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NOTA

LEPIDOPTEROLOGICA

A journal focussed on Palaearctic and General Lepidopterology

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Editors

Dr Bernard Landry (Genève, CH), e-mail: bernard.landry@ville-ge.ch
Dr Matthias Nuss (Dresden, D), e-mail: matthias.nuss@senckenberg.de
Paul Sokoloff (Kent, UK), e-mail: paul.sokoloff@ntlworld.com

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Vladimir Ivanovich Kuznetsov

28 February 1929 – 22 August 2008

Vladimir Ivanovich Kuznetsov, a leading Russian lepidopterologist, Professor of Entomology and Doctor of Biological Sciences, passed away on August 22, 2008 at the age of 79. His scientific career started in Leningrad (now St. Petersburg) at the State University with his PhD thesis “The Lepidoptera of Western Kopetdagh, their ecology and economical value”, which was prepared under the guidance of the famous Russian entomologist Prof. A. S. Danilevsky. From 1955, Vladimir Kuznetsov held various positions on the scientific staff of the Zoological Institute, Russian Academy of Sciences (St. Petersburg), where for a long period (1969–2002) he was head of Lepidoptera department in the Laboratory of Insect Taxonomy.

The vast scientific heritage of Prof. Kuznetsov includes more than 200 published works. He has described 3 new subfamilies, 9 tribes, 37 genera and subgenera, and 353 species and subspecies belonging to 20 different families of Lepidoptera. Furthermore, together with Prof. Stekolnikov he established 6 infraorders and 1 family. Prof. Kuznetsov made a significant contribution to the systematics of the very large and economically important family Tortricidae, in which he was among the main world experts. In the leaf-rollers alone he described more than 300 taxa of various rank.

Prof. Kuznetsov always had very wide range of scientific interests, from mining moths to butterflies, and many different aspects of lepidopteran ecology as well. Amongst his

most significant works were the papers on the leaf-rollers of the Amur region, where the ecological factors determining seasonal dynamics and phenological differentiation of the regional fauna are analyzed. Furthermore, he also contributed to studies in applied entomology, for example in the middle of the last century publishing a series of articles devoted to the pests of cultured and wild trees and shrubs in the southern parts of the former USSR. Later, in the 1990s, Prof. Kuznetsov edited two large 'lepidopterous' volumes of the well-known handbook "Insects and Mites – Pests of Agricultural Plants". During the last quarter of 20th century he concentrated on the problems of phylogeny and systematics of the order Lepidoptera, based mainly on the functional morphology of the male genitalia. For his fundamental work "New Approaches to the System of Lepidoptera of World Fauna" (published in co-authorship with Prof. A. A. Stekolnikov in 2001) Prof. Kuznetsov was honoured with the E. N. Pawlowsky Award in 2002.

The scientific work of Prof. Kuznetsov also won international acknowledgement. On many occasions he was invited to the largest European museums (Berlin, Budapest, Bucharest, Helsinki, Krakov, London) to study the collections and carry out cooperative research projects. For his impressive achievement in lepidopterology Prof. Kuznetsov was elected an Honorary Member of the Societas Europaea Lepidopterologica (SEL) in 1998 and Sociedad Hispano-Luso-Americana de Lepidopterologia (SHILAP) in 2000. As with most of the true naturalists, Prof. Kuznetsov enjoyed travelling, using every possible opportunity for field work and collecting material. The geographical scope of his journeys covered the vast territory of the former USSR from the White Sea coast at the north to the Transcaucasus and Turkmenistan at the south and Kuril Islands at the east. In 1986 and 1988 he took part in two large and highly successful zoological expeditions to Northern and Southern Vietnam, which discovered hundreds of insect species new to science.

Prof. Kuznetsov was always generous in sharing his extensive knowledge and wide experience with other people. Under his guidance over 25 young researchers from Russia, Ukraine, Lithuania, Georgia, Armenia, Kazakhstan, Turkmenistan, Tajikistan, and Kyrgyzstan completed their PhD theses; among them such well known lepidopterologists like S. Baryshnikova, E. Beljaev, J. De Prins, P. Ivinskis, V. Kononenko, A. Lvovsky, V. Mironov, M. Omelko, M. Ponomarenko, R. Puplesis, A. Zhdanko, and many others. All friends, colleagues and students of Prof. Kuznetsov will retain very pleasant memories of this unusual and very interesting person.

For the full list of publications by V. I. Kuznetsov and details of his biography see Sinev & Lvovsky (2009) and Vives Moreno (2009).

SERGEY SINEV

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Beautiful gelechiid moths – *Aristotelia baltica* A. Šulcs & I. Šulcs, 1983, stat. n. and related species (Gelechiidae)

OLE KARSHOLT¹ & NIKOLAY SAVENKOV²

¹ Zoologisk Museum, Universitetsparken 15, DK-2100 København Ø, Denmark;
e-mail: okarsholt@snm.ku.dk

² Latvijas Dabas Muzejs, K.Barona ielā, 4, LV-1712, Rīga, Latvija;
e-mail: nikolajs@dabasmuzejs.gov.lv

Abstract. *Aristotelia baltica* A. Šulcs & I. Šulcs, 1983 (stat. n.) is raised from being a subspecies of *A. coeruleopictella* Caradja (1920) to a separate species. It is compared with the closely related *A. coeruleopictella* and *A. pancaliella*. The adults and genitalia of these three species are described and illustrated. The female genitalia of *A. pancaliella* are figured for the first time. A lectotype of *A. pancaliella* (Staudinger, 1871) is designated. The larva and life history of *A. baltica* is described and illustrated for the first time.

Zusammenfassung. *Aristotelia baltica* A. Šulcs & I. Šulcs, 1983 (stat. n.) ist von einer Unterart von *A. coeruleopictella* Caradja (1920) zu einer separaten Art erhoben. Sie wird mit den nahe verwandten *A. coeruleopictella* und *A. pancaliella* verglichen. Die Falter und Genitalien dieser drei Arten werden beschrieben und abgebildet. Die weiblichen Genitalien von *A. pancaliella* werden zum ersten Mal abgebildet. Ein Lectotypus wird für *A. pancaliella* (Staudinger, 1871) festgelegt. Die Larve sowie die Lebensweise von *A. baltica* werden erstmalig beschrieben und illustriert.

Introduction

With at least 4530 described and numerous undescribed species (Hodges 1998: 147) the Gelechiidae is the third largest family of Microlepidoptera. In spite of some diversity in colour and wing pattern the larger number of Gelechiidae, especially in temperate and arid areas, have forewings with grey or brown colours and black markings.

Among the more colourful gelechiids are members of the genus *Aristotelia* Hübner, 1825. They often have yellow, orange or red-brown forewings with white and/or silvery markings. As currently delimited this genus is found in both temperate and warmer parts around the world, except some oceanic islands, being most diverse in the Nearctic and Neotropic regions. Seventeen species are found in Europe (Karsholt 2004), and several additional species are known in complexes of closely related species (O. Karsholt, in prep.).

Differences in genitalia between species are sometimes small, and many species are more easily recognized from external features. The labial palps are diverse in form and scaling, and they are useful in grouping the species. However, as in other genera of Gelechiidae such as *Gelechia* Hübner, 1825 or *Monochroa* Heinemann, 1870 the form of the labial palps does probably not reflect the phylogenetic relationships within the genus. Within *Aristotelia* some species are remarkable because of the form of their labial palps and in being extraordinary colourful. A few of these are dealt with below.

Abbreviations

CAUEC Christian Albrecht University Ecological Center, Kiel, Germany

LDM Latvian Museum of Natural History, Riga, Latvia

MGAB	Muséum d'Histoire Naturelle "Grigore Antipa", Bucarest, Romania
MHNG	Muséum d'histoire naturelle, Geneva, Switzerland
NHMW	Naturhistorisches Museum, Vienna, Austria
ZIN	Zoological Institute, Academy of Sciences, St. Petersburg, Russia
ZMHU	Zoologisches Museum der Humboldt-Universität, Berlin, Germany
ZMUC	Zoological Museum, Natural History Musum of Denmark

Results

Key to adult moths

- 1 Subapical patch in forewing white, with metallic base 2
 1' Subapical patch metallic blue, edged with black; antenna black with apical fifth white *A. baltica*
- 2 Antenna ringed black and white, smaller species (10–11 mm) *A. pancaliella*
 2' Antenna black, distal eight ringed with white; larger species (12–15 mm) *A. coeruleopictella*

Key to male genitalia

- 1 Valva pointed, tip exceeding tip of acuminate uncus 2
 1' Tip of rounded valva not or only shortly exceeding tip of rounded uncus *A. pancaliella*
- 2 Vesica in phallus with a cone-shaped, thorned sclerotization *A. coeruleopictella*
 2' Vesica in phallus with plate with 1–2 small thorns *A. baltica*

Key to female genitalia

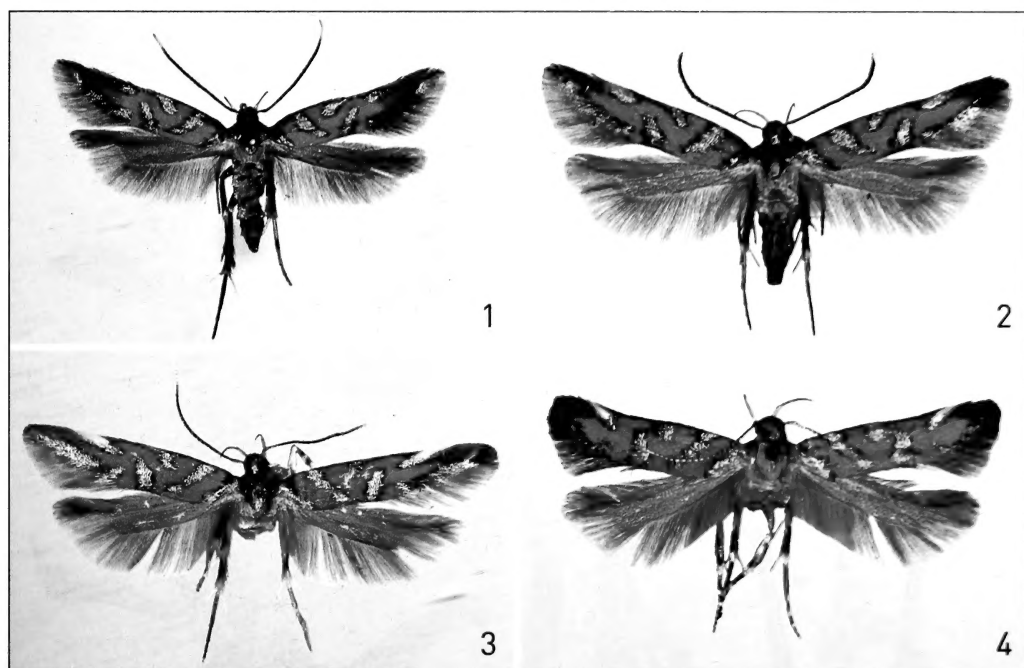
- 1 Ostium bursae a broadly u-shaped bowl 2
 1' Ostium bursae a v-shaped bowl *A. pancaliella*
- 2 Central part of ductus bursae densely spined; signum with 1–2 lateral thorns *A. baltica*
 2' Central part of ductus bursae weakly spined, signum with 3 lateral thorns *A. coeruleopictella*

Aristotelia coeruleopictella (Caradja, 1920)

Xystophora coeruleopictella Caradja, 1920: 106.

Aristotelia calloptera Omelko, 1999: 172 (figs), 174 (figs), 175.

Material. Lectotype: ♂, **Russia**, 'Kasakewitsch / 5582 Wlsm. 1908 / Lectotype *Xystophora coeruleopictella* Car. ♂, Des. Dr. A. Popescu-Gorj, Romania', gen. slide 671 Popescu-Gorj (MGAB) (examined). – Other material: **Russia**: 1♂, Ussuriskij regionj, Yakovlevka village, 17.vii.1926, leg. Diakonov & Filipiev, *Aristotelia pancaliella* Staudinger, 1870, male, det Piskunov, 1981 (ZIN); 1♀, same locality, but, 19.viii.1926, gen. slide OK 5109 (ZIN); 1♂, Primorskij Kraj, near Chinese border, Barabasch village,



Figs 1–4. Adults of *Aristotelia* species. 1–2. *A. baltica* A. Šulcs & I. Šulcs, Latvia (male right, female left). 3. *A. coeruleopictella* (Caradja), Far East Russia. 4. *A. pancaliella* (Staudinger), Lectotype, Russia.

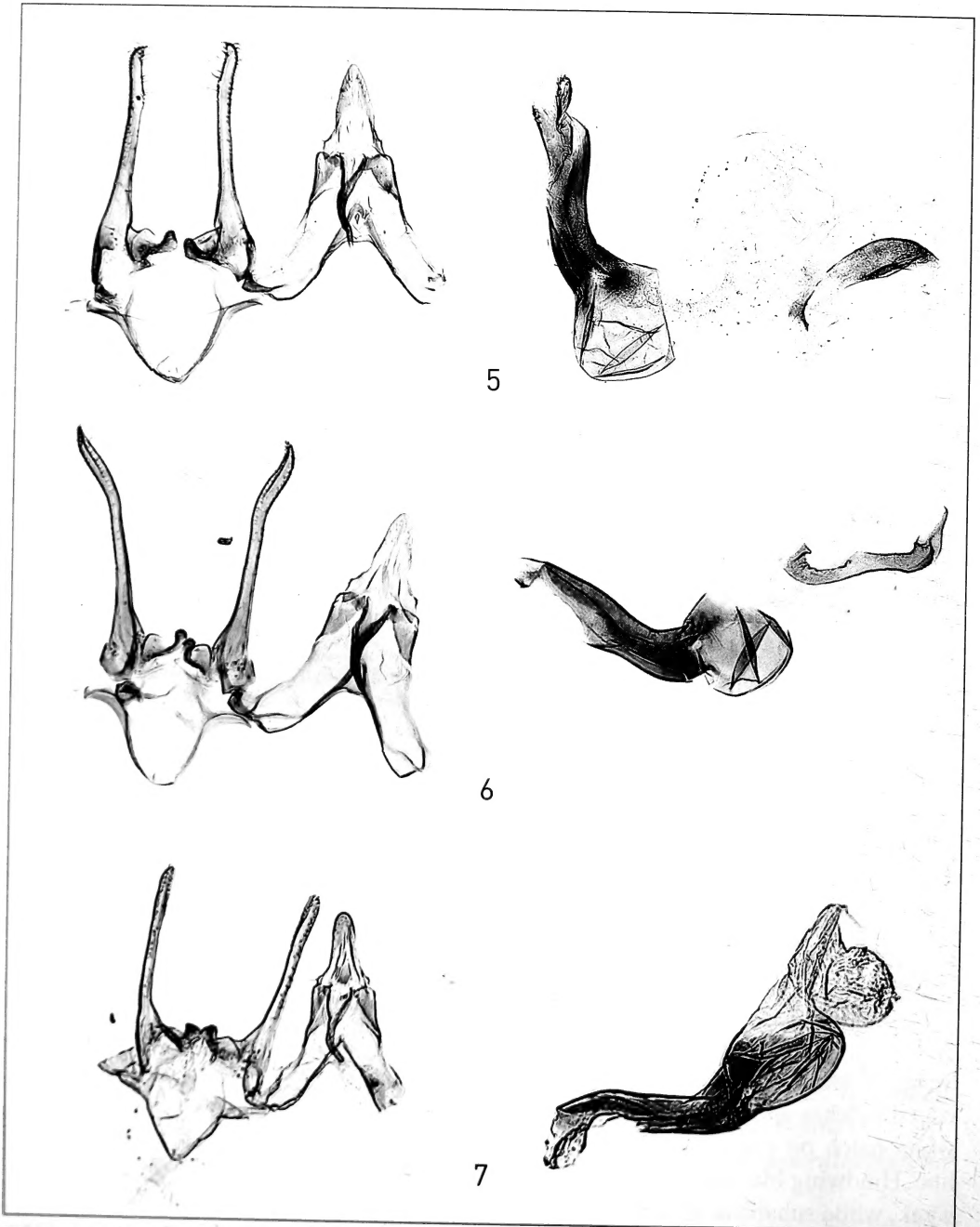
20.vii.1989, leg. S. Yu. Sinev, gen. slide HH 4980 (ZIN); 2♂, 1♀, Primorskij Kraj, Shkotovo distr., Anisimovka village, 17–20.vii.1994, by light, leg. N. Savenkov (LDM).

Diagnosis. *Aristotelia coeruleopictella* is characterized by its black antennae having the distal eighth ringed with white (apical fifth white in *A. baltica*; ringed black and white in *A. pancaliella*), and by its lanceolate, reddish orange forewings (not lanceolate and shorter in *A. pancaliella*) with metallic, black edged patches.

Description (Fig. 3). Wingspan 13–15 mm. Labial palp long, falciform, segment 2 orange-yellow; segment 3 longer than segment 2, black, upper surface mottled with yellow. Antenna black, distal eight ringed with white. Head and tegula shining metallic, thorax black. Forewing lanceolate, reddish orange with four shining metallic, black edged patches and similar markings at base and around apex and termen; a subapical white patch on costa with metallic base; stigmata absent; cilia grey without a cilia line. Hindwing blackish brown with dark grey cilia. Underside of forewing black with a weak, white subapical spot at costa.

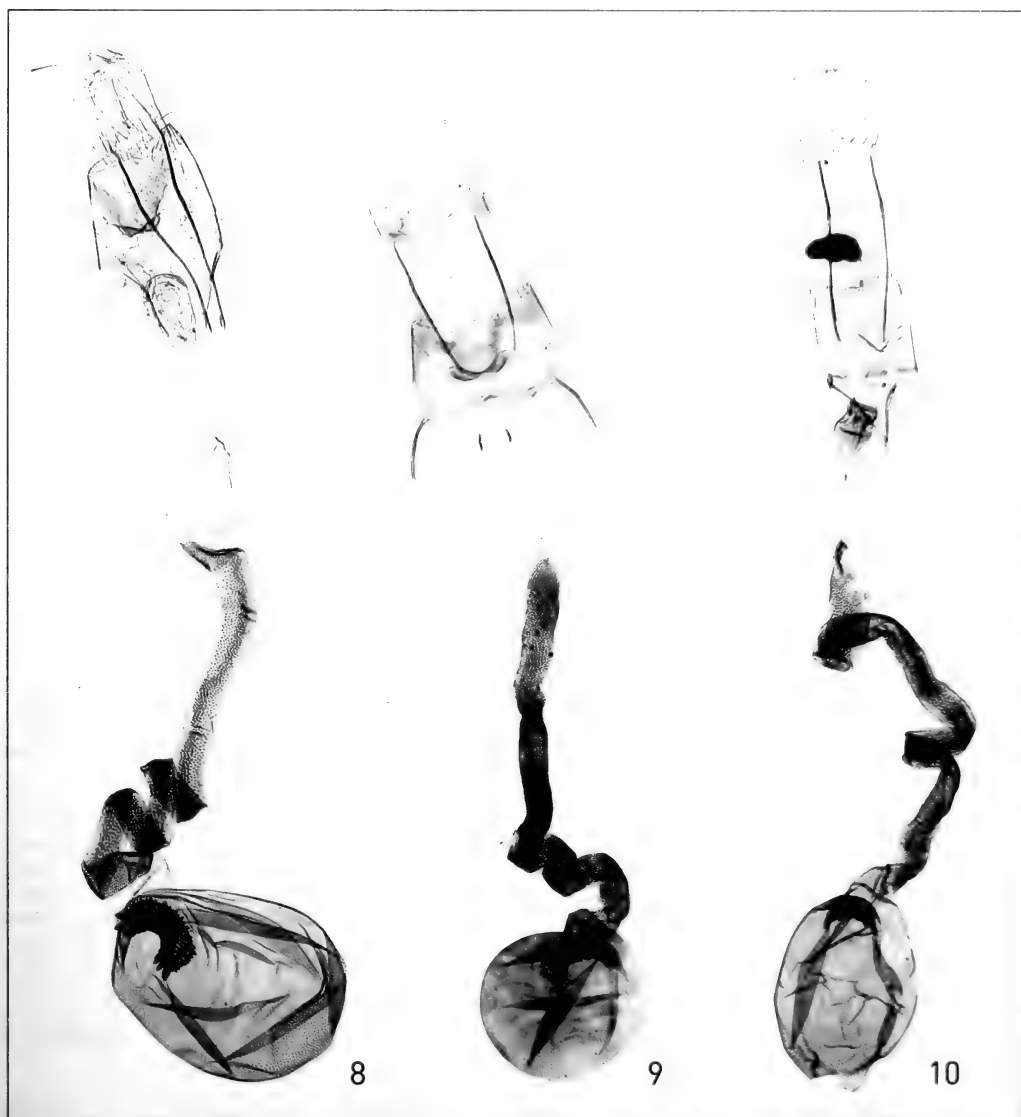
Male genitalia (Fig. 5). Uncus long; acuminate; gnathos slightly longer than uncus, slightly bent; valva very long and slender, slightly bent, exceeding beyond uncus, with apical thorn; sacculus reduced; vincular process tiny, rounded; saccus, short, semi-circular. Phallus bent, with small, globular base; distal-laterally with several small thorns; vesica with a cone-shaped, thorned sclerotization.

Female genitalia (Fig. 8). Apophyses anteriores about the length of segment VIII; ostium bursae a broadly v-shaped bowl; ductus bursae long, coiled, anterior third



Figs 5–7. Male genitalia of *Aristotelia* species. 5. *A. coeruleopictella* (Caradja), gen. prep. HH 4980. 6. *A. baltica* A. Šulcs & I. Šulcs, gen. prep. HH 4922. 7. *A. pancaliella* (Staudinger), Lectotype, gen. prep. OK 5112.

densely spined, central third less spined and posterior third without spines; signum large, broadly semicircular, covered with thorns and serrated margin ending with three larger lateral thorns.



Figs 8–10. Female genitalia of *Aristotelia* species. 8. *A. coeruleopictella* (Caradja), gen. prep. OK 5108. 9. *A. baltica* A. Šulcs & I. Šulcs, gen. prep. HH 4923. 10. *A. pancaliella* (Staudinger), gen. prep. OK 5110.

Distribution. Russia (Khabarovskij Kraj, Primorskij Kraj).

Life history. Early stages and host plant unknown. Adults have been collected in second part of July. Omelko (1999: 175) also gives August as flight period. Can be attracted to light.

Remarks. Caradja (1920: 106) described *Xystophora coeruleopictella* from two males collected at Kasakewitsch in Far East Russia by Raddé. He associated it with [*Argolamprotes*] *micella* (Denis & Schiffermüller, 1775). A lectotype was designated by Popescu-Gorj (1992: 145). To our knowledge it was not recorded again in the literature, apart from catalogues (Meyrick, 1925: 46; Gaede, 1937: 50), until Šulcs &

Šulcs (1983: 40). Park (1996: 61) stated the abdomen of the lectotype to be lost, but that was because its genitalia had been dissected. A drawing of the genitalia is kept in ZMUC. *Aristotelia calloptera* was described from a series of both sexes collected in the Primorye region, Russian Far East as well (Omelko 1999: 175). He apparently overlooked Caradja's description of *A. coeruleopictella*, and we consider *A. calloptera* Omelko as a junior synonym of *A. coeruleopictella* (Caradja). This synonymy was recently published by Ponomarenko (2008: 327).

The three species discussed in this paper were formerly placed under "*Aristotelia pancaliella* (Staudinger)" in the collection of ZIN, with specimens of *A. baltica* from Lithuania (and 1 specimen from a locality about 100 km north of St. Petersburg), and specimens of *A. coeruleopictella* from 'Ussuri' and 'Amur'.

The few examined specimens show almost no variation. According to Caradja (1920: 106) the medial part of the antenna is ringed black and white. We could not confirm that. Omelko (1999: 175) gave the wingspan as "11.5–14 mm". We did not examine such small specimens.

Aristotelia baltica A. Šulcs & I. Šulcs, 1983, stat. n.

Aristotelia coeruleopictella spp. *baltica* A. Šulcs & I. Šulcs, 1983: 41.

