs stored under constant laboratory conditions at 2º C was two times lower for insects of the Trans-Ural (TU) population compared to the West Siberian (WS) population (43 ± 6 % and 86 ± 7 % accordingly). The level of virus defined by PCR for TU and WS populations was 76±9 % and 36±6%, respectively. The major components of eggs were the same between populations. However, we found decreased concentrations of proteins important for embryogenesis in TU population, such as an arilforin-like molecule and no vitellin 2-like component. Field data were comparable to those of the laboratory, and in TU populations there was a decrease of density. The obtained results suggest that alteration in hormonal balance of the infected with nucleopolyhedrovirus (NPV) insects may lead to a decrease or absence of some key proteins of embryogenesis in eggs. It can influence hatching of larvae from eggs and, accordingly, population dynamics of the lepidopteran.
KEY WORDS: Lepidoptera, Erebidae, Lymantriinae, *Lymantria dispar*, population dynamics, embryonic death, nucleopolyhedrovirus.

**Muerte embrionaria como probable razón para el colapso de la densidad de población en *Lymantria dispar* (Linnaeus, 1758) (Lepidoptera: Erebidae, Lymantriinae)**

**Resumen**

Se investiga por primera vez con métodos bioquímicos y moleculares, las causas de la muerte masiva de embriones en una población de *Lymantria dispar* (Linnaeus1758). En este estudio se recogieron y analizaron masas de huevos de dos poblaciones en el territorio de Rusia: con baja (la población siberiana occidental) y alta densidad (Trans-Ural), respectivamente. La eclosión en primavera de las larvas de los huevos, guardados bajo condiciones contantes del laboratorio a 2º C, fue dos veces menor (la mitad) en las poblaciones de insectos de la Trans-Ural (TU) que en la del oeste siberiano (WS) (43 ± 6 % y 86 ± 7 % respectivamente). El nivel de virus definido por PCR para las poblaciones de TU y WS era de 76 ± 9 % y 36 ± 6 %, respectivamente. La mayoría de los componentes importantes de los huevos eran prácticamente los mismos entre las poblaciones. Sin embargo, encontramos una presencia reducida de proteínas importantes para la embriogénesis en la población de TU, como por ejemplo,una molécula parecida al pro-arilforin y una falta del componente pro-vitelín 2. Los datos de campo fueron comparables a éstos del laboratorio, y en las poblaciones de TU, había un decrecimiento de la densidad.

Los resultados obtenidos indican que la alteración en el balance hormonal de los insectos infectados con nucleopolihedrovirus (NPV) podría llevar a un disminucion o falta de algunas proteínas de la embriogénesis en huevos. Puede influir en el desarrollo de las larvas desde los huevos y, en consecuencia, en la dinámica de población del lepidóptero.
PALABRAS CLAVE: Lepidoptera, Erebidae, Lymantriinae, *Lymantria dispar*, dinámica de poblaciones, muerte embrionaria, nucleopolihedrovirus.

## Introduction

The gypsy moth is one of the most biologically and economically significant defoliator that periodically forms outbreaks in the territories of Eurasia, North America and North Africa (GIESE & SCHNEIDER, 1979; JOHNSON *et al*., 2005). Population dynamics of this insect can influence both abiotic and biotic factors, causing death of insects at various stages, including an egg phase. Insect eggs represent a self-sustaining system which provides the raw materials for building the larval body and the energy reserves for embryogenesis (SANDER *et al*., 1985). The development of the embryo is dependent upon the appropriate physiological and environmental conditions. The most important environmental condition for development of the embryo is favorable temperature and humidity (HAMILTON, 1950).

There are several studies of mass embryonic mortality of gypsy moth in natural populations (KONDAKOV, 1963; ILYINSKY & TROPIN, 1965; KOLTUNOV *et al*., 1998). This research demonstrates which abiotic or biotic factors cause embryonic death. Moreover, there are several observations about the unknown etiology of embryonic death. EGOROV (1958) demonstrated that in 1953 in the Altay territory there were up to 15 egg masses per tree. However, in the spring of 1954 a large portion of the embryos in the eggs were dead. That has led to the collapse of population density. Research of KONDAKOV (1963) in the Krasnoyarsk region in 1954 and 1955 has revealed a mass death of eggs without clear etiology. Laboratory cultivation of gypsy moth larvae from the Trans-Ural population in 1991, where the eggs were kept under 0º C and 60-70 % humidity, hatched in May at a rate of 5-10 % (KOLTUNOV *et al*., 1998). The same hatching rate authors observed in nature. Moreover, there is a study that in the Novosibirsk region decrease of gypsy moth density in 1997-1998 basically has been connected with mass death of embryos for unstated reasons (ILYINYKH, 2002).

It was shown that nucleopolyhedrovirus (NPV) could be one of the main factors of mortality in gypsy moth populations (ELKINTON, 1990; DWYER & ELKINTON, 1995; HOCH *et al*., 2001). Probably, NPV infections can be a factor resulting in the mortality of embryos (straight or indirectly). However, there are cases when the death rate from NPV at an embryo stage has still not been identified in our practice and in the literature. Moreover, nutrition content of the eggs could be one of the main reasons for successful development of embryos. It is known that lipid and carbohydrate reserves decrease as embryogenesis progresses (QUICKENDEN, 1970). Yolk proteins also take part in both energy storage and embryogenesis and they are critically important for development of the embryo (IZUMI *et al*., 1994).

Thus, in the known literature there are at least four studies about high mortality of embryos without clear etiology (EGOROV, 1958; KONDAKOV, 1963; KOLTUNOV *et al*., 1998; ILYINYKH, 2002). Therefore, in the present work the causes of this phenomenon on two populations of gypsy moth with low (WS population) and high (TU population) egg mortality are investigated using both biochemical and molecular methods.

## Material and Methods

### (a) Experimental design

The field and laboratory experiments were conducted during an outbreak of the gypsy moth in birch forests (*Betula pendula* Roth.) of Sverdlovsk (Trans-Ural population, Kamensk district) and

Novosibirsk (West Siberian population, Karasuksky district) regions of Russia in 2011-2012 (see figure 1). The investigations were performed at two stages of the outbreak: density increase in the West Siberian population (WS) and decrease in the Trans-Ural population (TU) (data from the Novosibirsk and Sverdlovsk Centers of Forest Protection).

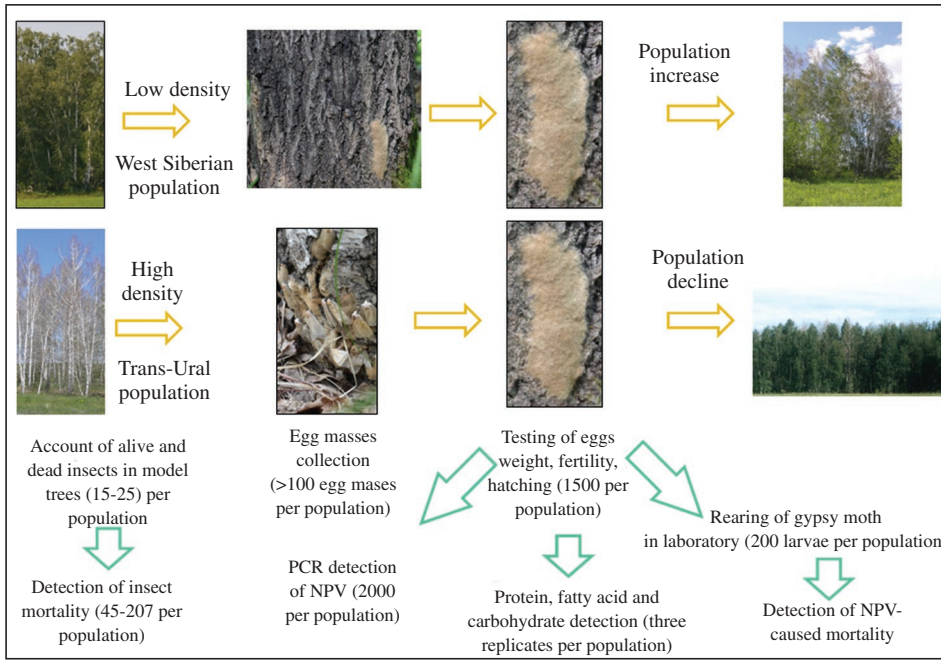


**Figure 1.–** Experimental design scheme (2011-2012).

For detection NPV-caused mortality, the number of studied plots per population varied from five to seven, and each 100 $m^2$ plot contained three to five model trees. The number of alive and dead insects was established at the larva and pupa stages by cutting branches from model trees under study, as described previously (ILYINYKH *et al*., 2004). To count the number of dead insects and to detect NPV in laboratory, three branches were cut per tree (one from low down, one from the middle and one from top of the crown). Cut branches fell on a parachute spread under the crown. The numbers of dead insects were counted on each branch and then this result was multiplied by the total number of branches in a tree (ILYINYKH *et al*., 2004). The cause of insect death (45-207 individuals per population) was determined by light microscopy (see next paragraph).

In 2011, more than 100 egg masses were collected in the third decade of September in both populations in studied plots. Eggs were stored at a temperature of 2º C prior to testing of hatching, fertility, mortality, weight, and virus with PCR. In January 2012 part of the eggs was stored at or below -20º C to test protein, fat, and carbohydrate content. Eggs from both populations were tested on fertility and weight (presented as mass per 100 eggs). Hatching and number of egg masses in field conditions for both populations were provided by the Centers of Forest Protection in 2011-2012. Moreover, the above- mentioned organizations provided data about the dynamics of the total areas of major defoliation (above 60 %) of birch forests caused by the gypsy moth for both populations in 2003-2014.

(b) Detection of nucleopolyhedrovirus

For detection of mortality from entomopathogens, 200 larvae from both populations were cultivated in May until reaching imago under conditions preventing exogenous virus on the artificial medium (AM) using the technique described by ILYINYKH (1997). Dead insects were examined on infection with light microscope (Biolam - R15; LOMO, Russia) using phase contrast.

Twenty cleared eggs from each of the studied egg masses were selected for PCR detection of NPV. Eggs were sterilized within 10 min in 0.25 % NaOH solution on a magnetic mixer, washed with sterile water and dried. Embryos were collected from eggs under sterile conditions (20 individuals per sample). Samples were stored at - 70º C until DNA was extracted.

Total DNA from samples of insects was extracted using the DNA Extraction kit ("MEDIGEN Laboratory", Russia) according to the protocol of the manufacturer. Detection of viral conjugation protein gene Ld130 was carried out in 20 l of buffer contained 10 l of PyroStartTM Fast PCR Master Mix (2X) ("Fermentas", USA); 0.1 l of forward (5' CGGGCATCATCCGCGGCC 3' (127651 - 127668)) and reverse (5 'CGCCCTCCAGCTCCGCGC 3' (127944 - 127927)) primers and 27.5 % of DNA on volume. Specific primers were designed using the full-genomic sequence (GenBank database at number NC_001973) of virus of gypsy moth. PCR carried out on a thermalcycler "DNA Engine Dyad® Peltier Thelmar Cycler" ("BIO-RAD", USA) using the following protocol (denaturation 30s with 94º C, annealing 30s with 68º C, synthesis 30 with 72º C (37 cycles)); synthesis of 7 min. - 72º C. The size of the detected gene fragment was 294 bp.

(c) Analysis

For protein, fatty acid and carbohydrate detection, 100 mg per sample of eggs from both populations were collected and homogenized using the FastPrep MP biomedicals (ICN) homogenizer and freeze dried. For testing of carbohydrate and protein concentrations frozen-dried samples were dissolved in distilled water. For determination of fatty acid concentration, the freeze-dried samples were dissolved in concentrated sulfuric acid.

Detection of fatty acid, carbohydrate and protein concentrations were carried out in triplicate using a spectrophotometer. Fat content was checked according to CHABROL & CHARONNAT (1937) with some modifications. The freeze-dried sample was incubated with 1 ml of sulfuric acid for 20 min at 100º C. The mix was cooled for 5 min and added to 500 l of vanillin (Sigma) and then dissolved in distilled water (13 mM). Optical density of the solution registered at 530 nm in 30 min. Concentration of fatty acids was determined with a calibration curve, using vegetable fatty acid (olive oil, 99 %) standards.

Detection of carbohydrates was carried out according to HANSEN & MOLLER (1975) with some modifications. We mixed 100 l of sample with 500 l of 0.5 % Antron (Sigma) solution in 72 % sulfuric acid and incubated for 11 min at 100º C. Then the mixture was quickly cooled to 0º C on ice. Optical density was detected at 630 nm in 60 min at 22º C. Concentration of carbohydrates were determined with a calibration curve, using starch (99 %, Sigma) standards. The protein concentration of samples was estimated by using the Bradford method (BRADFORD, 1976), using bovine serum albumin standards. Qualitative composition of proteins was detected with capillary electrophoresis (protein kit) (Agilent Bioanalazer).

Data are presented as mean ± the standard error. To check the data for normal distribution, the Wilk Shapiro W criterion was used. All results were assessed using one-way ANOVA, followed by Tukey's post-hoc tests to identify specific differences between means.

## Results

(a) Weight, fertility and mortality of eggs

We found that weight and fertility of eggs from both the WS (population increase) and TU

(population decline) populations did not differ (table 1). Moreover, the hatching of larvae in January was the same in both populations. However, in May (post-diapause) the hatching of larvae from eggs in the WS population was higher compared with the TU population (86±7 % and 43±6 % respectively, $p<0.01$) (table 1).

The same data was found in natural conditions during testing in the forest. Spring hatching in the TU population was about 30 % while in the WS population the hatching was about 85 %. The majority of larvae (approximately 90 %) that hatched from eggs in the TU population died of unclear reason at first and second instar. The study from the forest showed that the area around the TU population had low egg mass density: 21 ± 10 egg masses/ha (previous year 3650 ± 457 egg masses/ha). While the density of the egg masses in the WS population territory increased up 1240 ± 265 egg masses/ha (previous year 64 ± 23 egg masses/ha). Moreover, the total area of major defoliation (above 60 %) in the region increased from 28 hectares to 2500 while in the TU population this index decreased from 39945 hectares to 3. The data for both populations in 2003-2014 are shown on figure 2. These data demonstrate that the TU gypsy moth population (Sverdlovsk region) decreased, whilst the WS gypsy moth population (Novosibirsk region) increased.

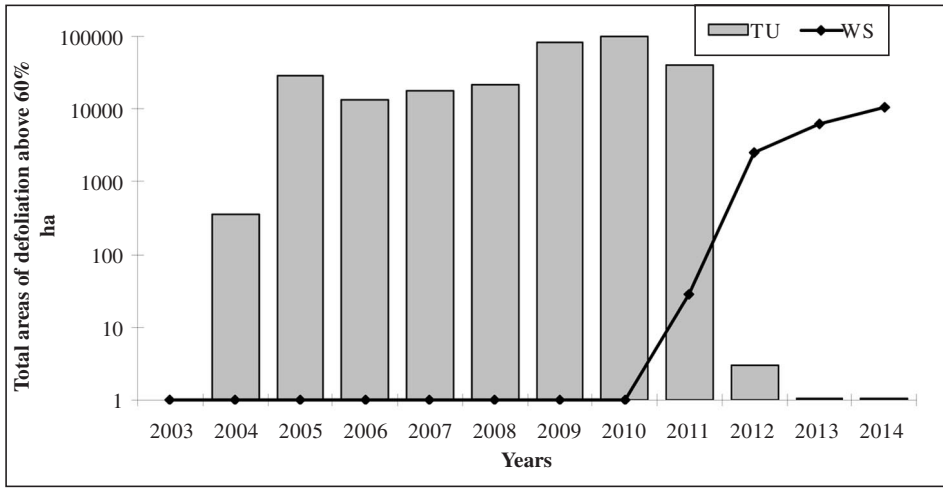


**Figure 2.–** The total areas of major defoliation (above 60 %) in the TU and WS populations in 2003-2014.

(b) NUTRITION CONTENT OF EGGS

The concentrations of proteins, lipids and carbohydrates in eggs were similar between both the TU and WS populations (figure 3). Concentration of lipids in eggs was on average 104 ± 13 mg/g, proteins averaged 16 ± 0.65 mg/g, and 1.93 ± 0.14 mg/g was the average concentration of carbohydrates. However, a qualitative protein assay showed that in eggs from the TU population, concentration of an arylphorin-like molecule (~ 75kDa) was 1.5 times lower ($p<0.001$) than in eggs from the WS population. Additionally, in eggs from the TU population, the vitellin 2-like component (~ 45kDa) was absent.

(c) INFECTIONS OF INSECTS

We did not find any infections, including NPV, in the embryos and hatched larvae with the light microscope. However, at cultivation on the artificial media, mortality of the TU population larvae from

NPV was 5±1% while larvae from the WS population did not die from virus ($p< 0.01$). The mortality of the larvae due to unstated reasons for the TU and WS populations was 92 ± 8 % and 12 ± 3 % ($p< 0.01$) respectively. The highest mortality (82 ± 7 %) for the TU population was observed in first instar larvae.

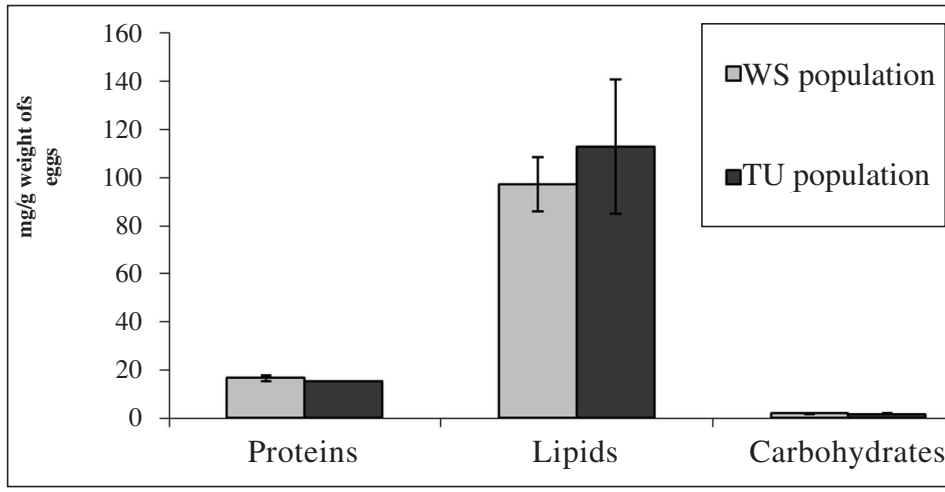


**Figure 3.–** Quantitative assay of nutrition in eggs from Trans-Ural (TU) and West Siberian (WS) populations of gypsy moth (January 2012).

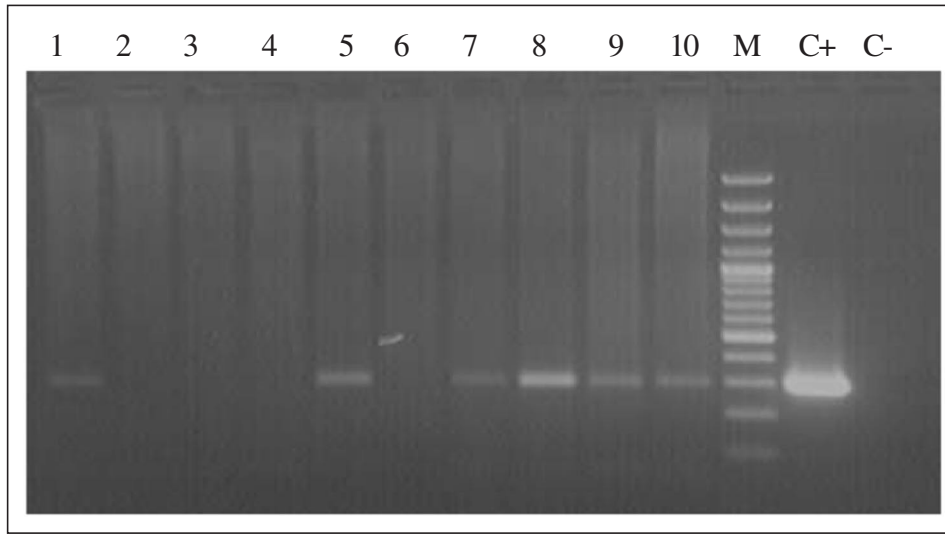


**Figure 4.–** PCR detection of virus LD 130 gene in embryos of the Trans-Ural gypsy moth population (2011). 1, 5, 7-10-positive at virus; 2-4, 6-negative at virus; M-ladder O'GeneRuler 100bp Plus DNA Ladder (FERMENTAS, USA); C+ - positive control, Ñ- - negative control.

In nature, the NPV carrying level (detected by PCR) among insects (embryos) from the TU population in 2011 was 76 ± 9 %, but mortality at the larva and pupa stages from NPV was 12 ± 5 %. The larvae from the WS population did not die from NPV in 2011; however, virus carrying quantity among embryos was 36 ± 6 % in the autumn. PCR detection of viral gene (LD 130) in embryos from the TU population showed 6 positive cases from 10 samples (figure 4). Data on the WS population aren't provided.

## Discussion

The TU population of gypsy moth was found to have increased mortality of embryos. This is probably the main factor of decline of population density in the area of the TU population. Several possible biotic reasons for embryonic death were analyzed in the study. Nutrition in eggs, an important factor of embryonic feeding, was similar for both the TU and WS populations. However, some key proteins of embryogenesis (arylphorin-like molecule and the vitellin 2-like component) were decreased or absent in eggs from the TU population. It is possible that the lowered survival of eggs from the TU population can be connected with the shortage of these substances.

It was demonstrated that NPV could be one of the main factors of mortality in population dynamics of the gypsy moth (DWYER & ELKINTON, 1995; HOCH *et al*., 2001; FULLER *et al*., 2012). At the same time, it is shown that the impact of this factor in various parts of gypsy moth areas can be different. In particular it is well known that in populations in the territory of Trans Ural and Western Siberia, NPVwas detected locally but at an insignificant level (about 10%) of larvae (ILYINYKH *et al*., 2004).

Baculoviruses infect over 600 species of insects (ROHRMANN, 2008), and in some cases, they were successfully used to control different insect pests (reviewed by INCEOGLU *et al*., 2006). Although horizontal route is thought to be the major pathway for baculovirus transmission (CORY & MYERS, 2003), some studies also reveal vertical transfer in field populations (reviewed by KUKAN, 1999; ZHOU *et al*., 2005; KOUASSI *et al*., 2009). Moreover, the vertical transmission of gypsy moth NPV was described earlier in our own investigations (ILYINYKH *et al*., 2004; ILYINYKH & POLENOGOVA, 2013). Individuals exposed to low doses of virus may acquire a non-fatal sublethal infection, but transmit the virus vertically to the next generation of insects (BURDEN *et al*., 2002; CABODEVILLA *et al*., 2011; MURILLLO *et al*., 2011). This may affect insect health, weight and fecundity (MYERS *et al*., 2000; VILAPLANA *et al*., 2008). Probably, NPV could be one of the reasons for embryo mortality in the TU population. The NPV is capable of affecting hormonal balance of the infected insects. In some baculoviruses the *egt*-gene was found, which is capable of coding the UDP-glucosyltransferase catalyzing binding of sugars by ekdisteroides (O'REILLY & MILLER, 1989; SLAVICEK *et al*., 1999). In particular infection of gypsy moth by NPV containing the *egt*-gene, led to abnormality of molting and growth of insects. Virus with a deletion of the *egt*-gene did not change the growth of insects (SLAVICEK *et al*., 1999).

Probably, alteration in hormonal balance of the infected insects (O'REILLY & MILLER, 1989; SLAVICEK *et al*., 1999) may lead to a decrease or absence of some key proteins of embryogenesis (arylphorin-like molecule and the vitellin 2-like component) in eggs from the TU population.

Perhaps, insects infected with NPV can demonstrate delay of development and lay eggs later in comparison with non-infected individuals or insects with smaller quantity of virus carriers. It can lead to a decrease in the sum of the effective temperatures necessary for normal embryogenesis of insects (especially in the conditions of a continental climate) and/or can change embryonic diapauses. It can influence hatching of larvae from eggs and, accordingly, population dynamics of the gypsy moth.

Possibly, in further research, the biochemical methods can be employed to diagnostics of a phase of depression in population dynamics of the gypsy moth.

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# Contribution to the faunal study of the Tortricidae of Pelion Mountains (Greece) with description of *Cydia magnesiae* Trematerra & Colacci, sp. n. (Lepidoptera: Tortricidae)

P. Trematerra & M. Colacci

**Abstract**

The following contribution highlights an overview of the 50 species of Tortricidae captured on Pelion Mountain, in Central Greece, during several field trips by the authors. Eleven new species to the Greek fauna were recorded: *Aethes margaritana, Eana incanana, Paramesia diffusana, Tosirips magyarus, Eudemis profundana, Ancylis badiana, Pelochrista modicana, Grapholita lathyrana, Grapholita tenebrosana, Dichrorampha alpigenana* and *Dichroranpha inconspiqua. Ceratoxanthis giansalottii, Endothenia apotomisana* and *Cydia pelionae* are found to be endemic to Greece. *Dichroranpha inconspiqua* is reported for the first time in Europe. *Cydia magnesiae* Trematerra & Colacci, sp. n. is described as new.
KEY WORDS: Lepidoptera, Tortricidae, fauna, first records, *Cydia magnesiae*, Greece.

**Contribución a la fauna de Tortricidae del Monte Pelion (Grecia) con la descripción de *Cydia magnesiae* Trematerra & Colacci, sp. n. (Lepidoptera: Totricidae)**

**Resumen**

La siguiente contribución, nos da una visión general de las 50 especies de Tortricidae capturadas en el Monte Pelion, en Grecia central, durante varios viajes de estudio realizados por los autores. Se registran once nuevas especies para la fauna de Grecia: *Aethes margaritana, Eana incanana, Paramesia diffusana, Tosirips magyarus, Eudemis profundana, Ancylis badiana, Pelochrista modicana, Grapholita lathyrana, Grapholita tenebrosana, Dichrorampha alpigenana* y *Dichroranpha inconspiqua. Ceratoxanthis giansalottii, Endothenia apotomisana* y *Cydia pelionae* son endémicas en Grecia. *Dichroranpha inconspiqua* es citada por primera vez en Europa. *Cydia magnesiae* Trematerra & Colacci, sp. n. se describe como nueva.
PALABRAS CLAVE: Lepidoptera, Tortricidae, fauna, nuevos registros, *Cydia magnesiae*, Grecia.

## Introduction

Our survey is based on specimens collected during 2016 by the junior author on the Pelion Mountains (Thessaly, Central Greece) (Figures 1-6). The Pelion Mountain range closes off the Pagasetic Gulf. The highest peak is Pourianos Stavros (altitude 1624 m). Pelion's diverse ecosystem is made up of coastal, plain and mountain zones. The area consists of thick forestal vegetation of deciduous forests and developed maquis shrubs. It has three vegetation zones with fourteen ecotypes, supporting rich species communities. The typical Mediterranean shrubland (*Quercetalia ilicis*) covers the low altitudes and includes most of the self-sown aromatic and pharmaceutical taxa, such as *Salvia fruticosa* Mill., *Thymus* spp., *Sideritis* spp., etc. The para-Mediterranean broad-leaved deciduous trees

zone (*Quercetalia pubescentis*) covers the middle altitude of the area and includes Oak (*Quercus frainetto* Ten.) and chestnut forests (*Castanea sativa* Mill.). The beech forest zone (*Fagetalia*) covers the areas above the para-Mediterranean zone up to the tree-limit zone.

The central part of the Pelion Mountains is covered by a thick beech-tree forest (*Fagus sylvatica* L.) with excellent structure and maintenance state, which is the dominant vegetation of the higher zones. There are also aspen-tree formations (*Populus tremula* L.) and willow trees (*Salix caprea* L.). Cultivated species consist mainly of fruit-trees (apples, apricots, cherries, kiwis, lemons, oranges, pears, almonds and walnuts and also olive trees and wineyards).

Depending on the area, the Pelion Mountains, have either a moist climate with long, hot summers and mild winters, very moist through all seasons, or a mild Mediterranean climate with hot and dry summers and mild winter season. Heat waves and intense cold periods are rare.

## Material and methods

The specimens reported in the paper were collected by M. Colacci on Pelion Mountains, mainly by net and by attraction to light at night-time. The localities visited were: Portaria, at 750 m a.s.l. and at 1000 m a.s.l.; Drakia, at 980 m a.s.l.; Chania, at 1150 m a.s.l. and at 1350 m a.s.l..

The material was primarily identified morphologically, supplemented by molecular data of the COI barcode region according to HAJIBABAEI *et al.* (2006) and RATNASINGHAM & HEBERT (2007).

In the compilation of the list we follow the systematic arrangement adopted by RAZOWSKI (2002, 2003) with some modifications suggested by BROWN (2005) and by GILLIGAN *et al*. (2014). Biology and distribution of the species are largely taken from RAZOWSKI (1996), TREMATERRA (2003) and AARVIK (2013), with new data from Trematerra's personal catalogue (unpublished data).