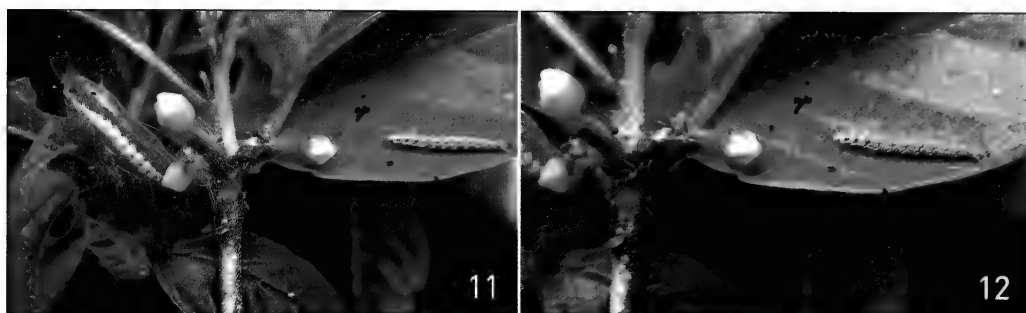
Material. Holotype: ♂, Latvia, Kaņdava (Čužas) 17.vii.1979, leg. I. Šulcs' (coll. Šulcs) (examined). – Paratype: 1♂, same data, but leg. A. Šulcs, gen. slide OK 3395 (ZMUC). – Other material: **Bosnia-Herzegovina:** 1♂, 1♀, 25 km SW Trebinje, e. l. 29.vi.1965, *Rhamnus*, leg. H. Malicky, gen. slide O. Karsholt 5113, 5114 (NHMW). **Latvia:** 3♂, 6♀, Kēmeri 1.-15.vi.1993, ex l. *Frangula alnus*, leg. N. Savenkov (CAUEC, LDM, ZMUC); 2♂, Kēmeri (Kūdra), 29.vii.1993, leg. N. Savenkov (LDM); 1♂, Dunava, vi.1993, leg. A. Barševskis (LDM); 1♂, Teiču reserve, 23.vii.1993, leg. N. Savenkov (LDM); 2♂, 1♀, Kaņdava, 27.vii.1994, leg. J. Junnilainen, gen. slide HH 4922, 4923; 1♀, Carnikava, 21.vii.1995, leg. J. Junnilainen (ZMUC); 1♀, Silene, Ilgas 28.vii.1997, A. Barševskis (LDM); 5♂, 8♀, Silene, Ilgas, 17.-26.vi.2002, ex l. *Frangula alnus*, leg. N. Savenkov, (CAUEC, LDM, ZMUC); 3♂, 6♀, Nīcgale, 10.-27.vi.2002, ex l. *Frangula alnus*, leg. N. Savenkov (LDM, CAUEC); 1♂, Slītere, 23.vii.2003, leg. N. Savenkov (LDM); 1♂, 5♀, Kaņdava (Čužas), 22.vii.1988, on *Potentilla fruticosa* flowers, leg. N. Savenkov (LDM); 1♂, 5♀, Kaņdava (Čužas), 14.-16.vii.2003, ex l. *Frangula alnus*, leg. N. Savenkov (LDM, CAUEC). **Lithuania:** 2♂, N. Vertiai, 23.vii.1980, 2♂, 2♀, 5.viii.1980, leg. P. Ivinskis, gen. slide HH 1582, OK 3671, 3672 (ZMUC); 1♀, N. Vertiai, 30.vi.1981, ex l. *Rhamnus*, 1♂, 7.vi.1986, ex l. *Rhamnus*, leg. P. Ivinskis (LDM).

Diagnosis. See under *A. coeruleopictella*.

Description (Figs 1–2). Wingspan 10–13 mm. Labial palp long, falciform, segment 2 orange-yellow; segment 3 longer than segment 2, black. Antenna black with apical fifth white. Head and tegula shining metallic; thorax black. Forewing lanceolate, reddish orange with four metallic blue, black edged patches and similar markings at base and around apex and termen; stigmata absent; cilia grey without cilia line. Hindwing blackish brown with dark grey cilia. Abdomen and underside of wings black.

Male genitalia (Fig. 6). Uncus long, acuminate; gnathos about as long as uncus, slightly bent; valva very long and slender, slightly bent, exceeding beyond uncus, tip pointed; sacculus reduced; vincular process tiny, rounded, fused; saccus, short, rounded. Phallus bent, with globular base; vesica with plate with 1–2 small thorns.

Female genitalia (Fig. 9). Apophyses anteriores about half to about two thirds length of segment VIII; ostium bursae a broadly u-shaped bowl; ductus bursae long,



Figs 11–12. Larvae of *A. baltica* A. Šulcs & I. Šulcs on *Frangula alnus*.

coiled, densely spined, posterior part without spines; signum broadly semicircular, covered with thorns, with serrated margin and pair of lateral thorns.

Distribution. Estonia, Latvia, Lithuania, Bosnia-Herzegovina, and European Russia, eastwards to the southern Urals (Junnilainen et al. in press).

Life history (Figs 11–12). The larva is light greyish, ornamented with lighter and darker pattern and an irregular dark lateral line. The abdomen has scattered, light hairs. Head and prothoracic plate light brown; anal plate concolorous with the abdomen. It feeds, probably after hibernation, in May and June on young leaves and flowers of *Frangula alnus* Mill. (Rhamnaceae) covering them with transparent silk. The larva is very mobile and when disturbed rapidly moves to the safe place in the web or falls down to the ground. The habitats are wet meadows with *F. alnus*, but moths are often found in some distance from *Frangula* trees (Ivinskis 1982: 44, 46, as *A. pancaliella*; Ivinskis in litt., N. Savenkov, pers. obs.). The adult flies in July to early August. It can be found during the day and is occasionally attracted to light. It has been observed on flowers of *Potentilla fruticosus* (L.) Rydb. (Rosaceae) and *Inula salicina* L. (Asteraceae) (Šulcs & Šulcs 1983: 41). The specimens from Bosnia-Herzegovina were, according to their labels, bred from “*Rhamnus*” (Rhamnaceae).

Remarks. *Aristotelia coeruleopictella* spp. *baltica* was described from three males and one female collected in the nature reserve ‘Čužas’ by Kandava in Latvia. The description included important distinctive characters when compared with *A. coeruleopictella*, but due to lack of material for comparison it was at that time not obvious if the two taxa should be considered as separate species. This has since proved to be the case as we have demonstrated.

The examined specimens show little variation. The two specimens from Bosnia-Herzegovina differ from those from the Baltic States by being slightly smaller and having the subapical spot on the forewings white with metallic base.

***Aristotelia pancaliella* (Staudinger, 1871)**

Gelechia pancaliella Staudinger, 1871: 312.

Material. Lectotype (here designated): ♂, **Russia**, ‘Sarepta [=Krasnoarmeysk], Chr.[istoph] / Orig[i]n[al]. / Zool. Mus. Berlin’, gen. slide O. Karsholt 5112 (ZMHU). – Other material: **Russia**. 1 ♀, Volgograd.

18-24.v.1967, leg. V. Zouhar, gen. slide O. Karsholt 5110 (ZMUC). **Syria:** 1 ♀, 20 km N E Damascus, 16-23.v.1961, leg. F. Kasy & E. Vartian (NHMW). **Turkey:** 2 ♂, Diyarbakir, Monastery Hill, caravanserai of Husrev Pasha, 1.vii.1941, collector unknown (MHNG); 1 ♂, prov. Kayseri, 5 km W Incesu, 1250 m, 30.vii.1989, leg. M. Fibiger & N. Esser (ZMUC).

Diagnosis. See under *A. coeruleopictella*.

Description (Fig. 4). Wingspan 10–11 mm. Labial palp long, falciform, segment 2 orange-yellow; segment 3 longer than segment 2, black. Antenna ringed blackish brown and white. Head and tegula shining metallic; thorax orange mottled with brown towards head. Forewing orange with three silvery, black edged patches and similar markings at base and around apex and termen; subapical patch on costa white with metallic base; stigmata absent; cilia dark grey without cilia line. Hindwing blackish brown with dark grey cilia. Underside of forewing shining black, with white subapical spot at costa. Abdomen dark grey, distal part of each segment on underside shining pale yellow.

Male genitalia (Fig. 7). Uncus long, rounded; gnathos about as long as uncus, slightly bent; valva long and slender, almost straight, extending shortly beyond uncus, tip rounded; sacculus reduced; vincular process rather stout, subtriangular, laterally emarginated; saccus broad, triangular. Phallus bent, with globular base; distal-laterally with one small thorn; vesica with few spinules.

Female genitalia (Fig. 10). Apophyses anteriores about half length of segment VIII; ostium bursae a v-shaped bowl; ductus bursae long, coiled, densely spined, posterior part without spines; signum semicircular, covered with thorns, with serrated margin and pair of large, lateral thorns.

Distribution. South of Russia, Turkey, and Syria.

Life history. Early stages and host plant unknown. According to Anikin & Piskunov (1995: 5) *A. pancaliella* occurs in dry steppe biotopes near the type locality in southern Russia. They state the larva to feed on flowers of *Frangula alnus*. However, this host plant record almost certainly refers to *A. pancaliella sensu* Ivinskis (1982), which is in fact *A. baltica*. Adults have been collected in late June and July. Those from Diyarbakir were, according to their labels, found on flowers of *Globularia* (Globulariaceae).

Remarks. *Aristotelia pancaliella* was described from a series of specimens collected by H. Christoph in early July near Sarepta [now Krasnoarmeysk] in southern Russia (Staudinger: 1871: 112). The name *pancaliella* was first proposed by Zeller (*in litt.*) and was made available by Staudinger. He associated it with [*Argolamprotes*] *micella* (Denis & Schiffermüller, 1775).

We studied a male syntype from the Staudinger collection in ZMHU. Due to the confusion about the identity of *pancaliella* as described above we designate this specimen a lectotype.

Aristotelia pancaliella differs from *A. coeruleopictella* and *A. baltica* by being smaller (more short-winged), and by having the antennae ringed black and white from base to tip.

Only few specimens were examined. One female from South Russia has many cream-coloured scales at the underside of both wings. The examined specimens from Turkey and Syria have white scales at the basal edge of the metallic patch at 2/3 of the dorsum of the forewing.

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Cucullia argentina (Fabricius, 1787) and *Saragossa porosa porosa* (Eversmann, 1854) from the steppes of Dobrogea, Romania (Noctuidae)

LEVENTE SZÉKELY¹ & VLAD DINCĂ²

¹ Str. Viitorului 31 B/9, Săcele (Braşov), 505600, Romania; e-mail: levi.szekely@gmail.com

² Departament de Genetică i Microbiologia, Universitat Autònoma de Barcelona, Bellaterra, Spain; e-mail: sudistu@yahoo.com

Abstract. *Cucullia argentina* (Fabricius, 1787) and *Saragossa porosa porosa* (Eversmann, 1854) are reported from the steppes of Dobrogea (south-eastern Romania). *Cucullia argentina* is new for the country's entomofauna while *S. p. porosa* is reported for the first time in Dobrogea and for the second time in Romania. Given the current data, both taxa reach in Dobrogea their south-western distribution limit in Europe. The relationship between *S. p. porosa* and *S. p. kenderesiensis* (Kovács, 1968) is discussed. The lack of clear morphological differences between the two taxa combined with their diminished range disjunction may require reconsidering the status of the subspecies *kenderesiensis*. The actual and potential distribution, ecology and conservation of *C. argentina* and *S. p. porosa* in Romania are discussed.

Résumé. *Cucullia argentina* (Fabricius, 1787) et *Saragossa porosa porosa* (Eversmann, 1854) sont rapportés des steppes de la Dobroudja (sud-est de la Roumanie). *Cucullia argentina* est une nouvelle espèce pour l'entomofaune du pays tandis que *S. p. porosa* est rapportée pour la première fois de la Dobroudja et pour la seconde fois de Roumanie. Les deux taxons atteignent donc dans la Dobroudja leur limite sud-occidentale en Europe. Le lien entre *S. p. porosa* et *S. p. kenderesiensis* (Kovács, 1968) est discuté. L'absence de différences morphologiques claires entre les deux taxons en combinaison avec la diminution de la disjonction de leurs aires de distribution pourraient signifier une nécessaire révision du statut de la sous-espèce *kenderesiensis*. La distribution actuelle et potentielle, l'écologie et la conservation de *C. argentina* et *S. p. porosa* en Roumanie sont commentées.

Rezumat. *Cucullia argentina* (Fabricius, 1787) și *Saragossa porosa porosa* (Eversmann, 1854) sunt semnalate din stepele Dobrogei (sud-estul României). *Cucullia argentina* este specie nouă pentru fauna României, în timp ce *S. p. porosa* este semnalată pentru prima dată din Dobrogea și pentru a doua oară în România. Având în vedere datele actuale, ambii taxoni ating în Dobrogea limita sud-vestică a distribuției în Europa. Relația dintre *S. p. porosa* și *S. p. kenderesiensis* (Kovács, 1968) este comentată. Lipsa unor diferențe morfologice clare între cei doi taxoni precum și disjuncția de areal mult diminuată ridică semne de întrebare asupra statutului subspeciei *kenderesiensis*. Distribuția actuală și potențială precum și aspecte legate de ecologia și conservarea lui *C. argentina* și *S. p. porosa* în România sunt comentate.

Introduction

Dobrogea is a historical region of ca. 15,500 km² which belongs to the Balkan Peninsula, the Danube representing the northern border of the Balkans (Fig. 1).

The first lepidopterist in Dobrogea was Josef Mann (1804–1889) from Vienna. In 1866 he published the first noticeable work on the Lepidoptera of Dobrogea province (Mann 1866), which at that time still belonged to the Ottoman Empire. During the XXth century, the Lepidoptera fauna of Dobrogea was studied by many Romanian lepidopterists. After 1980 research became even more intense through the efforts of a new generation of entomologists who turned Dobrogea into one of the best studied regions of Romania from the point of view of the Lepidoptera fauna.

The uniqueness of the Lepidoptera assemblages from Dobrogea is mainly determined by its geographic position, lying at the intersection of the faunal elements from Central

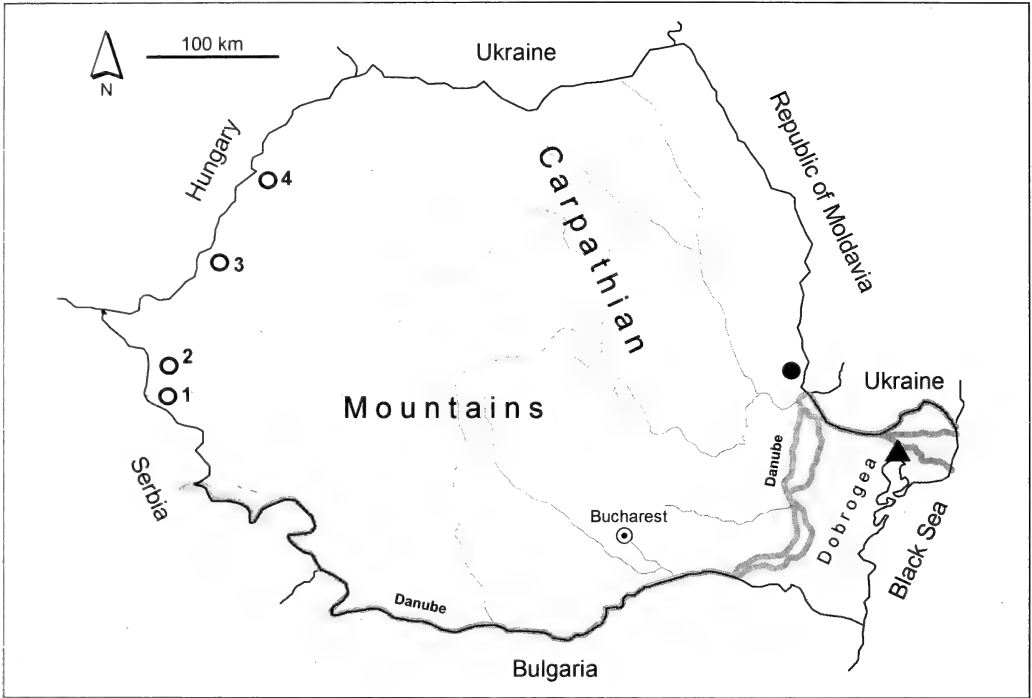


Fig. 1. Map of Romania indicating the position of Dobrogea and the distribution of *Cucullia argentina*, *Saragossa porosa porosa* and *S. porosa kenderesiensis*. ▲: New records of *C. argentina* and *S. p. porosa*: Sarinasuf-Plopu, Tulcea county (this paper); ●: *S. p. porosa*: Gârboavele forest, Galați county (Olaru & Nemeș 1969); ○: 1, 2 – *S. p. kenderesiensis*: the area Peciu Nou – Dinaș – Cruceni – Giera, Timiș county (Rákósy 1996, Neumann 1997); 3 – Nădab, Arad county (Neumann 1997, 1998); 4 – ca. 5 km N of Oradea, Bihor county (Rákósy 1996).



Fig. 2. Map of Dobrogea indicating the collecting site (Sarinasuf-Plopu, Tulcea county – black triangle) of *Cucullia argentina* and *Saragossa porosa porosa*.



Fig. 3. Sarinasuf-Plopu (Tulcea county, northern Dobrogea) (26.viii.2007). The *Artemisia* steppe is the optimal habitat for *Cucullia argentina* and *Saragossa porosa porosa*. Photo L. Székely.



Fig. 4. Steppe area at Sarinasuf-Plopu (Tulcea county, northern Dobrogea), 27.viii.2008. Photo L. Székely.

Europe, the west-asiatic steppes, Asia Minor and the east of the Balkan Peninsula. Therefore, Dobrogea represents the western distributional limit for several Lepidoptera taxa being characteristic for the south Ukrainian steppes, for example *Megaspilates mundataria* (Stoll, 1782), (Geometridae), *Cucullia biornata* Fischer v. Waldheim, 1840, *Saragossa siccanorum* (Staudinger, 1870) (Noctuidae).

On the other hand, several southern taxa typical of the Balkan Peninsula reach their northern European distributional limit in Dobrogea, for example *Lemonia balcanica* Herrich-Schäffer, 1847 (Lemoniidae), *Asovia maeoticaria* (Alphéraky, 1876) (Geometridae), *Polyphaenis subsericata* Herrich-Schäffer, 1861, *Episema korsakovi* (Christoph, 1885), *Dichagyris melanura* (Kollar, 1846).

According to the most recent publications (e.g. Rákósy & Székely 1996; Rákósy & Wieser 2000; Székely 2006), Dobrogea has recorded almost 900 species of macrolepidoptera. However, recent research (e.g. Dincă & Vila 2008; Székely & Dincă 2008; Dincă et al. 2009; present paper) continue to deliver valuable results including the discovery of new taxa for Dobrogea and/or Romania, many of them of high zoogeographical significance for the fauna of Europe. Such examples are *Cucullia argentina* (Fabricius, 1787) and *Saragossa porosa porosa* (Eversmann, 1854), both reaching in Dobrogea their southwestern limit of distribution in Europe.

Material and methods

The steppes of northern Dobrogea were investigated during 2007–2008: 25–27.viii.2007, 25–29.v.2008, 24–27.viii.2008, and 18–19.x.2008. The material was collected using classical methods: a 125 W mercury vapor bulb placed in front of a white sheet and powered by a portable gasoline generator. In addition, three to seven light traps with 8 W white and black light tubes were used during each collecting event.

The collecting site lies on the north-eastern shore of Razelm lake, namely between the villages of Plopu and Sarinasuf (Tulcea county, northern Dobrogea) (Fig. 2). The area has a pronounced steppe character (Figs 3, 4) and the salty soil allows for the considerable development of vegetation assemblages dominated by *Artemisia* (Asteraceae) (Fig. 3). The steppe meadows are not used for agriculture and the vegetation is allowed to develop to a certain extent due to extensive grazing by sheep, goats and cattle. These animals avoid the *Artemisia* plants which grow freely in the area.

Results and discussion

Cucullia argentina (Fabricius, 1787)

Material. Romania: 3♂, Northern Dobrogea, Tulcea county, Sarinasuf-Plopu, 2 m, 24–27.viii.2008, leg. & coll. L. Székely & I. Juhász.

Taxonomic notes. The *argentina* species group of *Cucullia* is characterized by morphologically similar species with entirely allopatric distributions. Although sometimes considered only as geographic subspecies of the same taxon, the Palaearctic taxa in the *argentina* group are generally recognized as distinct species: *Cucullia argentina*, *Cucullia nokra* Rungs, 1952, *Cucullia bubaceki* Kitt, 1925 and *Cucullia biradiata* Kozhanchikov, 1925 (Ronkay & Ronkay 1994).

Cucullia argentina was described by Fabricius based on material originating from Sarepta (Kazakhstan). Subsequently, several subspecies have been described under



Fig. 5. Male of *Cucullia argentina*, Sarinasuf-Plopu (Tulcea county, northern Dobrogea), 2 m, 24–27.viii. 2008. Photo L. Székely.

argentina such as: *achalina* Pungeler, 1900 (type locality Ashabad, Turkmenistan) and *grisescens* Wagner, 1931 (type locality Akşehir, Turkey). The name *grisescens* Wagner, 1931 being preoccupied by *Cucullia grisescens* Leech, 1900, has been replaced by *anatoliensis* Koçak, 1980 (Ronkay & Ronkay 1994). The subspecies *anatoliensis* was subsequently treated as synonym of the nominotypical subspecies (Hacker 1990; Ronkay & Ronkay 1994, 2006). Concerning the subspecies *achalina*, recent data suggest that this is in fact a distinct species so that *C. argentina* appears in its nominotypical subspecies throughout all its range (László Ronkay, pers. comm. 2009).

Considering Europe, *C. argentina* (Fig. 5) is similar in external appearance only to *Cucullia bubaceki* Kitt, 1925. The two taxa are strongly allopatric, with the latter being endemic to the Iberian Peninsula (Ronkay & Ronkay 1994).

Cucullia argentina is a small sized member of the genus, with a wing-span of 28–36 mm (our specimens have a wing-span of 31–33 mm).

Distribution. *Cucullia argentina* is widely distributed in the steppe areas of the center of the Palearctic region (western and central Asia), but it usually appears in isolated colonies scattered across its range. The species ranges from western Siberia (e.g. Kurgansk, Omsk, Tomsk, Novosibirsk) (Zolotareno & Dubatolov 2000), to central Asia: Mongolia, eastern Kazakhstan (Dzharkent), Uzbekistan (e.g. Chimkent, Issyk-Kul), western China (e.g. Kuldja, Tien-Shan, Altyn-Tagh) (Ronkay & Ronkay 1994, 2006; Wiesert 1998; Ivinskis & Miatleuski 1999; Kravchenko et al. 2005). The southern limit of the distribution passes through Daghestan (Nikolaevitch & Vjatcheslavovna 2002), central Turkey, western Iran, Irak (Ronkay & Ronkay 1994) and Israel (El Rom – the upper Golan Heights) (Kravchenko et al. 2005). *Cucullia argentina* reaches Europe towards its western limit of distribution: the south of the Ural mountains (Nupponen

& Fibiger 2002), western Kazakhstan (Hacker & Miatleuski 2001), eastern (Lugansk) and southern Ukraine (Kljuchko 2006; Kljuchko et al. 2006) including Crimea (Efetov & Budashkin 1990), Slovakia and eastern Romania (the current records). The records from Slovakia were for a long time considered as requiring confirmation (Ronkay & Ronkay 1994). In the collections of the Hungarian National History Museum of Budapest there is a specimen collected in eastern Slovakia (Presov) (labeled "Eperjes, 1914. leg. Issekutz"). The species was rediscovered in 1981 by Reiprich on the Plesivka planina (Plesivec) (Ronkay & Ronkay 2006).

The population discovered by us in south-eastern Romania (northern Dobrogea) lies at about 200 km from the nearest populations from southern Ukraine (area of Odessa) (see the distribution map from Kljuchko 2006). The species was not listed in the latest version of the Romanian Lepidoptera Catalogue (Rákossy et al. 2003) and is recorded hereafter for the first time in the Romanian entomofauna. There is no confirmed record of *C. argentina* from Bulgaria (S. Beshkov pers. comm.), so that the population from northern Dobrogea currently represents the south-western range limit of this taxon in Europe.

Biology and ecology. *Cucullia argentina* is a xerophilous species typical of the *Artemisia* steppes and can be found from dry semi-desert lowlands (e.g. our collecting locality is at 2 m above sea level) to arid mountain areas, up to 3000 m (Ronkay & Ronkay 1994).

The adults fly during the night, the specimens from Dobrogea being collected at light between 23:00 and 24:00.

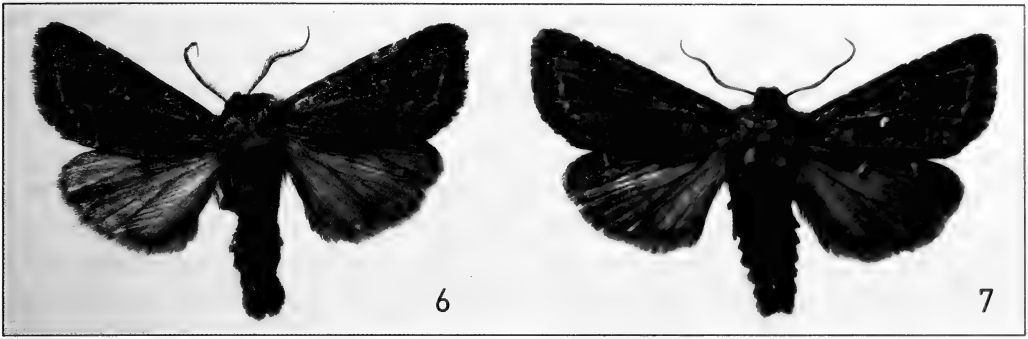
With few exceptions (e.g. the Ural region), the species has two yearly broods (Ronkay & Ronkay 1994, 2006) extending over April–May and July–August, according to geographical position and local climate. In northern Dobrogea the moths most probably fly during May and August. The larval development takes place during June–July and September–October (Ronkay & Ronkay 1994). The adults overwinter as pupae (Ronkay & Ronkay 2006).

The reported larval food plants are various species of *Artemisia* (Asteraceae) (Ronkay & Ronkay 1994, 2006) among which *A. campestris* L. (Nupponen & Fibiger 2002; Kljuchko 2006) and *A. scoparia* Waldst & Kit (Kljuchko 2006). Although in the area of Sarinasuf-Plopu we observed high densities of *Artemisia* (Fig. 3), no larvae have yet been found, and the larval food-plant of *C. argentina* in Romania is yet unknown. The *Artemisia* plants could not be identified to species level because at the end of August (when *C. argentina* was collected) they did not have any leaves; which are critical for an exact determination.

***Saragossa porosa porosa* (Eversmann, 1854)**

Material. Romania: 27♂, 12♀, Northern Dobrogea, Tulcea county, Sarinasuf-Plopu, 2 m, 26.viii.2007 (1♂); 25–29.v.2008 (14♂, 8♀); 24–27.viii.2008 (12♂, 4♀), leg. & coll. L. Székely & I. Juhász.

Taxonomic notes. The species was described by Eversmann from the south of the Ural Mountains (Orenburg). The subspecies *kenderesiensis* Kovács, 1968 was described from the Pannonian plain (Hungary) (Kovács, 1968), the collecting locality



Figs 6–7. *Saragossa porosa porosa*. 6. Male of *Saragossa porosa porosa* Sarinasuf-Plopu (Tulcea county, northern Dobrogea), 26.v.2008. Photo L. Székely. 7. Holotype of *Saragossa porosa kenderesiensis*, Kenderes (Hungary), 20.v.1964. In coll. Hungarian Natural History Museum. Photo L. Székely.

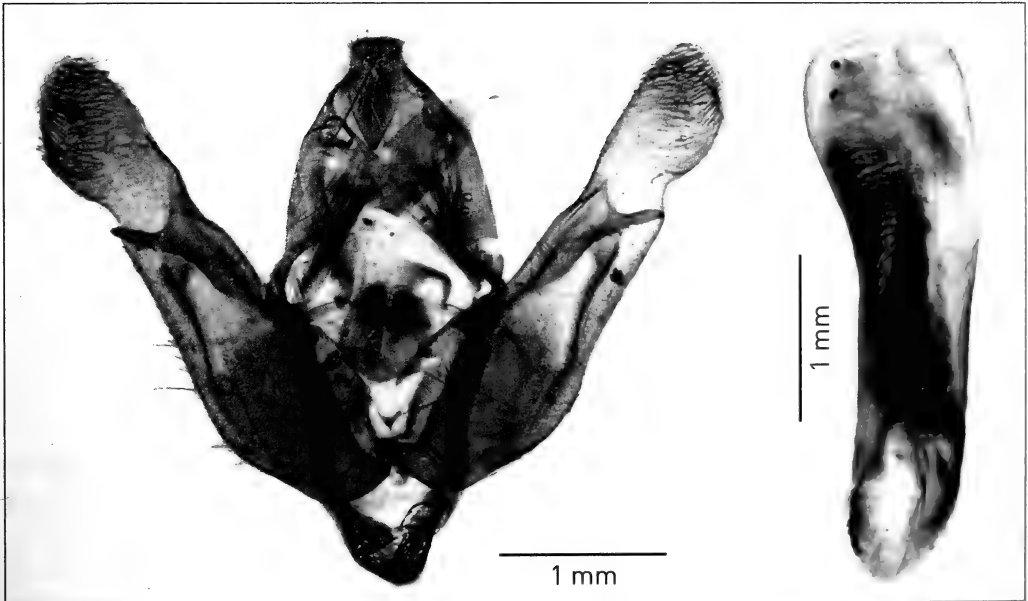


Fig. 8. Male genitalia of *Saragossa porosa porosa*, Sarinasuf-Plopu (Tulcea county), 24.viii.2008. prep. genit. 765/Dincă.

(Kenderes) lying far from the rest of the eastern European and west Asiatic populations. The taxonomic position of *S. porosa* changed repeatedly over time, the taxon being included in the genera *Orthosia* Ochsenheimer, 1816, *Hyssia* Guenée, 1852, *Sideridis* Hübner, [1821] or *Porosania* Beck, 2000 (Hacker et al. 2002). The species was placed within the genus *Saragossa* Staudinger, 1900 by Varga & Ronkay (1991) and Hacker et al. (2002).

Considering Europe, *S. porosa* (Figs 6, 7) is similar to *Hyssia cavernosa* (Eversmann, 1842), but a careful examination of the forewing pattern (and male antenna) allows for a safe separation. The two species can be easily separated based on both male and female genitalia (see Hacker et al. 2002).

According to the original description, the subspecies *kenderesiensis* (Fig. 7) differs from the nominotypical *porosa* through the darker and more brownish colour of the forewings that lack the violet tones. The wing span was reported to be slightly smaller in the case of *S. p. kenderesiensis* (19–33 mm) compared to *S. p. porosa* (29–35 mm) (Kovács 1968; Neumann 1997, 1998; Hacker et al. 2002; Kljuchko 2006). Our specimens have a wing span of 28–34 mm. All these data indicate that there is considerable overlap between the wing-span of the two subspecies.

Besides morphological differences, Kovács (1968) based his description of the subspecies *kenderesiensis* on the disjunct distribution of *S. porosa* which at that time was known to have eastern populations ranging only between the Volga and the Issyk-Kul and western populations restricted to the Pannonian Great Plain (Kovács 1968). Subsequently, new populations were discovered that considerably diminished the disjunction (see below under Distribution). It is also the case with the population recorded here from northern Dobrogea. With the new data, the disjunction becomes less pronounced, the current separation being of about 500 kilometers. Referring to the diagnosis of *S. p. kenderesiensis*, Hacker et al. (2002) mentioned the relative status of this subspecies that is only slightly differentiated from the nominotypical *S. p. porosa*. The male genitalia (Fig. 8) are reported to display insignificant differences between the two taxa (Hacker et al. 2002) (and see genitalia illustrations from Varga & Ronkay 1991; Rákósy 1996; Neumann 1997; Hacker et al. 2002).

The (1) slight wing pattern and size differences, (2) irrelevant distinction between the male genitalia and (3) considerably diminished range disjunction may require reconsideration of the status of the subspecies *kenderesiensis*. According to László Ronkay, *S. p. kenderesiensis* should not be considered as a distinct subspecies (L. Ronkay, pers. comm. 2009).

Distribution. *Saragossa porosa* has a wide distribution roughly following the presence of the western Asian and eastern European saline flats and *Artemisia* steppes. The nominotypical *S. p. porosa* is known from south-western Siberia (Novosibirsk) (Zolotarev & Dubatolov 2000), southern Urals (Nupponen & Fibiger 2002, Ronkay & Ronkay 2006), Daghestan (Nikolaevitch & Vjatcheslavovna 2002, 2003), Kazakhstan, Kirghisia, across the northern shores of the Caspian Sea to the Aral Sea and the Issyk-Kul (Kyrgyzstan) (Hacker et al. 2002). In Europe, the species ranges from western Kazakhstan (Hacker & Miatleuski 2001) to eastern Ukraine (Lugansk) and southern Ukraine (Kljuchko 2006; Kljuchko et al. 2006).

The subspecies *kenderesiensis* seems to be endemic to the Pannonian Great Plain, being described and known initially from Hungary (Kovács 1968). More recently, *S. p. kenderesiensis* was discovered in western Romania. The first specimen was collected in 1994 at ca. 5 km north of Oradea (Bihar county, Crişana) (Rákósy 1996) and between 1995–1997 was found in a few other localities from western Romania (Timiş and Arad counties, Banat) (Neumann 1997, 1998) (Fig. 1).

Nevertheless, *S. porosa* was recorded for the first time from eastern Romania as "*Orthosia porosa* Ev." (one male taken on July 7th, Gârboavele forest, Galaţi county) in the late 60's (Olaru & Nemeş 1969) (Fig. 1). The record was not accompanied by adult or genitalia illustrations and no comments were made concerning subspecific

status. Popescu-Gorj (1987) did not include the species in the list of the Romanian Macrolepidoptera while Rákósy (1996) referred only to the records of the subspecies *kenderesiensis* from western Romania. The latest version of the Romanian Lepidoptera Catalogue (Rákósy et al. 2003) included the record of Olaru & Nemeş (1969) and commented that the population from Gârboavele forest probably belongs to a different subspecies. Given the geographical position of the collecting site, the specimen collected by Olaru & Nemeş (1969) most probably belongs to the nominotypical subspecies. As a matter of fact, Gârboavele forest is relatively near (ca. 100 km) to our newly reported locality from northern Dobrogea (Sarinasuf-Plopu) (Fig. 1) and at less than 200 km from the nearest records in Ukraine. The area Sarinasuf-Plopu itself lies even nearer (about 150 km) to the Ukrainian records (area south-west of Odessa) (see map in Kljuchko 2006).

Biology and ecology. *Saragossa porosa* is a halobiont xerothermophilous species characteristic of steppe areas with *Artemisia*. According to Hacker et al. (2002), the nominotypical *S. p. porosa* is univoltine (June–July), while *S. p. kenderesiensis* is bivoltine (April–May, end of July–beginning of September). Published data support the bivoltine character of *S. p. kenderesiensis* (e.g. Rákósy 1996, Neumann 1997, 1998), but also indicate partial overlaps between broods (Neumann 1998). However, the voltinism of *S. p. porosa* is not so clear. Several reported collecting dates from the literature referring to *S. p. porosa* suggest that this taxon has a variable flight period according to locality and might be bivoltine at least in some parts of its range (possibly with short time separation or even partial overlap between broods). For example, in low altitude areas (100–350 m) from the south of the Ural Mountains, *S. p. porosa* was collected between the end of May, throughout June and until the end of July (Nupponen & Fibiger 2002). It was also collected at the end of June at low elevation (ca. 25 m) in western Kazakhstan (Dzhanibek) (Hacker & Miatleuski 2001) and at the beginning of July in Daghestan (Mount Salatau, 1300 m) (Nikolaevitch & Vjatcheslavovna 2003).

According to our data, in Dobrogea it appears that the adults of *S. porosa porosa* fly during May–June and August–September. Nevertheless, the collecting date (7th of July) of the specimen reported by Olaru & Nemeş (1969) from the Gârboavele forest suggests possible partial overlaps between broods as in the case of *S. p. kenderesiensis*. This is probably due to late or early emerged adults of the first and second broods respectively. According to some authors, the second brood is more abundant (Neumann 1997), although we could not observe this phenomenon in the case of the population from northern Dobrogea where slightly more adults were collected during May.

The moths seem to be active all night as specimens were collected from dusk until 0300 in the morning.

The known larval food plants are *Artemisia maritima* L., *A. pontica* L. and *Tanacetum* sp. (Kovács 1968, Nowacki 1998, Hacker et al. 2002, Ronkay & Ronkay 2006, Kljuchko 2006). Although no larvae of *S. p. porosa* have been found yet in the area Sarinasuf-Plopu, they most likely feed on *Artemisia* (species unidentified for the same reasons presented in the case of *C. argentina*), the plant being well represented at the collecting site.

Conservation of the steppe area of Sarinasuf-Plopu (northern Dobrogea)

Besides the two species discussed above, several other eremic taxa were collected in the steppe area of Sarinasuf-Plopu: *Cucullia biornata* Fischer v. Waldheim, 1840, *Cucullia scopariae* Dorfmeister, 1853, *Mycteroplus puniceago* (Boisduval, 1840), *Lacanobia blenna* (Hübner, [1824]), *Hadula stigmosa* (Christoph, 1887), *Saragossa siccanorum* (Staudinger, 1870), *Gortyna cervago* Eversmann, 1844, *Ulochlaena hirta* Hübner, [1813], *Chelis maculosa mannerheimii* (Duponchel, 1836), *Microloxia herbaria* (Hübner, [1813]), *Narraga tessularia kasyi* Moucha & Povolný, 1957, *Dyscia innocentaria* (Christoph, 1885), *Eupithecia biornata* Christoph, 1867, and *Eupithecia variostrigata* Alphéraky, 1878.

Many of these taxa are “rarities” in the Romanian entomofauna, often known based on only few specimens, while at Sarinasuf-Plopu they could be often observed in large numbers. Such examples are *H. stigmosa*, *M. puniceago* (30–50 specimens/night), and *N. tessularia kasyi* (more than 100 specimens/night).

These records point to the value of the steppe areas of Sarinasuf-Plopu, which were until now ignored by lepidopterists. Similar habitats where *Artemisia* is well represented are still to be found in several other parts of northern Dobrogea.

The main factor that could severely affect the investigated area is the ploughing of the land for agricultural purposes. Nevertheless, following the communist period (1989) intensive agricultural practices were much diminished and many areas were abandoned and naturally transformed into secondary steppes. This might allow a temporary recovery of the Lepidoptera fauna in open areas. Yet, the process risks being ephemeral as the natural trend of habitat closure (usually by vegetation successions leading to afforestation) might strongly affect such habitats in the medium and long term (Schmitt & Rákósy 2007).

Another significant disturbing factor in the area of Sarinasuf-Plopu is the burning of the vegetation over large areas. This method is still applied in the area, as even during August 2008 several hectares of burned vegetation could be observed.

The steppe area of Sarinasuf-Plopu could (and our data strongly indicate that it should) become a nature reserve with the mention that special attention should be paid to management aspects. Extensive and controlled grazing should be allowed in the area to maintain the steppe character and avoid habitat overgrowth by shrubs and trees.

Conclusions

The record of *C. argentina* from Sarinasuf-Plopu (Tulcea county) adds a new noctuid species to the check list of the Romanian Heterocera.

Saragossa porosa porosa is recorded for the first time from Dobrogea (Sarinasuf-Plopu) and for the second time in Romania, where it was known based on a single male. The area of Sarinasuf-Plopu (the collecting site of both taxa) marks their south-western limit of distribution in Europe.

The slight external differences, irrelevant distinction between the male genitalia, and considerably diminished range disjunction between *S. p. porosa* and *S. p. kenderesiensis*

may require reconsideration of the status of the latter subspecies. Although insufficiently studied from a lepidopterological point of view, the steppe areas of Dobrogea already shelter many Lepidoptera taxa that are very localized in Romania and Europe.

Improving the knowledge of their natural capital and protecting such steppe areas is mandatory given their particular species assemblages and the fragility of the habitats, which are prone to various disturbances such as agriculture, excessive grazing, and land burning.

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On the presence of *Scythocentropus inquinata* (Mabille, 1888) (Noctuidae: Xyleninae) on the Iberian Peninsula, a first record for continental Europe

ANTONIO S. ORTIZ, JOSÉ A. DE LA CALLE & JUAN JOSÉ GUERRERO

Departamento de Zoología y Antropología Física, Area de Biología Animal, Universidad de Murcia.
Campus de Espinardo, Apartado 4021, E-30071 Murcia; aortiz@um.es

Scythocentropus inquinata (Mabille, 1888) was described from specimens collected in Gabes (Tunisia). The species was originally placed in the genus *Hadena* Schrank, 1802. Later, it was described again as *S. ferrantei* Draudt, 1911 from Cairo (Egypt) and as *S. mercedes* Pinker, [1974] from a male collected at Las Mercedes on Tenerife Island. Fibiger & Hacker (2007) reported three species of the genus in the European fauna: *Scythocentropus scripturosa* (Eversmann, 1854) and *S. misella* (Püngeler, 1908), both found in South Russia, and *S. inquinata*, collected in Malta.

According to Fibiger & Hacker (2007) *Scythocentropus inquinata* is one of the most widespread South Palaearctic eremic noctuids, its range extending from Pakistan and North India through the Arabian Peninsula and North Africa, to the Canary Islands. This distribution corresponds to the Saharo-Sindian pattern.

The species inhabits desert and semi-desert environments and it is thought to have a univoltine life cycle, flying from October to November, or to be bivoltine in some localities, flying in March as well (Hacker & Schreier 2001). Other details of the life cycle and food plant preferences are unknown.

Material: 1♂, [Spain] Monte El Cambrón, Cartagena, 30SXG6361, 250 m, 18.x.2008 (Carmelo Abad, leg.). Deposited in the collection of the Department of Zoology and Physical Anthropology of Murcia University (Spain).

The single male was collected in a natural protected area of Sierra de la Muela and Cabo Tiñoso, in the southeastern Iberian Peninsula, close to the city of Cartagena, in a coastal mountainous landscape. This area is characterized by calcareous soils and has a termo-mediterranean bioclimatic regimen. Arbustive and thorny vegetations characteristic of arid and sub-arid ombroclima (named as murcian-almerian and mulyan distribution) are predominant and are drought-deciduous during the summer dry period. This plant association is known as *Mayteno europaei-Periplocetum angustifoliae* Rivas Goday & Esteve in Rivas Godoy 1951 *nom. inv. et corr.* Rivas-Martínez 1975. Outstanding species are *Periploca angustifolia* Labill. (Asclepiadaceae), *Maytenus senegalensis* Lam. (Celastraceae), *Clematis cirrhosa* L. (Ranunculaceae), *Arenaria montana* L. (Caryophyllaceae), *Chamaerops humilis* L. (Palmae), *Asparagus albus* L. and *A. acutifolius* L. (Liliaceae), *Ephedra fragilis* Desf. (Ephedraceae), *Osyris quadripartita* Salzm. (Santalaceae), etc. (see Alcaraz et al. 1991; Peinado et al. 1992).

New studies in this area will be carried out to determine if *Scythocentropus inquinata* is a recent arrival or migrant on the Iberian Peninsula.



Figs 1–2. Iberian specimen of *Scythocentropus inquinata*. 1. Adult. 2. Male genitalia.

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On the taxonomic history of *Phyllocnistis* Zeller, 1848 (Gracillariidae)

JURATE DE PRINS¹ & AKITO Y. KAWAHARA²

¹ Royal Museum for Central Africa, Leuvensesteenweg 13, B-3080 Tervuren, Belgium;
email: jurate.de.prins@africamuseum.be

² Department of Entomology, University of Maryland, 4112 Plant Sciences Building, College Park,
MD 20742 USA; email: kawahara@umd.edu

Abstract. For over 150 years, the proper taxonomic placement of *Phyllocnistis* Zeller has remained largely uncertain. The genus shares morphological and life history traits with several different families of Microlepidoptera, and these characteristics have made it challenging for microlepidopterists to correctly place the genus. *Phyllocnistis* includes *P. citrella* Stainton, a globally important economic pest of citrus. We review the taxonomic history of *Phyllocnistis* and provide a comprehensive list of references.

Introduction

The leaf-mining genus *Phyllocnistis* Zeller, 1848 is an example of a poorly studied genus whose taxonomic placement has vacillated between many different families. Eighty seven species of *Phyllocnistis* are described worldwide (De Prins & De Prins 2005, 2009), 36 from the Oriental region, 17 from Australasia, 15 from the Palaearctic, and 12 each from the Nearctic and Neotropical regions. Only five are known to occur in the Afrotropical region (De Prins & De Prins 2005, 2009). The distribution of most species is restricted to one biogeographical region. However, five species cross biogeographical boundaries: *P. saligna* (Zeller, 1839) occurs in the Palaearctic, Afrotropical, and Oriental regions, *P. selenopa* Meyrick, 1915 in the Oriental and Australian regions, *P. toparcha* Meyrick, 1918 in the Palaearctic and Oriental regions, and *P. vitegenella* Clemens, 1859 has a Holarctic distribution. *Phyllocnistis citrella* Stainton, 1856 has a cosmopolitan distribution. There are currently more than 800 publications on *Phyllocnistis*, most of which focus on the pest species *Phyllocnistis citrella* (Fig. 1).

Phyllocnistis is very similar to the Lyonetiid genus *Leucoptera* Hübner, 1825 in forewing pattern, but differs in having a smoothly-scaled head. Unlike most genera of Gracillariidae, all larval feeding instars of *Phyllocnistis* are sap feeding, creating a long, slender, serpentine, subepidermal mine, containing a dark median frass line deposited under the leaf epidermis. There are no tissue-feeding instars, hence no granular frass, but only three sap-feeding instars and one non-feeding, highly specialized, spinning instar. The mine terminates in a slightly enlarged cavity, usually near the edge of the leaf in which the last instar constructs a flimsy cocoon and pupates (Emmet 1985; Davis 1987, 1994; Davis & Robinson 1998; Parenti 2000). *Phyllocnistis* is very successful in its ability to exploit a wide range of host plants as it feeds on 26 plant families (Davis 1987; De Prins & De Prins 2009). Some species of *Phyllocnistis* (e.g., *P. citrella*) are cosmopolitan, fast spreading pests, causing substantial economic damage (Davis 1994; Heppner 1995; Heppner & Dixon 1995; Hoy 1996; Causton *et al.* 2006; Jahnke *et al.* 2006, 2007). For the Species of *Phyllocnistis* can often be distinguished

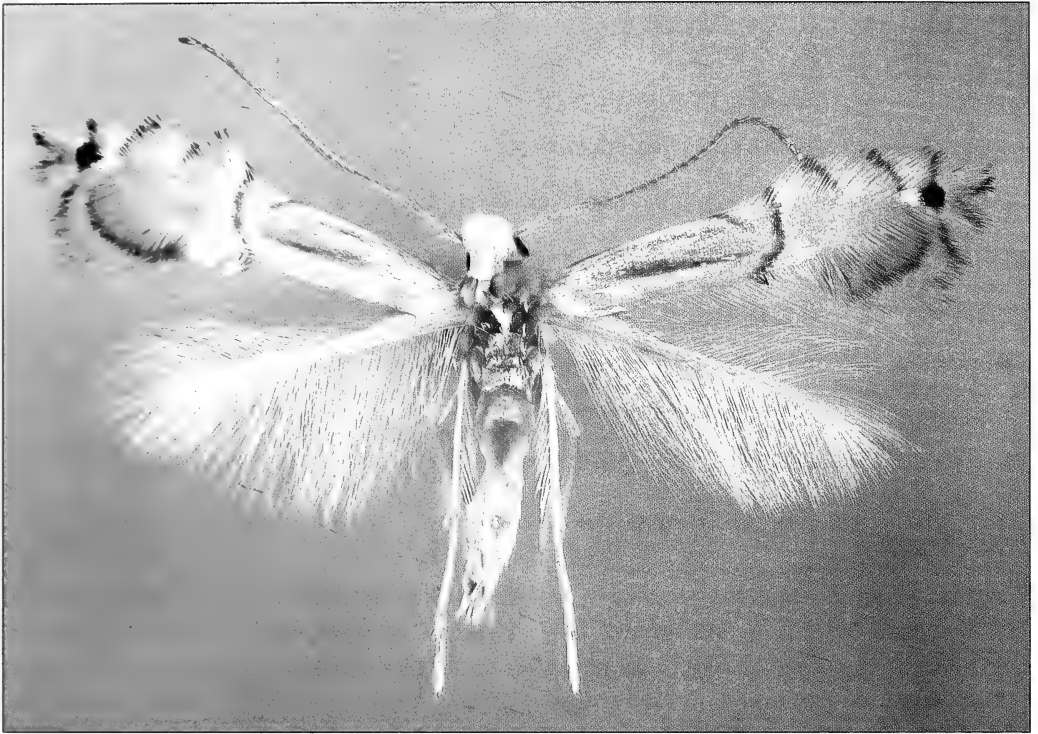


Fig. 1. *Phyllocnistis citrella* Stainton. Italy, Piemonte, Asti, fraz. Valgera, 120 m, 2–15.11.2002, e.l. *Citrus* sp., leg. G. Baldizzone, coll. MHNG. Forewing length ca. 2 mm.

by pupal morphology (Kawahara et al. 2009). The present paper aims to summarize the taxonomic history of *Phyllocnistis*.