**Abbreviations utilized in the distribution of specimens in Europe:**

IC – Iceland
NR – Norway
DK – Denmark
SW – Sweden
SF – Finland
EE – Eastern Europe
EN – Estonia
LV – Latvia
LT – Lithuania
PL – Poland
CZ – Czech Republic
SK – Slovakia
DT – Germany
NL – Netherlands
GB – United Kingdom
IR – Ireland
BL – Belgium
LX – Luxembourg
FR – France
ES – Spain
PR – Portugal
CO – Corsica
MA – Malta
IT – Italy
CH – Switzerland
AU – Austria
HG – Hungary
YU – ex Yugoslavia
RO – Romania
BG – Bulgaria
AL – Albania
GR – Greece
CR – Crete
TR – European Turkey

TORTRICIDAE
TORTRICINAE
TORTRICINI

*Tortrix viridana* Linneaus, 1758

Material examined: 5 ♂♂, 1 ♀, Portaria, 750 m, 15-V-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, PR, CO, IT, CH, AU, HG, YU, RO, BG, AL, GR); Morocco; Asia Minor; Georgia; Azerbaijan; Transcaucasus; W Kazakhstan; Iran.

*Aleimma loeflingianum* (Linnaeus, 1758)

Material examined: 1 ♂, Chania, 1350 m, 13-V-2016; 5 ♂♂, Portaria, 750 m, 15-V-2016; 4 ♂♂,

Chania, 1150 m, 15-V-2016; 3 ♂♂, Portaria, 1000 m, 19-V-2016; 1 ♂, 3 ♀♀, Portaria, 750 m, 12-VI-2016; 2 ♀♀, Portaria, 750 m, 23-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, PR, CO, IT, CH, AU, HG, YU, RO, BG, AL, GR, CR, TR); Asia Minor; Syria; Georgia; Caucasus; Transcaucasus; Iran.

*Acleris variegana* ([Denis & Schiffermüller], 1775)

Material examined: 1 ♂, Portaria, 1000 m, 8-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, PR, CO, MA, IT, CH, AU, HG, YU, RO, BG, AL, GR, CR); NW Africa; Caucasus; Transcaucasus; Ural Mts; Iran; Kazakhstan; Turkmenistan; Afghanistan; Tajikistan; SW Siberia; China; Japan; N America.

## COCHYLINI

*Obraztsoviana maculosana* (Haworth, 1811)

Material examined: 1 ♂, Chania, 1150 m, 19-IV-2016.

Distribution: Europe (EE, CZ, SK, DT, GB, IR, BL, FR, ES, PR, CO, IT, AU, HG, YU, RO, BG, GR, CR); Asia Minor; Israel; Transcaucasus.

*Ceratoxanthis giansalottii* Bassi, 2014

Material examined: 1 ♂, Portaria, 1000 m, 19-V-2016; 2 ♂♂, Chania, 1350 m, 10-VI-2016; 2 ♂♂, Chania, 1350 m, 20-VI-2016; 1 ♂, Chania, 1350 m, 28-VI-2016.

Distribution: Europe (GR).

*Aethes margaritana* (Haworth, [1811])

Material examined: 1 ♀, Portaria, 1000 m, 19-V-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, BL, LX, FR, ES, IT, CH, AU, HG, YU, RO, BG, AL, GR); Asia Minor; Transcaucasus; Kazakhstan; Central Asia; W Siberia. **New Record for Greece**.

## CNEPHASIINI

*Eana incanana* (Stephens, 1852)

Material examined: 1 ♂, 1 ♀, Chania, 1150 m, 15-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, BL, LX, FR, ES, IT, CH, AU, HG, YU, RO, BG, AL, GR); Transcaucasus; Russian Far East. **New Record for Greece**.

*Cnephasia incertana* (Treitschke, 1835)

Material examined: 1 ♂, Chania, 1150 m, 7-V-2016; 1 ♀, Portaria, 750 m, 15-V-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, PR, IT, CH, AU, HG, YU, RO, BG, AL, GR, CR, TR); N Africa; from Near East to Iraq; Transcaucasus.

*Cnephasia communana* (Herrich-Schäffer, 1847)

Material examined: 1 ♂, Chania, 1150 m, 27-IV-2016; 1 ♂, Chania, 1350 m, 27-IV-2016; 1 ♂, Portaria, 1000 m, 10-V-2016; 3 ♂♂, Chania, 1350 m, 13-V-2016; 1 ♂, Portaria, 1000 m, 8-VI-2016; 1 ♀, Chania, 1350 m, 10-VI-2016; 1 ♀, Chania, 1350 m, 20-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, BL, LX, FR,

ES, IT, CH, AU, HG, YU, RO, BG, AL, GR, CR); Morocco; Libya; N Africa; Asia Minor; Caucasus; Transcaucasus; Kazakhstan; Turkmenistan, WS Siberia.

Remarks: Identified morphologically, supplemented by molecular data of the COI barcode region.

*Cnephasia cupressivorana* (Staudinger, 1871)

Material examined: 3 ♂♂, Portaria, 750 m, 6-IV-2016; 2 ♂♂, Drakia, 980 m, 6-IV-2016; 2 ♂♂, Chania, 1350 m, 14-IV-2016; 3 ♂♂, Chania, 1150 m, 19-IV-2016; 1 ♂, Portaria, 750 m, 21-IV-2016; 1 ♂, Chania, 1150 m, 27-IV-2016; 1 ♂, Portaria, 750 m, 9-V-2016; 2 ♂♂, 1 ♀, Portaria, 1000 m, 10-V-2016; 10 ♂♂, Chania, 1350 m, 13-V-2016; 1 ♂, Portaria, 1000 m, 19-V-2016.

Distribution: Europe (BL, FR, ES, CO, IT, CH, AU, HG?, YU, RO, BG?, AL, GR, CR); Asia Minor; Kyrgyzstan.

*Cnephasia abrasana* (Duponchel, 1843)

Material examined: 2 ♂♂, 1 ♀, Portaria, 750 m, 21-IV-2016; 1 ♂, 1 ♀, Portaria, 750 m, 5-V-2016; 3 ♀♀, Portaria, 750 m, 9-V-2016; 2 ♀♀, Portaria, 1000 m, 19-V-2016.

Distribution: Europe (EE, EN, LT, SK, BL, FR, PR, CO, IT, AU, HG, YU, RO, BG, AL, GR, CR); Asia Minor.

*Cnephasia ecullyana* Réal, 1951

Material examined: 1 ♂, Portaria, 1000 m, 8-VI-2016; 1 ♀, Portaria, 750 m, 12-VI-2016.

Distribution: Europe (CZ, SK, DT, FR, ES, PR, IT, CH, AU, HG, YU, RO, BG, GR); Asia Minor.

ARCHIPINI

*Pseudargyrotoza conwagana* (Stainton, 1859)

Material examined: 1 ♀, Portaria, 750 m, 15-V-2016; 1 ♀, Chania, 1350 m, 10-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, PR, CO, IT, CH, AU, HG, YU, RO, BG, AL, GR); Asia Minor; Caucasus; Transcaucasus; China; Nepal; Russian Far East; S Korea; Japan.

*Epagoge grotiana* (Fabricius, 1781)

Material examined: 1 ♂, Portaria, 1000 m, 17-VI-2016; 1 ♂, 1 ♀, Portaria, 750 m, 23-VI-2016; 5 ♂♂, Chania, 1350 m, 28-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, CO, IT, CH, AU, HG, YU, RO, BG, AL, GR); Asia Minor; S Ural Mts; Kazakhstan.

*Paramesia diffusana* (Kennel, 1899)

Material examined: 1 ♂, Chania, 1350 m, 28-VI-2016.

Distribution: Europe (EN, ES, IT, CO, GR). **New Record for Greece**.

*Archips crataeganus* (Hübner, [1799])

Material examined: 1 ♀, Portaria, 750 m, 23-VI-2016.

Distribution: Europe (NR, DK, SW, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, CO, IT, CH, AU, HG, YU, RO, BG, GR, TR); Morocco; N Africa; Asia Minor; Ural Mts; Transcaucasus; Iran; Kazakhstan; Siberia; China; S Korea; Japan.

*Tosirips magyarus* Razowski, 1987

Material examined: 1 ♂, Portaria, 750 m, 15-V-2016.

Distribution: Europe (CO, IT, HG, YU, RO, BG, GR). **New Record for Greece**.

*Ptycholoma lecheana* (Linnaeus, 1758)

Material examined: 1 ♂, 1 ♀, Portaria, 750 m, 5-V-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, IT, AU, CH, HG, YU, RO, BG, AL, GR); Asia Minor; Caucasus; Ural Mts; Kazakhstan; Trans-Baikal; Russian Far East; China; Korea; Japan.

*Syndemis musculana* (Hübner, [1799])

Material examined: 1 ♂, 1 ♀, Portaria, 1000 m, 10-V-2016; 1 ♂, Chania, 1350 m, 13-V-2016; 1 ♂, 1 ♀, Chania, 1150 m, 17-V-2016; 3 ♂♂, Portaria, 1000 m, 19-V-2016; 1 ♀, Portaria, 1000 m, 8-VI-2016; 1 ♀, Chania, 1350 m, 10-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, CO, IT, CH, AU, HG, YU, RO, BG, GR); Caucasus; Transcaucasus; Ural Mts; Kazakhstan; Trans-Baikal; Mongolia; Russian Far East; Korea; Japan.

*Aphelia ferrugana* (Hübner, 1793)

Material examined: 1 ♂, Portaria, 750 m, 5-V-2016; 1 ♂, Portaria, 750 m, 9-V-2016; 2 ♂♂, Portaria, 1000 m, 10-V-2016; 4 ♂♂, Portaria, 1000 m, 19-V-2016.

Distribution: Europe (EE, CZ, SK, DT, NL, FR, IT, CH, AU, HG, YU, RO, BG, AL, GR); Asia Minor; Syria; Iraq; Caucasus; Iran.

OLETHREUTINAE
OLETHREUTINI

*Endothenia marginana* (Haworth, 1811)

Material examined: 1 ♂, Portaria, 750 m, 12-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, PR, CO, MA, IT, CH, AU, HG, YU, RO, AL, GR); NW Africa; from Ural Mts to Mongolia; Russian Far East; China.

*Endothenia apotomisana* Trematerra & Colacci, 2016.

Material examined: 1 ♂, Drakia, 980 m, 6-IV-2016.

Distribution: Europe (GR).

*Lobesia botrana* ([Denis & Schiffermüller], 1775)

Material examined: 1 ♂, Portaria, 750 m, 9-V-2016; 4 ♂♂, Portaria, 750 m, 10-V-2016; 4 ♂♂, Portaria, 1000 m, 19-V-2016.

Distribution: Europe (DK, SW, EE, LT, PL, CZ, SK, DT, GB, BL, LX, FR, ES, PR, CO, MA, IT, CH, AU, HG, YU, RO, BG, GR, CR); N Africa; Near East; Asia Minor; Iraq; Transcaucasus; Iran; Kazakhstan; Japan; N and S America.

*Eudemis profundana* ([Denis & Schiffermüller], 1775)

Material examined: 3 ♀♀, Portaria, 750 m, 23-VI-2016; 1 ♀, Portaria, 750 m, 26-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, IT, CH, AU, HG, YU, RO, BG, AL, GR); Asia Minor. **New Record for Greece**.

*Hedya nubiferana* (Haworth, 1811)

Material examined: 1 ♂, Portaria, 750 m, 5-V-2016; 2 ♂♂, Portaria, 750 m, 15-V-2016; 1 ♀, Portaria, 1000 m, 8-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, PR, IT, CH, AU, HG, YU, RO, BG, AL, GR, CR); Asia Minor; Iraq; Caucasus; Iran; Turkmenistan; WS Siberia; N America.

*Olethreutes arcuellus* (Clerck, 1759)

Material examined: 1 ♂, Chania, 1150 m, 19-IV-2016; 2 ♂♂, Chania, 1150 m, 7-V-2016; 1 ♂, Portaria, 750 m, 9-V-2016; 1 ♀, Portaria, 1000 m, 10-V-2016; 1 ♂, Chania, 1350 m, 13-V-2016; 1 ♂, 1 ♀, Portaria, 750 m, 15-V-2016; 2 ♂♂, 1 ♀, Chania, 1150 m, 17-V-2016; 1 ♀, 1 ♀, Portaria, 750 m, 22-V-2016; 1 ♂, Portaria, 1000 m, 8-VI-2016; 1 ♂, Chania, 1350 m, 10-VI-2016; 1 ♂, Chania, 1150 m, 15-VI-2016; 1 ♀, Portaria, 1000 m, 17-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, IT, CH, AU, HG, YU, RO, BG, AL, GR); Asia Minor; Caucasus; Ural Mts; Iran; Kazakhstan; NW China; W Siberia.

*Syricoris lacunana* ([Denis & Schiffermüller], 1775)

Material examined: 6 ♂♂, Chania, 1150 m, 17-V-2016; 6 ♂♂, 2 ♀♀, 1150 m, 15-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, PR, CO, IT, CH, AU, HG, YU, RO, BG, AL, GR); Asia Minor; Caucasus; Transcaucasus; W Siberia; NE China; Mongolia; Korea; Japan.

Remarks: Identified morphologically, supplemented by molecular data of the COI barcode region.

ENARMONIINI

*Ancylis badiana* ([Denis & Schiffermüller], 1775)

Material examined: 1 ♂, Chania, 1150 m, 27-IV-2016; 1 ♂, Chania, 1350 m, 10-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, CO, IT, CH, AU, HG, YU, RO, BG, GR); Asia Minor; Transcaucasus; China; Mongolia; Russian Far East; Korea; Japan. **New Record for Greece**.

EUCOSMINI

*Epinotia festivana* (Hübner, [1799])

Material examined: 1 ♂, Portaria, 750 m, 12-VI-2016.

Distribution: Europe (EE, CZ, SK, FR, ES, PR, IT, CH, AU, HG, YU, RO, AL, GR); Asia Minor; Crimea; Dagestan; Transcaucasus; Iran.

*Pelochrista agrestana* (Treitschke, 1830)

Material examined: 1 ♂, Portaria, 750 m, 26-VI-2016; 1 ♂, Portaria, 750 m, 5-IX-2016.

Distribution: Europe (LT, FR, CO, IT, AU, YU, BG, GR, CR); Asia Minor.

Remarks: Identified morphologically, supplemented by molecular data of the COI barcode region.

*Pelochrista modicana* (Zeller, 1847)

Material examined: 3 ♂♂, Portaria, 1000 m, 19-V-2016; 1 ♂, Portaria, 1000 m, 8-VI-2016; 1 ♂, Chania, 1350 m, 10-VI-2016; 2 ♂♂, Portaria, 1000 m, 17-VI-2016; 2 ♂♂, 1 ♀, Chania, 1350 m, 20-VI-2016.

Distribution: Europe (EE, PL, CZ, SK, DT, FR, ES, PR, IT, CH, AU, HG, YU, RO, BG, AL, GR); Asia Minor; Transcaucasus; Turkmenistan; Kazakhstan. **New Record for Greece**.

Remarks: Identified morphologically, supplemented by molecular data of the COI barcode region.

*Epiblema graphanum* (Treitschke, 1835)

Material examined: 1 ♂, Portaria, 1000 m, 19-V-2016; 1 ♂, Chania, 1350 m, 20-VI-2016.

Distribution: Europe (DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, BL, LX, FR, ES, IT, CH, AU, HG, YU, RO, BG, AL, GR); Asia Minor; Transcaucasus; Iran; Kazakhstan; Afghanistan; Trans-Baikal; WS Siberia; China.

Remarks: Identified morphologically, supplemented by molecular data of the COI barcode region.

*Epiblema* sp.

Material examined: 1 ♂, Portaria, 750 m, 15-V-2016; 1 ♂, Portaria, 1000 m, 19-V-2016.

Remarks: Identified only by molecular data of the COI barcode region.

*Notocelia cynosbatella* (Linneaus, 1758)

Material examined: 1 ♂, Chania, 1150 m, 27-IV-2016; 1 ♀, Portaria, 750 m, 5-V-2016; 3 ♂♂, Chania, 1150 m, 7-V-2016; 2 ♂♂, 1 ♀, Portaria, 1000 m, 10-V-2016; 1 ♂, 2 ♀♀, Chania, 1150 m, 17-V-2016; 2 ♂♂, 5 ♀♀, Portaria, 1000 m, 19-V-2016; 1 ♀, Portaria, 750 m, 22-V-2016; 1 ♀, Portaria, 1000 m, 8-VI-2016; 2 ♀♀, Chania, 1350 m, 10-VI-2016; 1 ♂, Portaria, 1000 m, 17-VI-2016; 1 ♀, Chania, 1350 m, 20-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, PR, CO, IT, CH, AU, HG, YU, RO, AL, GR); Near East; Asia Minor; Caucasus; Transcaucasus; Ural Mts; Iran; Turkmenistan; Kazakhstan; Mongolia; Russian Far East.

*Notocelia uddmanniana* (Linnaeus, 1758)

Material examined: 1 ♀, Portaria, 1000 m, 17-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, CO, IT, CH, AU, HG, YU, RO, AL, GR, CR); N Africa; Caucasus; Transcaucasus; Trans-Ural; Iran; Kazakhstan; Tadzikistan; S Siberia.

*Rhyacionia buoliana* ([Denis & Schiffermüller], 1775)

Material examined: 1 ♂, Chania, 1150 m, 17-V-2016; 2 ♂♂, Chania, 1150 m, 15-VI-2016; 1 ♂, 1 ♀, Portaria, 1000 m, 17-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, PR, CO, MA, IT, CH, AU, HG, YU, RO, BG, GR); N Africa; Asia Minor; Israel; Caucasus; Transcaucasus, Ural Mts; China; Korea; Japan; introduced to N and S America.

## GRAPHOLITINI

*Cydia plumbiferana* (Staudinger, 1871)

Material examined: 1 ♀, Chania, 1350 m, 28-VI-2016.

Distribution: Europe (FR, IT, GR, CR); Lebanon.

*Cydia succedana* ([Denis & Schiffermüller], 1775)

Material examined: 1 ♂, Chania, 1350 m, 10-VI-2016; 1 ♂, Chania, 1150 m, 15-VI-2016; 2 ♂♂, Chania, 1350 m, 20-VI-2016; 1 ♀, Portaria, 1000 m, 17-VI-2016; 1 ♀, Chania, 1350 m, 28-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, PR, CO, MA, IT, CH, AU, HG, YU, RO, BG, AL, GR, CR); Morocco; Asia Minor; Transcaucasus; Iran; Kazakhstan; Afghanistan; Central Asia; Mongolia.

*Cydia triangulella* (Goeze, 1783)

Material examined: 1 ♂, Portaria, 750 m, 5-IX-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, BL, LX, FR, ES, PR, IT, CH, AU, HG, YU, RO, BG, GR); Morocco; S Ural Mts; Caucasus; Transcaucasus; Japan.

Remarks: Identified morphologically, supplemented by molecular data of the COI barcode region.

*Cydia fagiglandana* (Zeller, 1841)

Material examined: 1 ♂, Portaria, 750 m, 23-VI-2016; 3 ♂♂, 1 ♀, Portaria, 750 m, 26-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, PR, CO, MA, IT, CH, AU, HG, YU, RO, BG, AL, GR, CR); NW Africa; Asia Minor; Syria; Caucasus; Iran, Turkestan.

Remarks: Identified morphologically, supplemented by molecular data of the COI barcode region.

***Cydia magnesiae* Trematerra & Colacci, sp. n.**

Material examined: Holotype, 1 ♂, 1 ♀, Portaria, 750 m, 23-VI-2016; Paratypes, 2 ♀♀, Portaria, 750 m, 26-VI-2016; 1 ♂, Portaria, 750 m, 5-IX-2016 (Sample ID: LEP-SS-00491). Deposited in the Trematerra collection, Campobasso, Italy.

Adult (Figure 10): Wing span 14-16 mm. Head brownish, palps light brown. Thorax brownish, abdomen honey colour. Forewing grey, sprinkled whitish-cream with greyish strigulae and suffusion; costal strigulae delicate, whitish or white-cream, dividings dark brown; post-apical strigula white-cream; speculum olive grey often with grey suffusion, with refractive lines and blackish inner spots, outer lines of speculum silvery. Dorsal patch white-grey, diffused distally and extending towards middle of wing, marked by brownish lines. Basal blotch brown-grey, distinctly convex medially; subtornal blotch dark brown often entirely edging speculum area, extending towards apex of wing. Cilia brownish grey; basal line creamish-grey. Hindwing brownish with cilia brown-cream, basal line cream. Males with greyish white blotch in anal area with white-cream cilia.

Male genitalia (Figures 11, 13, 14): Tegumen developed with enlarged base; small hairy prominence at top of tegumen proximally and scales on lateral surfaces; valvae elongate with costa convex in the median part; caudal angle of sacculus weak; neck of valva broad; cucullus slightly elongate, convex caudally, with small ventral group of spines; ventral incision quite pronounced; basal cavity rather elongated; aedeagus long and slender, basally large and at the terminal part very slender, slightly curved.

Female genitalia (Figures 12, 15): Subgenital sternite trapezoidal, strongly concave terminally; postostial part of sterigma small, slightly expanding posteriorly, convex terminally; colliculum membranous; cingulum elongated; ductus seminalis near corpus bursae; weak sclerite at base of ductus seminalis; bursa copulatrix developed and broad.

Distribution: Known only from the type locality.

Biology: Probably bivoltine. Our specimens were collected with the net at Portaria, on Pelion Mountain (Greece), in late June and in early September. Larval foodplant unknown.

Diagnosis: Externally *Cydia magnesiae* sp. n. looks like *Grapholita funebrana* (Tr.), but in the genitalia it is similar to *Cydia fagiglandana* (Z.) (DANILEVSKI & KUZNETSOV, 1968; RAZOWSKI, 2003) (Figures 7, 8). From the latter species in male genitalia it differs by the conformation of valvae, the caudal angle of the sacculus, by cucullus and by aedeagus having basal part enlarged (Figures 8, 11, 13, 14). The female genitalia differ by the post-ostial part of the sterigma, by the cingulum being elongated, by the presence of a weak sclerite at base of ductus seminalis, and by the absence of a diverticulum (Figures 9, 12, 15).

Barcoding analyses: The distance of the *C. magnesiae* (BCLEP040-16) from the nearest neighbour (NN) is equal to 2,98%. The NN is *C. fagiglandana* (BIN: BOLD AAC5023).

Etymology: The name is derived from Magnesia region (Thessaly, Greece).

Remarks: Identified morphologically, supplemented by molecular data of the COI barcode region.

*Cydia amplana* (Hübner, [1799])

Material examined: 7 ♂♂, 4 ♀♀, Portaria, 750 m, 5-IX-2016.

Distribution: Europe (DK, SW, EE, PL, CZ, SK, DT, NL, GB, BL, FR, ES, PR, IT, CH, AU, HG, YU, RO, BG, GR, CR); Asia Minor; Syria; Transcaucasus.

*Cydia pelionae* Trematerra & Colacci, 2016

Material examined: 1 ♂, Chania, 1150 m, 17-V-2016; 1 ♂, Portaria, 1000 m, 8-VI-2016; 2 ♂♂, Chania, 1150 m, 15-VI-2016; 1 ♂, 2 ♀♀, Portaria, 1000 m, 17-VI-2016.

Distribution: Europe (GR).

Remarks: Identified morphologically, supplemented by molecular data of the COI barcode region.

*Grapholita fissana* (Frölich, 1828)

Material examined: 1 ♂, Chania, 1350 m, 10-VI-2016.

Distribution: Europe (SW, EE, PL, CZ, SK, DT, LX, FR, IT, CH, AU, HG, YU, RO, BG, AL, GR); Asia Minor; Transcaucasus; Ural Mts.

*Grapholita lathyrana* (Hübner, [1813])

Material examined: 1 ♂, Chania, 1150 m, 19-IV-2016; 2 ♂♂, Chania, 1150 m, 7-V-2016; 6 ♂♂, Chania, 1350 m, 13-V-2016; 1 ♀, Chania, 1350 m, 10-VI-2016.

Distribution: Europe (PL, CZ, SK, DT, NL, GB, BL, FR, IT, CH, AU, HG, YU, RO, BG, AL, GR); **New Record for Greece**.

*Grapholita nebritana* Treitschke, 1830

Material examined: 1 ♀, Portaria, 750 m, 15-V-2016.

Distribution: Europe (EE, LT, PL, CZ, SK, DT, BL, FR, ES, PR, IT, CH, AU, HG, YU, RO, AL, GR); N Africa; Asia Minor.

*Grapholita tenebrosana* Duponchel, 1843

Material examined: 1 ♀, Portaria, 1000 m, 17-VI-2016.

Distribution: Europe (NR, DK, SW, SF, EE, EN, LV, LT, PL, CZ, SK, DT, NL, GB, IR, BL, LX, FR, ES, IT, CH, AU, HG, RO, BG, GR); Asia Minor; Transcaucasus; Kazakhstan; Russian Far East; Japan. **New Record for Greece**.

*Dichrorampha alpigenana* (Heinemann, 1863)

Material examined: 1 ♀, Chania, 1150 m, 19-IV-2016; 1 ♂, Chania, 1150 m, 15-VI-2016.

Distribution: Europe (DT, FR, IT, CH, AU, YU, GR); W Siberia. **New Record for Greece**.

Remarks: Identified morphologically, supplemented by molecular data of the COI barcode region.

*Dichrorampha inconspiqua* (Danilevsky, 1948)

Material examined: 4 ♂♂, Chania, 1150 m, 19-IV-2016; 1 ♂, Chania, 1150 m, 27-IV-2016; 4 ♂♂, Portaria, 1000 m, 10-V-2016; 2 ♂♂, Chania, 1350 m, 13-V-2016; 2 ♂♂, Chania, 1150 m, 17-V-2016; 3 ♂♂, 1 ♀, Portaria, 1000 m, 19-V-2016; 1 ♂, Chania, 1350 m, 10-VI-2016; 1 ♂, Chania, 1350 m, 20-VI-2016.

Distribution: Europe (GR); S Transcaucasus; Azerbaijan. **New Record for Europe**.

Remarks: Identified morphologically, supplemented by molecular data of the COI barcode region (Figures 16, 17, 18).

*Dichrorampha* sp.

Material examined: 1 ♀, Chania, 1350 m, 20-VI-2016.

Remarks: Identified only by molecular data of the COI barcode region.

**Discussion**

During the last decade, the Tortricidae from Greece have received only sporadic attention by both local and foreign lepidopterists with publications referring to one or few entities (e.g. AARVIK & KARSHOLT, 1993; TREMATERRA & KARSHOLT, 1996; TREMATERRA & AARVIK, 1998; GOZMANY, 2012; BASSI, 2014; TREMATERRA & COLACCI, 2016), while lacking summary works that consider the Hellenic fauna as a whole.

In RAZOWSKI (1996) mentioned 209 species of Tortricidae as present in Greece from the 925 recorded for Europe. In the latest checklist of Lepidoptera, the electronic version of the Fauna Europaea, the number of Tortricidae reported from Greece is 211 (AARVIK, 2013). In addition, there are two new species, *Endothenia apotomisana* Trematerra & Colacci and *Cydia pelionae* Trematerra &

Colacci, described from Pelion Mountains (TREMATERRA & COLACCI, 2016). For Crete Island, RAZOWSKI (1996) listed 30 species of Tortricidae, while in the Fauna Europaea are recorded 32 species (AARVIK, 2013). Recently HUEMER (2016) studied the Tortricidae collected by Walter Ruckdeschell on the island of Crete and cited 40 species thus increasing the total species number of the Island to 56. In the Trematerra personal catalogue are noted 233 species referred to Greece and 62 to Crete (unpublished data).

The species listed in the present paper are 50, of which 11 are recorded for the first time in Greece: *Aethes margaritana, Eana incanana, Paramesia diffusana, Tosirips magyarus, Eudemis profundana, Ancylis badiana, Pelochrista modicana, Grapholita lathyrana, Grapholita tenebrosana, Dichrorampha alpigenana* and *Dichroranpha inconspiqua*. *Ceratoxanthis giansalottii, Endothenia apotomisana*, and *Cydia pelionae* are endemic of Greece. *Dichroranpha inconspiqua* is reported for the first time in Europe. *Cydia magnesiae* sp. n. is described as new to science.

Thus, with the records cited in the present paper, the Lepidoptera Tortricidae of the Greek fauna are now 244.