Taxonomic history

Zeller (1848) described *Phyllocnistis* as a genus of “leaf-mining moths with eye caps” placing it just after *Lyonetia* Hübner, 1825 (Fig. 2). Soon thereafter, Herrich-Schäffer (1853–1855) placed *Phyllocnistis* in Tineidae, together with many other genera of small Lepidoptera. Stainton, in his lists (1854a–c, 1859), placed *Phyllocnistis* in the family Lyonetidae [sic], and this was followed by Frey (1856) and Wocke (1861, 1871). According to Stainton (1854a) the family Lyonetiidae contained five genera: *Bucculatrix* Zeller, 1839, *Cemiostoma* Zeller, 1848, *Lyonetia* Hübner, 1825, *Opostega* Zeller, 1839, and *Phyllocnistis* Zeller, 1848. However, in his lecture of 7 January 1856 to the Entomological Society of London, Stainton (1856) presented ‘*Phyllocnistis citrella* Atkinson in litt.’ as a new species of Indian Microlepidoptera feeding on *Citrus*. Stainton did not place this global economic pest into any of the then recognized lepidopteran families. He only indicated that the new species was similar to the European *Phyllocnistis saligna* (Zeller, 1839) and *P. suffusella* (Zeller, 1847). Wocke (1861) added *Phyllobrostis* Staudinger, 1859 to the list of Lyonetidae [sic] and later (1871) added *Opogona* Zeller, 1853. At about the same time, Herrich-Schäffer

verunkelt, hat aber auf den Vorderandfranzen ebenfalls vier braune verloschene Querstriche; die zwei hintersten setzen sich bis auf die Hinterrandfranzen fort. Das tief schwarze Pünktchen der Flügelspitze hat auf den Franzen hinter sich einen bräunlichen Querstrich, aus welchem das bräunliche, ziemlich lange Franzenschwänzchen hervorkommt. Die Hinterrandfranzen bräunlichgrau. Hinterflügel wie bei *Padifoliella*.

Unterseite etwas glänzend, bräunlichgrau, auf den Vorderflügeln haben die weisslichen Franzen um die Spitze die Zeichnung der Oberseite.

Das Exemplar in *F. v. Rösstn's* Sammlung war aus Böhmen; das vor mir befindliche aus der *Mann's*chen wurde einzeln im Juni 1842 bei Tivoli nächst Wien an Eschen gefangen. Beide Exemplare sind Männchen.

Anmerk. In der Aufzählung der von mir in Italien gesammelten Falter habe ich eine fragliche *Lyonetia somnulentella* (von Messina und Syracuse) beschrieben.

Da ich nur drei Exemplare besitze, so habe ich noch keine der Untersuchung des Flügelsäckers opfern wollen. — Von *Mann* erhielt ich aus der Wiener Gegend eine *Gractaria convolvella* n. sp., die bestimmt keine *Gractaria*, sondern nach genauer Prüfung einzell mit meiner *Somnulentella* ist. Von ihr habe ich das Geäder untersucht und mich dadurch von der Richtigkeit meiner Vermuthung, dass es keine *Lyonetia* sei, überzeugt. Die Subdorsalader ist nemlich ganz einfach. Die Discoidalzelle läuft sehr spitz zu; aus der an der Basis sehr verdünneten Subcostalader löst erst aus der Mitte, dann vor der Spitze ein Ast nach dem Vorderande; aus der Spitze der Zelle kommt eine Ader, die erst einen Ast an den Vorderand abgibt und sich dann in eine Gabel theilt; die Medianader, unterhalb deren die Falte deutlich ist, sendet vor der Spitze einen einzelnen Ast. Wobin diese Art gehöre, weiss ich noch nicht zu bestimmen.

Phyllocnistis n. gen.

(Fig. 31–34)

Caput convexum, laevigatum.

Antennae conchula parva instructae, alis anterioribus brevioris.

Palpi penduli filiformes.

Alae anteriores caudatae; cellula discoidalis unam venulas tres in marginem anticum, unam in apicem, unam in marginem posticum emittit; vena subdorsalis simplex; posteriores lanceolato-lineares, vena mediana dorso proxima venulas tres emittente.

Tibiae posticae suprae setoso ciliatae.

Larva apus cuniculos agit in foliis.

Metamorphosis in cuniculo contracto.

Von dem vorigen Genus unterscheidet sich *Phyllocnistis* schon durch die überall schuppenförmige und glatt anliegende Kopfbedeckung und die kürzern, weniger feinen Fühler. Die Vorderflügel haben eine kürzere Spitze und die Hinterflügel sind breiter. Die gleichfalls glatköpfige Gattung *Cenistoma* weicht durch den völligen Mangel der Taater und die ungeschlossene Zelle der Vorderflügel etc. ab; *Opostega* hat sehr grosse Augendeckel und ein nur aus vier einfachen Adern bestehendes Adergestüst der Vorderflügel.

Auf den Vorderflügeln ist die Mittelzelle breiter als bei *Lyonetia*, und aus der Spitze derselben gehen nur zwei aus demselben Punkt entspringende Adern in die Flügelspitze. Die Subcostalader sendet zwei Aeste in den Vorderand, deren ersterer viel kürzer ist als bei *Lyonetia*, die Medianader einen in den Innenrand. Ihr ziemlich nahe ist die Flügelfalte. Die Subdorsalader ist einfach, ziemlich kurz und gebogen. — Die Hinterflügel sind auf der Wurzelhälfte breiter als bei *Lyonetia*, aber am Vorderande hinter der Borste gleichfalls erweitert. Die wie dort zarte Subcostalader geht bald in den Vorderand über, um ihn in seinem übrigen Verlaufe zu verdicken. Die Medianader nimmt ihren Lauf nahe am Innenrande und hat erst einen langen Ast (bei dem ich aber ganz sicher bin, dass er die mit ihr verschmolzene Subdorsalader ist) und dann hinterwärts einen viel kürzern.

Die Miniraupe hat keine Beine; sie ist nach ihrer Struktur noch schlecht bekannt. Ihre Verwandlung in-

(1857) recognized *Phyllocnistina* as a separate group, which included three genera: *Bucculatrix*, *Cemiostoma*, and *Phyllocnistis*. On the basis of wing venation, Clemens (1859) transferred *Phyllocnistis* into *Lithocolletidae*, together with *Leucanthiza* Clemens, 1859, *Lithocolletis* Hübner, 1825, and *Tischeria* Zeller, 1839. Clemens (1859) placed these four genera in *Lithocolletidae*, but noted that his classification was in contrast to European authors who treated *Leucanthiza* and *Tischeria* as *Lyonetidae* [sic]. Unfortunately, Clemens did not indicate who the European authors were. Clemens also stated that he did not support the separation of these four genera into distinct families. At that time *Phyllocnistis* was placed in *Tineina*, which included many different genera of small moths (Clemens 1863; Zeller 1873, 1877; Chambers 1875; Frey & Boll 1876; van Deventer 1904). Stainton (1863) summarized the generic characters of twenty genera of leaf-mining Lepidoptera. He placed *Phyllocnistis* in a group with *Bucculatrix* Zeller, 1839, *Cemiostoma* Zeller, 1848, *Lithocolletis* Hübner, 1825, *Lyonetia* Hübner, 1825, and *Nepticula* Heyden, 1843. All these genera, except *Bucculatrix*, have a mining larva and *Lithocolletis* and *Phyllocnistis* pupate within the mine (Stainton 1863). Chambers (1871) noted that the larva of *Phyllocnistis* resembles the young cylindrical larva of *Lithocolletis* in general appearance and compared adult *Phyllocnistis* with the white species of *Lithocolletis*. In his work on Australian Microlepidoptera, Meyrick (1880: 136) made an attempt to classify the species he was describing and placed *Phyllocnistis* into *Lyonetidae* [sic], and stated “[*Phyllocnistis*] appears by its quite smooth head and apodal larva to be an extreme development of [*Opostega* and *Cemiostoma*]”. Heinemann & Wocke (1877) separated *Phyllocnistidae* as a separate family and included three genera within: *Phyllocnistis*, *Cemiostoma*, and *Bucculatrix*.

Even at the turn of the century, the definition and placement of *Phyllocnistis* differed among microlepidopterists. Noting similarities in early stages and habits of the American species, Busck (1900) proposed to broaden the definition of *Phyllocnistis*. He described *P. intermediella* Busck, 1900 from Florida, which has morphological features that are somewhat different from the species that had previously been described in the genus. Rebel (1901) allocated *Phyllocnistis* to the subfamily *Phyllocnistinae* along with *Bucculatrix* Zeller, 1839, *Cemiostoma* Zeller, 1848, *Opogona* Zeller, 1853, and *Opostega* Zeller, 1839, but placed *Phyllocnistinae* into family *Lyonetiidae*. Kirby (1903) divided *Lyonetiidae* into two subfamilies: *Lyonetiinae* and *Phyllocnistinae* [sic]. Meyrick (1895) transferred *Phyllocnistis* to *Tineidae* and in 1906 he placed it along with *Epicnistic* Meyrick, 1906, *Exorectis* Meyrick, 1906, *Leucoptera* Hübner, 1825, *Nepticula* Heyden, 1843, and *Setomorpha* Zeller, 1852. Spuler (1910) recognized three species of *Phyllocnistis*, *P. suffusella* Zeller, 1847, *P. sorhageniella* Lüders, 1900, and *P. saligna* (Zeller, 1839) and placed the genus in its own family *Phyllocnistidae*. Meyrick (1915a, b) continued to include *Phyllocnistis* in *Lyonetiidae*, which he spelled in different ways (Meyrick 1915a, b, 1916, 1920, 1921a). Other authors also included *Phyllocnistis* in *Lyonetiidae* (e.g. Turner 1923; Braun 1925). Braun and Meyrick independently¹ transferred *Phyllocnistis* from *Lyonetiidae* to *Gracillariidae* (Braun 1927; Meyrick 1928a, b, 1935, 1936), and such a placement has since been widely accepted (Turner 1947; Nye & Fletcher 1991; Davis & Robinson 1998). However,

some authors have treated *Phyllocnistis* as a separate family until recently (Seksyaeva 1981; Emmet 1985; Kuznetsov & Stekolnikov 1987; Powell & Opler 2009).

Placement of *Phyllocnistis* within Phyllocnistinae

Most modern authors divide Gracillariidae into three subfamilies: Gracillariinae, Lithocolletinae and Phyllocnistinae (Davis 1983; Davis & Miller 1984; Common 1990; Davis & Robinson 1998; Kuznetsov & Baryshnikova 1998; Parenti 2000; Dall'Asta *et al.* 2001; Heppner 2004; De Prins & De Prins 2005). However, some other authors have proposed to erect additional subfamilies: Oecophyllembiinae (Réal & Balachowsky 1966; Kumata 1998), Ornichinae (Kuznetsov & Stekolnikov 1987; misspelled as 'Orni-ginae' (Kuznetsov & Baryshnikova 2001; Kuznetsov & Stekolnikov 2001), and Orni-xolinae (Kuznetsov & Baryshnikova 2001). In the checklist of the Moths of America North of Mexico, Davis (1983) included *Phyllocnistis* Zeller, 1848 and *Metriochroa* Busck, 1900 in Phyllocnistinae, while Kuznetsov (1981) considered *Metriochroa* Busck, 1900 belonging to Gracillariinae. Later Davis and Robinson (1998) included *Cryphiomystis* Meyrick, 1922, *Metriochroa* Busck, 1900, *Phyllocnistis* Zeller, 1848 and *Prophyllonistis* Davis, 1994 in Phyllocnistinae. Kumata (1998) then transferred all but *Phyllocnistis* to Oecophyllembiinae based on hindwing venation and position of the larval thoracic spiracles. In the classification and checklist of the Lepidoptera species recorded in southern Africa, Vári *et al.* (2002) treated Oecophyllembiinae as a synonym of Phyllocnistinae and included *Cryphiomystis* Meyrick, 1922, *Metriochroa* Busck, 1900 and *Phyllocnistis* Zeller, 1848 into Phyllocnistinae. De Prins & De Prins (2005, 2009) recognized seven genera in Phyllocnistinae: *Angelabella* Vargas & Parra, 2005, *Corythoxestis* Meyrick, 1921b, *Eumetriochroa* Kumata, 1998, *Guttigera* Diakonoff, 1955, *Metriochroa* Busck, 1900, *Phyllocnistis* Zeller, 1848, and *Prophyllonistis* Davis, 1994. It still remains largely uncertain whether these groups are monophyletic, and we hope that future phylogenetic studies based on morphological and molecular characters of Gracillariidae will shed light on the phylogenetic position of *Phyllocnistis*, and its placement in the classification of Gracillariidae.

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¹ Although the publication of Braun (1927) preceded the publication of Meyrick (1928a), we consider that both authors came to the conclusion to include *Phyllocnistis* into Gracillariidae independently and at the same time. Braun (1927) published the description of *Phyllocnistis finitima* Braun, 1927, which she placed into Gracillariidae. Meyrick (1928a) significantly revised his monumental monograph of 914 pages, which includes the identification keys of genera, species, illustrations of wing venation and short species descriptions. He recognised six genera within Gracillariidae: *Acrocercops* Wallengren, 1881, *Gracilaria* [sic] Haworth, 1828, *Lithocolletis* Hübner, 1825, *Ornix* Treitschke, 1833, *Parectopa* Clemens, 1860, and *Phyllocnistis* Zeller, 1848. The preface of his revised handbook was written on 28th September 1927, the same year as the paper of Braun (1927) was published. We believe both lepidopterists communicated with each other on the placement of *Phyllocnistis*.

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Whittleia retiella (Newman, 1847) (Psychidae) from the salt marshes of Schleswig-Holstein, Germany, with descriptive and life-history notes

CORINNA RICKERT¹, HARTMUT ROWECK¹ & THOMAS SOBCZYK²

¹ Ökologie-Zentrum der Universität Kiel, Abteilung Landschaftsökologie, Olshausenstraße 75, D-24188 Kiel, Germany; e-mail: crickert@ecology.uni-kiel.de (corresponding author); hroweck@ecology.uni-kiel.de.

² Diesterwegstraße 28, D-02977 Hoyerswerda, Germany; e-mail: ThomasSobczyk@aol.com

Abstract. In 2007 new localities for *Whittleia retiella* (Newman, 1847) were found in the salt marshes of Schleswig-Holstein, Germany. Known only from a few old records this psychid moth was considered to be a very rare resident of the salt marshes in Germany, although occurring in the neighbouring states. During 2007–2009 it was found in several locations in great abundance although the flight period was very short. The classification as a very rare species (R) according to the Red list of threatened animals in Germany (Binot et al. 1998) should be upheld due to the rarity of suitable habitats.

Zusammenfassung. *Whittleia retiella* (Newman, 1847) konnte 2007 erstmals wieder in den Salzwiesen Schleswig-Holsteins nachgewiesen werden. Die Psychide wurde aufgrund einiger weniger alter Nachweise bisher als auf den Salzwiesen Deutschlands sehr selten vorkommend eingestuft, obwohl sie regelmäßig in den Nachbarstaaten nachgewiesen werden konnte. An mehreren Stellen an der Schleswig-Holsteinischen Küste wurde in den Jahren 2007–2009 während einer kurzen Periode eine große Anzahl an Individuen notiert. Die Einstufung in der Rote Liste der gefährdeten Tiere Deutschlands (Binot et al. 1998) in der Kategorie R sollte aufgrund des auf küstennahe Standorte begrenzten Vorkommens aufrechterhalten werden.

Introduction

Salt marshes in the Wadden sea area extend along the coastline from Esbjerg in Denmark to Den Helder in the Netherlands and form a natural boundary between the sea and the mainland. Plants as well as animals of the salt marshes are exposed to extreme living conditions due to tides, storms, and at times extreme solar radiation, which can result in high salt concentrations. The salt marshes of the Wadden Sea area offer a habitat to many insect species, but there are few studies of the insect fauna of marine salt marshes (Foster 2000). The Microlepidoptera are represented by about 40 halobiotic and some widespread species. *Whittleia retiella* is the only known European halobiotic psychid moth occurring in salt marshes, mostly feeding on *Puccinellia maritima* (Huds.) Parl. (Hättenschwiler 1985). In Denmark there are some inland localities in grassland ecosystems or heaths mostly close to the coast but without *Puccinellia maritima* (Huds.) Parl. and Hoffmeyer (1960) stated that this species should be found on sandy soils all over Jutland, but so far it has only been found in a few localities in East and North Jutland. The species is known from salt marshes of Great Britain, France, Belgium, The Netherlands, Denmark, and South Sweden, and with only older records from Germany.

Description and Life History

The species was named with the very brief description “Mr. Ingall has captured a small *Psyche* with beautifully mottled wings. It is very different from the known British

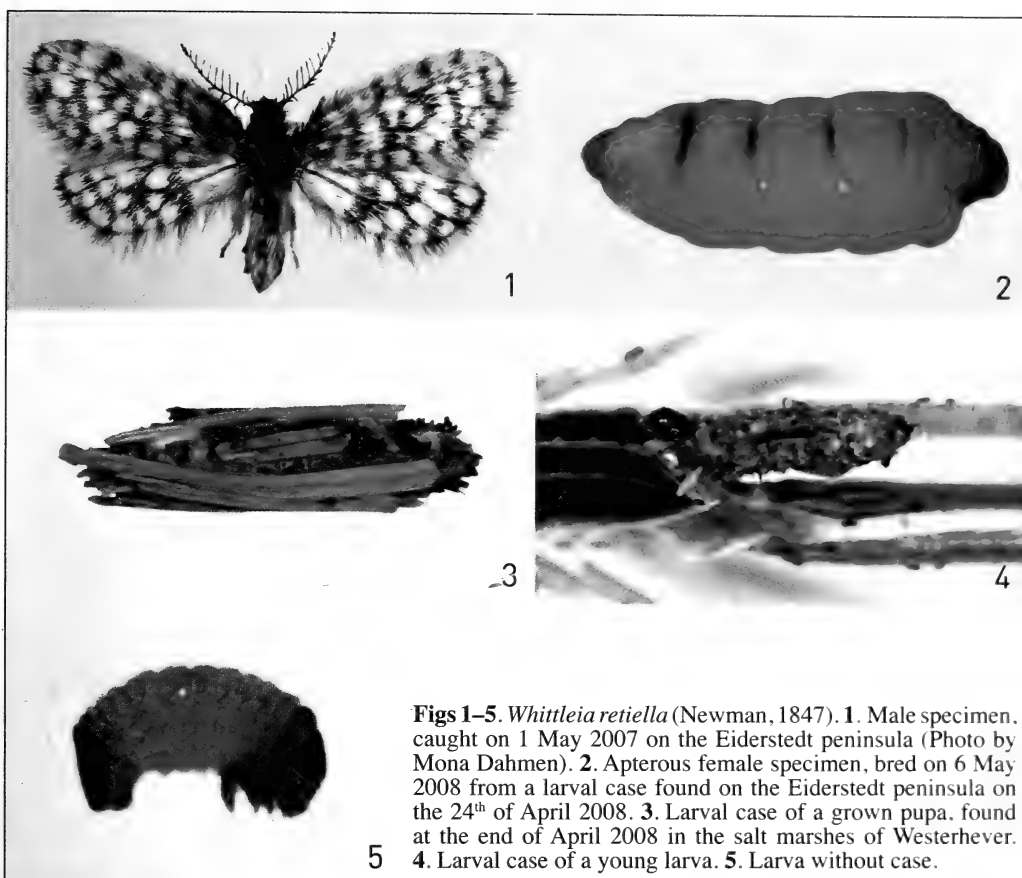
species, but in some degree resembles *Psyche undulella* on the continent: it is proposed to call the new species *Psyche retiella*." (Newman 1847). Newman (1850) later gave a more detailed description of the moth under the name *reticella*, which now is considered a misspelling. Tutt (1900) included the taxon in *Whittleia* as *W. retiella* (Nye & Fletcher 1991). It has also been known as *Epichnopteryx retiella*.

The males of *W. retiella* have a forewing length of only 4–5 mm and are the smallest member of the genus *Whittleia*. The fore- and hindwings are strongly rounded, being whitish with a pattern of dark grey with hair like scales. The antennae have 12–14 segments and are bipectinate, the pectinations without scales (Hättenschwiler 1985) (Fig. 1). Females are wingless with rudimentary legs and absent antennae (Fig. 2) and remain in the case until after oviposition. The case is attached to grass, has a size of 4–6 mm with pieces of dried grass fixed to the case (Fig. 3).

The males fly in the sunshine on warm and windless days around noon and close to the food plant. While male larval cases are often found close to the ground, the cases of female moths are attached close to the middle of the blade of grass. The male moths are attracted by the female pheromones and fertilisation takes place while females are still in the case: they leave the case after oviposition. It is one of the earliest moths in the salt marsh. In the literature a flight period from late May to early June is mentioned (Hättenschwiler 1985), but a flight period from late April and early May is recorded from The Netherlands (Friesland) and Denmark (Hoffmeyer 1960; Jansen 2005; Kaaber 1982).

The citation of subspecies *cimbriella* by Wolf (1949) is incorrect. Wolf cited ssp. *cimbriella* Rebel, 1938 as described in 1933 from Denmark and Schleswig. Rebel (1938) described the specimens found in Denmark (Jutland) as subspecies *cimbriella*, stating that the wingspan of the male continental specimens is smaller (7.5 mm) than that of specimens from Great Britain (8.5 mm) and that the markings on the wing were supposed to be rather blackish grey and less distinct when compared to the dark brownish weblike markings on British specimens. The female specimens are also supposed to be shorter (4 mm) and rather light honey brown compared to the specimens from Great Britain, which have a length of 5 mm and have a darker head. Examination of the large series of specimens (109 ♂ and 27 ♀) from the coast of Schleswig-Holstein suggests that this differentiation cannot be sustained. Males show a variation in size between 7 and 9.5 mm with a mean of 8.6 mm \pm 0.49 mm as well as a variation in colour from dark grey to rather brownish black. The length of the females ranges from 3 to 4.6 mm with a mean of 3.8 mm \pm 0.4 mm and they have a light honey coloured body with a darker head and slightly darker shades on the back. A possible explanation for the distinction of subspecies *cimbriella* made by Rebel (1938) might be the lack of available wild-caught specimens as he used mostly specimens bred from larvae for his description. However, when comparing newly bred specimens with wild-caught specimens from the same salt marshes on the west coast of Schleswig-Holstein no differences in size could be detected. The distinction of subspecies *cimbriella* thus cannot be sustained.

On the 12th of May 2008 one of the bred females, which was exposed to male moths after collection, laid eggs which developed to small larvae. After 2 weeks the larvae



Figs 1–5. *Whittleia retiella* (Newman, 1847). **1.** Male specimen, caught on 1 May 2007 on the Eiderstedt peninsula (Photo by Mona Dahmen). **2.** Apterous female specimen, bred on 6 May 2008 from a larval case found on the Eiderstedt peninsula on the 24th of April 2008. **3.** Larval case of a grown pupa, found at the end of April 2008 in the salt marshes of Westerhever. **4.** Larval case of a young larva. **5.** Larva without case.

already had constructed a case which resembled those of fully grown larvae but without attached pieces of grass (Fig. 4) and measured only 2 mm. The larva itself measured 1.7 mm and had a creamy white to yellowish colour with a black head and a blackish brown anal plate (Fig. 5).