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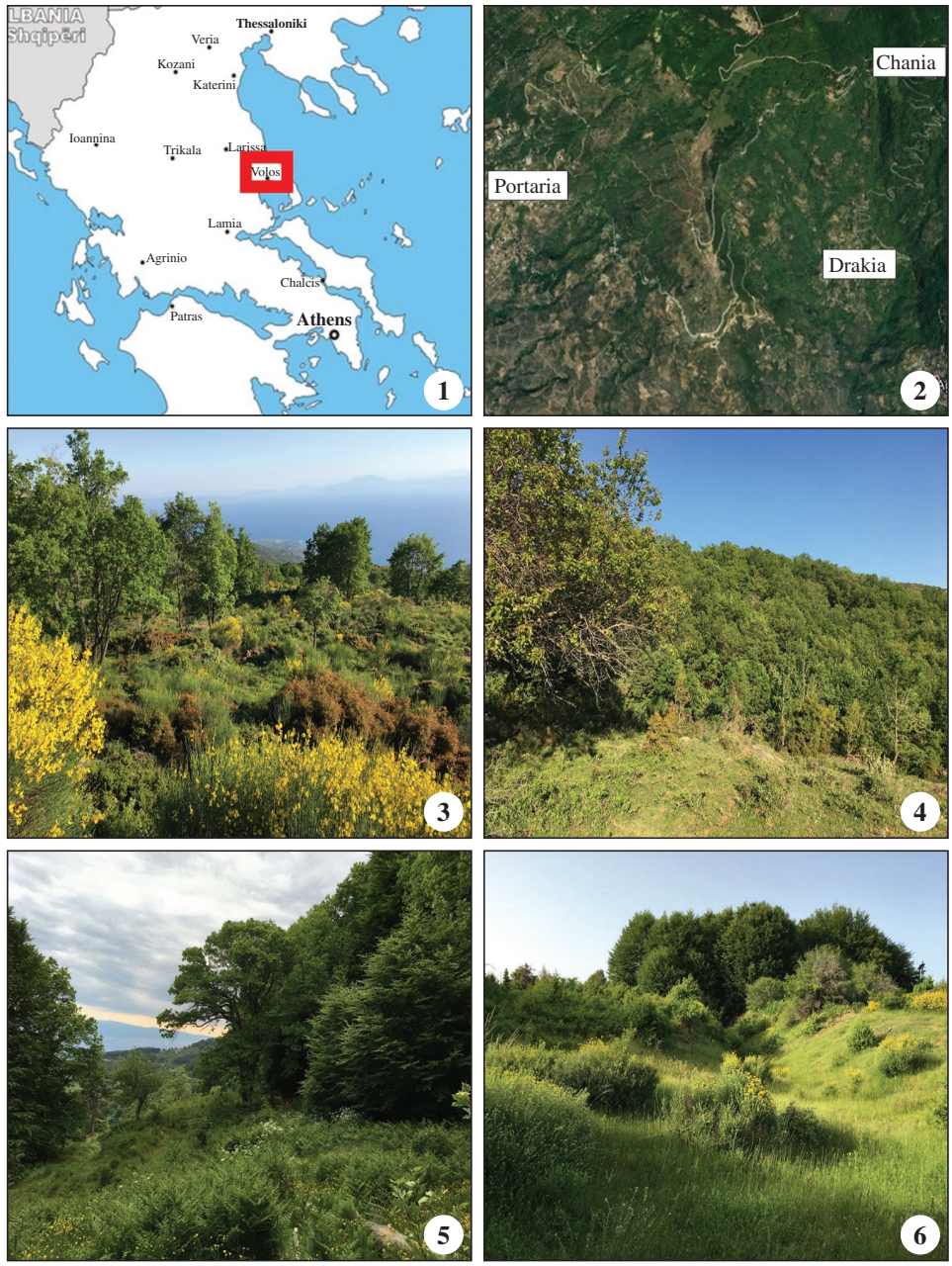
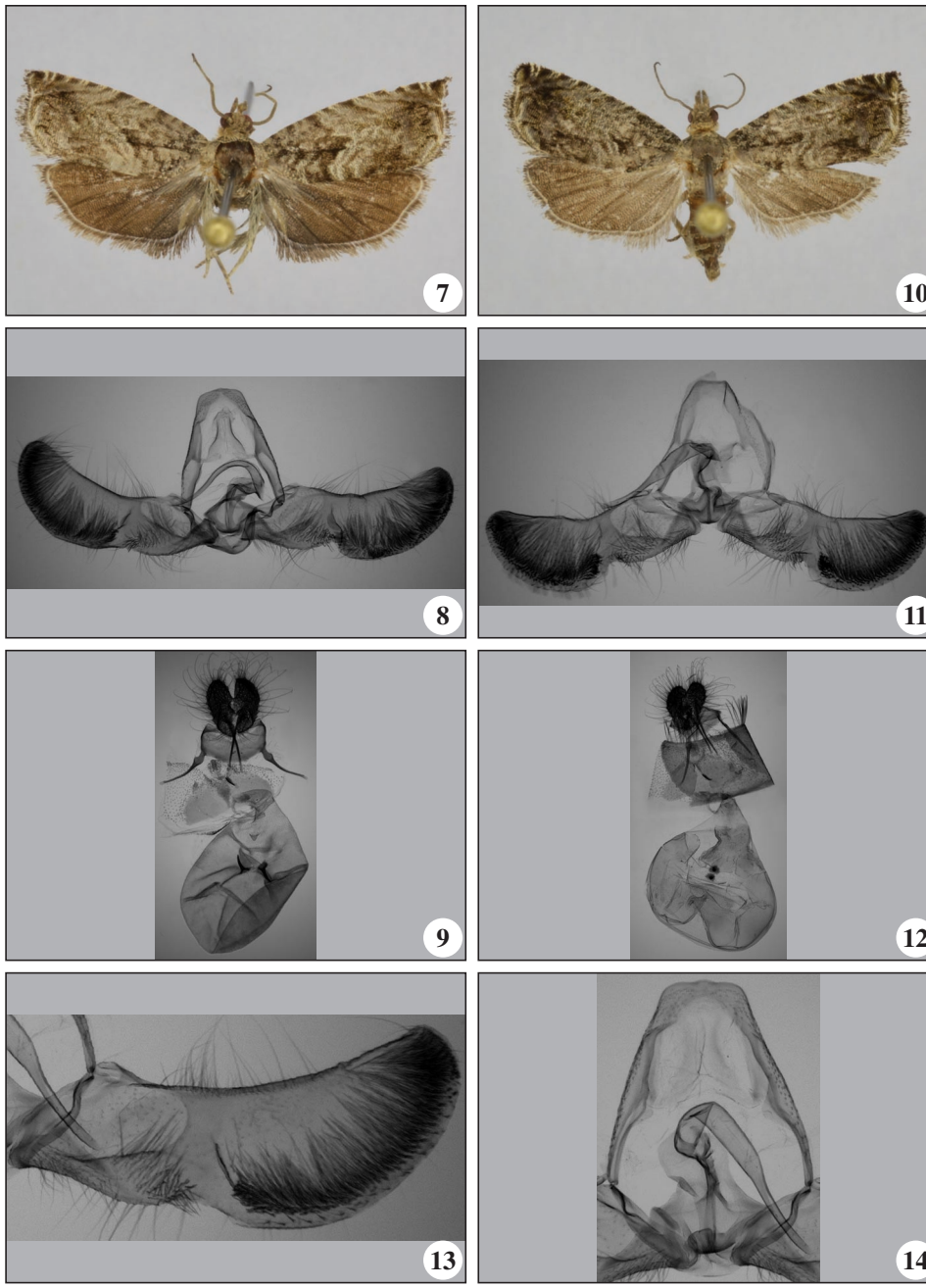
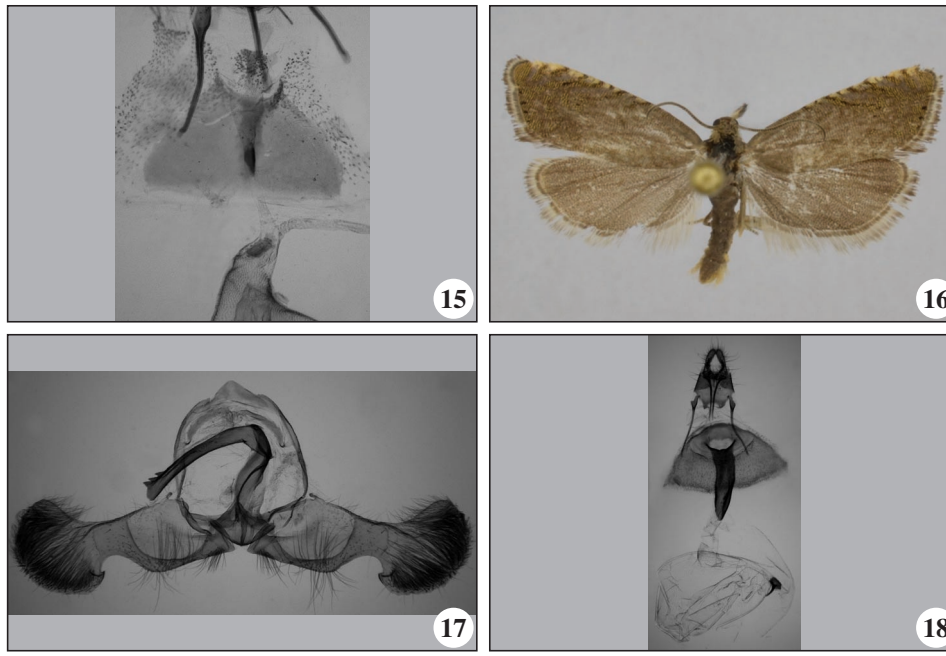



**Figs. 1-6.–** Study areas. **1.** Schematic representation, **2.** Aerial view, **3.** Panoramic view of the vegetation at 750 m a.s.l., **4.** Panoramic view of the vegetation at 1000 m a.s.l., **5.** Panoramic view of the vegetation at 1150 m a.s.l., **6.** Panoramic view of the vegetation at 1350 m a.s.l..




**Figs. 7-14.–** *Cydia fagiglandana* (Z.). **7**. Adult, **8.** Male genitalia, **9**. Female genitalia. *Cydia magnesiae* Trematerra & Colacci, sp. n. **10**. Adult, **11**. Male genitalia, **12.** Female genitalia**, 13.** Valva, **14**. Tegumen and aedeagus.




**Figs. 15-18.– 15.** Female genitalia. *Cydia magnesiae* Trematerra & Colacci, sp. n. Particular view of subgenital sternite, postostial part of sterigma, cingulum, ductus seminalis and weak sclerite at base of ductus seminalis. **16-18.** *Dichrorampha inconspiqua* (Danilevsky, 1948), **16.** Adult, **17.** Male genitalia, **18.** Female genitalia.

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# On the fauna of the Coleophoridae of Mexico (Lepidoptera: Coleophoridae)

H. W. van der Wolf

**Abstract**

16 new species are described from Mexico: *Coleophora papalotontli* van der Wolf, sp. n., *C. powelli* van der Wolf, sp. n., *C. saltoella* van der Wolf, sp. n., *C. tehuacanella* van der Wolf, sp. n., *C. coahuila* van der Wolf, sp. n., *C. popoloca* van der Wolf, sp. n., C. *bajacalsur* van der Wolf, sp. n., *C. penicillata* van der Wolf, sp. n., *C. pueblana* van der Wolf, sp. n., *C. catavinae* van der Wolf, sp. n., *C. puntaprietae* van der Wolf, sp. nov., *C. yagul* van der Wolf, sp. n., *C. bajacaliforniae* van der Wolf, sp. n., *C. iztac* van der Wolf, sp. n., *C. incerta* van der Wolf, sp. n. and *C. mexicacopa* van der Wolf, sp. n. Of *C. yagul* the foodplant is given and the larval case described and illustrated. The female genitalia of *C. mexicana* Landry, 1994 are described and illustrated for the first time. *C. versurella* Zeller, 1849 is reported from Mexico for the first time.
KEY WORDS: Lepidoptera, Coleophoridae, Nearctic, new species, Mexico.

**Sobre la fauna de Coleophoridae de México (Lepidoptera: Coleophoridae)**

**Resumen**

Se describen 16 nuevas especies de México: *Coleophora papalotontli* van der Wolf, sp. n., *C. powelli* van der Wolf, sp. n., *C. saltoella* van der Wolf, sp. n., *C. tehuacanella* van der Wolf, sp. n., *C. coahuila* van der Wolf, sp. n., *C. popoloca* van der Wolf, sp. n., C. *bajacalsur* van der Wolf, sp. n., *C. penicillata* van der Wolf, sp. n., *C. pueblana* van der Wolf, sp. n., *C. catavinae* van der Wolf, sp. n., *C. puntaprietae* van der Wolf, sp. nov., *C. yagul* van der Wolf, sp. n., *C. bajacaliforniae* van der Wolf, sp. n., *C. iztac* van der Wolf, sp. n., *C. incerta* van der Wolf, sp. n. y *C. mexicacopa* van der Wolf, sp. n. Se da la planta nutricia de *C. yagul* y se describe e ilustra el saco larvario. Por primera vez, se describe e ilustra la genitalia de la hembra de *C. mexicana* Landry, 1994. Se menciona por primera vez para México *C. versurella* Zeller, 1849.
PALABRAS CALVE: Lepidoptera, Coleophoridae, Neárctico, nuevas especies, México.

## Introduction

The Coleophora fauna of Mexico is poorly known. In the World Catalogue of Insects (BALDIZZONE *et al*., 2006) only three species are mentioned from Mexico: *Coleophora decipiens* Walsingham, 1914, *C. mexicana* Landry, 1994 and *C. pelinopis* Meyrick, 1933. The material dealt with in this paper mainly originated from the collection of the Essig Museum of Entomology, University of California, Berkely. It was collected during expeditions in the sixties, seventies and eighties of the twentieth century. The order in which the species are represented roughly follows Toll's systematic group system. In spite of the fact that Toll's system is based on palearctic species only and should be replaced by a more modern system, it is still useful. This is proven by the circumstance that most species described in this paper can be attributed to Toll's 30th group.

All specimens treated in this paper are deposited in the Essig Museum of Entomology, The University of California, Berkely.

**Abbreviations and Explanations**

EMEC: Essig Museum of Entomology, The University of California, Berkely.
gen. prep. Wf: genital preparation van der Wolf

Nahuatl: The language spoken by the Aztecs in Central Mexico, and still being used in several regions of Mexico.

**Systematic part**

*Coleophora mexicana* Landry, 1994

Material examined: MEX: Veracruz, 2 mi. W., El Joyita, 2230 m., Hwy H 140, 22-VIII-1977, E. I. Schlinger, gen.prep. ♀ Wf 12047; 1 ♀ MEX: Veracruz, 6 mi. SE Rinconada, 30-IX-[19]75 at light, J. Powell & J. Chemsak collectors, 1 ex. without abdomen; MEXICO: Veracruz, Coscomatepec NE, 9-VII-[19]75, J. A. Chemsak & J. Powell"

Diagnosis: The specimens exactly correspond with the description of *Coleophora mexicana* Landry, 1994, a species described after one male specimen collected at Gomes Farias, Tamaulipas, Mexico (LANDRY, 1994). According to Landry the species most likely belongs to the *ramitella* group of metallic-green Coleophoridae, and is closely related to *C. timarella* Landry & Wright, 1993. The female genitalia are here described for the first time.

Description female genitalia (Fig. 34): Papillae anales long, slender. Apophyses posteriores 1,5 times longer than anteriores. Sterigma subtrapezoid, medially excavated; caudal margin with strong bristles. Ostium bursae cup-shaped, almost as wide as sterigma, gradually narrowing into a transparent ductus bursae with central line; at 2/6 a chitinous sleeve with tiny spikes, at 5/6 a slightly chitinised convolution, at 6/6 a transparent section with very tiny spikes followed by an ovoid bursa; a thorn-like signum on an indistinct basal plate, and a small rasp-like signum.

Distribution: The specimens were collected at three different localities in Veracruz; the holotype was collected in Tamaulipas, the Mexican state north of Veracruz.

Bionomy: The early stages and the foodplant are not known.

*Coleophora versurella* Zeller, 1849

Material examined: "MEXICO: Puebla, 2 mi SW Tehuacan, 5300, 5-X-[19]75 blacklight trap J. Powell collector", 2 ♂♂, Wf. 12049, 12055.

Remark: The species is widespread over the holarctic, nearctic and neotropical regions, where it occurs in agricultural areas, feeding on the seeds of agricultural weeds. It is placed in the 30th species group of Toll's system, having the characteristic double-rod phallotheca.

Distribution: Palearctic: Widely distributed. Oriental: Arabian peninsula, India. Nearctic (adventive): Canada, U.S.A. Neotropical (adventive): Argentina, Chile. The species **is new for Mexico**.

Bionomy: The larvae feed in a tubular case on the seeds of Amaranthus, Atriplex and Chenopodium.

***Coleophora papalotontli* van der Wolf, sp. n.** (Fig. 1)

Holotype ♂: MEXICO, Puebla 2 mi. SW Tehuacan, 5300, 4-X-1975 blacklight trap 2300-0600 Powell, gen. prep. Wf 12051.

Diagnosis: A species characterized by its small size and almost uniform silvery whitish-beige colour. The double rods of the phallotheca of the male genitalia indicate that the species belongs to the

30th species-group of Toll's system. The main characteristic in the male genitalia is the crescent-shaped dorsal process of the sacculus.

Description: Wingspan 10 mm. Head whitish. Labial palp whitish. Antenna: the scape, without scale tuft, is whitish; flagellum ringed white and dark grey. Forewing uniformly silvery whitish-beige; fringes beige. Hindwing not visible: the specimen, not spread, is glued on cardboard.

Male genitalia (Fig. 17): Gnathos knob globular. Tegumen narrow, medially constricted. Pedunculus slender, slightly rounded. Transtilla slender. Valvula indistinct. Cucullus short, broad, with rounded apex. Ventral margin of sacculus with convex fold; dorsal process of sacculus crescent-shaped. Phallotheca with two slender straight rods with blunt tips slightly bent upwards. Cornuti a long curved bundle of needle-like spikes.

Female genitalia: Unknown.

Bionomy: The species flies in October at an altitude of 1780 meters. The early stages and the foodplant are unknown.

Distribution: The species is only known from the Mexican State of Puebla.

Etymology: The name of the species is derived from Nahuatl: *papalotontli* = small moth.

### ***Coleophora powelli*** **van der Wolf, sp. n.** (Fig. 2)

Holotype ♂: MEXICO, Puebla 2 mi SW Tehuacan, 5300, 4-X-[19]74 blacklight trap, J. Powell collector; gen. prep. Wf 12150. Paratypes: 1 ♂, same data, gen. prep. Wf 12057; 3 ♂ same data, but 5-X-19]74, gen. preps ♂ Wf 12148, 12149, 12048.

Diagnosis: A species of medium size characterized by almost uniform light greyish-beige colour, with darker costal region. The male genitalia indicate that the species belongs to Toll's 30th species-group with double phallotheca rods. It is closely related to *Coleophora saltoella* van der Wolf sp. n., from which it differs by the rectangular shape of the dorsal process of the sacculus, the longer and more slender cucullus and the greater number of cornuti.

Description: Wingspan 16 mm. Head whitish. Labial palp long, whitish internally and externally; third segment about 2/3rd length second. Antenna whitish, scape without scale tuft. Forewing uniformly light greyish-ochreous, with occasional faint dark scales and a darker costal region. Fringe whitish. Hindwing light beige. Fringe grey.

Male genitalia (Fig. 18): Gnathos knob globular. Tegumen stretched, medially constricted. Pedunculus slender, rounded. Transtilla linear, slender. Valvula small, triangular. Cucullus long, rather narrow, with rounded apex. Sacculus with slightly convex ventral margin, ending in a rather rectangular dorsal process. Phallotheca slender, with two rods with ladle-shaped upturned apices; cornuti with one long and one shorter bundle of needle-like spikes.

Bionomy: The species flies in October at an altitude of 1780 meters. The early stages and the foodplant are unknown.

Distribution: Only known from the Mexican State of Puebla.

Etymology: The species is named after Jerry A. Powell, who collected most of the specimens dealt with in this paper.

### ***Coleophora saltoella*** **van der Wolf, sp. n.** (Fig. 3)

Holotype ♂: MEX: Durango, 1 mi. W. El Salto, bl, 8600, 9-VIII-[19]86, Brown & Powell", gen. prep. Wf 12211. Paratypes: 1 ♂, MEX: Durango 8 mi. W. La Ciudad, 8700, 17-VIII-[19]72, MacNeil & Powell, gen. prep. Wf 12170; 2 ♂ [♂, MEXICO: Puebla 2 mi. SW Tehuacan, 5300, 5-X-1975, blacklight trap J. Powell collector, gen. preps. Wf 12053, 12056.

Diagnosis: A species characterized by its almost uniform nutbrown colour. It belongs to Toll's 30th species group, with double phallotheca rods. It is closely related to *Coleophora powelli* van der Wolf sp. n., from which it differs by its uniform brown colour, its hook-shaped dorsal process of the sacculus, the shorter and broader cucullus and the smaller number of cornuti.

Description: Wingspan 14 mm. Head dark brown. Labial palp internally whitish, externally light grey-brown; third segment about half length second. Antenna: scape without scale tuft, whitish; flagellum ringed white and dark grey. Forewing uniformly nutbrown, with narrow white costal streak. Fringes light grey. Hindwing light greyish-ochreous. Fringes light grey.

Male genitalia (Fig. 19): Gnathos knob globular. Tegumen stretched, medially strongly constricted. Pedunculus slender, slightly rounded. Transtilla robust, club-shaped, with strong bristles. Valvula indistinct, rounded. Cucullus broad, with rounded apex. Sacculus with convex ventral margin, with hook-shaped dorsal process. Phallotheca with two rods of equal length, gradually tapering towards apex and ending in triangular apical teeth; cornuti a bundle of long spikes.

Bionomy: The species flies in August-October at an altitude of 1780-2820 meters. The early stages and the foodplant are unknown.

Distribution: Found in the Mexican States of Durango and Puebla.

Etymology: The species is named after the type locality El Salto in the Mexican State of Durango.

### *Coleophora tehuacanella* van der Wolf, sp. n. (Fig. 4)

Holotype ♂: Mexico, Puebla 2 mi SW Tehuacan, 5300, 4-X-1975 blacklight trap Powell", gen.prep. Wf 12055. Paratypes: 2 ♂♂, same date, same locality, gen. prep. Wf 12054, 12144; 1 ♂, same locality, 5-X-1975, gen. prep. Wf 12045.

Diagnosis: A small-sized species. The male genitalia show a structure that is typical for species group 30 of Toll's system., which has a double-rod phallotheca. An almost identical genital structure can be found in *Coleophora meridionella* Rebel, 1912, a species from the mediterranean region, and in *Coleophora zymotica* Meyrick, 1931, described from Paraguay.

Description: Wingspan 9 mm. Head white. Labial palp long, white, second segment twice length of third. Antenna: scape without scale tuft, flagellum ringed white and ochreous. Forewing silvery white with sparse greyish scales. Fringes greyish-ochreous. Hindwing beige. Fringes ochreous.

Male genitalia (Fig. 20): Gnathos knob lozenge-shaped, narrow. Tegumen narrow, medially constricted. Pedunculus slender. Transtilla slender. Valvula small, inconspicuous. Cucullus large, gradually widening towards rounded apex. Sacculus narrow with convex ventral margin, with small rounded process; dorsal process hook-shaped with blunt apex. Phallotheca long, with two slender rods surpassing ventral margin of sacculus. Cornutus a long curved spine.

Female genitalia: Unknown.

Bionomy: The species flies in October at an altitude of 1780 meters The early stages and the foodplant are not known.

Distribution: Only known from the type locality in the Mexican State of Puebla.

Etymology: The name of the species refers to the type locality: the city of Tehuacan in the Mexican State of Puebla.

### *Coleophora coahuila* van der Wolf, sp. n. (Fig. 5)

Holotype ♂: Mex., 1 ♂, SE Saltillo Coah[uila]. 6800, 23-IX-[19]76, J. A. Chemsak, J. Powell at light, gen.prep. Wf 12206.

Diagnosis: A small-sized species characterized by its orange-brown colour and white costal region. Judging from the male genitalia it belongs to Toll's 30th species group with double-rod phallotheca.

Description: Wingspan 11 mm. Head white. Labial palp white; third segment 3/4th length second. Antenna, without scape tuft, with flagellum ringed black and white. Forewing orange-brown with occasionally dark scales giving it a rough appearance; costal region from base to 2/3rd white. Fringes silvery white. Hindwing light grey-brown. Fringes silvery white.

Male genitalia (Fig. 21): Gnathos knob conical. Tegumen stretched, medially constricted. Pedunculus broad, rounded. Transtilla hook-shaped. Valvula small, rounded. Cucullus long, gradually

widening towards rounded apex. Sacculus with ventral margin slightly convex, progressing with a scalloped margin to a small dorsal process. Phallotheca broad, two rods gradually tapering towards acute points surpassing the sacculus margin. Cornuti a long string of fine needles.

Bionomy: The species flies in September at an altitude of 2230 meters. The early stages and the foodplant are not known.

Distribution: So far only known from the Mexican State of Coahuila, which borders the U. S. State of Texas.

Etymology: The name refers to the Mexican State of Coahuila, where the species was collected. Nahuatl *coahuila (cuahuilan*) = Place among trees.

### ***Coleophora popoloca*** **van der Wolf, sp. n.** (Fig. 6)

Holotype ♂: MEXICO, Puebla 2 mi. SW Tehuacan, 5300, 4-X-[19]75 blacklight trap J. Powell collector", gen.prep. Wf 12143.

Diagnosis: A species characterized by its silvery white colour and small size. The male genitalia indicate that it belongs to Toll's 30th species group because of its twin-rod phallotheca. The main characteristics are the shape of the phallotheca and the spatulate dorsal process of the sacculus.

Description: Wingspan 12 mm. Head white. Labial palp white, third segment about half length of second. Antenna whitish, without scale tuft on scape. Forewing silvery white. Fringes greyish-white. Hindwing and fringes greyish-white.

Male genitalia (Fig. 22): Gnathos lob lozenge-shaped, narrow. Tegumen narrow. Pedunculus broadly widened. Transtilla broad, rectangular. Valvula large, rounded. Cucullus long, broad, with rounded apex. Sacculus narrow, ventral margin almost straight, ending in a spatulate process. Phallotheca stout, sclerotized, halfway divided into two straight rods with slightly curved apices. Cornutus a long thin spine.

Bionomy: The species flies in October at an altitude of 1780 meters. The early stages and the foodplant are unknown.

Distribution: The species is only known from the type locality: Tehuacan, in the Mexican State of Pueblo.

Etymology: The name of the species refers to the Popoloca, one of the original populations of the Tehuacan valley (PLUNKET *et al*., 2005). Nahuatl: popoloca = people who cannot be understood.

### ***Coleophora bajacalsur*** **van der Wolf, sp. n.** (Fig. 7)

Holotype ♂: MEX., Baja California Sur, Las Barracas, ca 30 km. E Santiago, 1-6-V-1982 Paul De Bach, collector malaise trap", gen. prep. Wf 12171.

Diagnosis: A medium-sized species with whitish ground colour suffused with light beige and with occasional dark scales. Costal area irregularly white. With its double-rod phallotheca it belongs to Toll's 30th species group. The male genitalia are characterized by a short cucullus, a sacculus with a hook-shaped ventral process and a crooked stout dorsal process.

Description: Wingspan 15 mm. Head beige. Labial palp white; third segment 3/4th length of second. Antenna: scape without scale tuft; flagellum ringed ochreous and white. Forewing ground colour white suffused beige, with occasional dark scales. Costal area white, irregularly bordered. Fringes light brown. Hindwing light beige. Fringes light brown.

Male genitalia (Fig. 23): Gnathos knob globular. Tegumen stretched, medially constricted. Pedunculus rather broad, rounded. Transtilla broad, crooked, tapering towards a rounded apex. Cucullus broad, short, with rounded apex. Valvula pronounced, rounded. Sacculus broad, with almost straight ventral margin with acute hook-shaped ventral process, and a stout slightly crooked dorsal process. Phallotheca with two slender rods, one with faint serrate dorsal edge. No cornuti observed.

Bionomy: The species flies in May. The early stages and the foodplant are unknown.

Distribution: Only known from the type locality: Mexico, Baja California Sur.

Etymology: The name is a shortening of Baja California Sur, the Mexican State where the species was collected.

### *Coleophora penicillata* van der Wolf, sp. n. (Fig. 8)

Holotype ♂: MEX., Durango 20 ml W. 8500, Dgo. MEX: 31-VII-[19]64, J. A. Chemsak & J. Powell, Black and White lights, gen.prep. Wf 12168. Paratype ♂ (Gen.prep. Wf 12218), MEX., Guerrero 10 km E. Tixtla, 18-22-IX-1982, elev. 1770 m. J. A. Powell & J. A. Chemsak".

Diagnosis: A medium-sized species with light beige silky appearance. It belongs to Toll's 30th species group with double-rod phallotheca. In the male genitalia it is characterized by a huge hook-shaped dorsal process of the sacculus with numerous apical bristles.

Description: Wingspan 15 mm. Head whitish. Labial palp very long, white, third segment as long as second. Antenna without scale tuft on scape; flagellum ringed dark brown and white. Forewing silky light beige, with a very fine white costal streak; very faint whitish streaks along veins. Fringes brown-grey. Hindwing light grey. Fringes brown-grey.

Male genitalia (Fig. 24): Gnathos knob lozenge-shaped. Tegumen stretched, medially constricted. Pedunculus slender, slightly rounded. Transtilla slender, linear. Valvula inconspicuous. Cucullus short, broad, with rounded apex. Sacculus broad, with slightly convex ventral margin, ending in a square corner with small acute process. Dorsal process long, slender, its hooked apex covered with numerous bristles. Phallotheca with two stout rods tapering to acute apices, each topped with a triangular tooth. Cornuti a long bundle of spines.

Bionomy: The species flies in July-September at an altitude of 1770-2800 meters. The early stages and the foodplant are unknown.

Distribution: The species is known from the Mexican States of Durango and Guerrero.

Etymology: The species-name penicillata (Latin: *penicillatus* = with a brush) refers to the apical brush of the dorsal process of the sacculus.

### *Coleophora pueblana* van der Wolf, sp. n. (Fig. 9)

Holotype ♂: MEXICO, Puebla 2 mi. SW Tehuacan, 5-X-[19]75, 5300, blacklight trap J. Powell collector, gen.prep. Wf 12139; specimen glued on cardboard. Paratypes: 1 ♂, same data as holotype, gen.prep. Wf 12147; 3 ♂♂, same data as holotype, but 4-X-[19]75, gen.preps. Wf. 12146, 12046, 12052.

Diagnosis: A species characterized by its small size. Its ground colour is grey, speckled with many black scales. Judging from the male genitalia the species is related to Toll's 30th species group with a double-rod phallotheca. The very short and inconspicuous cucullus is characteristic for the species.

Description: Wingspan 14 mm. Head ochreous-white. Labial palp long, ochreous-white; third segment 3/4th length second. Antenna without scale tuft on scape, flagellum ringed light beige and white. Forewing whitish suffused grey, occasionally darker scales giving the forewing a rough appearance. Fringes greyish. Hindwing whitish-ochreous. Fringes grey.

Male genitalia (Fig. 25): Gnathos knob globular. Tegumen stretched, medially constricted. Pedunculus triangular. Transtilla long, hook-shaped, forming a V. Valvula small, triangular, inconspicuous. Cucullus very short, inconspicuous. Sacculus broad, ventral margin convex, gradually tapering towards cucullus, dorsal process pronged. Phallotheca with two slender rods projecting beyond cucullus and sacculus, apices acute. Cornuti a long string of tightly packed short spines.

Bionomy: The species flies in October at an altitude of 1780 meters. The early stages and the foodplant are not known.

Distribution: The species is only known from the Mexican State of Puebla.

Etymology: The name pueblana refers to the Mexican State of Puebla, the type locality of the species.

### *Coleophora catavinae* **van der Wolf sp. n.** (Fig. 10)

Holotype ♂: Mex., Baja Calif. Norte. Arroyo Catavina, Hwy 1, 35 mi. S. Progresso, 1-IV-[19]76, P. Rude blacklite trap, gen.prep. Wf 12208. Paratypes: 1 ♂, same data as holotype; 1 ♂, Mex., Baja Calif. Norte, 1 mi N. Meling Ranch, 2100, 17-III-1972, J. Doyen & J. Powell, at light", gen.prep. Wf 12210.

Diagnosis: A medium-sized species with white ground colour and some black streaks along veins. The species belongs to Toll's 30th species group with double-rod phallotheca. In the male genitalia the species is characterized by the long cucullus and the long dorsal process of the sacculus. Judging from the male genitalia the species is closely related to *Coleophora puntaprietae.* For differences see there.

Description: Wingspan 13-15 mm. Head white. Labial palp white; third segment 3/4th length of second. Antenna, without scape tuft, white. Forewing whitish, with thin black streaks along veins, growing stronger towards apex, darkening the wingtip. Fringes grey. Hindwing grey. Fringes dark brown.

Male genitalia (Fig. 26): Gnathos knob lozenge-shaped. Tegumen stretched, medially constricted. Pedunculus broadly rounded. Transtilla linear, slender. Valvula inconspicuous. Cucullus long, slender, with rounded apex. Sacculus large, with slightly convex ventral margin. Ventral process a large chitinized triangle with rounded top. Dorsal process a long irregularly shaped arm reaching middle of cucullus. Phallotheca with double slender rods surpassing sacculus. Cornuti a bundle of spines.

Bionomy: The species flies in March-April at an altitude of 690 meters. The early stages and the foodplant are unknown.

Distribution: Only known from the Baja California Norte.

Etymology: The name is derived from the type locality: Arroyo Catavina.

### *Coleophora puntaprietae* **van der Wolf sp. n.** (Fig. 11)

Holotype ♂: Mex., Baja Calif. Norte 24 mi. N. Punta Prieta, 1-2-IV-[19]73, S. L. Szerlip, J. Powell, J. Donohue at blacklight, gen.prep. Wf 12215. Paratype: 1 ♂ same data as holotype, gen.prep. Wf 12216.

Diagnosis: A medium-sized species with greyish-white forewings densely sprinkled with dark grey, black and dark brown scales. The species belongs to Toll's 30th species group with double-rod phallotheca in the male genitalia. They show that the species is closely related to *Coleophora catavinae* van der Wolf, sp. n. The differences are that in *puntaprietae* the forewing is unicolorous, whereas *catavinae* has black streaks along the veins; in *puntaprietae* the cucullus is short and broad, in *catavinae* long and narrow.

Description: Wingspan 14 mm. Head greyish-white. Labial palp: second segment white, third segment ochreous, half length of second. Antenna, without scape tuft, greyish-white; flagellum greyish-white, vaguely ringed grey. Forewing greyish-white, densely sprinkled with dark grey, black and dark brown scales. Costal fringes white, dorsal fringes brown-grey. Hindwing light grey. Fringes dark grey.

Male genitalia (Fig. 27): Gnathos knob globular. Tegumen stretched, medially constricted. Pedunculus broadly rounded. Transtilla triangular. Valvula large, rounded. Cucullus stout, short. Sacculus large, with rather straight ventral margin. Ventral process small, rounded. Dorsal process a long irregularly shaped arm surpassing cucullus. Phallotheca with two slender rods reaching half-way sacculus. Cornutus a long spine.

Bionomy: The species flies in April. The early stages and the foodplant are unknown.

Distribution: Only known from the Baja California Norte.

Etymology: The name refers tot he type locality: Punta Prieta.

### *Coleophora yagul* **van der Wolf, sp. n.** (Fig. 12)

Holotype ♂: Mexico, Oaxaca, Yagul, 30 km. E. Oaxaca, 1500 m. case leg. 22-II-1998, e. l., 27-III-1998, leg. HWvdWOLF, gen.prep. Wf 8965.

Diagnosis: A medium-sized species with white groundcolour overlaid with multiple dark and light brown streaks of different widths along veins. The species, with a double-rod phallotheca, belongs to Toll's 30th species group.

Description: Wingspan 13 mm. Head ochreous. Labial palp ochreous-white; third segment 3/4th length of second. Antenna, without scape tuft, whitish, faintly ringed brown. Forewing ground colour white with many dark and light brown streaks of different widths along veins; costal margin white. Fringes greyish-brown. Hindwing greyish-ochreous. Fringes greyish-brown.

Male genitalia (Fig. 28): Gnathos knob globular. Tegumen rather broad, medially slightly constricted. Pedunculus stretched, slightly rounded. Transtilla slender, straight. Valvula inconspicuous. Cucullus rather short and narrow. Sacculus with rather straight ventral margin, progressing at 120º as a straight scalloped margin towards a blunt triangular dorsal process. Phallotheca with two slender rods tapering to acute apices. Cornuti a wavy bundle of numerous long spines.

Bionomy: One adult was bred from several larval cases found feeding on the leaves of Baccharis sp. Larval case (Fig. 33): Tubular, bivalved, length 8 mm. Oral opening 45º to the long axis. The colour of the case is greyish-ochreous. The surface of the case is rather rough. The case was collected in February, the adult emerged at the end of March in captivity inside the house, after having survived a flight to Europe. The species occurs at an altitude of 1500 meters.

Distribution: Only known from the Mexican State of Oaxaca.

Etymology: *Coleophora yagul* is named after the archeological site Yagul in the Mexican State of Oaxaca. The cases of the species were found among the ruins of this site on plants underneath an old tree. The Zapotec word *yagul* means old tree. (*ya* = tree, *gul* = old) (WIKIPEDIA).

### ***Coleophora bajacaliforniae*** **van der Wolf, sp. n.** (Fig. 13)

Holotype ♂: MEX., Baja Calif. Norte, 1 mi. N. Meling Ranch, 2100, 17-III-1972, J. Doyen & J. Powell, at light, gen.prep. Wf 12209. Paratypes: 2 ♂♂, same data as holotype, gen.prep. Wf 12207.

Diagnosis: A large species with greyish-white colour, sparsely sprinkled with very tiny black specks. Its systematic position is not clear. The male genitalia are reminiscent of those of *Coleophora granifera* Braun, 1919, a species known from Canada and the U.S.A. However, the habitus of the adult does not match.

Description: Wingspan 17-18 mm. Head greyish-white. Labial palp white, third segment half length second. Antenna without scape tuft; flagellum ringed dirty white and beige. Forewing greyish-white, sparsely sprinkled with very tiny black specks. Costal fringes white, dorsal ones greyish-brown. Hindwing greyish-white. Fringes greyish-brown.

Male genitalia (Fig. 29): Gnathos knob small, globular. Tegumen broad, not constricted. Pedunculus rather short, broad, rounded. Transtilla oblong, tapering towards a sharp point. Valvula oblong, rounded, progressing on to mid-cucullus. Cucullus short, broad. Sacculus with ventral margin convex, reaching up to a conical point reaching the rounded cucullus apex. Phallotheca broadly tubular, tapering to an acute point reaching towards valvula. Cornutus a slender spike.

Bionomy: The species flies in March at an altitude of 690 meters. The early stages and the foodplant are unknown.

Distribution: Only known from the Mexican State of Baja California Norte.

Etymology: The name of the species refers to the type locality: the peninsula of Baja California.

### ***Coleophora iztac*** **van der Wolf sp. n.** (Fig. 14)

Holotype ♂: MEX., 17 mi. SE Saltillo Coa[huilo], 6800, 23-IX-[19]76, at light J. A. Chemsak & J. Powell, gen.prep. Wf 12201.

Diagnosis: A medium-sized species with snow-white forewings. The systematic position of the species cannot be ascertained.

Description: Wingspan 14 mm. Head snow-white. Labial palp white, second segment twice length

third, which is tinged yellowish. Antenna without scale tuft; flagellum white, strongly ringed black. Forewing snow-white. Fringes greyish-white. Hindwing light grey. Fringes light grey.

Male genitalia (Fig. 30): Gnathos knob conical. Tegumen stretched, narrow, medially strongly constricted. Pedunculus long, broadly rounded. Valvula rounded, with strong bristles, and with a long acute process directed towards cucullus. Cucullus narrow, gradually widening towards rounded apex. Sacculus gradually narrowing towards a blunt triangular process. This process is strongly chitinized, with a strong tooth on its dorsal margin. On the border of the process and the sacculus are about 10 parallel chitinized ridges. Phallotheca broad, gradually tapering towards a blunt apex halfway the cucullus. Cornuti a sinuous bundle of long spines.

Bionomy: The species flies in September at an altitude of 2230 meters. The early stages and the foodplant are unknown.

Distribution: Only known from the type locality: The Mexican State of Coahuila.

Etymology: The name *iztac* refers to the colour of the forewing: Nahuatl: *iztac*= white.

### *Coleophora incerta* van der Wolf, sp. n. (Fig. 15)

Holotype ♂: MEX., Sin[aloa], El Palmito, 15 mi. W. 18-VII-[19]64, J. A. Chemsak, J. Powell, black and white lights, gen. prep. Wf 12179.

Diagnosis: A species characterized by differently coloured streaks along the forewing. It is difficult to attribute the species to a related group.

Description: Wingspan 16 mm. Head white. Antenna white, scape white without scale tuft. Labial palp white, third segment about as long as second. Forewing light yellow with narrow white costal streak; a brown wedge-shaped streak from root to apex, and a narrow brown streak along dorsum. Fringes brown. Hindwing grey-brown. Fringes grey.

Male genitalia (Fig. 31): Gnathos knob globular. Tegumen narrow, medially constricted. Pedunculus slender. Transtilla large, rhomboid. Valvula inconspicuous. Cucullus of medium length, broad, with rounded apex. Sacculus with slightly convex ventral margin ending in a hook-shaped dorsal process, at its root a triangular flap. Phallotheca heavily sclerotized, stout, gradually tapering towards an obtuse apex. Cornuti a short bundle of spikes.

Bionomy: The species flies in July. The early stages and the foodplant are unknown.

Distribution: The species is only known from the Mexican State of Sinaloa.

Etymology: The name of the species reflects its dubious systematic position. (Latin *incertus* = dubious).

### *Coleophora mexicocopa* van der Wolf, sp. n. (Fig. 16)

Holotype ♂: MEXICO, Puebla 2 mi SW Tehuacan, 5300, 5-X-[19]75, blacklight trap J. Powell collector, gen.prep. Wf 12142. Paratypes: 1 ♂, same data, gen.prep. Wf 12140; 1 ♂, same data, but X-4-75, gen.prep. Wf 12145.

Diagnosis: A medium-sized species with yellowish-white forewings. The systematic position of this species cannot be ascertained. In the male genitalia the species is characterized by the very short and inconspicuous cucullus, the large triangular dorsal process of the sacculus and the peculiar slender, crooked processes issuing from the transtilla.

Description: Wingspan 11-12 mm. Head whitish. Labial palp: second segment white, third segment yellowish, 1/3rd length second. Antenna: scape white, without tuft. Flagellum ringed white and black. Forewing whitish, gradually turning yellowish towards apex. Fringes beige. Hindwing greyish-white. Fringes beige.

Male genitalia (Fig. 32): Gnathos knob globular. Tegumen broad, medially not constricted. Pedunculus broad, rounded. Transtilla linear, slender, on each distal end a slender crooked process. Valvula large, rounded, inconspicuous. Cucullus transparent, rather short, gradually tapering into an acute more sclerotized apex. Sacculus broad, ventral margin convex, issuing into a triangular ventral

process, at the root with a finger-like process. Dorsal process large, triangular, surpassing the cucullus, at its dorsal margin an acute triangular process. Cornutus dagger-shaped.

Bionomy: The species flies in October at an altitude of 1780 meters. The early stages and the foodplant are unknown.

Distribution: Only known from Tehuacan in the Mexican State of Puebla.

Etymology: The name *mexicocopa* is the Nahuatl word for "mexican".

**Acknowledgments**

I wish to express my thanks to Jerry Powell and Peter Oboyski of EMEC for allowing me to study the Mexican Coleophoridae in their collection. I also thank Dr. Cees Gielis for photographing most of the imagos. Also a word of thanks for Dr. Antonio Vives for kindly translating the abstract into Spanish. Last but not least I thank my wife Wil van der Wolf-van Dalen for helping me with the Nahuatl names.

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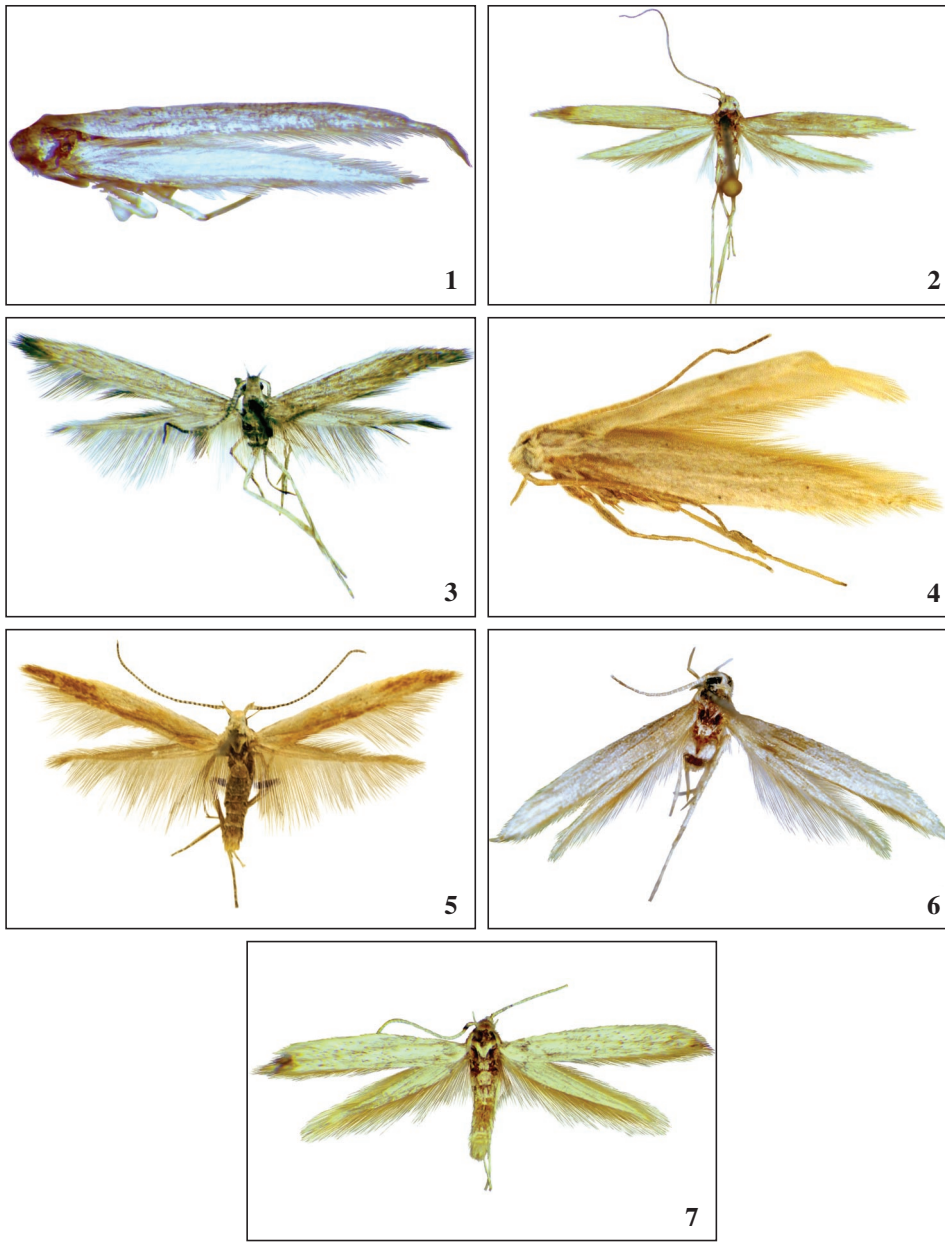


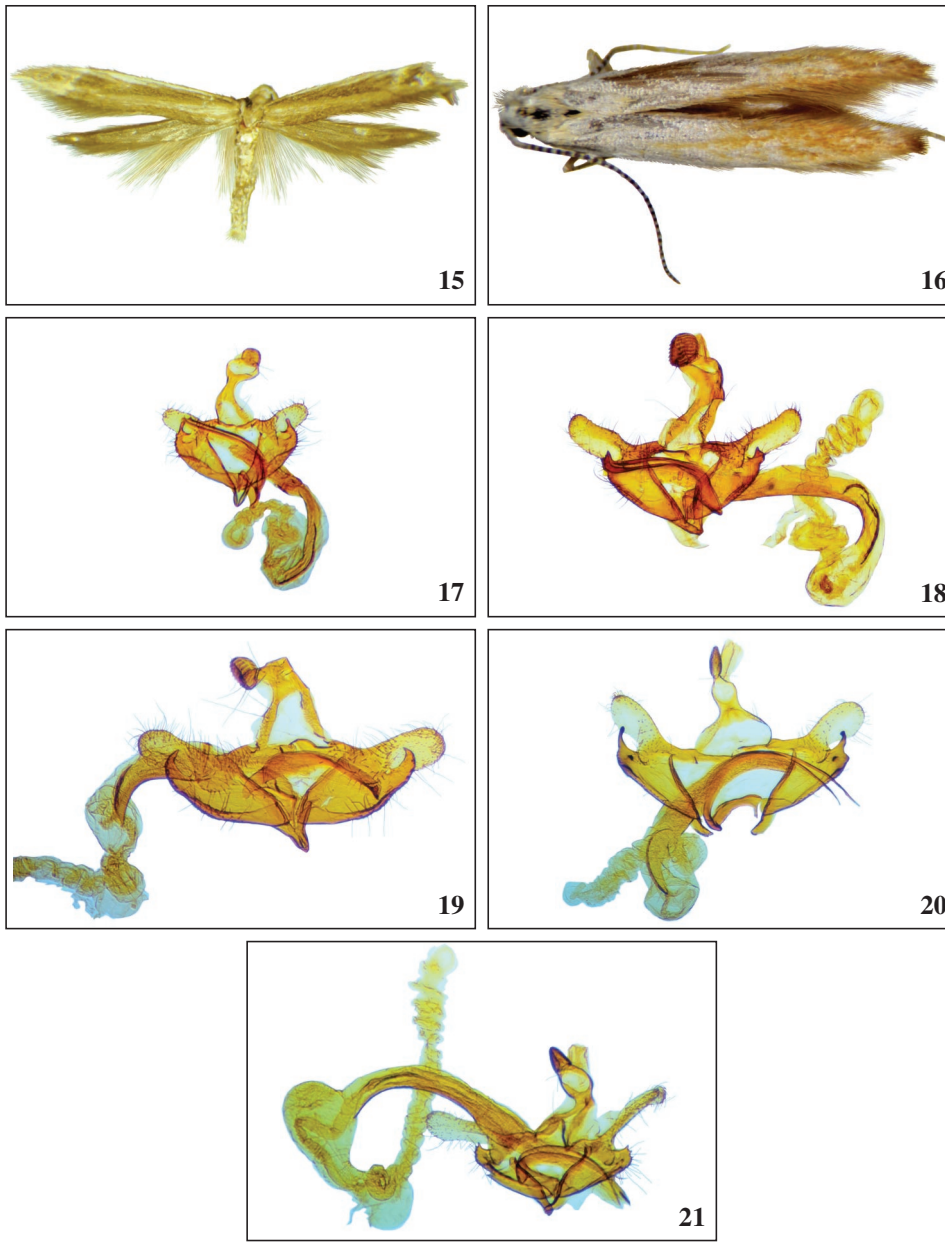

**Figs. 1-7.–** Adults: **1**. *Coleophora papalotontli* van der Wolf, sp. n., holotype. **2.** *C. powelli* van der Wolf, sp. n., holotype**. 3.** *C. saltoella* van der Wolf, sp. n., holotype. **4.** *C. tehuacanella* van der Wolf, sp. n., paratype. **5.** *C. coahuila* van der Wolf, sp. n., holotype. **6.** *C. popoloca* van der Wolf, sp. n., holotype. **7.** *C. bajacalsur* van der Wolf, sp. n., holotype.



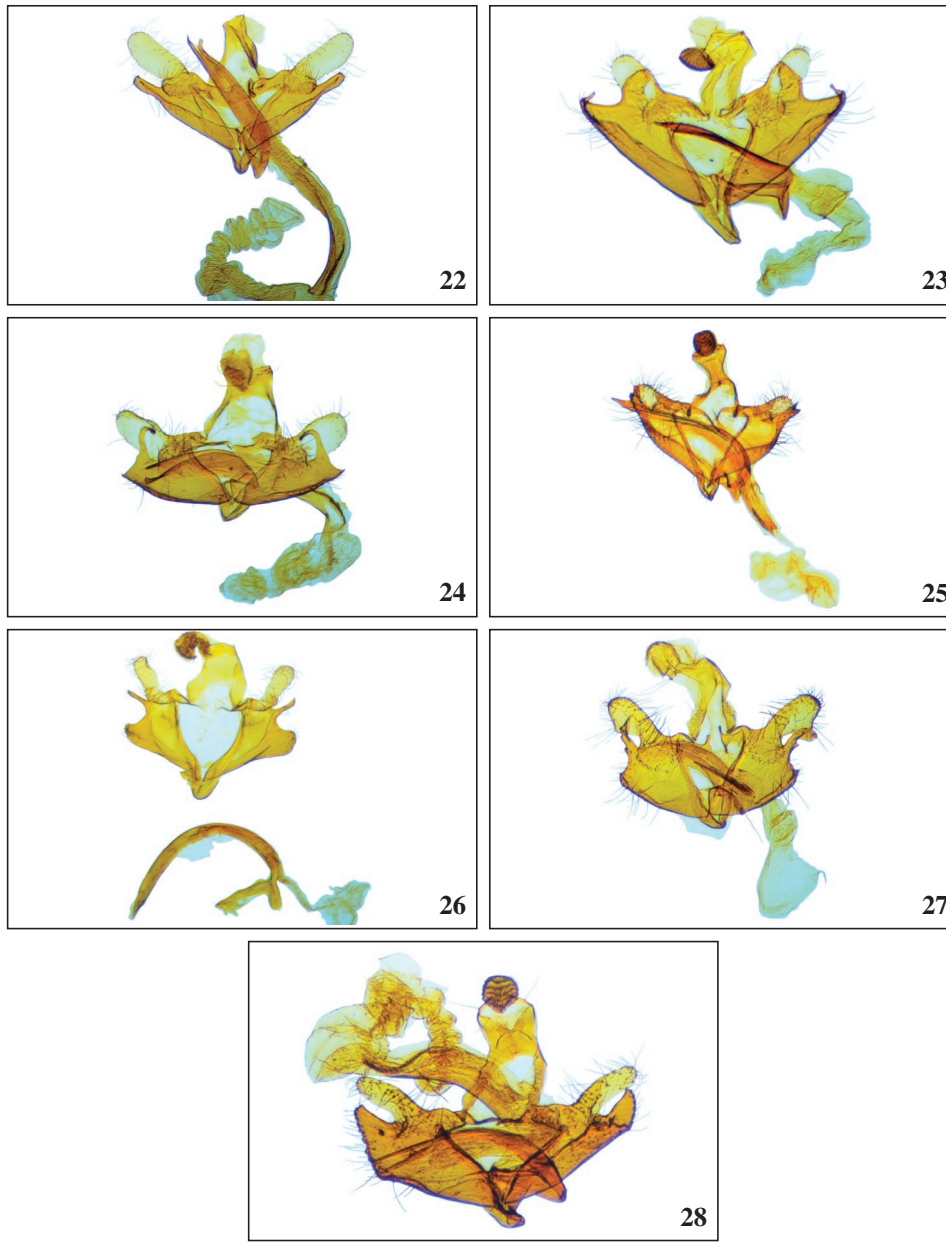




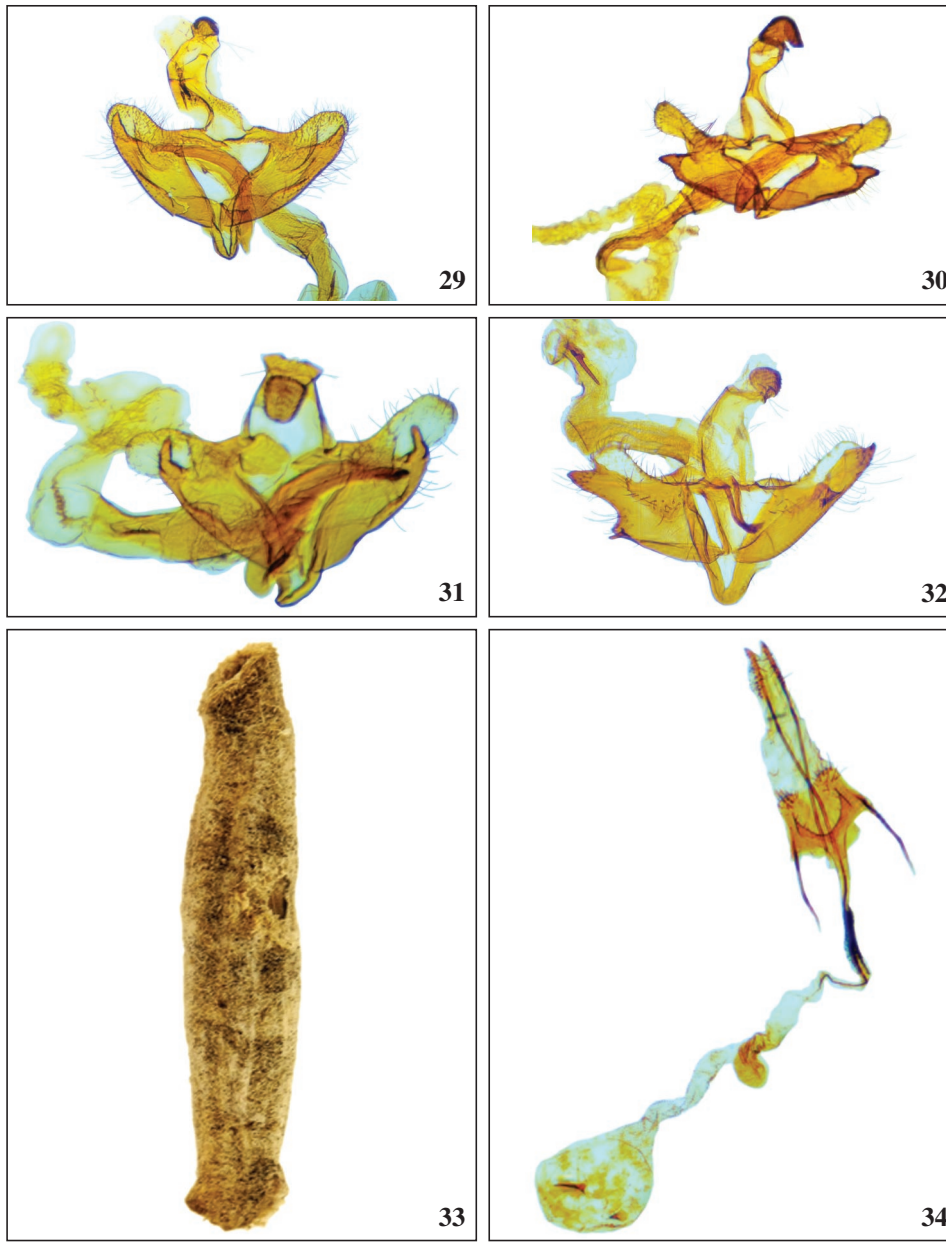

**Figs. 8-14.–** Adults: **8.** *C. penicillata* van der Wolf, sp. n., paratype. **9.** *Coleophora pueblana* van der Wolf, sp. n., paratype. **10.** *C. catavinae* van der Wolf, sp. n., paratype. **11.** *C. puntaprietae* van der Wolf, sp. n., holotype. **12.** *C. yagul* van der Wolf, sp. n., holotype. **13.** *C. bajacaliforniae* van der Wolf, sp. n., holotype. **14.** *C. iztac* van der Wolf, sp. n., holotype.