Occurrence in Germany

A first record of *W. retiella* was made by O. Meder in the end of May 1929 close to Bredstedt near Husum in the remnants of the Bredstedt Heath (Meder 1930). Meder also mentions specimens recorded by Dr. Trautmann from the vicinities of Flensburg, supposedly from 1913. In 1934 Wolf collected further specimens in the Kolker Heide near Husum and stated that the species should be widespread in the heathlands of Schleswig-Holstein, but was probably overlooked because of its small size (Wolf 1949). H. Wegener found another specimen in the collection of Rill (situated in the Zoological Institute and Museum of Hamburg) caught on 7.V.1959. There are few recent records, but Sobczyk (in Gaedicke & Heinicke 1999) suggested the possible occurrence of the species in Germany since records from Denmark close to the German border were known (Kaaber 1982). Probably because of the scarcity of records generally and no

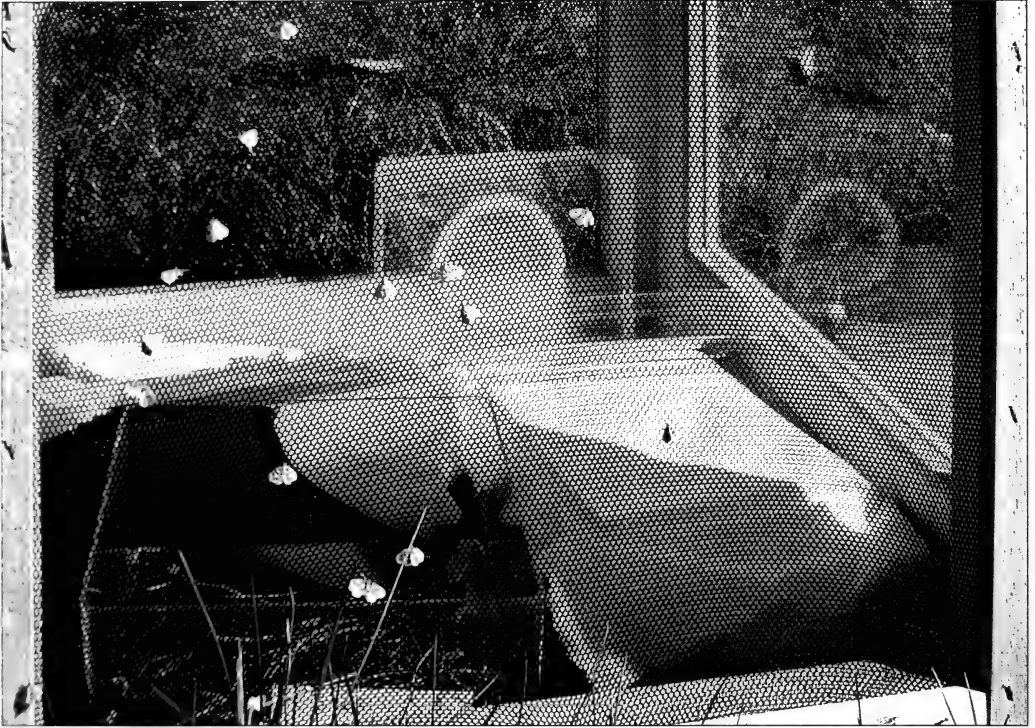


Fig. 6. Attraction experiment with two bred females of *Whittleia retiella* (Newman, 1847) close to Bredstedt on 5 May 2008.

further records in Germany, *W. retiella* was declared a very rare species in the Red list of threatened animals in Germany (Binot et al. 1998). The species is not mentioned for Germany in Karsholt & Razowski (1996).

From the 1st to the 5th of May 2007 more than 200 males of *W. retiella* were found on the salt marshes of Westerhever; on the 2nd of May specimens were also found at the Hamburger Hallig. All specimens were sitting on the tips of blades of *Puccinellia maritima* (Huds.) Parl. or flying close to the ground in the sunshine around noon. Although a search was also conducted before the 1st of May and after the 5th of May, no further specimens could be found. Peak emergence seems to occur during a short period of warm, sunny, and windless days in May after a longer period of warm spring weather. Though they are not easy to detect, at the end of April 2008 and 2009 numerous larval cases were found in the salt marshes of Westerhever and on the Hamburger Hallig with several females (Fig. 2) and a few male specimens emerging. On the 5th of May 2008 and again in the beginning of May 2009 hundreds of male specimens could be seen flying and were easily attracted to females sitting in a large cage (Fig. 6).

This short and specific flight period might also explain the lack of earlier records, since most collectors might have been simply searching in the wrong period, especially since the literature mentions a flying period from late May to early June (Hättenschwiler 1985), while in the years of 2007 to 2009 the only specimens found were already flying in the first days of May. Despite the recent recording of numerous specimens of this

psychid moth, the classification as a very rare species (R) for Germany is recommended on the basis of its restriction to threatened coastal habitats.

Acknowledgements

We are grateful to Dr. Nikolay Savenkov for his help setting the collected material, to Mona Dahmen, who took the photograph shown as Fig.1 and to K. Sattler for his assistance with references.

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Note

A recently published paper by Heinicke & Wegener (2009) provides data on recent records of *Whittleia retiella* in Lower Saxony.

Reference

- Heinicke, C. & H. Wegener 2009. Aktueller Nachweis von *Whittleia retiella* (Newman, 1847) in Niedersachsen (Lep., Psychidae). – Melanargia 21: 131–132.

Efetov, K. A. & Tarmann, G. M. 2008. *Chrysartona Swinhoe, 1892 (Lepidoptera: Zygaenidae, Procridinae)*. – Crimean State Medical University Press, Simferopol. – 116 pp, frontispiece, 22 plates (4 in colour). Size 265 × 175 mm. Hardcover (ISBN 966-2969-18-7). Price: 40.00 € (incl. postage). Obtainable via G. M. Tarmann, Tiroler Landesmuseen Betriebsgesellschaft m.b.H., Feldstraße 11a, 6020 Innsbruck, Austria.

The fifth volume of a series of books on Zygaenidae, published by Prof. K. A. Efetov and co-authors and printed by the Crimean State Medical University, deals with the little known south-east Asian genus *Chrysartona*. Most of the species are very similar externally but well separated in genitalia structures. As a result, several new species have only recently been described and the book provides a complete overview of all taxa. A short introduction is followed by a generic description, a checklist which includes three subgenera, 14 species and five subspecies, and a key to all taxa. Further chapters deal with hitherto insufficiently studied type specimens and – of major importance – give a full taxonomic treatment of all nominal taxa. High quality plates with line drawings of male and female genitalia, photographs of adult moths and pin-labels, including all primary types, and 23 excellent colour drawings of adults of all species and subspecies, executed by N. Y. Dyadenko and K. A. Efetov, are indispensable for a safe identification. Finally two colour plates depict eight well known Scientists to whom subgenera or species of *Chrysartona* have been dedicated. A reference list with 30 titles and two indices complete the book. As with other parts in this series, the book is well produced on high quality paper and bound in hard covers.

The authors, and particularly Prof. Efetov from Simferopol are to be congratulated for their repeated contributions to the taxonomy and biology of Zygaenidae which are all of the highest scientific standard. This most diligent research work spanning several years, and consistent high-quality publications greatly assist in the engagement of young amateurs and professionals in Zygaenidology. The review of *Chrysartona* is such an example which, despite of some repetition from earlier works, is not only most valuable for all colleagues dealing with Zygaenidae but also of interest for lepidopterist in general.

PETER HUEMER

Micropterix of Cyprus and the Middle East (Micropterigidae)

H. CHRISTOF ZELLER-LUKASHORT¹, MICHAEL A. KURZ², DAVID C. LEES^{3,4} & RACHELI SCHWARTZ-TZACHOR⁵

¹ Forsthubfeld 14, 5303 Thalgau, Austria, e-mail: christof.zeller@gmx.net

² Reischenbachweg 2, 5400 Hallein-Rif, Austria, e-mail: michael.kurz@gmx.at

³ Department of Entomology, Natural History Museum, Cromwell Road, London, SW7 5BD, U. K.

⁴ Institut National de la Recherche Agronomique, UR0633 Zoologie Forestière, F-45075 Orléans, France, e-mail: dclees@gmail.com

⁵ Ramat-Hanadiv, P.O. Box 5089 Zichron Yaacov 30900 Israel, e-mail: rachel22@013.net

Abstract. All known species of the genus *Micropterix* Hübner, 1825 (Micropterigidae) from Cyprus (*Micropterix cypriensis* Heath, 1985) and the Middle East (Israel, Lebanon: *Micropterix berytella* de Joannis, 1886, *Micropterix elegans* Stainton, 1867 and *Micropterix islamella* Amsel, 1935) are treated. The male genitalia of *Micropterix islamella* Amsel, 1935 are illustrated for the first time. The association of two *Micropterix* species with *Cyclamen persicum* Mill. (Myrsinaceae) is detailed. Adults and male genitalia of all species are illustrated, showing the habitus of all species in their natural environment.

Introduction

Here we treat the four species of the Palaearctic genus *Micropterix* of Cyprus and the Middle East: *Micropterix berytella* de Joannis, 1886, *Micropterix cypriensis* Heath, 1985, *Micropterix elegans* Stainton, 1867 and *Micropterix islamella* Amsel, 1935. All species are figured in colour (also in their natural environment), and their male genitalia are illustrated. Our focus in this paper is on the aspects of the species most useful for identification, namely wing colour patterns and male genital morphology. Besides this, we also provide details of the pollination of *Cyclamen* (Myrsinaceae) by *Micropterix* species, demonstrated in a previous experiment by Schwartz-Tzachor (1998).

In this paper we build on the previous important identification treatments by Heath (1987), Kozlov (1989, 1990a, b) and Zeller et al. (2007). Two of the species (*M. octopunctella* Amsel 1935, considered by Heath and here to be a synonym of *M. elegans*, and *M. islamella*) were redescribed by Kozlov (1988), who reexamined some of Amsel's types. We update all these treatments here.

Material and methods

The examined material was mainly collected by the authors, provided by others and investigated in different museums. For more information about collecting sites, preparation techniques and data archive see Zeller et al. (2007). For generating maps we used DIVA-GIS, a free computer program for mapping and geographic data analysis. We also inspected the unpublished manuscripts of John Heath at BMNH to extract relevant data, particularly for forewing length and to augment the distributional data.

Abbreviations

BMNH	British Museum of Natural History, London
MNHN	Muséum national d'Histoire naturelle, Paris
NHRS	Naturhistoriska Riksmuseet, Stockholm
UMB	Übersee-Museum, Bremen, Germany
SMNK	Staatliches Museum für Naturkunde, Karlsruhe

Ecology

We observed frequent visits of the moths *M. berytella* and *M. elegans* to the underneath of *Cyclamen* flowers. In closeup observations, we found that the moths appeared to eat pollen grains from the flowers, to mate on them, and to take shelter inside the flowers from rain and on cold nights. Schwartz-Tzachor (1998) tested the pollination efficiency of both *Micropterix* species on *Cyclamen persicum* and found that the moths successfully pollinated the flowers and significantly raised the percentage of fruit set. In addition, the moths appeared approximately three weeks after the beginning of flowering in the synanthous *C. persicum* population, and accompanied the flowering throughout the season (Schwartz-Tzachor et al. 2006).

Taxonomic treatment

Micropterix berytella de Joannis, 1886

Micropterix berytella de Joannis, 1886: 183, pl. 6 fig. 5. Type locality: Beirut, Lebanon. Syntype: in coll. MNHN.

Material. 5♂, 1♀, **Israel**, Haifa, Montfort, 180–300 m, 28.2.2006, leg. Hausenblas/Zeller; 7♂, 2♀, **Israel**, Zichron Yaacov, Ramat Hanadiv, 125 m, 24.–25.2.2006, leg. Hausenblas/Zeller; 2♂, **Israel**, Haifa, Abu Sennan, Asherat, 80 m, 28.2.2006, leg. Hausenblas/Zeller; 2♀, **Israel**, En Hemed, 100 m, 1.5.1998, leg. Hausenblas; 2♂, 1♀, **Lebanon**, Beirut, 10.3.1961, leg. Vartian.

Description of adults. (Figs 6, 7). Forewing length: ♂ 2,7–3,5 mm; ♀ 2,9–3,6 mm. Head black-brown, vestiture of hair-like scales on the head dirty white to yellow; antennae dark brown, bronze golden shining, 3/4 (♂), slightly more than 1/2 (♀) respectively of forewing length; thorax bronze golden, posteriorly with single purple scales; tegulae whitish golden to golden, posteriorly with purple scales; forewings bronzy golden to coppery, reddish golden along costa and outer margin, with silvery white markings; a narrow fascia across the whole wing width at 1/5; a narrow, outwardly bent, sometimes interrupted fascia across the whole wing width at nearly 1/2; sometimes a small costal spot at 2/3; at 3/4 a narrow fascia across the whole wing width, broadening from costa onwards, interrupted beyond the middle; a very narrow, slightly inwardly oblique fascia reaching from costa to the outer margin (this fourth fascia sometimes missing); fringe bronzy golden, whitish outwards; hindwings bronzy golden with purplish tinge and bronzy golden, outwards brighter fringe; legs and abdomen dark brown, bright golden shining.



Figs 1–5. Habitat and *Micropterix* species in their natural environment. 1. Habitat of *M. berytella* and *M. elegans* with *Cyclamen persicum* (photo by Zeller 2006). 2. *M. berytella* feeding on pollen of *C. persicum* (photo by Schwartz-Tzachor 2006). 3. *M. cypriensis* feeding on pollen of *Dactylorhiza romana* (photo by Thoma 2004). 4. *M. elegans* feeding on pollen of *Cistus salviifolius* (photo by Schwartz-Tzachor 2009). 5. *M. islamella* feeding on pollen of *Mercurialis annua* (photo by Schwartz-Tzachor 2006).

♂ **Genitalia.** (Fig. 11). Uncus moderately long and slender, with a spatulate tip; accessory claspers sledge-shaped and relatively large, weakly sclerotized with about ten moderately long and straight, stout and thickened setae at the ventral margin; additionally, beyond the accessory claspers two club-shaped lobes, with only one fairly long, stout and thickened seta; valve moderately long, slender, distinctly constricted beyond the middle; its distal third spoon-like enlarged and distinctly bent upwards; valve postbasally with three fairly long and stout setae at the inner surface, distal third with one or two rows of shorter, stout and thickened setae, as well as some longer setae.

Diagnosis. *M. cypriensis* has similar wing patterns, but it is distributed allopatrically, endemic to Cyprus. In Israel, the fourth fascia at the outer forewing margin of *M. berytella* is often missing. *M. berytella* specimens with interrupted fascia at 1/2 can be confused with *M. elegans*: *M. berytella* usually exhibits a fine, elongated fascia at 1/2, and therefore the vestiges of this fascia are more elongated and finer than those of *M. elegans*, which has more rounded spots at 1/2. For reliable identification, genitalic examination is needed.

Life history. *M. berytella* was found mainly on *Cyclamen persicum* (Figs 1, 2) and also on *Cistus salvifolius* L. (Cistaceae), feeding on pollen. This species inhabits the Mediterranean forest types “garrigue” and “batha”, occurring sometimes syntopically with *M. elegans*. According to de Joannis (1888), the specimens investigated by him were found on bushes. The adults appear between January and April.

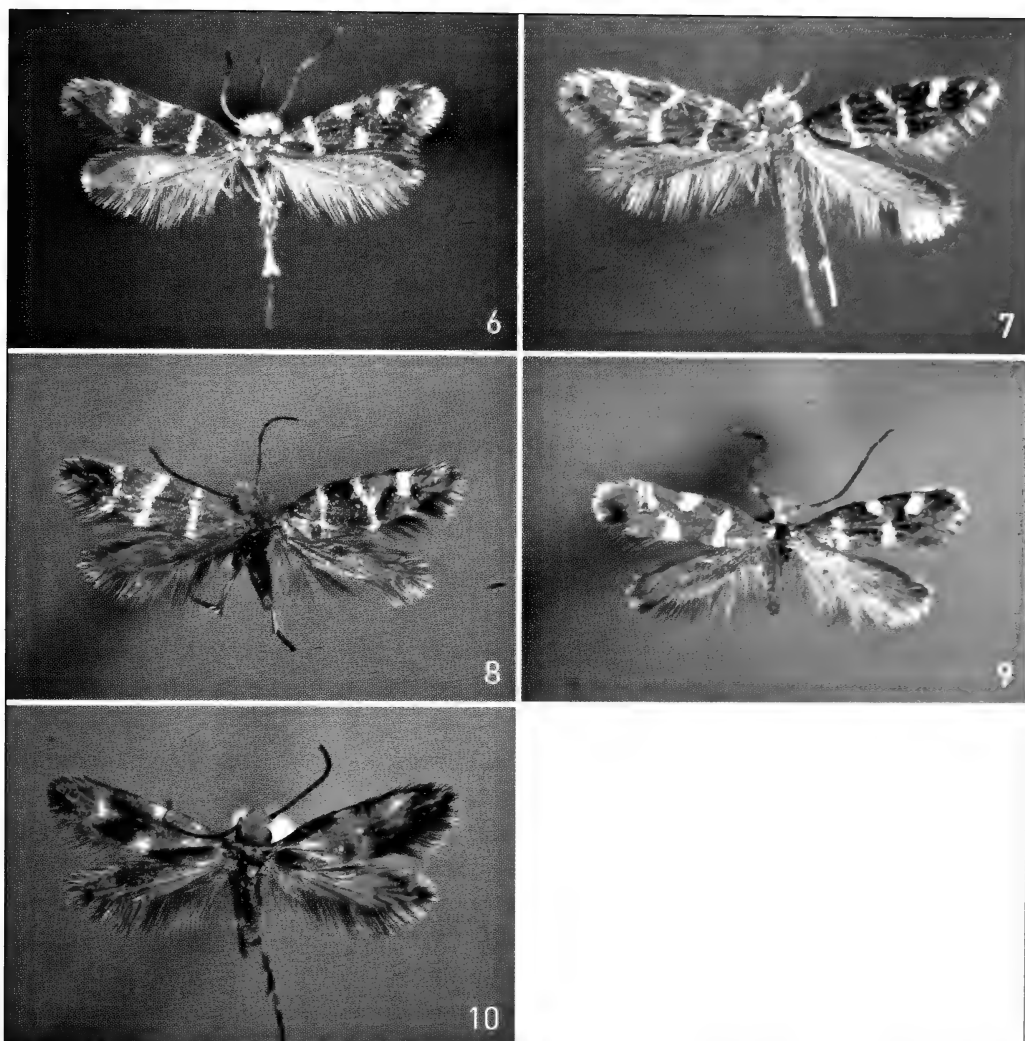
Distribution. Lebanon (Ghazir, Aley and near Beirut), Israel (northern Israel and Mount Carmel) (de Joannis 1886, 1888; Kurz et al. 2000–2009; Heath, unpublished manuscript) (Fig. 15).

Micropterix cypriensis Heath, 1985

Micropterix cypriensis Heath, 1985: 338–340. Type locality: Cyprus, Limassol, Yermasoyle. Holotype ♂: in coll. NHRS.

Material. 5♂, 28♀, **Cyprus**, near Paphos, 26.3.–24.1995, leg. Wimmer; 1♂, 3♀, **Cyprus**, Trodos mountains, Platres, 1200m, 8.5.1994, leg. Wimmer; 7 specimens, **Cyprus**, Akamas, Smigies, March 2004, observed by Thoma (see Fig. 3).

Description of adults. (Fig. 8). Forewing length: ♂ 2,5–3,6 mm; ♀ 2,8–4,0 mm. Head dark brown, vestiture of hair-like scales on the head dirty to rusty yellow; antennae dark brown, bronzy golden shining, 4/5 (♂), slightly more than 1/2 (♀) respectively of forewing length. thorax and tegulae bronzy golden, reddish to purple distad, proximad sometimes also silvery; forewings bronzy golden to reddish bronzy golden, purple to purple-violet at the apex and along the costal and outer margin (along the costa often only distad); forewings with silvery markings; near 1/4, a slender and straight fascia; a slender fascia at 1/2, slightly bent outwards; an elongated spot at 3/4 at the costal margin extending across the half wing width; near the apex, two small spots at the costal margin and at the outer margin, the posterior spot often larger and sometimes fused with the anterior spot, thus forming a fourth fascia (rarely one of these or both spots are missing); rarely an additional small costal spot near 3/5 may be present; fringe



Figs 6–10. Adults. **6.** *M. berytella* ♂. **7.** *M. berytella* ♀. **8.** *M. cypriensis* ♀. **9.** *M. elegans* ♂. **10.** *M. islamella* ♂.

golden, purple at its basis, whitish outwards; hindwings bronzy golden, especially apically with a strong purple tinge; fringe bronzy golden, lighter outwards; legs and abdomen brown, bronzy golden shining.

♂ **Genitalia** (Fig. 12). Uncus moderately long, flattened, broadened at its tip; tegumen slender; accessory claspers tennis racket-like shaped with a posterior row and an irregular group of short, stout and thickened setae at the inner surface; additionally, beyond the accessory claspers two large, irregular, weakly sclerotized and folded lobes with sharp edged tips and some irregular, stout and thickened setae; valves moderately long, distinctly constricted in the middle, spatulate at the tips; postbasally a small group of short setae at the inner surface, the spatulate end with an irregular row of moderately long, stout and thickened setae at the inner surface.

Diagnosis. *M. cypriensis* is the only species of this genus known from Cyprus.

Life history. *M. cypriensis* was found on *Dactylorhiza romana* (Seb.) (Orchidaceae) (Fig. 3). This species has been found in the margins of sparse pine forest with broom, *Cistus* and *Pistacia lentiscus* L. (Anacardiaceae) (Richard Thoma, pers. comm). The adults were found in March.

Distribution. Southern and western Cyprus (Troodos Mountains) (Heath 1996; Karsholt et al. 2004; Kurz et al. 2000–2009) (Fig. 16).

Micropterix elegans Stainton, 1867

Micropterix elegans Stainton, 1867: 42. Type locality: “Hunen, Palestine” [?Wadi Hunayn, near Jerusalem, Israel]. Holotype ♂: in coll. BMNH.

Micropterix octopunctella Amsel, 1935: 276. Type locality: “Tabgha, See Genezareth” [Lake Tiberias, Israel]. Junior subjective synonym.

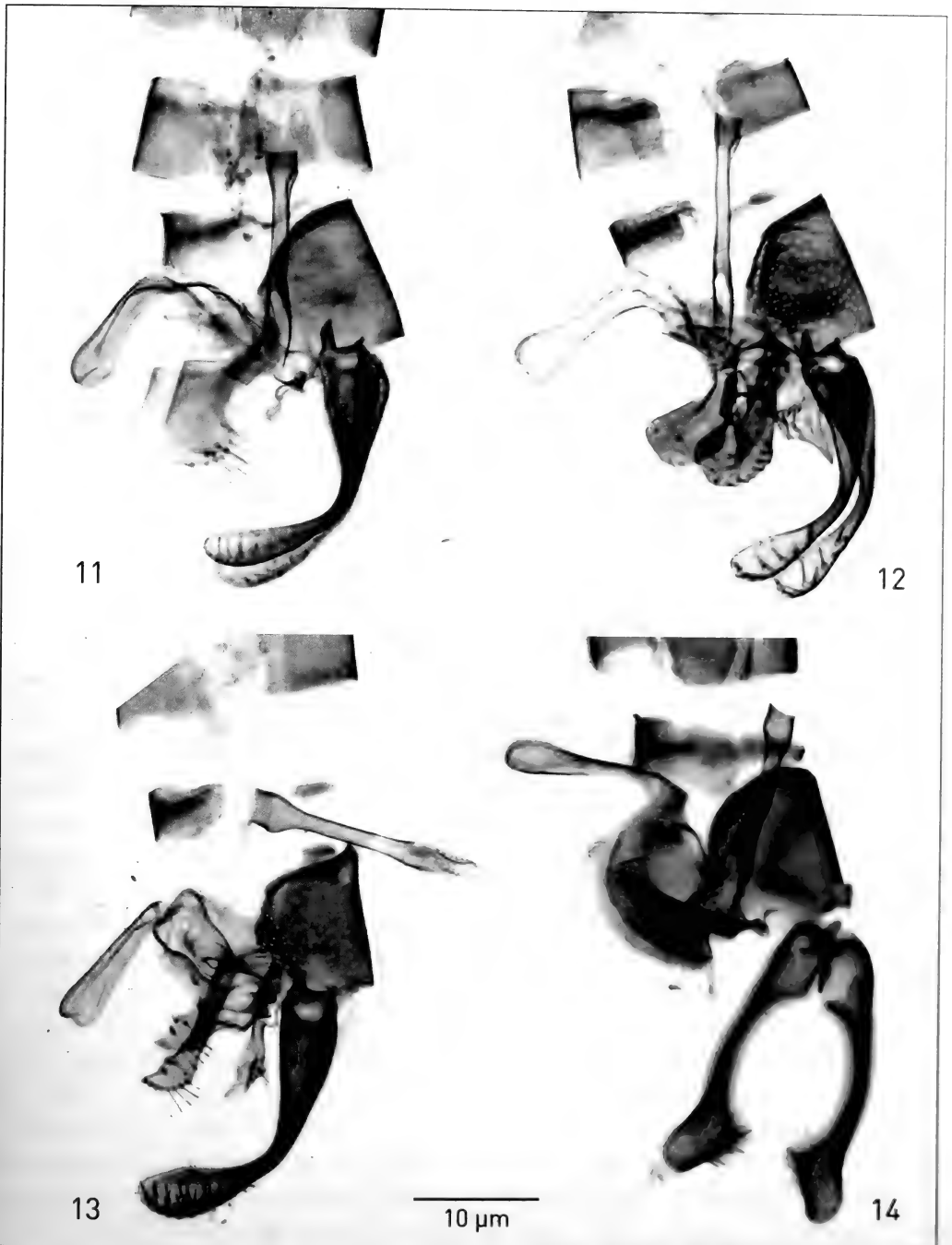
Material. 9♂, 5♀, **Israel**, Zichron Yaacov, Ramat Hanadiv, 125m, 24.–25.2.2006, leg. Hausenblas Zeller; 1♂, 1♀ **Israel**, Zichron Yaacov, Fureidis, 30 m, 2.3.2006, leg. Hausenblas/Zeller; 4♂, 1♀ **Israel**, En Hemed, 100m, 1.5.1998, leg. Hausenblas; 7♀ **Israel**, Adamit, 200 m, 29.4.1998, leg. Hausenblas.