**Figs. 15-21.–** Adults: **15.** *C. incerta* van der Wolf, sp. n., holotype. **16.** *C. mexicacopa* van der Wolf, sp. n., holotype. Male genitalia: **17.** *Coleophora papalotontli* van der Wolf, sp. n., holotype. **18.** *C. powelli* van der Wolf, sp. n., paratype. **19.** *C. saltoella* van der Wolf, sp. n., paratype. **20.** *C. tehuacanella* van der Wolf, sp. n., paratype.




**Figs. 22-28.–** Male genitalia: **21.** *C. coahuila* van der Wolf, sp. n., holotype. **22.** *C. popoloca* van der Wolf, sp. n., holotype. **23.** *C. bajacalsur* van der Wolf, sp. n., holotype. **24.** *C. penicillata* van der Wolf, sp. n., holotype. **25.** *Coleophora pueblana* van der Wolf, sp. n., holotype. **26.** *C. catavinae* van der Wolf, sp. n., holotype. **27.** *C. puntaprietae* van der Wolf, sp. n., holotype. **28.** *C. yagul* van der Wolf, sp. n., holotype.




**Figs. 29-34.–** Male genitalia: **29.** *C. bajacaliforniae* van der Wolf, sp. n., holotype. **30.** *C. iztac* van der Wolf, sp. n., holotype. **31.** *C. incerta* van der Wolf, sp. n., holotype. **32.** *C. mexicacopa* van der Wolf, sp. n., holotype. Larval case; female genitalia: **33.** Larval case of *Coleophora yagul* van der Wolf, sp. n. **34.** Female genitalia of *Coleophora mexicana* Landry, 1994.

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# REVISION DE PUBLICACIONES
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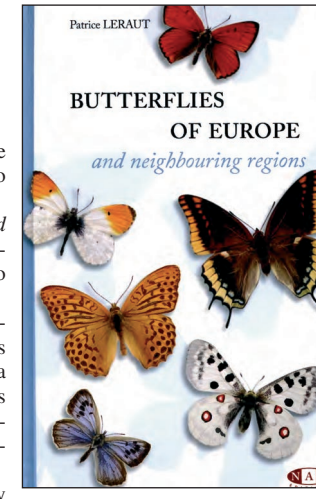


Tenemos en nuestras manos el quinto volumen de esta serie, que en este caso sería el primero, ya que trata los Rhopalocera (Papilionoidea) y los cuatro anteriores, trataban los Heterocera.

El formato del libro es similar al popular de Higgins & Riley *A Field Guide to the Butterflies of Britain and Europe*, pero en esta ocasión, está mucho más enriquecido al describirse una nueva especie (*Euchloe mirei*) y cuatro nuevas subespecies.

Después de una introducción y generalidades, se pasa al grueso del trabajo donde se estudian las especies consideradas en el libro. A continuación, nos encontramos con una parte muy ilustrativa, donde se indican como se separa una mariposa diurna de una nocturna, sobre el polimorfismo, características medioambientales en montañas y zonas boreales, el medioambiente mediterráneo, sobre las migraciones, sobre la nomenclatura y conservación de las mariposas, seguido de un listado de las especies estudiadas.

De cada especie considerada, se dan los datos morfológicos del macho y de la hembra, las posibles variaciones (donde se indican un gran número de formas), se comentan las especies próximas, la biología, datos de vuelo y unos comentarios adicionales y de un mapa marcando en negro, la zona de distribución.

Todos los adultos están fotografiados a lo largo de 655 planchas a todo color de los adultos y 44 planchas de las genitalias. Si bien las fotografías de las genitalias, faltan las de muchas especies, algunas de las más complicadas, como los Lycaenidae y, en otros casos, lamentablemente, no permiten su utilización. Añoramos los excelentes dibujos de las genitalias de los volúmenes anteriores.

No podemos terminar estas líneas, sin felicitar al autor, nuestro estimado colega Patrice Leraut (conocido por sus aportaciones lepidopterológicas principalmente en el campo de los Pyraloidea) por un trabajo bien ejecutado y fruto del cual, se han clarificado y sacado a la luz muchos problemas sistemáticos y taxonómicos. Igualmente felicitamos a la Editorial, por un trabajo bien realizado y la acertada idea de presentar el libro en dos idiomas en inglés y en francés, lo que sin duda le dará una mayor difusión, por lo que lo recomendamos abiertamente a todos los interesados en el mundo de los Rhopalocera, considerando que no debería de faltar en ninguna biblioteca especializada o general.

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# Taxonomic review of the genus *Epilepia* Janse, 1931 from China, with descriptions of two new species (Lepidoptera: Pyralidae, Epipaschiinae)

H. Rong & H. H. Li

**Abstract**

Three species of the genus *Epilepia* Janse, 1931 from China are reviewed. *Epilepia denticulata* Rong & Li, sp. n. and *E. longaduncata* Rong & Li, sp. n. are described as new. Photographs of adults and genitalia are provided.
KEY WORDS: Lepidoptera, Pyralidae, Epipaschiinae, *Epilepia*, new species, China.

**Revisión taxonómica del género *Epilepia* Janse, 1931 de China, con descripción de dos nuevas especies (Lepidoptera: Pyralidae, Epipaschiinae)**

**Resumen**

Se revisan tres especies del género *Epilepia* Janse, 1931 de China. *Epilepia denticulata* Rong & Li, sp. n. and *E. longaduncata* Rong & Li, sp. n., se describen como nuevas. Se proporcionan fotografías de los adultos y genitalias.
PALABRAS CLAVE: Lepidoptera, Pyralidae, Epipaschiinae, *Epilepia*, nuevas especies, China.

## Introduction

The genus *Epilepia* was established by Janse in 1931 to accommodate three species: the type species *Macalla melanosparsalis* Janse, 1922, *E. melanobrunnea* (Janse, 1922) transferred from *Macalla*, and *E. simulata* Janse, 1931. Later on, INOUE & YAMANAKA (1975) transferred *M. dentatum* Matsumura & Shibuya, 1927 and *M. melanobasis* Hampson, 1906 to *Epilepia*, and SPEIDEL (2007) described *E. meyi* from Nigeria.

*Epilepia dentatum* (Matsumura & Shibuya, 1927) described from Japan is the only species distributed in the Palearctic Region, which was recorded in China and Korea (LI *et al.*, 2009). The aim of the present paper is to review three *Epilepia* species in China, including two new species.

## Material and methods

Specimens examined in the present study were collected by light traps. Adults were examined using an Olympus SZX9 stereo microscope. Permanent mounting methods of genitalia and venation follow the techniques introduced by LI (2002). Images of adults were taken by using a Leica M205A stereo microscope and images of genitalia were taken by using a Leica DM750 microscope, and all refined in Photoshop CS5 software.

All the studied specimens, including the types of the new species, are deposited in the Insect Collection of Nankai University (NKU), Tianjin, China.

**Taxonomic accounts**

*Epilepia* Janse, 1931
*Epilepia* Janse, 1931: 466.

Type-species: *Macalla melanosparsalis* Janse, 1922, by original designation.
Type locality: South Africa.

Generic characters: Body medium size. Head (Fig. 1): Labial palpus slender, first segment thicker than second, second segment with hair-like scales on ventral surface distally. Maxillary palpus short and compressed in both male and female (except long brush-like in male of *E. dentatum*). Antenna with short cilia on ventral surface in male, without scape extension; female antenna slightly thinner than male. Forewing (Figs 2-4) with discal and discocellular spots represented by a tuft; terminal line with evenly spaced spots along its inner side. Hindwing with metal flash near costal margin, with a short strip from upper corner to lower corner of cell. Wing venation (Fig. 5): Forewing with $R_3$, $R_4$ and $R_5$ stalked; hindwing with $Sc+R_1$ and Rs departed, $M_1$ and Rs from upper angle of cell; both wings with $M_2$ and $M_3$ separated. Mid and hind tibiae with hair-like scales on outer side.

Male genitalia (Figs 6-8). Uncus elongate, often widened distally. Gnathos absent. Valva sub-ovate, with a sclerotized wavy fold from base reaching below dorso-apex; costa developed; sacculus absent. Juxta rectangular. Aedeagus with a denticle or a hook before apex ventrally.

Female genitalia (Figs 9-11). Papillae anales collar-shaped in basal half, shovel-shaped in distal half. Apophyses anteriores usually membranous distally, longer than apophyses posteriores. Antrum differing in shape. Corpus bursae ovate; signa two, with dense denticles.

Diagnosis: *Epilepia* is similar to *Teliphasa* Moore, 1888 in the forewing with both discal and discocellular spots represented by a tuft, and the postmedian line curved outward and forming an angle medially. *Epilepia* can be separated from *Teliphasa* by the hindwing without a discocellular spot, and in the male genitalia by the elongate uncus, the absence of a gnathos, and the sub-ovate valva. In *Teliphasa*, the hindwing bears a discocellular spot; and the semicircular uncus is undeveloped, the gnathos is present, and the valva is sub-rounded in the male genitalia.

***Epilepia denticulata* Rong & Li, sp. n.** (Figs 2, 6, 9)

Type material. CHINA: Holotype ♂♂, Maoershan Nature Reserves (25.9ºN, 110.5ºE), Guilin, Guangxi, 1016 m, 23-VII-2015, coll. Mu-jie Qi and Sheng-nan Zhao, slide No. RH15361. Paratypes (6 ♂♂, 7 ♀♀). GUANGXI: 5 ♂♂, 4 ♀♀, 23-25-VII-2015, other data same as holotype, slide Nos. RH15362 ♀, RH15376 ♂, RH15533 ♂; 1 ♀, Yinshan Park, Dayaoshan Nature Reserves, Jinxiu, 1364 m, 21-VII-2015, coll. Mu-jie Qi and Sheng-nan Zhao; 1 ♀, Yangmeiao, Huanjiang County, Hechi, 1180 m, 24-VII-2015, coll. Mei-qing Yang and Gaeun Lee; GUIZHOU: 1 ♂, 1 ♀, Dongdai, Limingguan, Libo County, 720 m, 19-VII-2015, coll. Mei-qing Yang and Gaeun Lee, slide No. RH15375 ♂.

Diagnosis: This new species is similar to *E. longaduncata* Rong & Li, sp. n. in both forewing pattern and male genitalia. It can be distinguished in the male genitalia by the valva with costa nearly straight dorsally, the juxta with length about 1.3 times the width, and the aedeagus with a denticle near apex ventrally; and in the female genitalia by the rectangular antrum. In *E. longaduncata* sp. n., the costa of the valva is convex beyond middle dorsally, the length of the juxta is about 0.8 times the width, and the aedeagus has a long hook near apex ventrally; and the antrum is torch-shaped in the female genitalia.

Description: Adult (Fig. 2) wingspan 25.0-30.0 mm. Head white. Male labial palpus slender; first segment white on basal half, black mixed with grayish green on distal half, about 1/4 length of second; second segment exceeding vertex apically, white mixed with blackish gray on basal half, blackish gray on distal half, ventral surface with short blackish gray mixed with yellowish fuscous hair-like scales on distal 1/4; third segment black on basal half, white on distal half, tapering, about 1/4 length of second; female labial palpus slightly shorter than male. Maxillary palpus compressed and short, white mixed with pale yellowish fuscous. Antenna black, with white annulations on dorsal

surface; male with short grayish white cilia on ventral surface, cilia along outer side line about 1.2 times of diameter of antenna, inner side line about 2.0 times of diameter of antenna. Thorax and tegula blackish gray, mixed with dirty white and grayish green. Forewing basal area black with dense white scales on anterior 1/3, white with dense pale yellowish fuscous scales on posterior 2/3, with an arched semicircular strip at base; median area white, suffused with black and pale yellowish fuscous scales; distal area blackish gray, slightly paler near termen; antemedian line black, from middle of lower margin of cell slightly arched outward to basal 1/4 of dorsum; postmedian line black, wide, from beyond 2/3 of costal margin arched inward to $M_3$, then oblique inward to base of $CuA_2$, finally vertical to distal 1/3 of dorsum, beyond postmedian line at costal margin set a white mixed with black spot; discal and discocellular spots represented by a black tuft, with white scales bordering its outside; rectangular black patch placed along costal margin above discal spot; terminal line pale yellow, evenly spaced with uniform black rectangular spots along its inner side, interrupted with pale yellow on veins. Hindwing deep gray, darkening toward apex, with weak metal flash near costal margin; with a short oblique black strip from upper corner to lower corner of cell. Cilia of both wings pale yellow, interrupted with black on extension of veins. Legs with inner side white; outer side black, with dense white and grayish green scales on femora and tibiae, mid tibiae with black mixed with white and grayish green hairs, hind tibiae with white hairs, tarsi with each tarsomere white at apex. Abdomen with 3rd to 5th segments white mixed with black and yellow on ventral surface, remaining segments black mixed with yellow; black suffused with white on dorsal surface, 1st to 3rd segments white anteriorly.

Male genitalia (Fig. 6): Uncus with basal half uniformly narrow, distal half widened to apex, apex concave in triangle at middle; with dense fine hairs dorsally. Valva sub-ovate, narrowed basally, with dense fine hairs, with a sclerotized wavy fold from base reaching below dorso-apex; costa nearly straight dorsally, narrowed basally and distally, produced roundly and with dense setae ventro-medially. Juxta broad, sub-rectangular, with length about 1.3 times width, weakly sclerotized, with dense microtrichia posteriorly. Aedeagus slender, about 3/5 length of ventral margin of valva, its basal 1/3 membranous, distal 2/3 weakly sclerotized, with a denticle near apex ventrally; cornuti composed of a bunch of long spines, one of them slightly stronger and longer.

Female genitalia (Fig. 9): Papillae anales collar-shaped in basal half, shovel-shaped in distal half, with hairs of varying length. Eighth segment rectangular, with dense long setae posteriorly; sternite banded, triangularly produced at middle anteriorly. Apophyses anteriores about 1.3 times length of apophyses posteriores, slightly thicker, distal 1/4 membranous. Antrum rectangular. Ductus bursae thick, strongly sclerotized. Corpus bursae ovate, about 1.5 times length of ductus bursae; signa with dense denticles, smaller signum sub-rectangular, larger signum rounded.

Distribution: China (Guangxi, Guizhou).

Etymology: The specific name is derived from the Latin *denticulatus*, meaning denticulate, referring to the denticle near apex of the aedeagus.

### ***Epilepia longaduncata*** **Rong & Li, sp. n.** (Figs. 3, 7, 10)

Type material. CHINA: Holotype ♂, Baihualing (25.3ºN, 98.8ºE), Baoshan, 1474 m, 5-VIII-2014, coll. Kai-jian Teng, Shu-rong Liu and Hua Rong, slide No. RH15182. Paratypes (175 ♂♂, 127 ♀♀). YUNNAN: 11 ♂♂, 5-7-VIII-2014, other data same as holotype; 2 ♂♂, Dahaoping, Tengchong, 2020 m, 6-VIII-2007, coll. Dan-dan Zhang; 1 ♂, 2 ♀♀, Baihualing, Mt. Gaoligong, Baoshan, 1473 m, 29-30-VII-2013, coll. Shu-rong Liu, Yu-qi Wang and Kai-jian Teng, slide Nos. RH15365♂, RH15366 ♀; 1 ♀, Yexianggu, Xishuangbanna, 762 m, 17-VII-2014, coll. Kai-jian Teng, Wei Guan, Xiu-chun Wang and Shu-rong Liu; 1 ♂, Baihualing, Baoshan, 1577 m, 6-VIII-2015, coll. Kai-li Liu and Hao Wei; 1 ♂, Xiajinchang, Malipo County, Wenshan, 1470 m, 27-VII-2016, coll. Kai-jian Teng, Gaeun Lee and Tao Wang; 1 ♀, Yexianggu, Jinghong, 762 m, 8-VIII-2016, coll. Kai-jian Teng, Gaeun Lee and Tao Wang; LIAONING: 1 ♀, Da'ansi, Qianshan, Anshan, 245 m, 6-VIII-2016, coll. Mu-jie Qi, Juan Li and Yan-yan Jia; ZHEJIANG: 2 ♂♂, 2 ♀♀, Chansi, Mt. Tianmu, 350 m, 15-VIII-1999, coll. Hou-hun

Li *et al.*, slide Nos. WSS03086 ♂, WYP05119 ♀; 1 ♂, 3 ♀♀, Wuyanling, Taishun, 28-VII–1-VIII-2005, coll. Yun-li Xiao, slide No. WYP05108 ♀; 18 ♂♂, 3 ♀♀, Qingliangfeng, Lin'an, 900 m, 8–12-VIII-2005, coll. Yun-li Xiao, slide Nos. WYP05052 ♂, WYP05053 ♂, WYP05109 ♂, WYP05227 ♀, RH16045 ♂, RH16046 ♀; 2 ♂♂, 8 ♀♀, Mt. Tianmu, Lin'an, 350 m, 7-8-VIII-2007, coll. Qing Jin; 3 ♀♀, Shunxi, Lin'an, 420 m, 11-12-VIII-2007, coll. Qing Jin; 1 ♀, Zhonglieci, Mt. Tianmu, 400 m, 24-VII-2011, coll. Xi-cui Du; 1 ♂, Xianrending, Mt. Tianmu, 1500 m, 25-VII-2011, coll. Xi-cui Du and Xiao-bing Fu; 1 ♂, 1 ♀, Sanmuping, Mt. Tianmu, 800 m, 29-VII-2011, coll. Xi-cui Du and Xiao-bing Fu; 1 ♂, Shunxiwu, Qingliangfeng, 390 m, 18-V-2012, coll. Lin-lin Yang and Zhen-guo Zhang; 1 ♂, Mt. Longtang, Qingliangfeng, 500 m, 22-V-2012, coll. Lin-lin Yang and Zhen-guo Zhang; 25 ♂♂, Zhonglieci, Mt. Tianmu, 365 m, 27-VI-2013, coll. Ai-hui Yin and Xiu-chun Wang; 13 ♂♂, 4 ♀♀, Mt. Tianmu, 325 m, 28-VI-2013, coll. Ai-hui Yin and Xiu-chun Wang; 3 ♂♂, 6 ♀♀, Huangtanyu, Mt. Jiulong, 467 m, 3-9-VII-2013, coll. Ai-hui Yin and Xiu-chun Wang; 1 ♀, Neijiujian, 430 m, 7-VII-2013, coll. Ai-hui Yin and Xiu-chun Wang; 6 ♂♂, Sanmuping, Mt. Tianmu, 789 m, 12-13-VII-2014, coll. Ai-hui Yin, Xue-mei Hu and Qing-yun Wang; 4 ♀♀, Qianjiangyuan, Mt. Tianmu, 866 m, 7-10-VII-2014, coll. Ai-hui Yin, Xue-mei Hu and Qing-yun Wang; 5 ♂♂, 2 ♀♀, Lao'an. Mt. Tianmu, 555 m, 4-5-VII-2014, coll. Ai-hui Yin, Xue-mei Hu and Qing-yun Wang, slide No. RH15372 ♀; 2 ♀♀, Tianmu Village, Mt. Tianmu, 335 m, 1-VII-2014, coll. Ai-hui Yin, Xue-mei Hu and Qing-yun Wang; 1 ♀, Xiguan, Mt. Tianmu, 566 m, 16-VII-2014, coll. Ai-hui Yin, Xue-mei Hu and Qing-yun Wang; 1 ♂, 5 ♀♀, Sanmuping, Mt. Tianmu, 789 m, 16-17-VII-2015, coll. Ai-hui Yin, Kang Lou and Tao Wang, slide Nos. RH15369 ♂, RH15370 ♀, RH15371 ♂; 1 ♀, Ganzhuling, Simingshan, Yuyao, 853 m, 24-VII-2015, coll. Ai-hui Yin, Kang Lou and Tao Wang; 1 ♂, 1 ♀, Simingshan, National Forest Park, Ningbo, 822 m, 1-2-VIII-2016, coll. Qing-yun Wang, Mei-qing Yang and Ping Liu; 1 ♂, 1 ♀, Taohuadao, Zhoushan, 629 m, 4-VIII-2016, coll. Qing-yun Wang, Mei-qing Yang and Ping Liu; 1 ♂, 4 ♀♀, Daishandao, Zhoushan, 21 m, 5-VIII-2016, coll. Qing-yun Wang, Mei-qing Yang and Ping Liu; 6 ♀♀, Changgangshan National Forest Park, Zhoushan, 64 m, 6-VIII-2016, coll. Qing-yun Wang, Mei-qing Yang and Ping Liu; 2 ♂♂, 1 ♀, Laofoyan Village, Shuangxikou, Jiangshan, 424 m, 7-9-VIII-2016, coll. Qing-yun Wang, Mei-qing Yang and Ping Liu; 1 ♀, Huangtianhu, Jingning, 787 m, 11-VIII-2016, coll. Qing-yun Wang, Mei-qing Yang and Ping Liu; 2 ♂♂, 6 ♀♀, Shimendong, Qingtian, 102 m, 19-21-VIII-2016, coll. Qing-yun Wang, Mei-qing Yang and Ping Liu, slide Nos. RH16467 ♂, RH16468 ♀, RH16470 ♀; 4 ♂♂, 15 ♀♀, Linkeng Village, Yongjia, 387 m, 23-27-VIII-2016, coll. Qing-yun Wang, Mei-qing Yang and Ping Liu; ANHUI: 1 ♂, Tanqiao, Huangshan, 6-VIII-2004, coll. Jia-sheng Xu and Jia-liang Zhang; 1 ♂, 2 ♀♀, Jiuhua, Mt. Jiuhua, 9-VIII-2004, coll. Jia-sheng Xu and Jia-liang Zhang, slide No. RH16039 ♂; 1 ♂, Mozitan, Huoshan County, 12-VIII-2004, coll. Jia-sheng Xu and Jia-liang Zhang; FUJIAN: 1 ♂, Tongmu, Mt. Wuyi, 15-VII-2012, coll. Zhi-bo Wang and Zhen-guo Zhang; 1 ♂, Tongmu, Mt. Wuyi, 3-VIII-2012, coll. Zhi-bo Wang; JIANGXI: 1 ♀, Mt. Jinpen, 19-VII-2006, coll. Jia-sheng Xu and Wei-chun Li; 1 ♀, Xiaoxidong, Mt. Jinggang, 1-VII-2011, coll. Li-jun Yang; HENAN: 3 ♂♂, 4 ♀♀, Mt. Jigong, Xinyang, 700 m, 13-VII-2001, coll. Dan-dan Zhang, slide Nos. WYP05075 ♂, WYP05132 ♂; 1 ♀, Shuiliandong, Tongbai, 300 m, 16-VII-2001, coll. Dan-dan Zhang, slide No. WYP05112; 1 ♂, Mt. Baiyun, Luoyang, 1560 m, 22-VII-2001, coll. Dan-dan Zhang, slide No. WYP05136; 1 ♂, Mt. Huaguo, Yiyang, 1000 m, 1-VIII-2006, coll. Deng-hui Kuang and Hui Zhen; HUBEI: 1 ♀, Yanjia'ao, Luotian, 24-VII-2012, coll. Yun-li Xiao and Yu-ping Wang; 1 ♂, 1 ♀, Mahe, Xianfeng, 400 m, 26-VII-1999, coll. Hou-hun Li *et al.*; 1 ♂, Cangxi, Xinhua County, 8-VIII-2004, coll. Yun-li Xiao; 1 ♂, 1 ♀, Mt. Wudang, Shiyan, 172 m, 7-IX-2012, coll. Jin-wei Li; 1 ♂, Tiantangzhai, Luotian County, 570 m, 17-IX-2012, coll. Li-jun Yang; 5 ♀♀, Taohuachong, Yingshan County, 635 m, 23-27-VI-2014, coll. Wei Guan and Mei-qing Yang; 4 ♂♂, 1 ♀, Taohuachong, Mt. Dabie, 661 m, 19-24-VI-2014, coll. Xiao-hua Chen and Chang Pan; 1 ♂, Taohuachong, Yingshan County, 590 m, 24-VI-2014, coll. Jiu-yang Luo and Yao Fei; 2 ♂♂, Taohuachong, Mt. Dabie, 590 m, 25-VI-2014, coll. Li-jun Xue; 2 ♂♂, Wujiashan, Yingshan County, 880 m, 29-VI-2014, coll. Xiao-hua Chen and Chang Pan; 2 ♂♂, Wujiashan, Yingshan County, 880 m, 30-VI-2014, coll. Wei Guan and Mei-qing Yang; 1 ♂, Qingtianguan, Luotian County, 590 m, 2-VII-2014, coll. Yao Fei and Jiu-yang Luo; 1 ♂, Qingtianguan, Luotian County, 2-VII-2014, coll. Zhen-

hua Liu and Chang Pan; 5 ♀♀, Qingtianguan Forest Farm, Luotian County, 570 m, 1-4-VII-2014, coll. Wei Guan and Mei-qing Yang; 3 ♂♂, Qingtianguan, Mt. Dabie, 590 m, 2-3-VII-2014, coll. Li-jun Xu; HUNAN: 3 ♂♂, Yueyan Village, Dao County, 21-22-VIII-2012, coll. Jin-wei Li and Xiao-hua Chen; 2 ♂♂, Zhupo Village, Huitong County, 23-VIII-2012, coll. Jin-wei Li and Xiao-hua Chen; GUANGDONG: 2 ♂♂, Heishiding, Fengkai, 7-V-2010, coll. Dan-dan Zhang and Bo Tong; 1 ♂, Heishiding, Fengkai, 1-V-2011, coll. Dan-dan Zhang and Bo Tong; 2 ♂♂, Mt. Danxia, Shaoguan, 96 m, 6-7-VI-2012, coll. Jin-wei Li; GUANGXI: 1 ♀, Huaping, Yachang, Leye County, 910 m, 28-VII-2004, coll. Jia-sheng Xu; 11 ♂♂, 4 ♀♀, Huaping, 950 m, 6-8-VIII-2006, coll. Wei-chun Li, slide Nos. RH16047 ♂, RH16048 ♀; 1 ♂, Nonggang, Nature Reserves, 21-VIII-2011, coll. Mu-chun Cheng; 2 ♀♀, Peixiu, Rongshui, 30-VIII-2011, coll. Jin-wei Li; 1 ♂, Mt. Jinzhong, 957 m, 18-VII-2013, coll. Xiao-hua Chen; 1 ♀, Tengmao Village, Jingxi County, 672 m, 9-VII-2015, coll. Dan Xu and Ji-ping Wan; 1 ♂, Hekou, Mt. Daoyao, Jinxiu, 823 m, 18-VII-2015, Mu-jie Qi and Sheng-nan Zhao; 1 ♀, Jiuwanshan, Hechi, 1600 m, 24-VII-2015, coll. Ji-ping Wan; SICHUAN: 1 ♂, 2 ♀♀, Baoxing County, 1100 m, 1-VIII-2004, coll. Ying-dang Ren, slide No. WYP05149 ♀; 1 ♂, Bifengxia, Ya'an, 1115 m, 27-VI-2016, coll. Kai-jian Teng and Xiao-fei Yang, slide No. RH16469; CHONGQING: 1 ♂, Mt. Jinyin, Qianjiang, 1100 m, 25-VII-2012, coll. Jun Zhang and Lin-jun Xu; 1 ♂, Aikou, Qianjiang, 900 m, 27-VII-2012, coll. Jun Zhang and Lin-jun Xu; GUIZHOU: 2 ♂♂, 3 ♀♀, Chishuisuoluo, 390 m, 27-30-V-2000, coll. Yan-li Du, slide Nos. WYP05092 ♂, WYP05146 ♂; 1 ♀, Wanxiang, Leishan County, 900 m, 14-IX-2005, coll. Jia-liang Zhang; 1 ♂, Daheba, Mayanghe, 430 m, 6-VI-2007, coll. Xi-cui Du, slide No. RH16252; 1 ♂, Baishao, Kuankuoshui, 800 m, 12-VIII-2010, coll. Xi-cui Du; 1 ♂, Maolan, Libo, 21-VIII-2011, coll. Jin-wei Li; 1 ♀, Maolan Nature Reserves, 1-IX-2011, coll. Jin-wei Li; 2 ♂♂, Maolan Nature Reserves, 797 m, 12-VII-2013, coll. Xiao-hua Chen; 2 ♂♂, 1 ♀, Dongdai, Limingguan, Libo County, 720 m, 19-VII-2015, coll. Mei-qing Yang and Gaeun Lee, slide Nos. RH15353 ♂, RH15354 ♀, RH15375 ♂; SHAANXI: 1 ♂, Tianping Village, Langao, 577 m, 16-VIII-2016, coll. Wei-xing Feng and Wen-tao Shi; GANSU: 1 ♀, Bifenggou, Wen County, 860 m, 9-VII-2005, coll. Hai-li Yu, slide No. WYP05158.

Diagnosis: This new species is similar to *E. denticulata* sp. n., and the differences between them are stated under the preceding species.

Description: Adult (Fig. 3) wingspan 23.0-27.0 mm. Head white mixed with grayish green. Male labial palpus slender; first segment black, about 1/3 length of second; second segment exceeding vertex apically, white mixed with black except basal 1/3 and distal 1/3 black on outside, ventral surface with short white mixed with black hair-like scales apically; third segment black, grayish green mixed with white apically, tapering, about 1/3 length of second; female labial palpus with second segment black apically. Maxillary palpus compressed and short, white mixed with black. Antenna yellowish fuscous, with white annulations on dorsal surface; male with short grayish white cilia on ventral surface, cilia along outer side line about 1.2 times of diameter of antenna, inner side line about 2.0 times of diameter of antenna. Thorax white, mixed with grayish green, black apically; tegula white, mixed with grayish green and black. Forewing with basal area white, with dense black and grayish green scales; median area white, with sporadic black and grayish green scales; distal area blackish gray, fuscous mixed with dirty white near termen; antemedian line black, from middle of lower margin of cell slightly arched outward to basal 1/4 of dorsum; postmedian line black, wide, almost indistinguishable from black background of distal area, from distal 1/3 of costal margin obliquely outward to $M_3$, then oblique inward to base of $CuA_2$, finally vertical to distal 1/3 of dorsum, beyond postmedian line at costal margin set a white mixed with black spot; discal and discocellular spots represented by a black tuft, with white scales bordering its outside; longitudinal rectangular black patch placed along costal margin above discal spot; terminal line dirty white, evenly spaced with uniform black rectangular spots along its inner side, interrupted with dirty white on veins. Hindwing with basal half white on anterior half, tinged with metal flash, gray on posterior half; distal half blackish gray; with a short oblique gray strip from upper corner to lower corner of cell. Cilia of both wings pale yellow, interrupted with black on extension of veins. Legs with inner side white; outer side black, femora and tibiae with dense white and grayish green scales, mid tibiae with black mixed

with white and grayish green hairs, hind tibiae with white hairs, tarsi with each tarsomere white at apex. Abdomen black, mixed with white on posterior margin of each segment, or white mixed with black on posterior margin of each segment on ventral surface; black with dense white scales or white with dense black scales on dorsal surface.

Male genitalia (Fig. 7): Uncus with basal 3/5 uniformly narrow, then slightly widened to before apex, apex narrowly rounded; with dense short hairs dorsally. Valva sub-ovate, narrowed basally, with dense fine hairs; with a sclerotized wavy fold from base reaching below dorso-apex; costa slightly convex beyond middle dorsally, narrowed basally and distally, produced roundly and with dense setae ventro-medially. Juxta broad, sub-rectangular, with length about 0.8 times width, nearly membranous, with dense microtrichia on posterior 1/3. Aedeagus about 2/3 length of ventral margin of valva, basal half weakly sclerotized, distal half slightly thinner, with a long hook near apex ventrally; cornuti being a bunch of long spines.

Female genitalia (Fig. 10): Papillae anales collar-shaped in basal half, shovel-shaped in distal half, with hairs of varying length. Eighth segment rectangular, with long setae posteriorly; sternite slightly narrowed toward middle, produced in trapezoidal shape at middle anteriorly. Apophyses anteriores with distal 1/4 slightly wider and membranous, about 1.2 times length of apophyses posteriores. Antrum torch-shaped. Ductus bursae thick, basal 3/4 with dense microtrichia, distal 1/4 nearly membranous. Corpus bursae sub-ovate, about 2.0 times length of ductus bursae; signa different in size, rounded, with dense denticles.

Distribution: China (Anhui, Chongqing, Fujian, Henan, Hubei, Hunan, Gansu, Guangdong, Guangxi, Guizhou, Jiangxi, Liaoning, Shaanxi, Sichuan, Yunnan, Zhejiang).

Etymology: The specific name is derived from the Latin prefix *long*-, meaning long, and the word *aduncatus*, meaning hooked, referring to the long hook near apex of the aedeagus.

*Epilepia dentatum* (Matsumura & Shibuya, 1927) (Figs. 4, 8, 11)
*Macalla dentatum* Matsumura & Shibuya, 1927: 349. TL: Japan (Kyoto).
*Epilepia dentatum* (Matsumura & Shibuya): Inoue & Yamanaka, 1975: 108.

Material examined: CHINA, Tianjin: 1 ♂, Mt. Baxian, Ji County, 550 m, 23-VI-2001, coll. Hou-hun Li *et al*.; 8 ♂♂, Mt. Baxian, Ji County, 500 m, 12-16-VII-2005, coll. Hou-hun Li *et al*., slide Nos. WYP05046, WYP05117, WYP05157; 1 ♂, Heishuihe, Mt. Baxian, Ji County, 550 m, 19-VII-2009, coll. Bing-bing Hu *et al*.; 14 ♂♂, 11 ♀♀, Mt. Baxian, Ji County, 23-24-VII-2015, coll. Hou-hun Li and Pei-xin Cong, slide Nos. RH15447 ♂, RH15448 ♀; 3 ♂♂, 2 ♀♀, Mt. Jiulong, Ji County, 10-12-VII-2009, coll. Wei-chun Li; Hebei: 1 ♂, Tainingsi, Yi County, 150 m, 19-VII-2000, coll. Hai-li Yu; 1 ♀, Laoniuyu, Jingxing, 26-VII-2000, coll. Hai-li Yu, slide No. ZDD01109; 8 ♂♂, 2 ♀♀, Suanzaoping, Neiqiu, 670 m, 28-29-VII-2000, coll. Hai-li Yu, slide Nos. ZDD01110 ♂, WYP05118 ♀, WYP05134 ♂; 1 ♂, Shuangyuanfeng, Mt. Wuling, Xinglong County, 800 m, 2-VII-2009, Qing Jin *et al*.; 5 ♂♂, 1 ♀, Shuangyuanfeng, Mt. Wuling, Xinglong County, 800 m, 16-29-VII-2011, coll. Hou-hun Li and Yan-peng Cai, slide Nos. LLJ14010 ♀, RH15450 ♂; Shanxi: 5 ♂♂, 3 ♀♀, Manghe, Yangcheng County, 594 m, 13-17-VII-2012, coll. Wei Guan and Xiu-chun Wang, slide Nos. LLJ14008 ♀, LLJ14009 ♂, RH15409 ♂, RH15410 ♀; Zhejiang: 1 ♀, Chanyuansi, Mt. Tianmu, 350 m, 20-VIII-1999, coll. Hou-hun Li *et al*.; 15 ♂♂, 5 ♀♀, Laoan, Mt. Tianmu, 555 m, 3-6-VII-2014, coll. Ai-hui Yin, Xue-mei Hu and Qing-yun Wang, slide Nos. RH15442 ♂, RH15443 ♂, RH15444 ♀; 3 ♂♂, 2 ♀♀, Qianjiangyuan, Mt. Tianmu, 866 m, 8-10-VII-2014, coll. Ai-hui Yin, Xue-mei Hu and Qing-yun Wang; 3 ♂♂, Sanmuping, Mt. Tianmu, 789 m, 13-14-VII-2014, coll. Ai-hui Yin, Xue-mei Hu and Qing-yun Wang; 3 ♂♂, 23 ♀♀, Sanmuping, Mt. Tianmu, 789 m, 16-17-VII-2015, coll. Ai-hui Yin, Kang Lou and Tao Wang, slide Nos. RH15445 ♂, RH15446 ♀; 2 ♂♂, 1 ♀, Xiguan, Mt. Tianmu, 566 m, 16-18-VII-2014, coll. Ai-hui Yin, Xue-mei Hu and Qing-yun Wang; 1 ♂, Tianmu Village, Mt. Tianmu, 335 m, 18-VII-2015, coll. Ai-hui Yin, Kang Lou and Tao Wang; 1 ♂, Mt. Tianmu, 335 m, 19-VII-2015, coll. Ai-hui Yin, Kang Lou and Tao Wang; 1 ♂, Laofoyan Village, Shuangxikou, Jiangshan, 424 m, 9-VIII-2016, coll. Qing-yun Wang, Mei-qing Yang and Ping Liu; 1 ♀, Linkeng Village, Yongjia, 387 m, 25-VIII-2016, coll. Qing-yun Wang, Mei-qing Yang and Ping Liu; Henan: 1 ♂,

Shiziping, Lushi, 1200 m, 21-VII-2001, coll. Dan-dan Zhang, slide No. WYP05288; 1 ♂, Baligou, Hui County, 780 m, 12-VII-2002, coll. Xin-pu Wang, slide No. WYP05051; 3 ♂♂, 1 ♀, Xiuwu, Mt. Yuntai, Jiaozuo, 1028 m, 5-9-VIII-2014, coll. Pei-xin Cong, Sha Hu and Lin-jie Liu, slide No. RH15449 ♂; HUBEI: 1 ♂, Houhe, Wufeng, 1000 m, 12-VII-1999, coll. Hou-hun Li *et al*., slide No. WYP05234; 1 ♂, Shayuan, Hefeng, 1260 m, 17-VII-1999, coll. Hou-hun Li *et al*., slide No. WYP05126; GUANGXI: 8 ♂♂, 7 ♀♀, Huaping, 1300 m, 6-7-VIII-2006, coll. Wei-chun Li, slide Nos. WYP05288 ♂, WYP05289 ♀; HAINAN: 1 ♂, Mt. Wuzhi, 700 m, 19-V-2007, coll. Zhi-wei Zhang and Wei-chun Li; 1 ♂, Mt. Diaoluo, 940 m, 31-V-2007, coll. Zhi-wei Zhang and Wei-chun Li; GUIZHOU: 1 ♂, Pobao, Limingguan, Libo, 740 m, 20-VII-2015, coll. Mei-qing Yang and Gaeun Lee, slide No. RH15333.

Diagnosis: Adult (Fig. 5) wingspan 22.0-28.0 mm. This species can be distinguished from the above two new species by the long brush-like maxillary palpus in male and the forewing not white in the median area; in the male genitalia by the uncus widened distally, the juxta with a horsehead-shaped process, and the aedeagus without a hook or denticle near apex ventrally (Fig. 8); and in the female genitalia by the infundibulate antrum (Fig. 11).

Distribution: China (Fujian, Guangxi, Guizhou, Hainan, Hebei, Henan, Hubei, Hunan, Shanxi, Sichuan, Taiwan, Tianjin, Zhejiang); Japan, North Korea.

**Discusion**

*Epilepia dentatum* (Matsumura & Shibuya, 1927) was described from Japan, and was also found in China and Korea. The two new species described in this paper are closely associated with *E. dentatum*. However, we found the three species different from the African species in the external characters by the absence of the scape extension in male, and in the male genitalia by the absence of the gnathos and the valva lacking the process at base of the upper margin; in the African species, the scape extension and the gnathos are present, and the valva bears a process at base of the upper margin. We tentatively place these two species in the genus *Epilepia*, and their affiliation with the African species needs further study.

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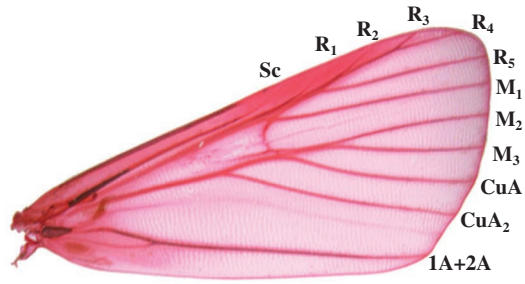
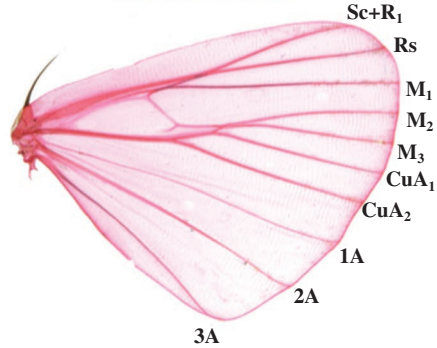
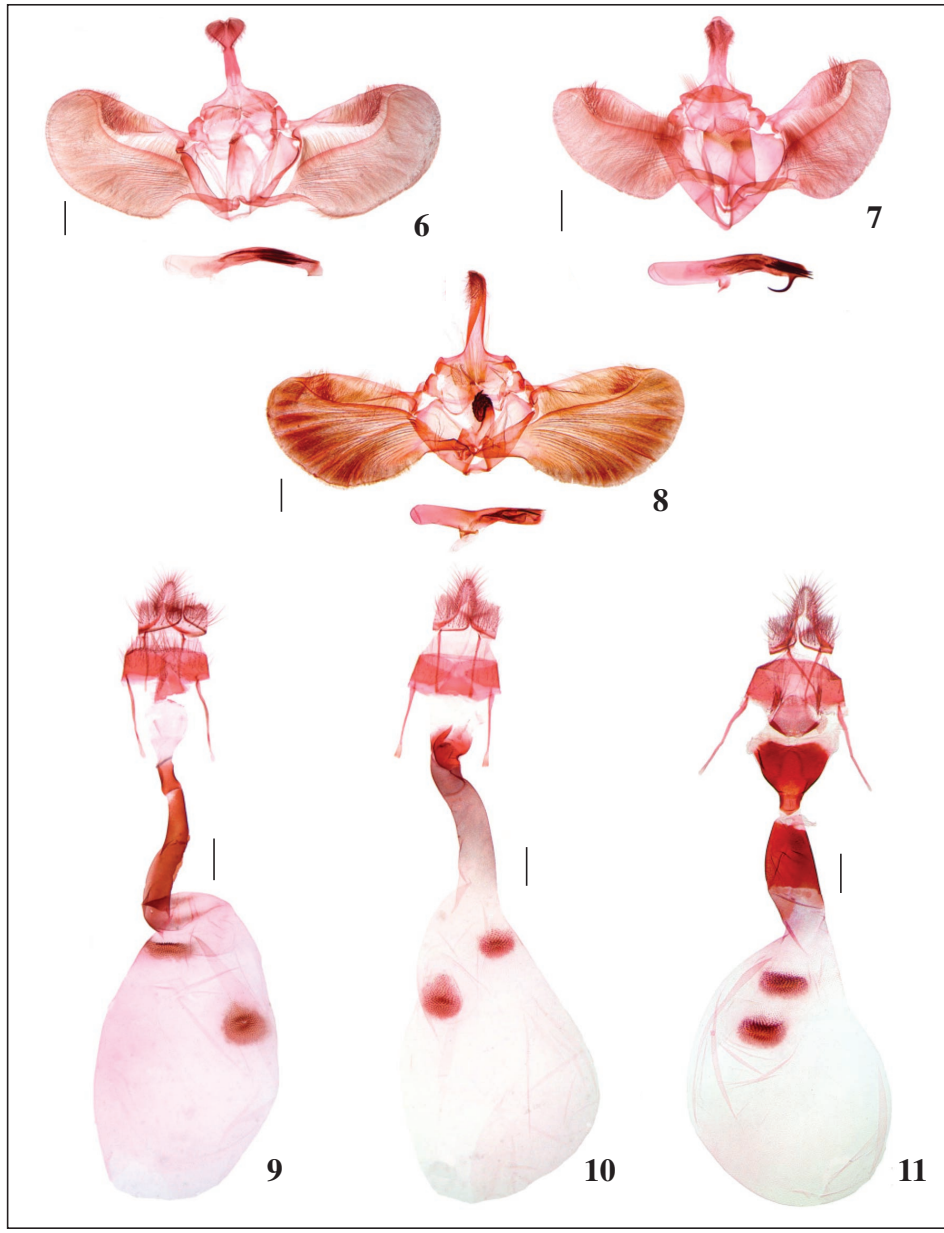



5

**Figures 1-5.–** Adults and venation of *Epilepia* spp. **1.** Head of *E. denticulata* Rong & Li, sp. n., male; **2.** *E. denticulata* Rong & Li, sp. n., paratype, female; **3.** *E. longaduncata* Rong & Li, sp. n., holotype, male; **4.** *E. dentatum* (Matsumura & Shibuya), male. **5.** Venation of *E. dentatum* (Matsumura & Shibuya). Slide No. RH16039W. Scale bars: 1=1.0 mm, 2–5=2.0 mm.




**Figures 6-11.–** Male genitalia of *Epilepia* spp. **6.** *E. denticulata* Rong & Li, sp. n., paratype, slide No. RH15533; **7.** *E. longaduncata* Rong & Li, sp. n., paratype, slide No. RH16045; **8.** *E. dentatum* (Matsumura & Shibuya), slide No. RH15447. Scale bars: 0.5 mm. **9-11.–** Female genitalia of *Epilepia* spp. **9.** *E. denticulata* Rong & Li, sp. n., paratype, slide No. RH15362; **10.** *E. longaduncata* Rong & Li, sp. n., paratype, slide No. RH16046; **11.** *E. dentatum* (Matsumura & Shibuya), slide No. RH15446. Scale bars: 0.5 mm.

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# First data on Pterophoridae of Cambodia (Lepidoptera: Pterophoridae)

P. Ya. Ustjuzhanin & V. N. Kovtunovich

**Abstract**

We give first data on Pterophoridae of Cambodia. In previous publications, there was no indication of their habitat in Cambodia. Now we present 15 Pterophoridae species of 11 genera.
KEY WORDS: Lepidoptera, Pterophoridae, distribution, new data, Cambodia.

**Primeros datos sobre Pterophoridae de Camboya (Lepidoptera: Pterophoridae)**

**Resumen**

Damos los primeros datos sobre Pterophoridae de Camboya. En publicaciones previas, no se había indicado su hábitat en Camboya. Ahora presentamos 15 especies de Pterophoridae de 11 géneros.
PALABRAS CLAVE: Lepidoptera, Pterophoridae, distribución, nuevos datos, Camboya.

## Introduction

Cambodia is located in south-eastern Asia, in the south of the Indochinese Peninsula. It borders with Vietnam in the East, Laos in the North-East, and Thailand in the North and North-West. Cambodia is mostly a flat country. A characteristic feature of the landscape of the country are isolated hills - "phnoms", towering over the plain at 600-700 m. Most of the country is covered by tropical rainforests.

Until the present, the plume moths fauna of Cambodia, has never been mentioned in the scientific literature. The materials obtained from Russian colleagues Sergei Murzin (Moscow) and Oleg Kosterin (Novosibirsk), gave rise to the writing of our work.

The Pterophoridae fauna of Cambodia is similar to that of Thailand and Vietnam. 34 species of plume moths were given for Thailand (YANO, 1961, ARENBERGER, 2010; KOVTUNOVICH & USTJUZHANIN, 2006), 26 species - for Vietnam (GIELIS, 2003, USTJUZHANIN & KOVTUNOVICH, 2009; 2010; 2015). But 4 species discovered in Cambodia, *Xyroptilia oksana* Kovtunovich & Ustjuzhanin, 2006, *Exelastis pumilio* (Zeller, 1873), *Exelastis atomosa* (Walsingham, 1885), *Parafuscoptilia tabuliformis* Hao & Li, 2005, have not been found in these countries yet.

As a result of our examination of material on plume moths of Cambodia, we have indicated 15 species. All of them are marked as new for the fauna of the country. Thus, there is no doubt that further research in Pterophoridae of this region will be supplemented with many other new species not known for Cambodia.

## Material and methods

We have examined over 300 plume moths specimens from Cambodia. For determination of

specimens collected by our colleagues we used modern publications (ARENBERGER, 1995; 2002; 2010). In difficult cases of species identification, we compared the material with the collection funds of Pterophoridae in The Natural History Museum (UK, London). The examined material is deposited in the private collection of Ustjuzhanin and Kovtunovich.

**Taxonomy**

*Platyptilia* sp.

Material: 1 ♂, Phnom-Bokor Natural Resources, 10º 38'N, 104º 05'E, h-550 m, 25-XI / 6-XII-1999, M. & S. Murzin; 1 ♀, Phnom-Bokor Natural Resources, 10º 38'N, 104º 05'E, h-400 m, 24 /31-X-2007, S. Murzin; 1 ♂, Koh-Kong Prov., Tatui village, 23-V-2013, O. Kosterin.

Notes: It will be possible to determine this species when extra material is available.

*Xyroptilia oksana* Kovtunovich & Ustjuzhanin, 2006

*Xyroptilia oksana* Kovtunovich & Ustjuzhanin, 2006: 259. (Type locality: Java, Indonesia)

Material: 1 ♂, Rattanakiri Prov., Bang Lung, 13º 44'N, 107º 02'E, h-350 m, 5 / 6-VI-2013, O. Kosterin.

Distribution: Indonesia (Java), India, Sri Lanka, Cambodia.

*Nippoptilia cinctipedalis* (Walker, 1864)

*Oxyptilus cinctipedalis* Walker, 1864: 935. (Type locality: Australia)

*Nippoptilia minor* Hori, 1933. (Type locality: Japan)

*Trichoptilus eochrodes* Meyrick, 1935. (Type locality: Hunan, China)

*Oxyptilus caryornis* Meyrick, 1935. (Type locality: Tien-Mu-Shan, China)

Material: 1 ♀, Kirirom Nat. Res., 11º 18'N, 104º 05'E, h-650 m, 15 / 17-XII-2007, S. Murzin.

Distribution: Australia, Japan, Palau, China, Thailand, Cambodia.

*Nippoptilia vitis* (Sasaki, 1913)

*Stenoptilia vitis* Sasaki, 1913: 3. (Type locality: Japan)

*Oxyptilus formosanus* Matsumura, 1931: No. 2061. (Type locality: Japan)

Material: 2 ♂♂, 3 ♀♀, Pailin, h-200 m, 11 / 16-V-2009, S. Murzin.

Distribution: Japan, Korea, Nepal, India, Thailand, Taiwan, Cambodia.

*Exelastis pumilio* (Zeller, 1873)

*Mimeseoptilus pumilio* Zeller, 1873: 324. (Type locality: Texas, USA)

*Marasmarcha liophanes* Meyrick, 1886: 19. (Type locality: Reunion Island)

*Mimaesoptilus gilvidorsis* Hedemann, 1896: 8 (not Zeller, 1877). (Type locality: Virgin Islands, St. Croix)

Material: 1 ♂, 1 ♀, Kirirom Natural Resources, 11º 18'N, 104º 05'E, h-650 m, 9 / 16-XII-1999; 2 ♂♂, 1 ♀, 14 / 20-XI-2007; 23 exemplars, 5 / 17-XII-2007; 3 exemplars, Trapeang Rung, 80 km SE Koh-Khon, h-10 m, 20 / 29-XII-2008; 1 ♀, 15 km SE Tuol Kruos, 11º 11'N, 104º 10'E, h-100 m, 20 / 28-XII-2009; 2 exemplars, Sihanoukville, 10º 37'N, 103º 26'E, 29-31-XII-1999; 62 exemplars, 1 / 31-XII-2008, 17 exemplars, 1 / 13-I-2009; 5 exemplars, 6-10-V-2009, S. Murzin; 1 ♀, Kep prov., Kep Treetop Bungalar, 6-XII-2010, O. Kosterin.

Distribution: Nepal, Cambodia, Philippines, New Guinea, Tchad, Gambia, Tanzania, Mali, Zimbabwe, Swaziland, Rep. S. Africa, Seychelles, Reunion Island, Madagascar, Nigeria, Kenya, USA., Argentina, Brazil, Ecuador, Bolivia, Colombia, Surinam, Costa Rica, Cuba, Puerto Rico, Guadeloupe, Mexico, Jamaica, Virgin Islands, Fatu Hiva, Guam, Palau.

*Exelastis atomosa* (Walsingham, 1885)

*Aciptilia atomosa* Walsingham, 1885: 885. (Type locality: India)

Material: 1 ♂, Kirirom Nat. Res., 11º 18'N, 104º 05'E, h-650 m, 15 / 17-XII-2007, S. Murzin; 1 ♂, 150 km SW Phnom Penh, Elephant Mountains Staeng Chral, h-300 m, 24-III-2002, A. Sochivko.

Distribution: India, Nepal, Cambodia, Ethiopia, Tanzania, Kenya, Swaziland, Madagascar.

*Parafuscoptilia tabuliformis* Hao & Li, 2005.

*Parafuscoptilia tabuliformis* Hao & Li, 2005:36. (Type locality: Fujian Prov., China)

Material: 23 exemplars, Kirirom Natural Resources, 11º 18'N, 104º 05'E, h-650 m, 15 / 17-XII-2007, S. Murzin.

Distribution: SE China, Cambodia.

*Stenoptilodes taprobanes* (Felder & Rogenhofer, 1875)

*Amblyptilia taprobanes* Felder & Rogenhofer, 1875: plate 140, fig. 54. (Type locality: Sri Lanka)

*Platyptilia brachymorpha* Meyrick, 1888: 240. (Type locality: India)

Material: 1 ♂, 2 ♀♀, Kirirom Natural Resources, 11º 18'N, 104º 05'E, h-650 m, 5 / 17-XII-2007; 10 exemplars, Sihanoukville, 10º 37'N, 103º 26'E, 1 / 31-XII-2008, S. Murzin.

Distribution: Europe, Turkey, Indonesia, Sri Lanka, Thailand, Cambodia, India, New Guinea, Australia, Tchad, Sao Tome, Cote d'lvoire, Nigeria, Tanzania, Kenya, Madagascar, Seychelles, USA, Paraguay, Bolivia.

*Sphenarches anisodactylus* (Walker, 1864)

*Oxyptilus anisodactylus* Walker, 1864: 934. (Type locality: Sri Lanka)

*Pterophorus diffusalis* Walker, 1864: 945. (Type locality: Australia)

*Sphenarches synophrys* Meyrick, 1886: 17. (Type locality: New Hebrides)

Material: 1 ♂, Sihanoukville, 10º 37'N, 103º 26'E, 1 / 31-XII-2008; 2 ♀♀, 1 / 13-I-2009, S. Murzin; 1 ♀, Rattanakiri Prov., Bang Lung, 13º 44'N, 107º 02'E, h-350 m, 5 / 6-VI-2013, O. Kosterin; 2 ♀♀, Pailin, h-200 m, 11 / 16-V-2009, S. Murzin.

Distribution: Nepal, Japan, China, Sri Lanka, India, Taiwan, Thailand, Cambodia, Vietnam, Malaysia, Indonesia, Solomon Islands, New Guinea, Bismarck Islands, Australia, Cameroun, Seychelles, Reunion Island, Madagascar, Kenya, Tanzania, Zaire, Gambia. Guinea, Nigeria, Tchad, Malawi, Swaziland, Cote d'lvoire, Ghana, USA., Brazil, Dominica, Grenada, Panama, Virgin Islands, Bahamas, St. Thomas, Puerto Rico, Peru, Paraguay, Fiji Islands, New Hebrides, Tonga Islands, New Caledonia, Palau, Bonin Island, Guam.

*Sphenarches zanclistis* (Meyrick, 1905)

*Oxyptilus zanclistis* Meyrick, 1905: 582. (Type locality: Myanmar [Burma])

Material: 1 ♂, Kirirom Natural Resources, 11º 18'N, 104º 05'E, h-650 m, 15 / 17-XII-2007; 2 ♂♂, Pailin, h-200 m, 11 / 16-V-2009, S. Murzin.

Distribution: Nepal, India, Sri Lanka, Thailand, Cambodia, Myanmar, Indonesia, Australia.

*Buckleria paludum* (Zeller, 1841)

*Pterophorus paludum* Zeller, 1839: 277. (Type locality: Germany)

*Trichoptilus paludicola* Fletcher, 1907: 20. (Type locality: Sri Lanka)

*Pselnophorus dolichos* Matsumura, 1931: No. 2071. (Type locality: Japan)

Material: 5 exemplars, 15 km SE Tuol Kruos, 11º 11'N, 104º 10'E, h-100 m, 20 / 28-XII-1999; 1 ♀, Sihanoukville, 10º 37'N, 103º 26'E, 29 / 31-XII-1999; 31 exemplars, Kirirom Natural Resources, 11º 18'N, 104º 05'E, h-650 m, 15 / 17-XII-2007; 9 exemplars, Trapeabg Rung, 80 km SE Koh-Khon, h-10 m, 20 / 29-XII-2008; 9 exemplars, Sihanoukville, 10º 37'N, 103º 26'E, 1 / 31-XII-2008, 2 exemplars, 1 / 13-I-2009; 3 exemplars, Centr. Caradamon Mts., 30 km N Trapeabg Rung, 10 km E Tatai, h-350 m, 4 / 10-II-2010, S. Murzin.