Description of adults. (Fig. 9). Forewing length: ♂ 2,5–3,1 mm, ♀ 2,7–3,3 mm. Head dark brown, vestiture of hair-like scales on the head dirty to brownish yellow; antennae dark brown, bronzy golden shining, 4/5 (♂), slightly more than 1/2 (♀) respectively of forewing length; thorax bronzy golden, tegulae silvery, bronzy golden distad; forewings bronzy golden, more or less reddish along costa and outer margin with silvery white, sometimes diffuse markings; at 1/5 an irregular diffuse spot in the middle of the wing, sometimes enlarged to a complete narrow fascia across the whole wing width; at 1/2, two spots at costa and inner margin each, not precisely opposite to each other; at 3/4, an inwardly oblique spot from costa to the middle of the wing; fringe bronzy golden, purple at the base, whitish outwards; hindwings bronzy golden, especially at the apex with a purple tinge; fringe bronzy golden, outwards brighter; abdomen and legs brown, golden shining.

♂ Genitalia. (Fig. 13). Uncus moderately long, slender, tip broadly rounded; accessory claspers relatively long and slender; near their tips three strongly modified, stout and thickened setae at the inner surface; about eight moderately long, more or less bent, stout and thickened setae at the anterior margin; additional, strongly irregular lobes beyond the accessory claspers, often folded, bearing a single, bent, stout and thickened seta; valves moderately long, stout, constricted in the middle, the distal third spatulate and somewhat bent upwards; postbasally two or three thickened as well as many normal setae at the inner surface; the distal third at the inner surface with a row of long setae as well as one or two irregular rows of short, straight, stout and thickened setae.

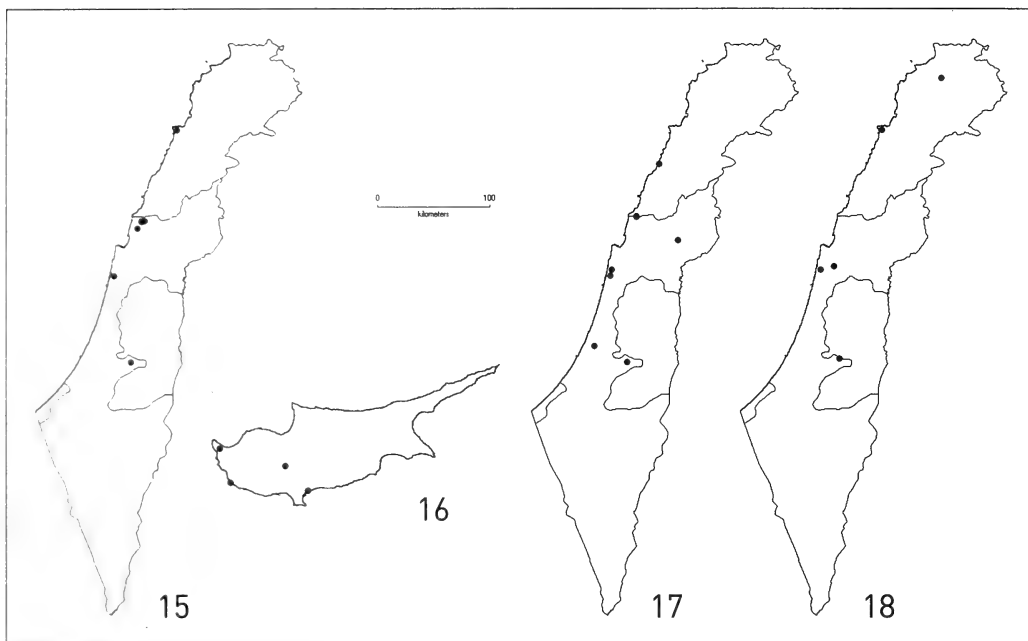
Diagnosis. *M. elegans* is sometimes similar to *M. berytella* (q.v.).

Life history. *M. elegans* was found mainly on *Cyclamen persicum* and also on *Cistus salvifolius*, feeding on pollen (Fig. 4). This species inhabits the Mediterranean forest types “garrigue” and “batha”, syntopically with *M. berytella*. The adults appear between January and April.



Figs 11–14. ♂ genitalia. 11. *M. berytella*. 12. *M. cypriensis*. 13. *M. elegans*. 14. *M. islamella*.

Distribution. ?Syria (Meyrick 1912), Israel (Jordan valley, Lake Tiberias, northern Galilea, Mount Carmel and near Jerusalem), Lebanon (east of Saïda) (Stainton 1867; Amsel 1935; Kurz et al. 2000–2009; Heath, unpublished manuscript) (Fig. 17).



Figs 15–18. Distribution maps. 15. *M. berytella*. 16. *M. cypriensis*. 17. *M. elegans*. 18. *M. islamella*. Red dot indicate supposed occurrence (see text).

Micropterix islamella Amsel, 1935

Micropterix islamella Amsel, 1935: 276–277. Type locality: “Kirjat [Kiriath] Anavim” [near Jerusalem, Israel]. Type ♂: probably lost or destroyed in coll. SMNK (Kaltenbach in litt.). 1 Paratype ♂: “Kirjat [Kiriath] Anavim”. Examined by J. Heath. In coll. UMB. (Heath, unpublished manuscript).

Material. 1♂, 1♀, **Israel**, Zichron Yaacov, Fureidis, 30m, 2.3.2006, leg. Hausenblas/Zeller; 7♂, 1♀, **Israel**, Yogne'am 'Illit, 180 m, 2.3.2006, leg. Hausenblas/Zeller.

Description of adults. (Fig. 10). Forewing length: ♂ 2,8–3,5 mm; ♀ 3,2–3,6 mm. Head black-brown, vestiture of hair-like scales on the head rusty yellow; antennae dark brown, bronze golden shining, 5/6 (♂), 4/7 (♀) of forewing length; thorax golden; tegulae bluish to violet; forewings violet to reddish violet, with coppery golden and golden markings: a bronzy golden fascia across the whole wing width at 1/5, from the tegulae to this fascia two small bronzy golden lines, one along the inner margin, the other directly in the middle of the wing; a golden fascia across the whole wing width in the middle slightly bent outwards and bronzy golden bordered, sometimes interrupted in the middle; at 3/4 a trapezoid golden spot inwardly directed and reaching the middle of the wing, also bronzy golden bordered; from this spot following the costa to the apex a narrow bronzy golden band recurrent along the tergal margin and broadening towards the spot; fringe bronzy golden; hindwings bronzy golden with purplish tinge and bronzy golden fringe; legs and abdomen dark brown, bright golden shining.

♂Genitalia. (Fig. 14). Uncus very long, slender, distally somewhat broadened with some hair-like setae, forming a separate, clearly distinguishable unit with accessory

claspers; between the uncus and the accessory claspers additional triangular-shaped lobes, more weakly sclerotized and only the distal tip visible; accessory claspers moderately developed and distally trapezoid shaped, distally with long, thickened setae, which have sickle-shaped ends, pointing caudal; valvae moderately long, stout, distally constricted at medial part, the distal ends golf club-like, enlarged and bent upwardly; distal fourth at the inner surface bearing 10 to 15 thickened straight, spinoid setae, clustered at the outer margin of the bend of the valvae.

Diagnosis. *M. islamella* can be easily distinguished from all other species in this region by the purple ground coloration of the forewings and more golden and diffuse spots and fasciae.

Life history. *M. islamella* was found in a forest of *Pinus brutia* Ten. (Pinaceae), feeding on pollen of *Mercurialis annua* L. (Euphorbiaceae) (Fig. 5), and at one locality occurring syntopically with *M. elegans*. A.S. Talhouk found this species abundantly on “peach” (Heath, unpublished manuscript).

Distribution. Israel (near Jerusalem and Mount Carmel), Lebanon (near Beirut and Ain Jouaik [?Nabaa Jouaik, 70 km northeast of Beirut, indicated by a red dot on Fig. 18]) (Amsel 1933, 1935; Kurz et al. 2000–2009; Heath, unpublished manuscript).

Discussion

Compared to other genera in the family Micropterigidae, the genus *Micropterix* exhibits remarkably uniform male genitalic structures (Zeller et al. 2007: figs 2, 3 and p. 244). However, closely related species can easily be separated and even grouped using this character system.

For example, the similar male genitalic claspers and accessory lobes of *M. berytella*, *M. cypriensis* and *M. elegans* and also *M. sicanelia* Zeller, 1847 (from Sicily) suggest a close relationship although *M. elegans* has the most distinctive accessory structures. The geographical proximity and restricted ranges of the first three species in particular (Cyprus, Lebanon and Israel) seems also consistent with them being part of a locally radiated clade. These three species exhibit distinctly divided male genitalia (dorsal part with uncus, tegumen and accessory claspers; ventral part with valvae and vinculum), accessory claspers with spinoid setae, which are not T- or Y-shaped, as well as stout valvae (Zeller et al. 2007).

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Additional records of Pterophoridae from the Cape Verde Islands, with description of a new species of *Agdistis* Hübner

CEES GIELIS¹ & OLE KARSHOLT²

¹ Nationaal Natuurhistorisch Museum Naturalis, Department of Entomology, P.O. Box 9517, NL-2300 RA Leiden, The Netherlands; email: C.Gielis@net.hcc.nl

² Zoological Museum, Natural History Museum of Denmark, Universitetsparken 15, DK-2100 Copenhagen Ø, Denmark; email: okarsholt@snm.ku.dk

Abstract. This paper deals with Pterophoridae collected in the Cape Verde Islands in December 2002. Among the six species recognized one new species, *Agdistis notabilis* sp. n. is described and figured, and one species *Stenoptilodes taprobanes* (Felder & Rogenhofer, 1875) is recorded from the Cape Verde Islands for the first time. An overview of the Pterophoridae of the Cape Verde Islands is given in a table.

Resumo. Este trabalho trata de micro lepidópteros da família Pterophoridae colhidos em Dezembro de 2002 nas Ilhas de Cabo Verde. De entre as seis espécies reconhecidas, uma espécie nova, *Agdistis notabilis* sp. n. é descrita e ilustrada, e outra espécie *Stenoptilodes taprobanes* (Felder & Rogenhofer, 1857) é registada pela primeira vez para estas ilhas. Na tabela 1 apresentamos os Pterophoridae actualmente dados como existentes nas Ilhas de Cabo Verde, assim como a sua distribuição por ilha.

Introduction

The Cape Verde Archipelago consists of nine inhabited and six uninhabited islands, altogether 4033 km², situated in the Atlantic Ocean about 600 km west of Senegal. They are of volcanic origin and have not been connected to mainland Africa. The climate is very dry, with low average rainfall and long periods of drought. Along the coasts and in the mountains the vegetation benefits from some humidity brought by the wind from the ocean.

The islands were uninhabited when they were first visited by Europeans in 1456. The composition of the original vegetation is unknown, since the influence of man over the last 500 years (especially grazing from goats) has had an enormous impact on the vegetation (see Lobin & Ohm 1987 for further details). The number of higher plant species is only 724, 65 of which are considered endemic (Arechavaleta et al. 2005).

The position of the Cape Verde Islands made them a natural stepping-stone on the sea route between Africa (for example during the slave-trade era) or Europe to the New World, and during the 19th century several naturalists participating in expeditions used the opportunity during stops at the islands to collect specimens, including Lepidoptera, which they brought back to Europe. It was, however, not until the 1950s that more specific collections by Finnish entomologists resulted in the first overview of the Lepidoptera fauna of the Cape Verde Islands (e.g. Nyström 1958). In the 1980s German entomologists (especially Bernd Traub) stayed for several years on the islands as part of development programs during which they collected Lepidoptera. Based on this extended knowledge Harten (1993) published a checklist of terrestrial arthropods of the Cape Verde Islands. An updated checklist comprising all terrestrial animals and plants has recently been completed (Arechavaleta et al. 2005). The number of Lepidoptera recorded from the islands is still only 188 species, and even though the archipelago is

low in diversity due to its isolated position and dry climate the number will certainly grow considerably when more detailed studies, particularly of its microlepidoptera are undertaken.

The checklist by Harten (1993: 275) included only three species, and the one by Báez & García (2005: 89) only four species of Pterophoridae. Recently Arenberger (2006), based on new material collected by E. & U. Aistleitner, recorded 10 species of Pterophoridae from the archipelago, two of which were identified only to genus. During two weeks of holiday in late December 2002 the second author collected Lepidoptera from the four islands of Sal, Santo Antão, Santiago, and São Vicente. The Pterophoridae, which were identified by the first author, included six species, including an undescribed species of *Agdistis*, which is described below.

Abbreviations

CG	Collection of Cees Gielis
Gent	Genitalia slide
ZMUC	Zoologisk Museum, Natural History Museum of Denmark

Species treatments

Agdistis tamaricis (Zeller, 1847)

Material. 1♀. Santiago, Tarafal, sea level, 29-30.xii.2002 (O. Karsholt), gent CG 5225 (ZMUC).

Agdistis bifurcatus Agenjo, 1952

Material. 1♀. Santo Antão, Ponta del Sol, 100 m, 25.xii.2002 (O. Karsholt), larva on *Limonium* sp. (ZMUC), 7♂, 4♀, same locality but 26.xii.2002 (O. Karsholt), gent CG 5222 (♂), 5221 (♀) (ZMUC, CG).

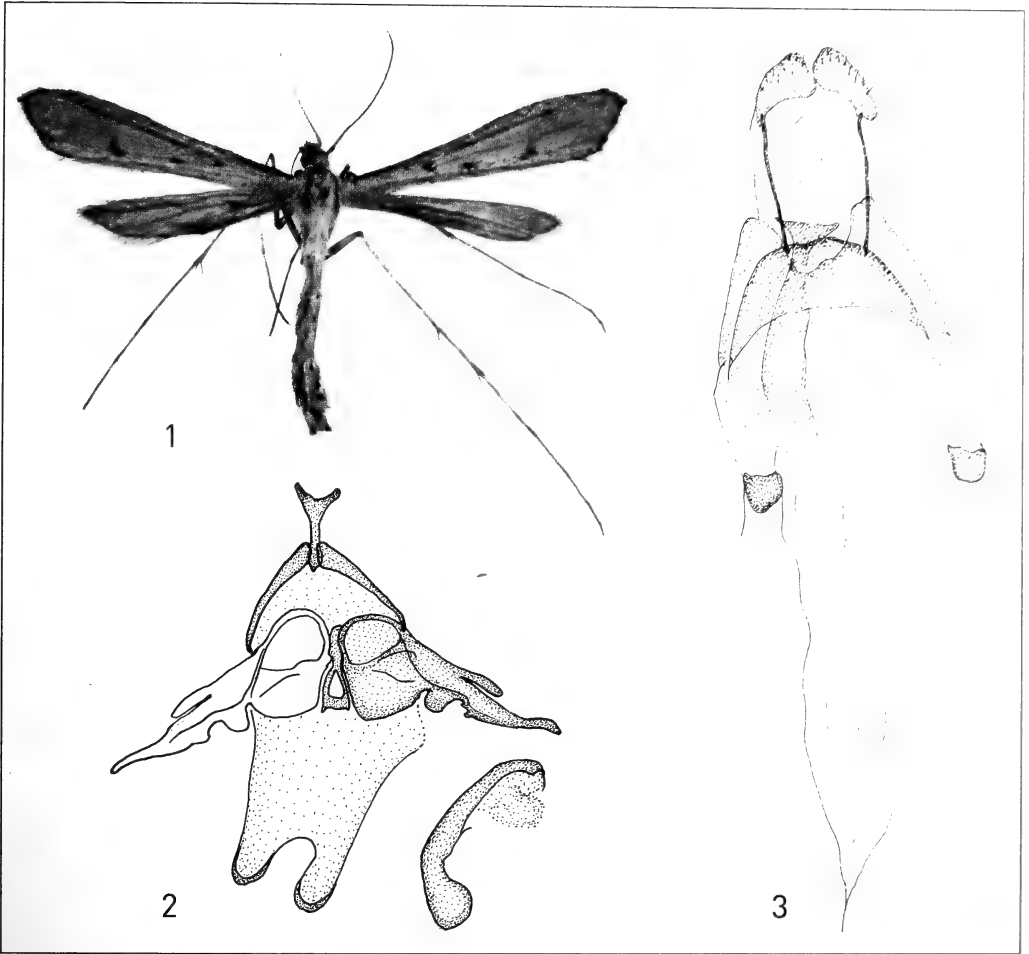
Biology. The locality is a north facing slope close to the sea. The adult specimens were caught at night, with the help of a pan-lamp, over *Limonium* sp. (Plumbaginaceae). The larva is recorded as feeding on *Limonium ferulaceum* L. in southern Spain (Huertas Dionisi 1999). This species does not occur in the Cape Verde Islands, but three other *Limonium* species are recorded from Santo Antão (Arechavaleta et al. 2005: 49).

Agdistis notabilis sp. n.

(Figs 1–3)

Material. Holotype ♂: "Cape Verde Islands, Santiago, Tarafal, sea level, 29-30.xii.2002, O. Karsholt" (ZMUC). – Paratypes: 2♂, 3♀, same locality and date, genitalia slide CG 5224 (♂), 5223 (♀) (ZMUC, CG).

Diagnosis. *Agdistis notabilis* is among the smaller *Agdistis* species. It resembles *A. piccolo* Gielis from Namibia but the markings are less distinct and with fewer individual dark scales on the wing. The female genitalia has a simpler antrum, and the lamina antevaginalis is arched (furcate in *A. piccolo*). The valvae in the male genitalia have an almost triangular shape. A similarly shaped structure is also present in *A. unguica* Arenberger from the Republic of South Africa, but that species has the tip of the valvae



Figs 1–3. *Agdistis notabilis* Gielis & Karsholt, sp. n. 1. Adult. Holotype male, Cape Verde Islands, Santiago, Tarafal, sea level, 29-30.xii.2002 (O. Karsholt) (ZMUC). 2. Male genitalia, gent CG 5224 (ZMUC). 3. Female genitalia, gent CG 5223 (ZMUC).

serrated and a pronounced double uncus. The smaller Palaearctic species *A. salsolae* Walsingham and *A. pseudocanariensis* Arenberger have complicated male (valvae and saccular processes) and female genitalia structures (antrum and lamina antevaginalis).

Description (Fig. 1). Male, female. Wingspan 12–14 mm. Head appressedly scaled, pale brown-grey. Palps curved up, as long as eye-diameter, pale brown-grey. Antennae $2/3$ of wing length, brownish grey. Thorax, mesothorax, tegulae, and abdomen pale brown-grey. Dorsum of abdomen with some small groups of brown scales. Hind legs brown-grey. Spur pairs of unequal length, medial spurs slightly longer than lateral spurs.

Forewings brown-grey, naked field (see Remarks) grey-brown. A small brown spot at $2/3$ of costal margin of naked field, another spot at base of naked field, and spots on dorsal margin of naked field at $1/4$ and at $2/3$. Fringes brown-grey, with narrow basal fringe line along termen. Underside grey-brown. Hindwings and fringes brown-grey.

Underside brown-grey. Venous scales in complex structure, with small black scales along the vein reaching 2/3 wing length; basally long brown-grey scales create 'roof' covering small black scales.

Male genitalia (Fig. 2). Symmetrical. Valva gradually narrowing and ending in acute tip. Basal part of valva blister-like, enlarged; mid section with longitudinal cucullar projection and saccular blister; saccular process followed by spiny extension of margin of valva. Tegumen simple. Uncus forked. Saccus simple, triangular. Sternite VIII shaped as bluntly forked plate. Phallus moderately curved, with vesicular extension at tip.

Female genitalia (Fig. 3). Ostium flat. Antrum funnel-shaped, extending into tubular ductus bursae. Ductus bursae gradually extending into bursa copulatrix. Lamina antevaginalis arched and covering plate-like sternite VIII. Sternite VIII medially notched at apex. Sternite VII with two laterally positioned small lobes. Apophyses anteriores absent. Apophyses posteriores 1.5X papillae anales. Papillae anales simple.

Biology. The moth flies in December. The type series was collected at light. The host plant is unknown.

Distribution. Only known from the Cape Verde Islands.

Remarks. Arenberger (2006: 69) recorded an "*Agdistis* spec." from Ilha da Brava based on a single female specimen. The photograph (*loc. cit.* p. 74) of its genitalia resembles that of *A. notabilis*, though the antrum may be differently shaped, and it is possible that this female may belong to *A. notabilis*.

The naked field of the forewing is the triangular area with the tip at the discus reaching towards the termen. This field has fewer and smaller scales than the remaining part of the wing.

Etymology. The name reflects the notable spots along the dorsal margin of the naked field of the forewing.

***Lantanophaga pusillidactyla* (Walker, 1864)**

Material. 1♂, Santo Antão, Ponta del Sol, 100 m, 25.xii.2002 (O. Karsholt) (ZMUC).

***Stenoptilodes taprobanes* (Felder & Rogenhofer, 1875)**

Material. 1♂, 3♀, Santo Antão, Ponta del Sol, 100 m, 25.xii.2002 (O. Karsholt) (ZMUC, CG).

Remarks. Recorded for the first time from the Cape Verde Islands.

***Megalorhipida leucodactylus* (Fabricius, 1794)**

Material. 2♂, Santo Antão, Ponta del Sol, 100 m, 26.xii.2002 (O. Karsholt) (ZMUC); 1♂, São Vicente, Mindelo Airport, 50 m, 27.xii.2002 (O. Karsholt) (ZMUC).

Discussion

With ten named and one unidentified species of Pterophoridae this family is well represented in the Cape Verde Islands. Even though this proportion may become smaller when more microlepidoptera become identified, very few other faunas have a represen-

Tab. 1. Distribution of Pterophoridae in the Cape Verde Islands. No species of this family has yet been recorded from the island of São Nicolau or from any of the smaller islands.

species	Santo Antão	São Vicente	Sal	Boavista	Maio	Santiago	Fogo	Brava	Island not specified	Endemic	Mainland Africa
<i>Agdistis tamaricis</i> (Zeller, 1847)		X		X		X					X
<i>Agdistis bifurcatus</i> Agenjo, 1952	X										X
<i>Agdistis notabilis</i> sp. n.						X		?		X	
<i>Hellinsia aistleitneri</i> Arenberger, 2006							X			X	
<i>Megalorhipida leucodactyla</i> (Fabricius, 1794)	X	X	X			X	X	X			X
<i>Sphenarches anisodactylus</i> (Walker, 1853)									X		X
<i>Hepalastis pumilio</i> (Zeller, 1873)						X		X			X
<i>Exelastis atomosa</i> (Walsingham, 1886)							X				X
<i>Lantanophaga pusillidactyla</i> (Walker, 1864)	X							X			X
<i>Stenoptilodes taprobanes</i> (Felder & Rogenhofer, 1875)	X										X
<i>Stenoptilia</i> sp.							X			?	

tation of Pterophoridae of about 5% of all Lepidoptera. Only in the Galapagos Islands does the number of Pterophoridae represent about 5% of the total Lepidoptera fauna (B. Landry, in litt.), and this family is generally well represented in oceanic islands. The distribution of Pterophoridae within the Cape Verde Islands is still imperfectly known as can be seen in Table 1. Most species are still known from only one island, and even smaller samples than that used in the present study may include new and little known species. Table 1 also shows that the Pterophoridae of Cape Verde Islands, as with the rest of the Lepidoptera fauna of this archipelago, belong with the Afro-tropical fauna.

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The life cycle of the little known and endangered endemic Madeiran Brimstone Butterfly *Gonepteryx maderensis* Felder, 1862 (Pieridae)

ANTÓNIO M. FRANQUINHO AGUIAR¹, ANDREW WAKEHAM-DAWSON² & JOSÉ G. FREITAS JESUS¹

¹ Laboratório de Qualidade Agrícola, Caminho Municipal dos Caboucos 61, 9135-372 Camacha, Madeira, Portugal; email: antonioaguiar.sra@gov-madeira.pt

² Mill Laine Farm, Offham, Lewes, East Sussex, BN7 3QB, UK; email: andrewwd@fsmail.net

Abstract. *Gonepteryx maderensis* Felder, 1862 is an endemic Endangered Species of European Conservation Concern restricted to the humid laurel forest (humid *laurisilva*) of Madeira. It has not hitherto been well studied. The life cycle is described and illustrated for the first time based on a limited number of eggs (six) and larvae (four) collected from the wild. Data collected since 1932 show that this species is univoltine with the adults surviving for many months prior to mating and oviposition on the sole host-plant *Rhamnus glandulosa* Aiton (Rhamnaceae). Further study is necessary to underpin the conservation of this little-known species.