Distribution: Europe, Iran, south of western Siberia, the Far East of Russia, Japan, India, Sri Lanka, Thailand, Cambodia.

*Megalorhipida leucodactyla* (Fabricius, 1794)

*Pterophorus leucodactylus* Fabricius, 1794: 346. (Type locality: Virgin Islands)
*Pterophorus oxydactylus* Walker, 1864: 944. (Type locality: Sri Lanka)
*Trichoptilus centetes* Meyrick, 1886: 16. (Type locality: New Guinea)
*Trichoptilus adelphodes* Meyrick, 1887: 266. (Type locality: Australia)
*Trichoptilus ralumensis* Pagenstecher, 1900: 239. (Type locality: Bismarck Islands)
Material: 1 ♂, Pailin, h-200 m, 11 / 16-V-2009, S. Murzin.

Distribution: Spain, Morocco, Israel, Lebanon, Jordan, Saudi Arabia, Yemen, Dubai, Oman, Iran, Pakistan, Somalia, Congo, Nigeria, Cote d'lvoire, Cameroun, Tchad, Liberia, Sierra Leone, Gambia, Nigeria, Cape Verde Islands, Kenya, Tanzania, Swaziland, Rep. S. Africa, Uganda, Madagascar, Seychelles, Reunion, Mauritius, Ethiopia, China, Taiwan, Vietnam, Thailand, Malaysia, India, Sri Lanka, Maldives, New Guinea, Solomon Islands, Australia, USA, Argentina, Chile, Paraguay, Brazil, Ecuador, Colombia, Panama, French Guyana, Mexico, Peru, Venezuela, Bahamas, Jamaica, St. Thomas, St. Vincent, Puerto Rico, Virgin Islands, Suriname, Galapagos Islands, Mariana Islands, Wake Island, Marshall Islands, Gilbert Islands.

*Trichoptilus regalis* (Fletcher, 1909)

*Oxyptilus regalis* Fletcher, 1909: 25. (Type locality: Sri Lanka)
*Oxyptilus chordites* Meyrick, 1913: 106. (Type locality: Sri Lanka)
Material: 1 ♂, Pailin, h-200 m, 11 / 16-V-2009, S. Murzin.
Distribution: China, India, Sri Lanka, Thailand, Cambodia, Indonesia.

*Adaina microdactyla* (Hübner, [1813])

*Alucita microdactyla* Hübner, [1813]: pl. 5, figs. 26, 27. (Type locality: Europe)
*Pterophorus carphodactylus* Stephens, 1834: 374. (Type locality: England)
*Adaina montivola* Meyrick, 1937: 170. (Type locality: China)
*Adaina subflavescens* Meyrick, 1930: 568. (Type locality: Indonesia)
Material: 6 ♂♂, 5 ♀♀, Phnom-Bokor Natural Resources, 10º 38'N, 104º 05'E, h-550 m, 25-XI / 6-XII-1999, M. & S. Murzin; 3 exemplars, Kirirom Natural Resources, 11º 18'N, 104º 05'E, h-650 m, 15 / 17-XII-2007; 2 ♂♂, 9 / 16-XII-1999; 1 ♂, Sihanoukville, 10º 37'N, 103º 26'E, 1 / 31-XII-2008; 1 ♀, 1 ♀, Trapeabg Rung, 80 km SE Koh-Khon, h-10 m, 20 / 29-XII-2008; 13 exemplars, 15 km SE Tuol Kruos, 11º 11'N, 104º 10' E, h-100 m, 20 / 28-XII-2009; 6 exemplars, Sihanoukville, 10º 37'N, 103º 26'E, 1 / 13-I-2009; 50 exemplars, 29 / 31-XII-1999, S. Murzin.

Distribution: Europe, Russia (European part), Turkey, Israel, Iran, Georgia, Nepal, China, Japan, Madagascar, Vietnam, Indonesia, Philippines, Taiwan, New Guinea, Solomon Islands.

*Pterophorus albidus* (Zeller, 1852)

*Aciptilus albidus* Zeller, 1852: 397. (Type locality: South Africa)
*Alucita endogramma* Meyrick, 1922: 549. (Type locality: Fiji)
*Alucita endophaea* Meyrick, 1930: 567. (Type locality: Mozambique)
*Aciptilia suffiata* Yano, 1963: 200. (Type locality: Okinawa, Japan)
Material: 1 ♀, Pailin, h-200 m, 11 / 16-V-2009, S. Murzin.

Distribution: Japan, Thailand, Cambodia, Vietnam, Indonesia, Philippines, Kei, Irian Jaya, Australia, Fiji Islands, South Africa, Gambia, Mozambique, Nigeria, Kenya, Malawi, Tanzania, Congo, Uganda, Cameroon, Tchad, Cote d'lvoire, Zimbabwe, Zanzibar, Madagascar, Reunion Island.

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# REVISION DE PUBLICACIONES
# *BOOK REVIEWS*

**W. R. Arnscheid & M. Weidlich**
**Microlepidoptera of Europe, Volumen 8 Psychidae**
**423 páginas, 23 láminas color**
**Formato 25 x 17,5 cm**
**Brill, Leiden, 2017**
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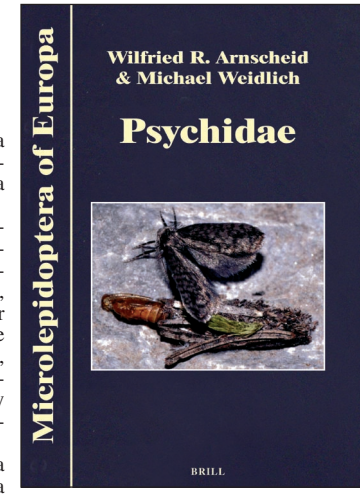


De nuevo tenemos en nuestras manos otra entrega de la ya clásica obra sobre los Microlepidoptera de Europa, concretamente el volumen octavo, que, de la mano de estos dos conocidos especialistas de esta familia a nivel Paleártico.

La confección general es la ya conocida de los anteriores volúmenes, pero en esta ocasión la familia Psychidae, agrupada dentro de la superfamilia de los Tineoidea, nos dan a conocer las subfamilias Eumasiinae (nueva), Naryciinae, Taleporiinae, Placodominae, Thyphoniinae, Epichnopteriginae y Oiketicinae, que a pesar de haber sido estudiada por el Dr. Bourgogne y el Dr. Kozhanchikov (1956), nos demuestran que siempre hay cosas nuevas que descubrir, como ha ocurrido en este caso, estableciéndose una nueva subfamilia Eumasiinae, un nuevo género Palaeoacanthopsyche y tres nuevas especies, así como 22 nuevas sinonimias y 10 nuevas combinaciones, agrupadas en 247 especies, lo que dan un mayor valor a la obra en sí misma.

Después de un resumen sobre el concepto de la obra, pasamos a una introducción general e histórica de los principales aspectos, métodos para su colección y estudio, las ilustraciones y los agradecimientos, continuando con un interesante capítulo sobre la sistemática, clasificación y morfología.

Ya dentro de la parte principal de la obra, nos presentan una lista sistemática y claves de las subfamilias y tribus, pasando a tratar todos los géneros válidos con sus sinonimias y especies tipo, con datos generales sobre su descripción, genitalia, distribución, bionomía y anotaciones extras, así como una detallada descripción del saco larvario que permite su identificación.

Similar es el tratamiento a cada una de las especies consideradas donde nos presenta las referencias bibliográficas de cada una de ellas, así como de sus sinonimias, una diagnosis sobre su morfología externa, como la genitalia masculina, saco larvario, distribución, biología y, cuando es necesario, comentarios que permiten despejar dudas sobre la problemática con respecto a la especie tratada y a las próximas, así como otros datos de interés. Todas las especies están detalladamente fotografiadas a todo color, así como la genitalia de los machos y los sacos larvario de cada una de ellas.

Con una excelente y detallada tabla donde podemos apreciar a primera vista donde se encuentran cada una de las especies consideradas y con una bibliografía especializada, se termina la obra.

Nuevamente este octavo volumen, mantiene la excelente calidad de los anteriores, por lo que felicitamos a la Editorial por su esfuerzo y dedicación en esta obra y no podemos por menos de felicitar a los autores por un trabajo bien realizado, en el que podemos ver una vez más la gran profesionalidad del mismo.

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# Inter-island differentiation of *Leptotes (Cyclyrius) webbianus* (Brullé, 1839) in the Canary Islands (Spain), with description of two new subspecies from La Palma and Gran Canaria (Lepidoptera: Lycaenidae)

X. Mérit, L. Manil, R. Vila & M. Wiemers

**Summary**

Phenotypic and molecular genetic analyses of the Canary Islands' endemic *Leptotes (Cyclyrius) webbianus* (Brullé, 1839) reveal new subspecies in La Palma and in Gran Canaria, both differentiated from the nominotypical subspecies found in Tenerife and La Gomera. On El Hierro, the current population turned out to be a recent reintroduction from Tenerife or La Gomera, whereas the original population reported more than a hundred years ago seems to have become extinct.
KEY WORDS: Lepidoptera, Lycaenidae, *Leptotes (Cyclyrius) webbianus*, new subspecies, Canary Islands, Spain.

**Diferenciación inter-islas de *Leptotes (Cyclyrius) webbianus* (Brullé, 1839) en las Islas Canarias (España), con la descripción de dos nuevas subespecies de La Palma y Gran Canaria (Lepidoptera: Lycaenidae)**

**Resumen**

El análisis fenotípico y genético del endemismo de las Islas Canarias *Leptotes (Cyclyrius) webbianus* (Brullé, 1839) revela nuevas subespecies en La Palma y en Gran Canaria; ambas se diferencian de la subespecie nominotípica encontrada en Tenerife y La Gomera. En El Hierro, la actual población ha resultado ser una reintroducción desde Tenerife o La Gomera, mientras que la población original, documentada hace más de cien años, parece haberse extinguido.
PALABRAS CLAVE: Lepidoptera, Lycaenidae, *Leptotes (Cyclyrius) webbianus*, nuevas subespecies, Islas Canarias, España.

## Introduction

A large series of *Leptotes (Cyclyrius) webbianus* (Brullé, 1839) was collected in La Palma and Tenerife by Luc Manil in the early 1980s (December 1981 and July 1983) along with a lower number of male and female specimens from Gomera and Gran Canaria. Luc Manil suspected at that time that the La Palma *L. webbianus* [collected at the same place where *Hipparchia tilosi* Manil, 1984 was described] might represent a different subspecies. More recently, in July/August 2014, Xavier Mérit visited the islands of Tenerife, La Palma, La Gomera and El Hierro to collect fresh specimens of *L. webbianus* for DNA analysis.

## Abbreviations

The following abbreviations are used in the text:

| | |
|---|---|
| DNA | Desoxyribonucleic acid, a molecule that carries the genetic information for all organisms |
| Ma | million years |
| NHMW | Naturhistorisches Museum, Wien |
| MNCN | Museo Nacional de Ciencias Naturales, Madrid |

## Material & methods

The following material was used for phenotypic analyses: Tenerife (57 individuals: 21 ♂♂, 36 ♀♀), La Gomera (3 individuals: 2 ♂♂, 1 ♀), Gran Canaria (13 individuals: 10 ♂♂, 3 ♀♀), La Palma (44 individuals: 25 ♂♂, 19 ♀♀), and El Hierro (5 individuals: 5 ♂♂).

The width of the black margin was measured against a paper ruled in millimetre squares at space nº 2 of the males' hindwings and at space nº 4 of the forewings.

DNA barcodes (a 658 bp fragment of the mitochondrial gene cytochrome *c* oxidase I) were obtained from specimens of all inhabited islands in the Canaries (Tab. 1) using standard laboratory methods (see WIEMERS & FIEDLER, 2007; DINCĂ *et al.,* 2011; RITTER *et al.,* 2013) using the primer pairs LepF (5**'-** ATT CAA CCA ATC ATA AAG ATA TTG GAA C-3') and LepR (5'- TAA ACT TCT GGA TGT CCA AAA AAT C A-3'), or UniLepF1/UniLepR1. The latter primers are identical to LepF/LepR but have a universal T7 tail (5' - TAA TAC GAC TCA CTA TAG GG – 3') or T3 tail (5' - ATT AAC CCT CAC TAA AG – 3'), respectively, attached to their 5' end. In addition, the single available sequence from GenBank was included in the analysis.

**Table 1.–** Material of *Leptotes (Cyclyrius) webbianus* used for DNA analysis of the mitochondrial gene COI

| Voucher | Sex | Island | Location | Altitude | UTM | Date | Remarks | GenBank |
|---|---|---|---|---|---|---|---|---|
| 14V523 | ♂ | El Hierro | La Frontera, Las Lapas, El Luchón | 400 m | 28 RBR 0474 | 22-VII-2014 | X. Mérit leg. | KU648399 |
| BA09001 | ♂ | Gran Canaria | Cruz de Tejeda | 1560 m | 28 RDR 4199 | 10-V-2009 | B. Acosta leg. | KU648391 |
| BA09002 | ♂ | Gran Canaria | Cruz de Tejeda | 1560 m | 28 RDR 4199 | 10-V-2009 | B. Acosta leg. | KU648392 |
| PR02001 | ♂ | La Gomera | Garajonay | 1200 m | 28 RBS 7911* | 29-VIII-2002 | e.o. J.E. Pateman leg. | KU648395 |
| PR02002 | ♀ | La Gomera | Garajonay | 1200 m | 28 RBS 7911* | 31-VIII-2002 | e.o. J.E. Pateman leg. | KU648396 |
| BA09005 | ♀ | La Palma | Cubo de la Galga, Puntallana | 341 m | 28 RBS 2985 | 29-VII-2009 | B. Acosta leg. | KU648393 |
| 14H868 | ♂ | La Palma | Bosque de los Tilos, San Andrés y Los Sauces | 370 m | 28 RBS 2687 | 1-VIII-2014 | X. Mérit leg. | KU648398 |
| MW15001 | ♀ | Tenerife | Aeropuerto de Tenerife Sur, Granadilla de Abona | 70 m | 28 RCS 4503 | 23-I-2015 | M. Wiemers leg. | KU648394 |
| 14H867 | ♂ | Tenerife | Monte Izaña, Pico de Las Flores | 1455 m | 28 RCS 6143 | 6-VIII-2014 | X. Mérit leg. | KU648397 |
| | | Tenerife | Los Gigantes | | 28 RCS 2026* * approximate | 30-III-2015 | K. Hermansen leg. | KU310889 |

## Results

### Phenotypic analysis

The extension of the black margin on the dorsal side of forewings and hindwings varies between the islands. In the male specimens from Tenerife, La Gomera and El Hierro (butterflies collected by X.

Mérit in 2014), the black margin of both wings typically measures less than 1 mm (0.7-1.1 mm) in width, whereas it measures approximately 1.5 mm in width in specimens from Gran Canaria and approximately 2 mm (1.8-2.3 mm) in width in the specimens from La Palma.

The postdiscal white band between veins 1 and 5 on the hindwing underside measures less than 1 mm (min: 0.8 mm - max: 0.9 mm) in width in specimens from Tenerife, La Gomera, Gran Canaria and El Hierro, compared to a width of about 1.5 mm (min: 1.3 mm – max 1.6 mm) in specimens from La Palma.

### Molecular analysis

The DNA analysis of the mitochondrial gene cytochrome *c* oxidase I (COI) confirms the differentiation of the population from La Palma with respect to the Tenerife/La Gomera lineage (minimum genetic p-distance = 1.2%, which corresponds to an age of ca. 0.5-0.8 Ma ago assuming typical substitution rates of 1.5–2.3% per Ma), as well as from the Gran Canaria population (minimum genetic p-distance = 1.5%, which corresponds to ca. 0.7-1.0 Ma ago) (Fig. 1). All analysed specimens from the other islands (Tenerife, La Gomera, and El Hierro), however, have identical COI haplotypes.

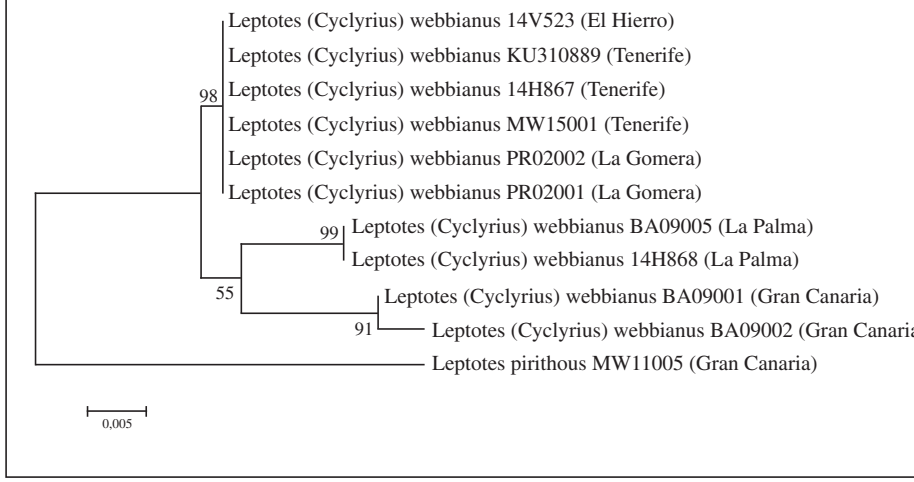


**Fig. 1.–** Molecular Phylogenetic analysis of cytochrome c oxidase I sequences of *Leptotes (Cyclyrius) webbianus* by the Maximum Likelihood method.

The phylogenetic relationships were inferred by using the Maximum Likelihood method based on the General Time Reversible model. The tree with the highest log likelihood (-1688.5823) is shown. The percentage of trees in which the associated taxa clustered together in a 500 replicates-bootstrap analysis is shown next to the branches. Initial tree(s) for the heuristic search were obtained automatically by applying Neighbour-Join and BioNJ algorithms to a matrix of pairwise distances estimated using the Maximum Composite Likelihood (MCL) approach, and then selecting the topology with superior log likelihood value. A discrete Gamma distribution was used to model evolutionary rate differences among sites (5 categories (+G, parameter = 0.1)). The tree is drawn to scale, with branch lengths measured in the number of substitutions per site. The analysis involved 11 nucleotide sequences. There were a total of 1220 positions in the final dataset. Evolutionary analyses were conducted in MEGA7 (KUMAR *et al.,* 2016).

DESCRIPTIONS OF TWO NEW SUBSPECIES

***Leptotes (Cyclyrius) webbianus palmae* Mérit, Manil, Vila & Wiemers, ssp. n.**

Material: Holotype ♂, SPAIN, La Palma, San Andrés y Los Sauces, Los Tilos, LP105, 370 m, 1-VIII-2014, X. Mérit leg., deposited in MNCN (fig. 2). Paratypes 1 ♂, 1 ♀, La Palma, near Los Tilos, 400 m, 25-26-VII-1983, L. Manil leg., deposited in Coll. MNCN; 6 ♂♂, 5 ♀♀, La Palma, near Los Tilos, 400 m, 25-26-VII-1983, L. Manil leg., Coll. L. Manil; 2 ♂♂, 5 ♀♀, La Palma, San Andrés y Los Sauces, Los Tilos, LP105, altitude 370 m, 1-VIII-2014, X. Mérit leg., Coll. X. Mérit; 1 ♂, 1 ♀, La Palma, Llano Molino, Barranco de la Galga, N 28º 45' 55"-W 17º 46' 20", 400 m, 1-VIII-2014, X. Mérit leg., Coll. X. Mérit; 8 ♂♂, La Palma, Las Nieves, Barranco de la Madera, N 28º 42' 14"-W 17º 47' 20", altitude 410 m, 31-VII-2014 / 2-VIII-2014, X. Mérit leg., Coll. X. Mérit; 1 ♀, La Palma, Barranco de Agua, altitude 200-700 m, 31-VII-1988, M. Wiemers leg., Coll. M. Wiemers; 2 ♀♀, La Palma, San Isidro, altitude 1000 m, 1-VIII-1988, M. Wiemers leg., Coll. M. Wiemers; 3 ♂♂, 1 ♀, La Palma, Barrranco de la Galga, altitude 400-800 m, 3-VIII-1988, M. Wiemers leg., Coll. M. Wiemers; 1 ♂, 1 ♀, La Palma, Barrranco de la Galga, altitude 400-800 m, ex-larva, 1-IX-1988, M. Wiemers cult., Coll. M. Wiemers. 1 ♂. used for DNA analysis, La Palma, San Andrés y Los Sauces, Los Tilos, LP105, 370 m, 1-VIII-2014, X. Mérit leg., Coll. R. Vila, code 14H868.

Description and diagnosis: The specimens from La Palma (fig. 2) differ from those from Gran Canaria, Tenerife, La Gomera and El Hierro (specimens collected in 2014) by:

1. the extension of the black margin of both forewings and hindwings upperside,
2. the larger extension of all the white markings, particularly the larger width of the postdiscal white band of the underside of the hindwings.
3. their larger size (mean wingspan approximately 1-2 mm larger than on the other occidental islands, 1-3 mm larger than in Gran Canaria). This character is not constant.

(1) In the male specimens from Tenerife, La Gomera and El Hierro (specimens collected in 2014), the black margin of both wings typically measures less than 1 mm (0.7-1.1 mm) in width, whereas it measures approximately 2 mm (1.8-2.3 mm) in width in all specimens from La Palma (red arrow).
(2) The white submarginal spot near the tip of the forewing underside extends along the submarginal area till vein V5 or V4 in most specimens (green ellipse on the plate). The spot in the discal area of spaces 7-8 (black arrows) is whitish rather than brown as in the other islands. The postdiscal white band between veins 1 and 5 on the hindwing underside measures less than 1 mm in width in specimens from Tenerife, La Gomera, Gran Canaria and El Hierro (specimens collected in 2014) compared to a width of about 1.5 mm in specimens from La Palma.
(3) In the female, the upperside is often fulvous rather than dark brown as in the other islands, but with a well-contrasted 2 mm dark brown marginal strip in both fore- and hindwings (red arrow).
(4) The reverse side of the forewing shows often more contrasted ocelli than in most specimens originating from the other islands (blue arrows).

Distribution: This new subspecies is only known from the island of La Palma. Historical *L. webbianus* (extinct) collected in El Hierro more than a century ago (see discussion below and the picture on the plate) were probably closely related to ssp. *palmae*.

Derivatio nominis: The name of the new subspecies is derived from La Palma island where the subspecies is distributed.

***Leptotes (Cyclyrius) webbianus grancanariensis* Mérit, Manil, Vila & Wiemers, ssp. n.**

Material: Holotype ♂, SPAIN, Gran Canaria, Cruz de Tejeda, altitude 1450 m, 8-VII-1983, L. Manil

leg., deposited in MNCN (fig. 3) - Paratypes 1 ♂, Gran Canaria, Cruz de Tejeda, altitude 1450 m, 8-VII-1983, L. Manil leg., deposited in Coll. MNCN; 1 ♂♂, 1 ♀, Gran Canaria, Cruz de Tejeda, altitude 1450 m, 8-VII-1983, L. Manil leg., Coll. L. Manil; 1 ♂, 1 ♀, Gran Canaria, Pozo de la Nieves, altitude 1850 m, 09-VII-1983, L. Manil leg., Coll. L. Manil; 2 ♂♂, Gran Canaria, Fontanales, altitude 1400 m, 19-VII-1983, L. Manil leg., Coll. L. Manil; 1 ♂, Gran Canaria, Arines, altitude 1300 m, 8-VIII-1990, B. Turlin leg., Coll. X. Mérit; 2 ♂♂, used for DNA analysis, Gran Canaria, Cruz de Tejeda, altitude 1560 m, 10-V-2009, B. Acosta leg., Coll. B. Acosta; codes BA09001 and BA09002.

Description and diagnosis: The specimens from Gran Canaria (fig. 3) differ slightly from those from Tenerife, La Gomera and El Hierro (specimens collected in 2014) by the extension of the black margin of both forewings and hindwings of the dorsal face and by the width of the white line of the ventral side of the hindwings.

In the male specimens from Tenerife, La Gomera and El Hierro, the black margin of both wings typically measures less than 1 mm in width, whereas it measures approximately 2 mm in width in all specimens from La Palma and 1.5 mm in width in all specimens from Gran Canaria.

The postdiscal white band between veins 1 and 5 in specimens from Gran Canaria does not exhibit significant differences from the specimens from Tenerife and La Gomera.

The mean wingspan is slightly smaller than in the other islands, but very small specimens are particularly frequent in Gran Canaria.

Distribution: This new subspecies is known only from Gran Canaria.

Derivatio nominis: The name of the new subspecies is derived from Gran Canaria island where the subspecies is distributed.

## Systematic placement and synonymy

Original description:

*Polyommatus webbianus* Brullé, 1839. *Hist. Nat. Can. Ent.,* **1839**: p. 93-94, pl. 4, fig. 1, 1a.
Locus typicus: Tenerife island: Las Cañadas (above 1,400 m)

Junior synonyms:

*Lycaena fortunata* Staudinger, 1870. *Berl. Ent. Z.,* **14**: 99-100.
Locus typicus: Tenerife island

*Polyommatus webbianus* f. *brunnea* Nordman, 1935. *Commentat. Biol.* 6: 6-7. Female form.
Locus typicus: La Palma island: La Caldera

*Cyclyrius* Butler, 1897. *Proc. zool. Soc. Lond.,* **1896**: 830.
Type species of *Cyclyrius* Butler, 1897 is *Polyommatus webbianus* Brullé

FOX *et al.,* (1965) synonymized *Cyclyrius* with *Leptotes* Scudder, 1876*,* but this suggestion was not followed by most subsequent authors who continued to use *Cyclyrius* or the misspelling *Cyclirius* (but see VIVES MORENO, 2014). We provisionally use *Cyclyrius* as subgenus of *Leptotes*, pending further study on the phylogeny of *Leptotes*, and consider the following subspecies:

*Leptotes (Cyclyrius) webbianus webbianus* (Brullé, 1839), from Tenerife (fig. 4), La Gomera and El Hierro (current population)

*Leptotes (Cyclyrius) webbianus palmae* Mérit, Manil, Vila & Wiemers, ssp. n., from La Palma

*Leptotes (Cyclyrius) webbianus grancanariensis* Mérit, Manil, Vila & Wiemers, ssp. n., from Gran Canaria

## Discussion

### Inter-island differentiation of *Leptotes (Cyclyrius) webbianus*

According to VAN DEN BOGAARD (2013), the Canary Islands formed between 23 Ma (Fuerteventura) and 1.1 Ma (El Hierro), and lie on the oldest hotspot track in the Atlantic Ocean, which dates back to the Late Jurassic. With 15 Ma, Gran Canaria is the oldest of the western islands, followed by Tenerife and La Gomera (12 and 11 Ma, respectively). With an age of 1.7 Ma, La Palma is only slightly older than El Hierro. Our genetic analysis does not rule out any sequence of colonization events, but is consistent with the scenario that one of the older islands (such as Gran Canaria, Tenerife or La Gomera) was colonized first, and the species then spread to the other islands in a stepwise fashion. The current spread of *Leptotes pirithous* in the Canary Islands (WIEMERS *et al.,* 2013) shows that such colonization can happen within a few years. The lack of differentiation between populations on Tenerife and La Gomera probably indicates persistent gene flow between these islands. This is unsurprising considering the relatively small distance between them (less than 30 km). Additionally, it seems plausible that specimens of *Leptotes (Cyclyrius) webbianus* can frequently be blown over by trade winds to La Gomera from the high altitude plateau of Las Cañadas del Teide, where the species can be extremely abundant (WIEMERS 1995b).

### *Leptotes (Cyclyrius) webbianus* on El Hierro - an interesting case of local extinction and recolonization

*Leptotes (Cyclyrius) webbianus* was discovered on El Hierro in 1889 by Simony (REBEL & ROGENHOFER, 1894) by at least three male samples deposited in the NHMW (Fig. 5). The collected specimens show a black margin on the forewings and hindwings upperside with a very similar width as the specimens from La Palma. Moreover, the white line on the verso of the hindwings also shows a similar pattern to those from La Palma. WIEMERS (1995b) reported the existence of these specimens as the only records known from El Hierro, but was unfortunately unable to see them at that time. No further records are known from El Hierro until MÉRIT (2015) 'rediscovered' it in 2014. Interestingly, the newly found specimens display a black margin and white line similar to the specimens from Tenerife and La Gomera. The DNA analysis also supports the hypothesis of a recent recolonization of El Hierro by specimens from Tenerife or La Gomera. It is very likely that the former population discovered by Simony disappeared for unknown reasons and that a new population originating from Tenerife or La Gomera recolonized the island. Unfortunately, the samples collected in 1889 are probably too old for DNA analyses, hence we cannot conclude whether the former population could have been close or identical to the newly described *Leptotes (Cyclyrius) webbianus palmae*.

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**Figs. 1-5.–** *Leptotes (Cyclyrius) webbianus grancanariensis* ssp. n. Male holotype R/V (first row) and female paratype R/V (second row): Gran Canaria, Cruz de Tejeda, 1450 m, 8-VII-1983, L. Manil leg. **2.** *Leptotes (Cyclyrius) webbianus webbianus* from Tenerife. Male R/V (first row): Las Cañadas, 2300 m, 13-VII-1983, and female R/V (second row): Taganana, 20 m, 17-XII-1981. L. Manil leg. **3.** *Leptotes (Cyclyrius) webbianus webbianus* from La Gomera. Male R/V (first row): Chipude, 1200 m, 21-VII-1983 and female R/V (second row): Las Rosas, 600 m, 20-VII-1983. L. Manil leg. (Photos L. Manil). **4.** *Leptotes (Cyclyrius) webbianus* from El Hierro. Left: male R/V: El Hierro: Montaña Tenezedra, 700 m, 29-VIII-1889, Simony leg., in coll. NHMW (Photos M. Wiemers). Right: male R/V: El Hierro: El Lunchón, 22-VII-2014, X. Mérit leg. (Photos L. Manil); *Leptotes (Cyclyrius) webbianus palmae* ssp. n. The 4 pictures on the left: Male paratype R/V (first row) and female paratype R/V (second row). Los Tilos, La Palma, 26.VII.1983, L. Manil leg. (Photos L. Manil). The 4 pictures on the right: Male holotype (first row) and female allotype (second row) (San Andrés y Los Sauces, Los Tilos, LP105, 370 m, 1-VIII-2014. X. Mérit leg. (Photos L. Manil). M: Male. F: female. R: recto (upperside). V: verso (underside).

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# Two new species of *Tachyphyle* Butler, 1881 from South America (Lepidoptera: Geometridae)

J. Viidalepp & A. Lindt

**Abstract**

The Neotropical emerald geometrid genus *Tachyphyle* Butler, 1881 as revised by PITKIN (1996), consists of fifteen described species. This article is aimed at presenting descriptions of two additional species, *Tachyphyle nielseni* Viidalepp & Lindt, sp. n. from Argentina which is similar to *T. acuta* Butler, 1881 and *Tachyphyle selini* Viidalepp & Lindt, sp. n. from Costa Rica and Ecuador, which is similar with *T. undilineata* (Warren, 1900). The adults and their male genitalia are illustrated.
KEY WORDS: Lepidoptera, Geometridae, new species, Costa Rica, Nicaragua, Ecuador.

**Dos nuevas especies de *Tachyphyle* Butler, 1881 de América del Sur (Lepidoptera: Geometridae)**

**Resumen**

Los geométridos esmeralda del género Neotropical *Tachyphyle* Butler, 1881, revisados por PITKIN (1996), consistien en quince especies descritas. El objeto de este artículo es presentar la descripción de dos especies adicionales, *Tachyphyle nielseni* Viidalepp & Lindt, sp. n. de Argentina la cual es similar a *T. acuta* Butler, 1881 y *Tachyphyle selini* Viidalepp & Lindt, sp. n. de Costa Rica y Ecuador, que es similar a *T. undilineata* (Warren, 1900). Se ilustran los adultos y su genitalia del macho.
PALABRAS CLAVE: Lepidoptera, Geometridae, new species, Costa Rica, Nicaragua, Ecuador.

## Introduction

BUTLER (1881) characterized the genus *Tachyphyle* and the typical species *T. acuta* Butler, 1881. Warren described two decades later *T. allineata* (Warren, 1900) (as *Dichorda allineata* Warren, 1900) from Venezuela and *T. undilineata* (Warren, 1900) from Guiana, *T. occulta* (Warren, 1901) from Colombia, *T. costiscripta* (Warren, 1906) from French Guiana, *T. fuscicosta* from Brazilian Amazonas and *T. albisparsa* (Warren, 1907) from Peru.

PROUT (1912) listed 15 species in this genus, but revised the genera *Tachychlora* Prout, *Tachyphyle* and *Phrudocentra* Warren anew in the Seitz volume (PROUT, 1932), adding brief descriptions of two further taxa (*T. antimima* Prout, 1932 from Peru and *T. apicibadia* Prout, 1932 from Colombia), and combining (*Phalaena*) *pigraria* Sepp, 1848 from Surinam and (*Geometra*) *basiplaga* Walker, 1861 from Brazil with the genus *Tachyphyle*. Additional species, *Tachyphyle hamata* Schaus, 1912 and *T. oleaster* Schaus, 1912 from Costa Rica, *T. aganapla* Dyar, 1913 from Mexico and *T. maiester* Dyar, 1914 from Panama were discussed as well by PROUT (1932-1938). PITKIN (1996) followed Prout's treatment of the genus but transferred to *Tachyphyle (Tachychlora*) *pretiosa* Thierry-

Meig, 1816 and listed the fifteen species in an alphabetical arrangement. The taxonomic structure of this heterogeneous genus is analyzed by VIIDALEPP (2017).

## Material and methods

The present study was initiated by attempts to identify moths that have accumulated in the collection of the Estonian Museum of Natural History (EMNH, Tallinn) and in the IZBE insect collection which is deposited at the Estonian University of Life Sciences (IZBE, Tartu). The main material was collected between 1999 and 2013 and prepared for investigation by Aare Lindt. Additional material collected by T. Kesküla, V. Soon, V. Viidalepp and J. Viidalepp (in the IZBE collection), by A. Selin and T. Armolik (in the private collection of A. Selin) were used as well.

The mounting of emerald green moths is a complicated process and the method that was used was to inject some water into the thorax of a specimen, followed by keeping the moth in a container with high air moisture environment for 1-2 hours, finally desiccating the mounted sample at around 60°C for about 12 hours. Such a treatment prevents the green moths from further fading in collection. Palpi, antennae, legs and details of wing venation were measured using an ocular micrometer and binocular microscopes, using 40x magnification. The genital slides of males and females were treated using established procedures (HARDWICK, 1950), inspected in glycerol, embedded in Euparal and photographed in ventral view. Moths were photographed prior to investigation of the genital structures using a Canon 300D digital camera, while the genital slides were photographed with an Olympus SZ60 microscope and Leica M165C digital camera. The photographs obtained were augmented using Adobe Photoshop Elements v. 7 in order to clarify their resolution.

We thank Erki ÕUNAP for his attempts for DNA barcode analysis; however, these results were not encouraging. Dr G. BREHM has kindly taken over the COI barcoding of the new species *T. selini* and *T. undilineata,* for his Geometridae phylogeny project.

## Description of new species

### *Tachyphyle nielseni* Viidalepp & Lindt, sp. n. (Figures 1, A-E)

Type material: Holotype, ♂: Argentina, [prov.] Neuquen 15: Piedra del Aguila, 19-XII-1978, Mision Cientifica Danesa. Gen. prep. 88/2001 (JV/ZMUC). Paratypes, 3 ♂, the same data as Holotype. The Holotype and paratypes are deposited in the collection of the Zoological Museum of University of Copenhagen (ZMUC), Denmark.

Remark: The collection site "Neuquen 15" (Figure 1D) lies at Rio Limay between Neuquen and S. C. de Bariloche (40º 03'S, 70º 04'W); biotope: transition between bush steppe and Patagonian steppe (SCHMIDT-NIELSEN *in* MADSEN *et al*., 1980).

Additional material: *T. acuta* Butler: Paraguay (slide 7590); Peru (slide7266); Ecuador (slides 6602, 6630); Fr. Guiana; Costa Rica (slides 7065, 7266); Nicaragua (slides 8044, 8531). *T. olivia* Schaus, 1901: A male specimen from Brazil, Espiritu Santu, labelled as *T. olivia* in coll. Herbulot in ZSM, Munich, and a male specimen in the BMNH collection with the slide Geo 14185 examined.

Diagnosis. The new species is similar to *Tachyphyle acuta* in facies, differing in the forewing apex less acute and distal margin of forewing convex (Figure 1A); male hind leg has proximal spurs and tibial hairpencil entirely lost. Male genitalia (Figure 1B): uncus short and bidentate (triangular, pointed in *T. acuta*), sacculus not produced distally, and aedeagus (Figure 1C) provided with two distal prongs (one sclerite in *T. acuta* and one wide based cornutus in *T. olivia* Schaus). *T. olivia* shares a bifid uncus and a bifid last abdominal sternite with *T. nielseni* but differs in the shape of cornutus which is single, wide based and thick, and in forewing costa speckled yellowish and dark grey.

Description. Wing span of males 20-22 mm (Figure 1A). The frons is flat and smooth, white, with a green line in its middle. The upper edge of the frons has a pair of flat tufts of white scales ventral to the bases of antennae; the fillet is broad, white. The palpus is whitish, its third segment 0.12 mm long.

The antennae are bipectinate in the basal 2/3 and filiform in apical third, the longest pectinations 0.4 mm long or four times the diameter of the shaft. The forewing veins $M_1$ and $M_3$ are free ($R_{2+}M_1$ and $M_3$+$CuA_1$ being short-stalked in *T. acuta*). The apex of the discal cell appears concave, produced towards the wing apex. The hindwing veins Rs+$M_1$ and $M_3$+$CuA_1$ are short-stalked. The male hind tibia is slightly shorter than the tarsus, slender, without a distal projection and without a hair pencil, the proximal spurs being completely reduced. The apex of the forewing is not extended or angulate, without a black apical spot. The hindwing tornus is angulate but not extended (the forewing apex being angulate, and the hindwing tornus extended in *T. acuta*). The ground colour of wings upperside is apple green, the fringe green (the ground colour being darker, the fringe lighter green in *T. acuta*). The postmedial line is thin, straight, whitish.

Male genitalia (Figures 1 B, C. E). The uncus is flat, apically bidentate, converging towards the tips, 0.37 mm long, (conical, pointed, 0.7 mm long in *T. acuta*). The socii are tiny, membranous; the gnathos is a broad loop with a cochlear (medial projection) present, triangular, short (slenderer, with the hooked cochlear tapering to the tip in *T. acuta*). The valvae are well fused, with a small crista in the middle, bearing some setae (the sacculus is projecting a free arm, about 0.4 mm long in *T. acuta*). The juxta as a small rounded plate, distally fused to aedeagus. The saccus is conical (rounded or oval in shape in *T. acuta*). The aedeagus is straight, with its basal third sclerotized, the distal part membranous, with two long (ca 1.0 mm) prongs which are tapering distally (without long prongs, slightly pistol-shaped in *T. acuta*). The sternite A8 with two triangular distal projections (Figure 1E). The coremata are absent (small coremata pencils are attached to the bases of valvae in *T. acuta*).

Remarks: *T. acuta* (identified according to the images of male genitalia from the lectotype (Pitkin, 1996, Figs 130, 179; the image of a male moth by L. Pitkin (1996: Figure 53) has forewing apex acute and distal margin concave, and it may be not conspecific) has its palpi longer (0.22 mm, while 0.12 mm in *T. nielseni*, sp. n.), and hind tibiae provided with a thin hair pencil and with the proximal spurs reduced to their black tips visible at the base of distal spurs. *T. nielseni,* sp. n. has lost both the hair pencil and distal spurs of the hind tibia.

*T. olivia* differs from the new species *T. nielseni* sp. n. in dark tipped forewing with its distal margin slightly concave, and in genitalia as described above. The combination of a forked uncus and the absence of sacculus projection is shared by *T. nielseni*, sp. n. and *T. olivia* Schaus, 1901, but the shape of triangular projections of the sternite A 8 (wide spaced in *T. olivia*), and the presence of a wide-based cornutus on vesica of *T. olivia* allow to distinguish between these species. *T. olivia* has also its ground colour darker and the forewing apex slightly projecting.

Etymology: The species name is derived from Dr. Ebbe Schmidt Nielsen's family name, gender masculine.

### ***Tachyphyle selini*** **Viidalepp & Lindt, sp. n.** (Figures 1 F, 2 A-E)

Type material: Holotype: ♂, Costa Rica, Bri Bri, 278 m, 12-II-2007, 09º 35' 31"N, 82º 53' 55"W (IZBE0121228) (A. Lindt). Paratypes: 1 ♂, Costa Rica, Golfito, 50 m, 14-II-2007, 10º 36' 58"N, 84º 01' 15"W (IZBE0121230) (A. Lindt); 1 ♂, Costa Rica, Playa Hermosa, 135 m, 07-II-2007, (gen. 8335) (IZBE0121231) (A. Lindt); 1 ♂, Costa Rica, Siquirres, 550 m, 09-II-2007, 10º 03' 33"N, 83º 26' 35"W (A. Lundt) (IZBE0121232); 2 ♂♂, Costa Rica, Esquipulos, 400 m, 20-II-2007, (IZBE 0121233) (A. Lindt); 1 ♂, Costa Rica, Laguna de Arenal, 700 m, 16-III-2007, 10º 33' 44"N, 84º 34' 54"W (A. Lindt) (gen. 8045) (DNA voucher 947 Õunap) (IZBE0121234); 4 ♂♂, Costa Rica, Cariari, 03-V-2001, 10º 34' 49"N, 83º 42' 11"W (Selin & Armulik); 5 ♂♂, 1 ♀, Costa Rica, Limon, Bri Bri, 60 m, 14-IV-2001 (gen. 6853, 7037, 7059); 1 ♀, Costa Rica, Ciudad Cortes, 8º 59' 29"N, 83º 32' 36"W, 21-IV-2001 (Selin & Armulik) (gen. 6853) (IZBE 0121235) (coll. A. Selin); 3 ♂♂, Ecuador, Manabi prov., Beche, 50 m, 15-V-2007, 0º.12' 32"N, 79º 54' 04"W (gen. 8467) (IZBE0121236, IZBE 0121238, IZBE 0121239) (A. Lindt); 1 ♂, Ecuador, Esmeraldas prov., San Javier, 97 m, 6-V-2007 (gen. 8468) (IZBE 0121237) (A. Lindt); 1 ♂, Ecuador, Arajuno, 540 m, 8-II-2008, 01º 09' 49"S, 77º 39' 28"W (gen. 329) (IZBE 0121223) (A. Lindt).

Additional material: *T. undilineata*: Ecuador (slides 6611, 328); Fr. Guyana (slides 7036, 7060, 7103, 7104, 7105, 7106); Nicaragua: San Juan prov., Bartola (slide 8321). Additonal samples are deposited in the private collections of the collectors A. Lindt, A, Selin, in the insect collections of EMNH (Tallinn) and IZBE (Tartu). *T. occulta*: 2 ♂♂, Ecuador: Occidente: Esmeraldas, Maldonado 50 m, 07-V-2007, 01º 08' 51"S, 78º 48' 31"W (slide 8336) (IZBE0121239, IZBE 0121240); Ecuador, Esmeraldas prov., San Javier 94 m (slide 8468); Holotype and genital slide in BMNH compared (VIIDALEPP *et al*., 2011); 2 ♂♂, Nicaragua, San Juan prov., Bartola, 2-6-VI-2008 (slides 8034, 8043) (Viidalepp leg.), in coll. IZBE, Tartu.

Diagnosis. Very alike to *Tachyphyle undilineata* Warren and *T. occulta* Warren in its wing pattern but distinct in the structure of male genitalia: the harpe of *T. selini* consists of one single, straight, stick-shaped process which is directed outward. The harpe of *T. undilineata* consists of 2-4 (usually 3) stout horns which are directed dorsally, while more than a dozen small, flat thorns, curved distally, characterize *T. occulta.* The distal projection of sacculus is short (absent in *T. occulta*, longer in *T. undilineata*) and antennal pectinations are up to 0.5-0.55 mm long in males; sterigma of *T. selini* appears less sclerotised than in females of *T. umdilineata*.

Description. Wing span 21-25 mm in males, 26 mm in females (Figure 1F). The frons is flat, green, with a broad white stripe above and two white spots at lower margin. The fillet is white, broad. There are two flat tufts of white scales to antennae bases as an extension of the white interantennal fillet. The third segment of palpus is 0.25 mm long in males and 0.4 mm long in females. The antennae are bipectinate in the basal two-thirds and filiform in the apical third in both sexes, the length of the external pectinations reaching 0.55-0.6 mm in males, 0.4-0.5 mm in females. The forewing has the veins $R_2$-$M_1$ stalked, $M_3$ free, the hindwing has the veins $M_1$ and $M_3$ stalked with nearby veins (Rs and CuA1, respectively). The hind tibia has the proximal spurs reduced and hidden in scaling, with black tips only hardly visible, distanced 0.25 mm from the base of distal spurs. The male hind tarsus is longer than the tibia (as about 4: 3). The distal margin of the forewing is slightly concave, the wing apex acute, the hindwing tornus being produced like in *T. acuta* and *T. undilineata* (Figure 1G). The ground colour of wings is dull green, gradually tending paler towards the distal margin of wings, with sparse fuscous transverse irroration just as in *T. undilineata.* The costa of the forewing is sparsely mottled with fuscous, tending blackish towards the apex. The fringe has a black spot at forewing apex. The antemedial and postmedial lines are inconcrete, being marked by denser fuscous striation. The discal spots are fuscous in forewings but sometimes tiny or absent in hindwings. The underside of wings is pale green with the discal spots fuscous, the pale distal area of wings more contrasting than above. *T. undilineata* and *T. occulta* share this wing pattern.

Male genitalia (Figures 2 A-E): The entire genital armature is very similar to that in *T. undilineata* (Figures 2 F-G) in overall build but differing in the short (0.1 mm) and relatively broad projection of the sacculus, in the harpe consisting of a single straight spine, pointing ventrally. The spines of the harpe are thinner, more numerous, and curved towards the apex of the valva in *T. occulta* (Figure 2H).

*T. selini* has the longest (>0.6 mm), sharp-tipped and the deepest (0.35-0.4 mm) split uncus while the uncus is shorter than 0.5 mm in *T. undilineata* and *T. occulta*, with rounded tips and shorter (<0.2 mm) medial incision. However, one dissected male from Ecuador has a shorter uncus combined with one thin rod-likea harpe.

Female genitalia: The bursa copulatrix is oblong, membranous, without a signum. The sterigma is bordered by a slightly sclerotized fold posteriorly only (2 slides studied). The sterigma is broad, rounded-triangular in *T. undilineata*, bordered anteriorly by wrinkled, sclerotized folds.

Etymology: The new species is named in honour of the collector, Mr. Allan Selin.

Remarks: *T. undilineata* (15 ♂♂, 2 ♀♀ from French Guiana and 1 ♂ from Ecuador for comparison, male genitalia (compared to the slide 12934 in the British Museum) differs from *T. selini*, sp. n. in the distal projection of the sacculus, which is slenderer, about 0.25 mm long in average, and in the harpe consisting of two to four (usually three) stout, tubular, horn-shaped, parallel-lying spines curved dorsal (Figures 2, F-G). The male antennal pectinations appear shorter (not exceeding 0.55 mm) in *T. selini*, if compared to those in *T. undilineata.* The third segment of palpus is short (0.2 mm in males, 0.32 mm in

females of *T. selini*). The male hind tibia has the proximal spurs reduced to tips visible at the base of distal spurs.

*Tachyphyle occulta* Warren, 1901 (Figures 2, H-I)

The species was described from Colombia a year after the publication of *T. undilineata*. Prout (1912) listed the both species, but later (PROUT, 1932-1938) synonymized the names. The facies of the both, *T. occulta* ana *T. undilineata* (and *T. selini* described above) is similar indeed. Dr. M. Scoble, Mr. M. Honey and Mr. G. Martin kindly put photos of the primary type of *T. occulta* at the author's disposal.

WARREN (1901: 451) characterized this species as follows. "Forewings: dull green, with scattered purplish striae; cell-spot large, purplish; first line represented by a purplish streak at costa and a spot on median and submedian veins respectively; outer line obsolete, except towards inner margin, where it is marked by a spot on the submedian; a purplish streak at apex… Hindwings: with reddish cell-spot, and faintly marked reddish central line which is slightly bent in below the median vein. Underside yellow-green, with all the margins whitish, except costal margin of forewing, which remains greenish yellow; cell-spots red-brown. Collar, thorax and abdomen yellow-green; vertex, face and palpi white; these last with a slight ochreous flush. Expanse of wings: 31 mm."

The original description is to be supplemented as follows: Facies like in related species *T. undilineata* and *T. selini*. The difference in the forewing pattern, the antemedial band outcurved and the postmedial band incurved in the anal fold, seems inconstant.

Male genitalia (Figures 2, H-I) The uncus is bifid in its distal half; the sacculus is not protruding distally but smoothly fused to the valvula (projecting free in two allied species); the harpe is more complex, consisting of 7-12 thin spines in a row, pointing to the ventral margin of the valva (1-4 tubular thorns in a row, pointing to the costal margin of a valva in *T. selini* and *T. undilineata*); the saccus is projecting knob-shaped (rounded in related species).

Genitalically different from allied species *T. undilineata* and *T. selini*, *T. occulta* is restored from synonymy with *T. undilineata*.

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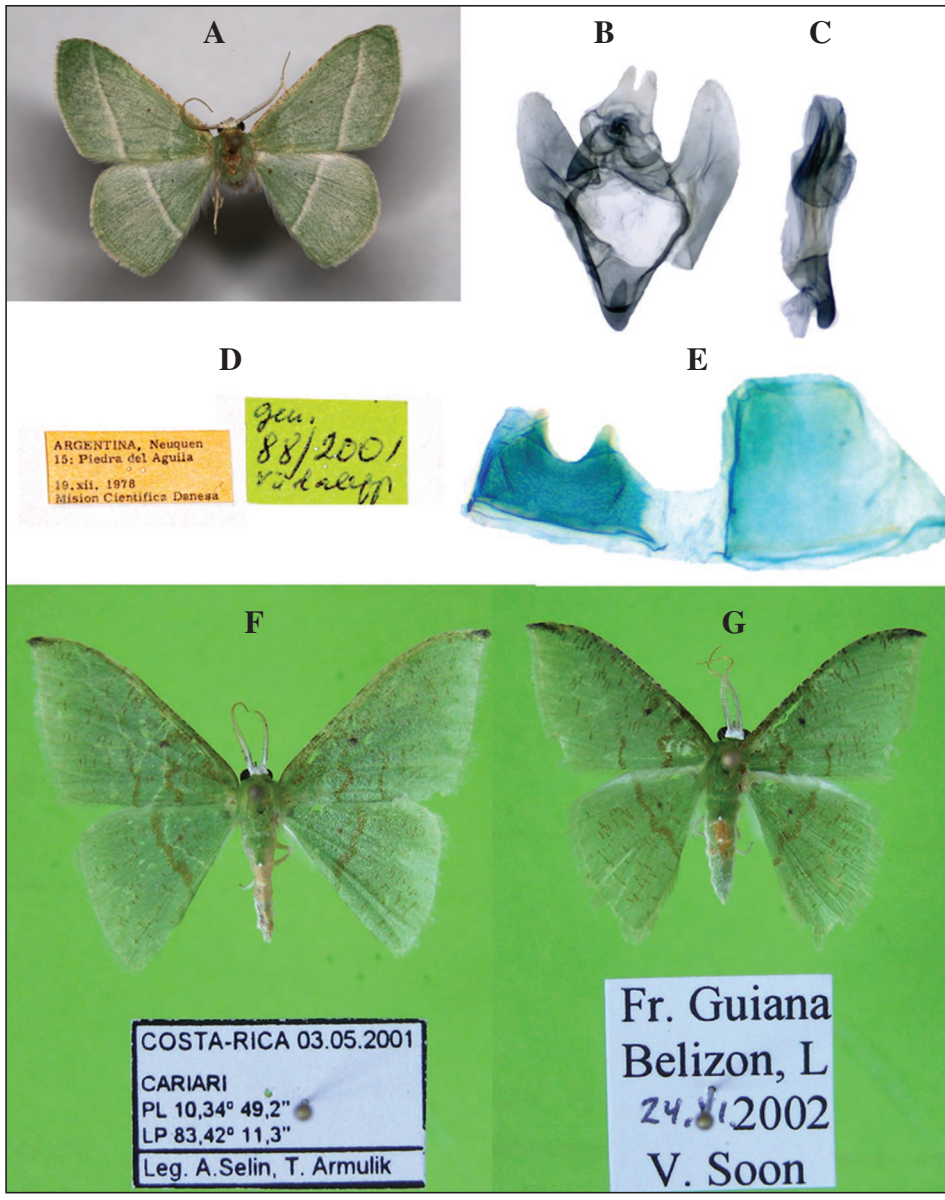
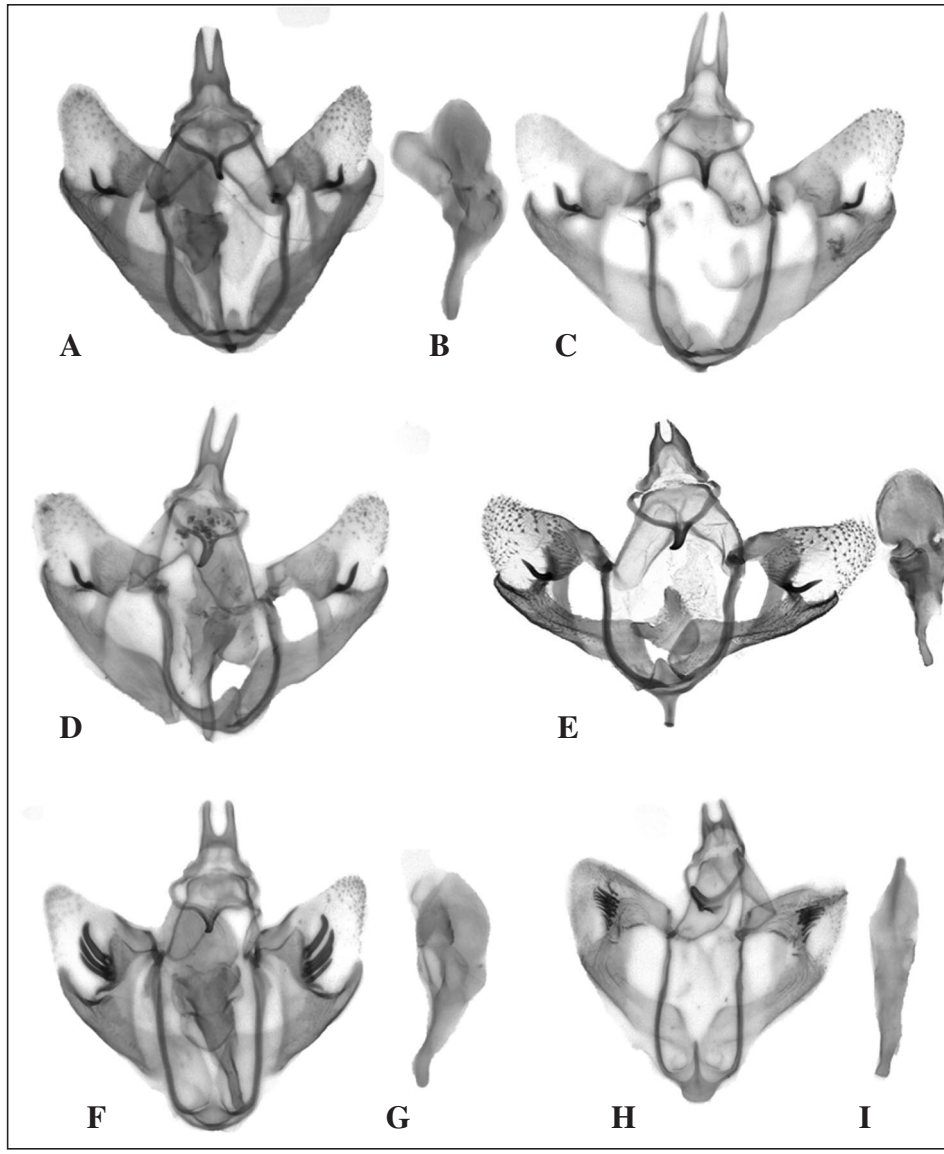



**Figures 1 A-G.–** A. Adult of *Tachyphyle nielseni* Lindt & Viidalepp, sp. n. (male, paratype). **B**. Male genitalia of *T. nielseni* Lindt & Viidalepp, sp. n. (paratype). **C**. Aedeagus of *T. nielseni* Lindt & Viidalepp, sp. n. (paratype). **D**. Labels of the paratype of *T. nielseni*. **E**. Last abdominal sternite and tergite of male *T. nielseni* Lindt & Viidalepp, sp. n. (paratype). **F**. Adult of *Tachyphyle selini* Lindt & Viidalepp, sp. n. (male, holotype). **G**. Adult of *T. undilineata* Warren.




**Figures 2 A-I.– A**. Male genital armature of *Tachyphyle selini* Lindt & Viidalepp, sp. n. (paratype from Costa Rica) (aedeagus not ectracted). **B**. Aedeagus of *T. selini* Lindt & Viidalepp, sp. n. (paratype from Costa Rica). **C**. Male genital armature of *T. selini* Lindt & Viidalepp, sp. n. (paratype from Costa Rica). **D**. Male genital armature of *T. selini* Lindt & Viidalepp, sp. n. (paratype from Ecuador) (aedfeagus not extracted). **E**. Male genital armature of *T. selini* Lindt & Viidalepp, sp. n. (paratype from Ecuador) (with aedeagus extracted). **F**. Male genital armature of *Tachyphyle undilineata* Warren (from French Guiana) (aedeagus not extracted). **G**. Aedeagus of T. undilineata Warren from Ecuador. H. Male genital armature of *T. occulta* Warren (from Nicaragua). **I**. Aedeagus of *T. occulta* Warren (from Nicaragua).