Resumo. O Pierídeo *Gonepteryx maderensis* Felder, 1862 é uma espécie endémica, considerada em risco e restringida à laurissilva húmida da Ilha da Madeira. O seu ciclo de vida, que não foi previamente bem estudado, é descrito e ilustrado pela primeira vez com base num número limitado de ovos (seis) e larvas (quatro), colhidas na natureza. Informação acumulada desde 1932 indicam que esta espécie é univoltina, com a sobrevivência dos adultos durante muitos meses antes do acasalamento e postura na sua única planta hospedeira, o sanguinho – *Rhamnus glandulosa* Aiton (Rhamnaceae). Estudos adicionais são necessários para garantir a conservação desta espécie pouco conhecida.

Introduction

The Madeiran brimstone butterfly *Gonepteryx maderensis* Felder, 1862 is a distinct species (Kudrna 1975; Brunton et al. 1996) endemic to the humid laurel forest (humid *laurisilva*; see Press & Short 1994) of Madeira Island, where it has been recorded flying mostly between 420 and 1800 m above sea level from March to September (Wakeham-Dawson et al. 2002). It has been classified as an Endangered Species of European Conservation Concern (van Swaay & Warren 1999) as it is limited to Madeira and specifically to the humid *laurisilva*, which is also of conservation concern and being re-established in a number of areas (Wakeham-Dawson & Warren 1998; Wakeham-Dawson et al. 2000). However, few studies have concentrated on the ecology of *G. maderensis*, making it a species about which little is known. As well as being isolated in Madeira, *G. maderensis* is not easy to study as the adult butterflies generally remain high in the *laurisilva* canopy. Occasionally, adults (males in particular) seek nectar from flowering plants closer to the ground (Wakeham-Dawson et al. 2000). Males may patrol over relatively large distances between areas of humid *laurisilva*, but females are more localised in their movements. Oviposition takes place on only one species of host-plant: Macaronesian Buckthorn *Rhamnus glandulosa* Aiton (Rhamnaceae). This tree is usually present as a component of the upper canopy, making observation and collection of eggs generally difficult (Wakeham-Dawson & Martin, unpublished obs.). However, *G. maderensis* eggs have also been observed on a young, low-growing wild *R. glandulosa* plant (Aguiar, unpublished obs.)

Manley & Allcard (1970) suspected *G. maderensis* to have two generations per year. However, Brunton et al. (1996) thought it could be univoltine with the adults surviving for many months prior to mating and oviposition. Unlike other *Gonepteryx* spp., neither sex of *G. maderensis* reflects ultra-violet (UV) light from the undersides of the wings (Brunton et al. 1996), perhaps giving a cryptic advantage against predators when the butterflies are roosting beneath similarly non-UV reflecting laurel leaves during long periods of unsuitable weather and/or diapause as adults.

The current paper describes the life cycle of *G. maderensis* in detail for the first time from a limited number (six eggs and four larvae collected from the wild) of captive-reared specimens and uses data from literature and field observations recorded between 1932 and 2009 to investigate the distribution and voltinism of this species. Results are discussed in relation to other *Gonepteryx* spp., but as these results are limited, several further questions are raised for future studies.

Material & methods

The life cycle of *G. maderensis* was observed in captivity from six eggs and four L1-larvae collected in June 2000 at two sites inside the *laurisilva* zone indicated below; note that the *laurisilva* at Chão da Ribeira is more pristine than at Chão dos Louros:

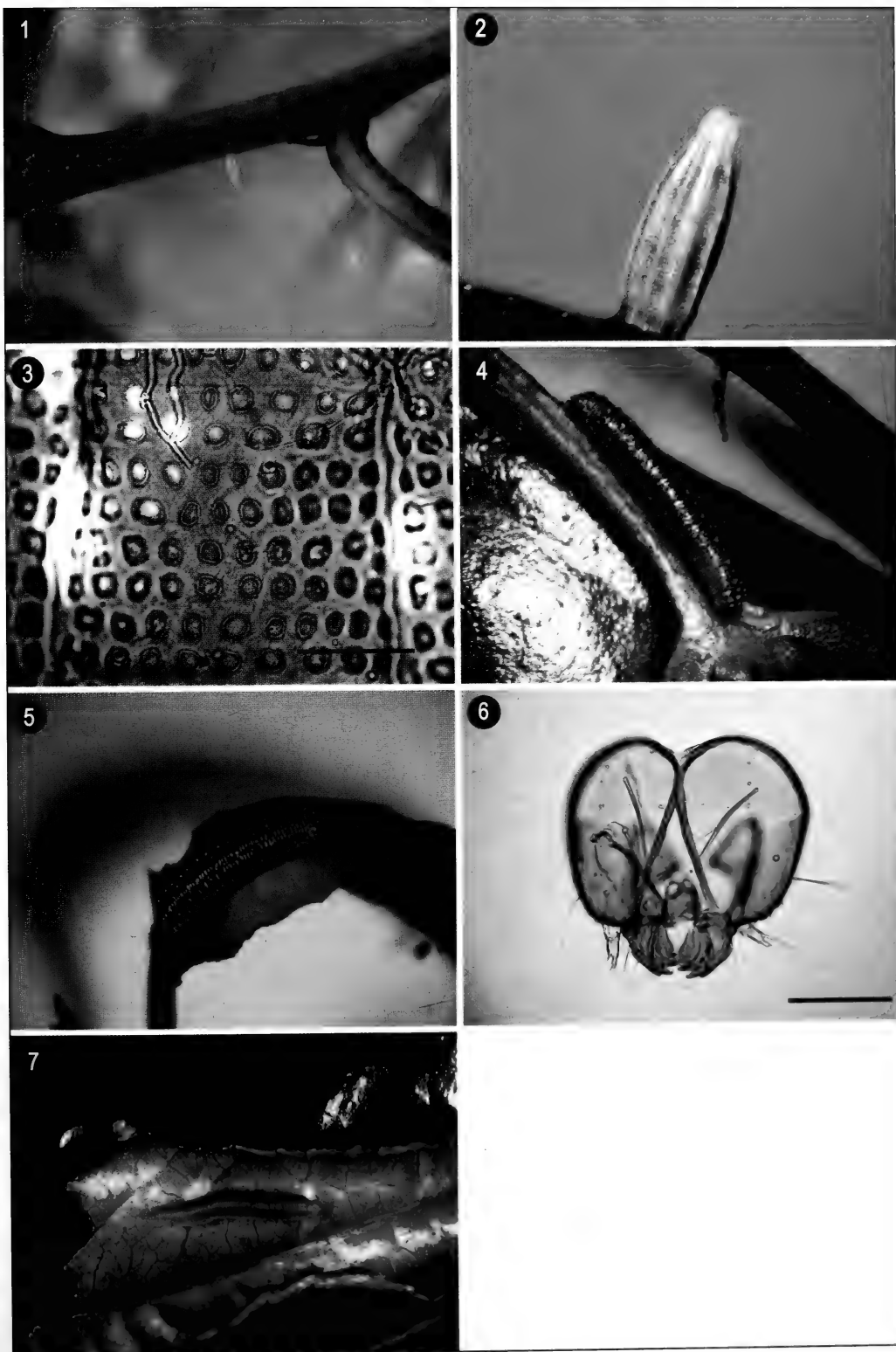
One egg collected at Chão dos Louros, slightly below the Encumeada Pass (UTM: 311490.45 m E; 3626166.21 m N), at an altitude of approximately 800 m on 19 June, and an L1-larva collected on 6 July 2000.

Five eggs collected deep in the Chão da Ribeira valley (UTM: 302377.14 m E; 3629812.45 m N) at approximately 500 m on 27 April and 8 June 2000. Three L1-larvae collected at the same locality on 8 and 28 June 2000.

The rearing was carried out in the laboratory at room temperature in two round plastic breeding cages. These were transparent cylinders 20 cm in diameter and 40 cm high, with base and lid of durable green polythene. One small potted plant of *Rhamnus glandulosa* was put inside each breeding cage to serve as a food source for the larvae. No particular light source was used other than the normal room artificial illumination by eight fluorescent tubes, which were turned on for at least seven hours daily. In addition, there was a source of natural daylight from the all-width windows of one of the room's walls.

Given the limited number of eggs and larvae observed in the study, results are presented as ranges, rather than means and standard deviations. Specimens were disturbed as little as possible to ensure survival through the complete life cycle and few measurements were taken. Future studies involving more eggs and larvae would allow more measurements to be taken for statistical analysis.

Figs 1–7. *Gonepteryx maderensis* immature stages. **1.** A singly laid egg on a fresh twig of *Rhamnus glandulosa*. **2.** The egg's chorion surface in detail. **3.** Microscopic preparation of an egg's chorion (scale bar = 0.21 mm). **4.** L1-larva with body length of 5 mm. Dorsal secreting hairs with droplets and protruding dark bases are clearly visible; these are closer together near the head and anal regions. **5.** L1-larva with body length of 5.6 mm; figure showing an even better view of the defensive droplets. **6.** Microscopic preparation of the L1-larva cephalic capsule (scale bar = 0.19 mm). **7.** L2-larva with a body length of 10 mm.



Description of the stages

Egg (n = 6): The eggs are laid singly on both surfaces and the margins of the young leaves, and sometimes twigs, of *Rhamnus glandulosa* (Fig. 1). Eggs are yellowish-white when freshly deposited, but become orange-yellow close to eclosion. Eggs have been found only from late April to July (also see Wakeham-Dawson & Aguiar 2003). The egg is cone-shaped and 1.45 to 1.50 mm in length from base to apex. It is 0.5 mm wide at the base, 0.65 to 0.70 mm at the maximum width and 0.28 mm wide at the apex (Fig. 2). The chorion is folded into nine vertical keels, which are separated by 0.19 mm wide furrows. The chorion's (egg case) surface is covered with microscopic nodules that are 15 by 8.8 μm in size (Fig. 3). At the egg's maximum width it is possible to observe 5 horizontal rows (each 97 μm in length) of 13 nodules. The micropyle is oval-shaped: dimensions: 0.28 by 0.21 μm . Sometimes the larvae partially eat the egg case after hatching.

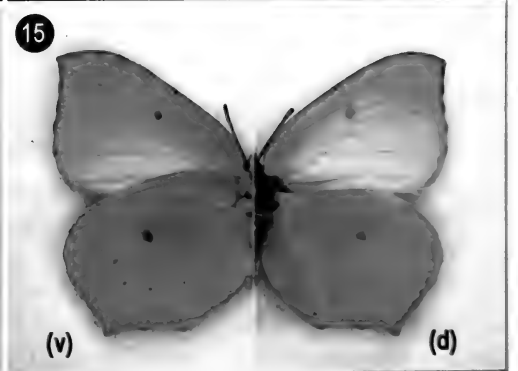
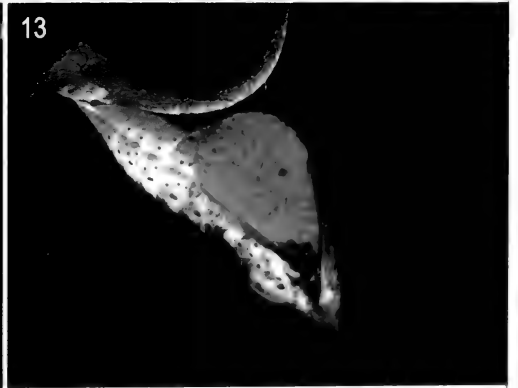
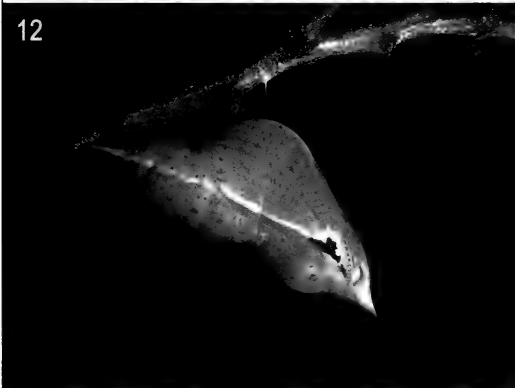
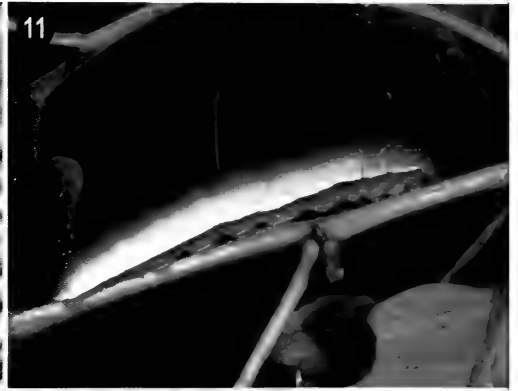
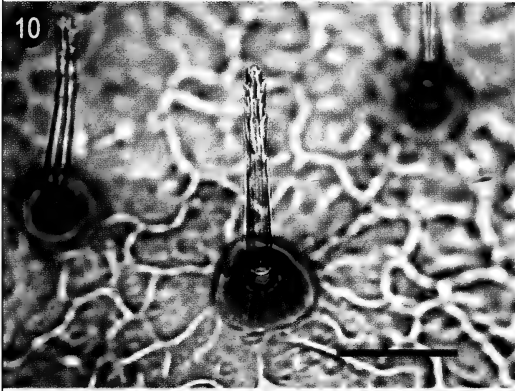
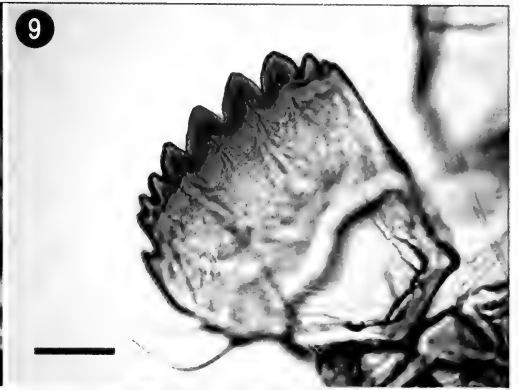
First instar larva (L1) (n = 10): This is yellowish-green with a length of 2 mm when freshly emerged from the egg. This stage lasts for five to seven days and when the first moult occurs the L1-larva is around 8 mm long. At this stage and during L2 (but less visibly during the other stages), the larva has a double row of erect dorsal glandular hairs that secrete tiny droplets of a clear, highly adhesive liquid.

Halfway through the L1 stage the secreting hairs are clearly visible inserted in dark bases along the dorsum of all body segments, but are most abundant near the head and on the last body segment (Figs 4, 5). During this and subsequent stages, the whole body becomes covered with a second type of small hair that also has a dark base. However, it is still possible to distinguish the secreting hairs from these smaller hairs as the secreting hairs are inserted in prominent tubercles. The larva at this stage has a very small cephalic capsule, with a width of 0.44 mm (Fig. 6).

Second instar larva (L2) (n = 10): This is yellowish-green, but with a more intense green colour than in L1. The L2 stage lasts for two to three days and the larva reaches a length of 12 mm by the time the second moult occurs (Fig. 7).

Third instar larva (L3) (n = 10): This is green with a narrow spiracular white stripe that runs along the whole length of the body (Fig. 8). The white stripe has a subtle white suffusion above it. The cephalic capsule is now almost 2 mm in width and the mandibles have developed many more cutting teeth (Fig. 9). The entire body and the cephalic capsule are covered with setae bearing tubercles (Fig. 10) that appear to be minute black dots to the naked eye and give the larva a 'velvety' appearance. The L3 stage is completed in three days and the larva attains a maximum length of 18 mm by the third moult.

Figs 8–15. *Gonepteryx maderensis* immature and adult stages. **8.** L3-larva with a body length of 14 mm. **9.** Microscopic preparation of an L3 mandible (scale bar = 0.17 mm). **10.** Microscopic preparation showing setae and dark tubercles in the cephalic capsule of an L3-larva (scale bar = 0.05 mm). **11.** L4-larva with a body length of 35 mm. **12.** Pupa hanging 'head-down' from a twig of the food plant. **13.** A male, just before leaving the pupa. The chrysalis has become transparent enough to show the characteristic bright orange of the male's fore-wings. **14.** Dorsal (d) and ventral (v) views of a set male. **15.** Dorsal (d) and ventral (v) views of a set female.



Fourth instar larva (L4) (n = 10): Similar to L3 stage larva, but the white suffusion above the white longitudinal stripe is more extended dorsally (Fig. 11). The L4-larva completes the fourth stage in five to six days and attains a maximum length of around 35 mm before pupating.

Larvae of *G. maderensis* are very sluggish during the day, but appear to be more active during the night when they feed. In all moults the larvae eat their shed skins. The only observed larval defensive behaviour involved the larvae falling from their host-plant and hanging suspended by a silk thread until the disturbance had ceased.

Pupa (n = 10): Just before pupating (pre-pupa stage) the larva suspends itself, 'head-down' from a twig or leaf by the cremaster and a silk thread around the body; the green colour becomes paler, the longitudinal white stripes disappear and the body inflates slightly making the individual segments more visible. The pupa has a length of 23–26 mm and this stage lasts for 11–12 days (Fig. 12).

Imago (n = 10): Just before eclosion the pupal tegument becomes transparent and it is very easy to see by the unexpanded wings' colour if the future imago will be a male or a female (Fig. 13).

In the male (Fig. 14), the dorsal surfaces of the fore-wings are bright orange (more intensely so in the discal-cellular area) turning yellow just before the external margin, with an indistinct orange spot in the discal cell. The costa and external margin are bordered by a fine brown line, which becomes darker at the terminal extremities of veins. The hind-wings are yellow with an orange spot in the discal cell. Small reddish-brown dots are present at the terminal extremities of the veins. The male has a wingspan of 52–57 mm.

The ventral surfaces of the wings are greenish-yellow with an orange tint in the fore-wings and a submarginal row of small brown spots on hind- and (less visibly) on the fore-wings. On the ventral surfaces of both fore- and hind-wings the discal cell spot is light red-brown, with a paler centre.

The female (Fig. 15) is similar to the male, but the dorsal surface of both wings is pale yellow with an orange tint near the fore-wing costa. The ventral surfaces are pale yellow with a slight orange tint in the discal cell and costa. The female has a wingspan of 59–61 mm.

The thorax and abdomen of both males and females are covered in long silver hairs and the tips of the abdomens are dusted with yellow scales.

Biology

Imagos were seen flying from altitudes between 50 and 1800 m a.s.l. (Appendix). Despite this, 80% of the encounters registered were made at altitudes between 500 and 1000 m. This coincides with the altitudinal distribution of *G. maderensis*' plant host, *Rhamnus glandulosa* (Fig. 16).

Based on the very limited data currently at our disposal, there seems to be no differences in the life cycle duration at either of the localities where the eggs were collected. The average duration of the combined larval stage was 17.5 days; for the pupal stage this

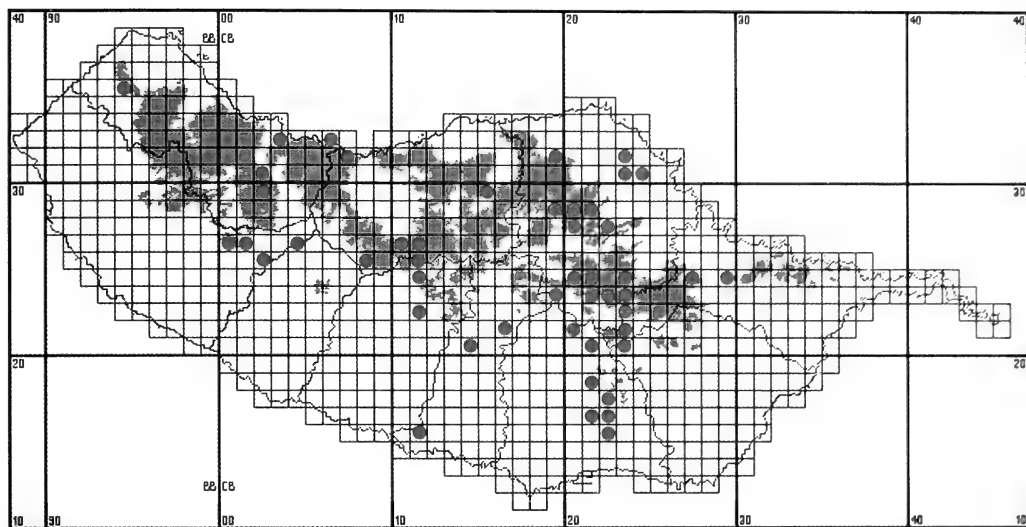


Fig. 16. Distribution of *G. maderensis* and humid laurisilva, of which Macaronesian Buckthorn *Rhamnus glandulosa* is an infrequent component between 500–1000 m in Madeira Island. The map is overlaid with a grid representing 1 × 1 km-squares; locations where specimens were captured or observed are marked with red circles; the green area corresponds to the distribution of humid laurisilva forest.

was 11 days. Together the pre-adult stages lasted on average for 29.3 days (with a minimum of 27 days and a maximum of 32 days).

The number of specimens collected or observed per month (Fig. 17) indicates that this species is univoltine with egg-laying in (or around) June followed by probable death of the egg-producing adults. Egg, larval and pupal development then all takes place around June and July, with no diapause during any of these stages. The next generation of adults is on the wing by July and these fly until November before a winter diapause as adults until January. In the first few months of the year there is sporadic temporary suspension of diapause during periods of good weather. Adult activity increases as summer approaches and the life cycle starts again with egg-laying in or around June. The first half-year peak in observed adult numbers is lower than the peak during the second half of the year. This may be explained by over-winter mortality (i.e. fewer adults are still alive to fly after the winter) and the effects of cooler weather during the first half of the year (i.e. there are fewer days where conditions are suitable for flight).

Discussion

Madeira is an oceanic North Atlantic island, which has probably never had a land link to Africa, its nearest continent. Only species that can survive long distance migration or have been accidentally transported have colonised the island. As the prevailing wind blows down from Europe, the butterfly fauna is essentially European (Wakeham-Dawson et al. 2000). The total fauna comprises about 20 species and the status of some of the taxa is debated. Some authors consider that up to six of these (including *G. maderensis*) are endemic. The other taxa have colonised the island more recently

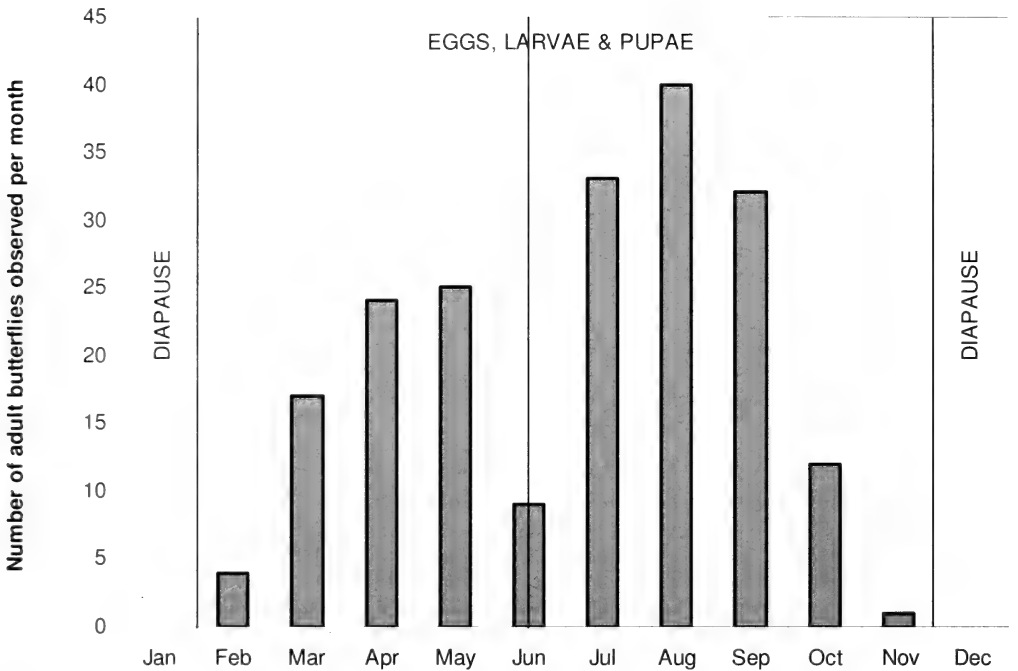


Fig. 17. Number of adult *G. maderensis* specimens captured or observed by month in the period 1932 – 2009 (see Appendix).

and some in very recent history (Wakeham-Dawson et al. 2000). Island populations are particularly sensitive to ecological pressures and one of the taxa, *Pieris brassicae wollastoni* (Butler, 1886), appears to have become extinct in the near past, perhaps as a result of parasite or disease introduction by another species (e.g. Gardiner 2003). Although there is anecdotal suggestion that *G. maderensis* was more common in recent history (e.g. Wakeham-Dawson & Warren 1998), there is no current evidence that it is declining in a similar way to *P. brassicae wollastoni*.

The current study is based on limited data from few eggs and larvae, so until further breeding or rearing studies are carried out it is not possible to make any really conclusive comparisons between *G. maderensis* and other *Gonepteryx* species. However, results of the present study clearly indicate that *G. maderensis* is univoltine with a life cycle not unlike that of *G. rhamnii* in Britain and most parts of Europe (Bibby 1983; Ebert & Rennwald 2001; Fartmann 2004). The closely related *G. cleopatra* (L.) is also considered to be univoltine over much of Europe, but has been observed ovipositing on *R. alaternus* leaves as early as 3 March (Athos Peninsula, N. Greece; Wakeham-Dawson, unpublished obs.). However, *G. cleopatra* may over-winter as pupae in northern Africa, and a partial second brood has also been observed in both *G. cleopatra* and *G. rhamnii* in that area (Tennent 1996). Another relative, *G. cleobule* (Hübner, 1825) has several named subspecies in the Canary Islands, all of which use *Rhamnus* spp. as host-plants. On these islands, adults have been observed in all months; with

larvae observed in April, August and December. The number of generations per year and the presence of periods of diapause in the life cycle are uncertain. The *G. cleobule* early stages are similar to those of *G. maderensis*, but a published close comparison has not yet been made. In *G. cleobule*, the egg is yellow and has eight longitudinal ribs; the larvae are green with white lateral stripes bordered ventrally by fine yellow lines; the pupa is green with a brown head spine, brown markings at wing origins, many small brown spots across the body and along the outer border of the wing sheath, as well as white lateral stripes (Wiemers 1995). The secreting hairs observed in *G. maderensis* larvae also occur in *Pieris rapae* L., where the fluid consists primarily of a series of chemically labile, unsaturated lipids (mayolenes) that are derived from 11-hydroxylinolenic acid (Smedley et al. 2002). The secretion is a potent deterrent and provides effective defence against a range of predatory arthropods. However, specific parasitoids such as the braconid *Cotesia glomerata* (Linnaeus) seem to use the droplets to effectively locate *P. rapae* larvae for oviposition and are not adversely affected by the secretion (Takabayashi et al. 2000; Shiojiri & Takabayashi 2005). As far as we know, the composition of the *G. maderensis* droplets is unknown. Droplet secretion in this and related *Gonepteryx* species deserves further study.

In *G. rhamni*, larvae disturbed while resting or feeding during any of the larval stages rear up from the host-plant (often from the mid-vein of a *Rhamnus* leaf), holding on only with anal claspers and prolegs until the body is at about 30 degrees (Wakeham-Dawson, unpublished obs.). In this position, the larvae have the appearance of a green twig. *G. rhamni* larvae appear to rest in the day in the mid-rib of a leaf when small and feed at night. Later on, the larger larvae begin to feed in the day, as well as at night. *Gonepteryx maderensis* larvae were observed to be less active during the day than at night. They were not observed to rear up as in *G. rhamni* and the only observed defensive behaviour involved the larvae falling from their host-plant and hanging suspended by a silk tread. Further observations of the *G. maderensis* larvae's defensive behaviour and daily feeding cycle are needed before fuller comparisons can be made.

In the current study, we observed the presence of a *G. maderensis* egg on a food-plant twig. Currently, we have no way of assessing whether this is normal activity or not. *G. rhamni* and *G. cleopatra* generally lay eggs on food-plant leaves, especially buds or younger leaves, allowing the larvae more immediate access to food (Bibby 1983; Ebert & Rennwald 2001; Fartmann, 2004; Wakeham-Dawson, unpublished obs.). Further observations need to be made on oviposition location by *G. maderensis* for comparison with other *Gonepteryx* spp.

This brief study is based on limited data, but it has identified that *G. maderensis* is most probably univoltine. It has described the *G. maderensis* life cycle in detail for the first time and identified gaps in our knowledge that need further research in order to underpin the conservation of *G. maderensis*.

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Appendix

Adult *G. maderensis* specimens captured or observed on Madeira Island in the period 1932–2009. Key: UTM = Universal Transverse Mercator Coordinates; C = captured; O = observed; M = male; F = female. See Wakeham-Dawson et al. (2002) for more details. Observations made between 2002 and 2009 are recorded in various papers by the authors or are new observations recorded for the first time in the present paper.

Locality	Altitude	Date	UTM Coordinates	C/O	Adults	M	F
Encumeada	1000	03-07-1932	28SCB1125	O	2		
Rabaçal	1050	17-07/ 4-08-1935	28SCB0026	C	2		
Ribeiro Frio	780	01-09-1954	28SCB2323	C	1	0	1
Ribeiro Frio	780	02-08-1964	28SCB2323	C	1	1	0
Poiso	1000	04-09-1973	28SCB2320	C	1		
Santana	420	13-09-1973	?	C	1		
Encumeada	1000	13-09-1973	28SCB1125	C	25		
Ribeiro Frio	880	07-08-1974	28SCB2323	C	2	2	0
Fajã da Nogueira	600	23-08-1974	?	C	1		
3 km west Poiso	1400	27-05-1905	28SCB2120	C	4		
Fajã da Nogueira	600	6/9-05-1975	?	C	1		
Monte	750	24-08-1975	28SCB2216	C	1		
Pico Alto	1000	24-08-1975	28SCB2118	C	4		
Fajã da Nogueira	1000	26-08-1975	28SCB1125	C	2		
Ribeiro Frio	800	29-08-1975	28SCB2323	C	1		
Encumeada	1000	30-08-1975	28SCB1125	C	1		
Monte	450-650	1975/1976	28SCB2116	?			
Encumeada	1007	1975/1976	28SCB1125	?			
Curral das Freiras	600-700	1975/1976	28SCB1621	?			
Paul da Serra	1450	1975/1976	28SCB0426?	?			
Terreiro da Luta	868	1975/1976	28SCB2217	?			
Ribeiro Frio	800-900	1975/1976	28SCB2323	?			
Pico do Arieiro	1800	1975/1976	28SCB1923	?			
Quinta Grande	600	06-06-1976	28SCB1115	C	1		
Pico das Pedras	900	12-08-1976	28SCB2227	C	3	0	3
Encumeada	1000	07-05-1977	28SCB1125	C	6	4	2
Encumeada	1000	07-05-1977	28SCB1125	C	3		
Ribeiro Frio	750	09-05-1977	28SCB2323	C	2		
Queimadas	880	03-06-1980	28SCB2128	C	1	1	0
Ribeiro Frio	850-900	04-09-1980	28SCB2323	C	1	1	0
Ribeira da Metade	500	??-04-1981	28SCB2324	O	3	0	3
Ribeiro Frio	850-900	??-07-1981	28SCB2323	O	8		
Fajã da Nogueira	500-600	??-08-1981	?	O	2		
Queimadas/C. Verde	880-950	????	?	C	1		
Queimadas/C. Verde	880-950	12-08-1985	?	O	2	2	0

Continuation.

Locality	Altitude	Date	UTM Coordinates	C/O	Adults	M	F
Ribeiro Bonito	500-600	15-08-1985	28SCB1931	O	2		
Balcões	899	21-08-1985	28SCB2323	O	2	2	0
Encumeada	1000	14-06-1993	28SCB1125	C	1		
Levada das 25 Fontes	965	01-06-1996	28SCB0126	O	1		
Chão da Ribeira	600	18-07-1996	28SCB0230	O	4	4	0
Levada do Folhadal	1010	03-05-1997	28SCB0225	O	1	1	
Pináculo	1015	03-05-1997	28SCB0825	O	3	1	2
Estrada Porto da Cruz/ Portela	610	23-09-1997	28SCB2924	O	1	0	1
Chão da Ribeira	450	24-07-1998	28SCB0230	C	1		
Encumeada	600	28-07-1998	28SCB1026	C	1		
Chão da Ribeira	500-600	03&04-1998	28SCB0230	O	1		
Chão da Ribeira	500-600	24-07-1998	28SCB0230	O	1	0	1
P. Ecológ. do Funchal	500-1400	30-07-1998	28SCB2120	O	1	1	0
Ribeiro Frio	850-900	??-07-1998	28SCB2323	O	4		
Encumeada	850-1007	??-07-1998	28SCB1125	O	4		
Ribeiro Frio/Poiso	900-1350	??-07-1998	CB2321+CB2322	O	1		
Recinto da Feira Agro- Pecuária	666	15-07-1999	28SBB9436	O	1	1	0
Estrada S. Vicente/ Encumeada	639	15-07-1999	28SCB1026	O	1	1	0
Vereda Queimadas/ Caldeirão Verde	880-950	05-08-1999	?	O	5	5	0
Chão da Ribeira	500-600	28-02/6-03- 2000	28SCB0230	O	4		
Estrada S. Vicente/ Seixal	100	23-03-2000	28SCB0332	O	1	1	0
Chão dos Louros	795	15-06-2000	28SCB1126	O	1	1	0
Chão da Ribeira	619	28-06-2000	28SCB0229	C	4		
Above Montado do Sabugal	955	10-08-2000	28SCB2124	O	2	2	0
Fajã da Nogueira (near the Central)	610	10-08-2000	28SCB2124	O	1	0	1
Estrada Encumeada/ Rosário	590	24-08-2000	28SCB1026	O	2	1	1
Estrada Encumeada/ Rosário	650	14-09-2000	28SCB1026	O	1	1	0
Estrada Encumeada/ Rosário	424	14-09-2000	28SCB1026	O	1	1	0
Casa do Barreiro, PEF	970	08-03-2001	28SCB2118	O	1	1	0
Ribeiro Frio	850-900	08-03-2001	28SCB2323	O	1	0	0

Continuation.

Locality	Altitude	Date	UTM Coordinates	C/O	Adults	M	F
P. Ecológ. do Funchal	1200-1600	09-03-2001	?	O	2	2	0
Estrada Encumeada/ Rosário	424	14-09-2000	28SCB1026	O	1	1	0
Casa do Barreiro, PEF	970	08-03-2001	28SCB2118	O	1	1	0
Ribeiro Frio	850-900	08-03-2001	28SCB2323	O	1	0	0
P. Ecológ. do Funchal	1200-1600	09-03-2001	?	O	2	2	0
Encumeada	1000	7/10-03-2001	28SCB1125	O	4		
Posto Florestal, Lamaceiros, Portela	840	7/10-03-2001	28SCB2724	O	4		
Achada do Teixeira to Queimadas	1330	12-08-2001	28SCB2027	O	2	2	0
Pico das Pedras (Park Entrance)	887	12-08-2001	28SCB2227	O	1	1	0
Encumeada	800	27-09-2001	28SCB1115	O	1	1	0
Encumeada	800	8/12-10-2001	28SCB1125	O	12	11	1
Chão da Ribeira	500-600	22-04-2002	28SCB0229	O	16	8	8
Fajã da Nogueira (before the Power station)	625	14-05-2002	28SCB2123	O	2	1	1
Fajã da Nogueira (before the Power station)	625	14-05-2002	28SCB2123	O	1	1	0
Montado do Sabugal	840	14-05-2002	28SCB2024	O	1	1	0
Risco Fall, Rabaçal	1200	09-07-2002	28SCB0126	O	1	1	0
Ribeiro Frio	850-900	14-07-2002	28SCB2323	O	1	0	1
Encumeada	1000	10/17-04-2003	28SCB1125	O	1	1	0
Posto Florestal, Lamaceiros, Portela	840	10/17-04-2003	28SCB2724	O	1	1	0
Chão da Ribeira	500-600	10/17-04-2003	28SCB0229	O	1	1	0
Sao Vincente	50	10/17-04-2003	CB0632+CB0731	O	2	1	1
Lombo do Urzal, Boaventura	370	05-02-2004	28SCB1529	O	1	1	0
Levada da Central da Serra de Água	598	19-02-2004	28SCB1124	O	2	1	1
Levada do Bom Sucesso	200	18-03-2004	28SCB2215	O	1	1	0
Boca da Corrida	1193	26-07-2004	28SCB1420	O	1	1	0
Terra Grande, Serra de Água	440	25-11-2004	28SCB1122	O	1	1	0
Poiso/Pico do Arieiro	1590	04-08-2006	28SCB2021	O	1	1	0
Boca da Corrida	1235	07-08-2006	28SCB1420	O	1	1	0
Ribeiro Frio	899	23-04-2009	28SCB2323	O	2	1	1

Leraut, P. 2009. Moths of Europe, vol. 2, Geometrid moths. – N.A.P. Editions, Verrières le Buisson, France, 808 pp., 158 colour plates, numerous line drawings and distribution maps. English text. ISBN 978-2-913699-09-4. Price 85.00 € (See www.napeditions.com).

French lepidopterist Patrice Leraut recently published a second volume in the “Moths of Europe” series, three years after the publication of volume 1 on the Saturniidae, Lasiocampidae, Sphingidae, Arctiidae, etc. This pocket-size field guide on the European Geometridae, as the book is described on its back cover, will be welcomed as it covers the whole European fauna. Many good, regional, and comprehensive guides and monographs are available, but a synthesis on a European scale has not been published since the works of Culot (1917–1919, 1919–1920) and Prout *in* Seitz (1912–1916, 1934–39), both of which are outdated and Seitz has been out of print for many years.

The book opens with a general introduction to the Lepidoptera, followed by a classification of the Geometridae based on wing venation characters. There is a description of the European habitats of the Geometridae. Short chapters are also included on collecting, polymorphism, specimen preparation, identification, nomenclature, and conservation. The typical treatment of a species comprises a short description of the imago and differences between male and female, variation, similar species, biology, flight-time, distribution, status, comments, and a distribution map. The majority of the species covered are illustrated in 158 high quality colour plates, and if necessary, supplemented with black-and-white line drawings of diagnostic features of the genitalia and other characters.

This field guide is generally very helpful as an identification guide. The coverage in a field guide does not need to be comprehensive, a strategy the author has apparently chosen. Not all European species are illustrated in the plates, and in unillustrated species the reader is often, but not always, given an indication of the most similar taxa. Numerous non-European species are illustrated in the plates including some of which are highly unlikely to be found in Europe. I find the inclusion of these species somewhat irrelevant, but perhaps they are justified from a curiosity point of view? Many lepidopterists who are mainly interested in species identifications are likely to find this ‘colour atlas type of field guide’ with basic biological information about the species useful. I would have liked to see more specimens illustrated to show the variation within a species and the specimens would have been better shown in plates with a consistent magnification relative to each other. Locality details of the illustrated specimens would have been appreciated, giving better understanding of the correlation between the external appearance and the geographical area.

The book cannot only be treated as a field guide as it also proposes numerous taxonomic changes, but this latter aspect is dealt with in a debatable manner. My major problem is the apparent lack of scientific approach: In many cases the author does not provide information on the material upon which the conclusions are drawn. This means that the analyses are not verifiable. The results and conclusions may be correct, and I agree with some of them, but the lack of evidence makes them impossible to evaluate. If the taxonomic and nomenclatural decisions were removed from the book and submitted to a peer-reviewed journal, I find it hard to believe that such a journal would have published them in the way they are presented here.

I will now give some examples to support these observations.

- On page 9 Leraut lists the four new genera, seven species, and 17 subspecies described in the book. However, the wealth of other taxonomic and nomenclatural changes that are distributed throughout the book – new synonymies, new combinations, and new status revisions – are not listed. I was left to wonder about the rationale behind this decision.

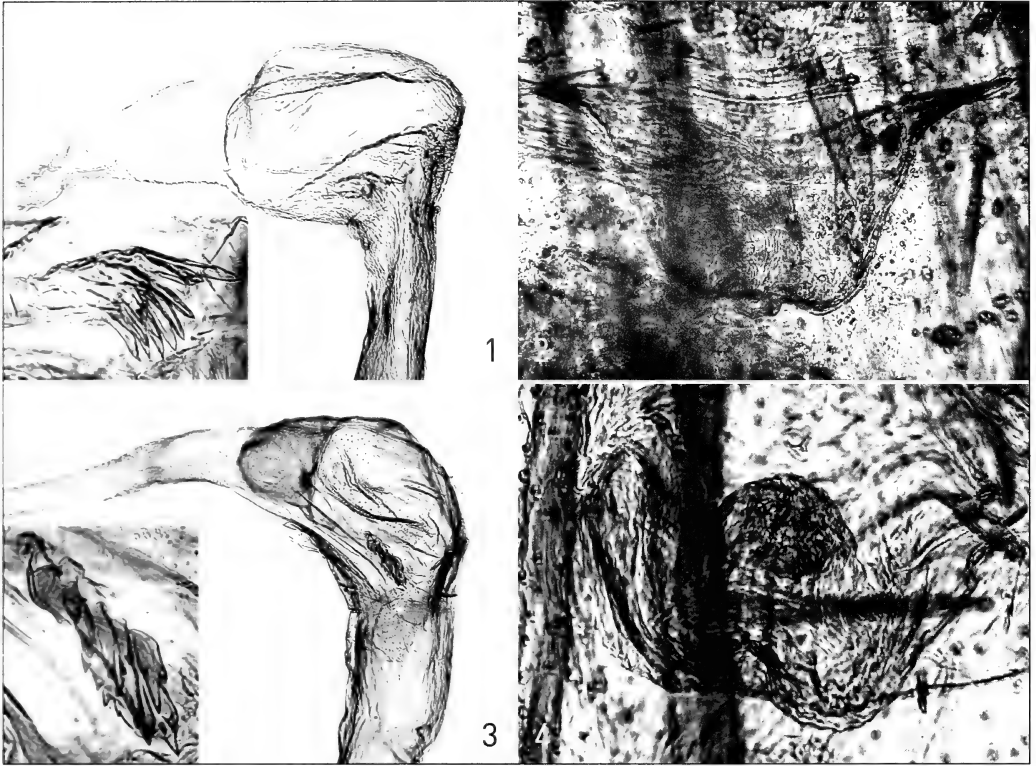
- As mentioned earlier, some of the taxonomic conclusions of Leraut cannot be evaluated on a scientific basis because there is no indication on the (type) material on which the conclusions were drawn. As examples in this category there is the synonymisation of *Amorhognia* Zeller,

1849 (Note: This should read *Amorphogynia* Warren, 1894. Leraut has apparently used by mistake the author and year of description of *necessaria* Zeller, 1849, which is the type species of *Amorphogynia*) with *Lycia* Hübner, 1825, (already proposed by Viidalepp in 1996!) and the synonymisation of *Nyssiodes* Oberthür, 1880, with *Lycia* Hübner, 1825. Were the type specimens of the relevant type species examined? In which collections? What characters were found to support these views? *Narraga catalaunica* Herbulot, 1943 is stated on p. 72 to be 'bona sp., stat. rev.'. The authenticity of this claim is difficult to judge, even if correct, when Leraut writes only 'Examination of genitalia of *catalaunica* compared with those of *nelvae* from Morocco revealed that these two taxa are indeed distinct.' Only male genitalia are illustrated, and Leraut does not tell us whether the type material was examined. Under *Chiasmia aestimaria* (Hübner) (p. 71) he writes: 'Markings can be widely smoky in hue, as in f. *sareptanaria* (Staudinger, 1871) (often erroneously treated as valid species).' Who has made the 'error'? Why is it incorrect to treat this name as valid for a separate species or subspecies? *Kuchleria garciapitai* Exposito, 2005, 'is in my view only a synonym of *K. menadiara* [(Thierry-Mieg)]' (p. 55); under *Idaea sericeata* (Hübner, 1813) Leraut writes (p. 739): '*Idaea subrecta* (Prout, 1935) from High Atlas, bona sp., stat. rev., with transverse lines sinuous and closer together.', no genitalia are illustrated and the differences described are not self-evident from the specimens illustrated; under *Hylaea fasciaria* he writes (p. 212): 'The North African population has the moths smaller and dull green (red. f. unknown): ssp. *compararia* Staudinger, 1894, stat. rev. (previously treated as separate species).'; and under *Scopula incanata* one can read (p. 776): 'See also *Scopula punctabilineatella* (Lucas, 1937), bona sp., stat. rev., from Morocco.', but there is not even a separate text entry for *S. punctabilineatella* and further, there is no indication who has made the claim that this taxon is not valid at the species level and its relationship to *S. guancharia* (Alphéraky, 1889), which is not featured in the book is not mentioned. The list goes on, and examples of this kind are too numerous to mention.

- The descriptions of new taxa are based on morphological evidence, but some of the diagnostic features are so minute and difficult to see in the line drawings that they cannot really be substantiated without further morphological and/or molecular analysis. For example *Harrisonodes* Leraut, 2009 is said to differ from *Lycia* Hübner, 1825 by minute differences in the male and female genitalia, but those are not illustrated. I illustrated these structures in Figs 1–4 and I question their value as a genus level synapomorphy. Leraut describes two new subspecies for *Parietaria serotinaria* (Denis & Schiffermüller), bringing the total to five, on the basis of small differences in the curvature of the phallus and wing pattern. He illustrates two male genitalia of *Parietaria serotinaria vesubiaria* Leraut (Figures 127a, 128c) that have different structures in the apex of the juxta, which appear more diagnostic than the mentioned phallus characters. Perhaps a mistake has occurred in the labelling of the plate? Many of the new taxa are extralimital, they are not found in Europe (e.g. *Isturgia tozeurensis* Leraut, *Ifrania* Leraut and *Menophra tameliltensis* Leraut). This approach cannot be justified because the book, after all, is a field guide for the **European** Geometridae.

- Numerous new forms are formally described; for example, six new forms for *Erannis defoliaria* (Clerck) alone! Here it suffices to say that according to the International Code of Zoological Nomenclature (1999), an infrasubspecific name is not available [Art. 45.5].

- Distribution maps are in many instances obscure, misleading or even wrong. It seems to me that for the species treated in the Geometrid Moths of Europe series (Hausmann 2001; Mironov 2003; Hausmann 2004) most of the maps are simply reproduced here as they appear in the original works. The distribution maps of the remaining taxa are superficial. According to the author: '...when the information [on the distribution] at hand is more imprecise, the distribution is given by country'. I agree that knowledge may be imprecise in certain areas of Europe, but I would argue that species distributions in many countries, like Finland, which I am familiar with, are very well known and accurate. Detailed information has been available in publications



Figs 1–4. Everted male vesica with sclerotisations shown in insert and female antrum of *Lycia alpina* (Sulzer, 1776) (Figs 1–2) and *Lycia hirtaria* (Clerck, 1759) (Figs 3–4). 1. Slide PS1399, 2. Slide PS1400, 3. Slide PS1322, 4. Slide PS1323. When Leraut described new genus *Harrisonodes*, *Ph[alae]na* *B[ombyx]* *alpina* being its type species, it was diagnosed to differ from *Lycia* (p. 110): ‘In [*Harrisonodes*] male, aedeagus features sclerotised ‘ridges’ in vesica, no sclerotized ‘arms’, and: ‘In [*Harrisonodes*] female, antrum is preceded by a sclerotized circular structure, which nevertheless has no sclerotized median patch.’ Leraut did not illustrate vesicas or the sclerotized circular structure of the antrum [*lamella antevaginalis?*]. Figures 1 and 2 illustrate that both mentioned species have similar sclerotized, spine-shaped structures in the vesica, and while the structure of antrum is diagnostic between *hirtaria* and *alpina* (Figs 3–4), such sclerotization is not found in other European *Lycia* species, thus questioning the value of mentioned male and female characters as genus level synapomorphies.

for decades (for example Mikkola et al. 1985; Mikkola et al. 1989; Huldén et al. 2000). The constantly updated distributions by biogeographical regions are even available on the internet (Kullberg et al. 2002). Thus the maps displaying the arctic-alpine *Pygmaena fusca* (*Macaria*!, see Kullberg et al. 2002; Scoble & Krüger 2002) in the hemiboreal zone of South Finland and in Skåne, Sweden, or *Narraga fasciolaria* (Hufnagel), a migrant species that has been recorded a few times in the southern coast of Finland, as occurring North of the Arctic circle, are very misleading. Several obvious distribution errors are also included; just to mention a few, the Mediterranean *Abraxas pantaria* (Linnaeus) is NOT recorded in Finland, whereas *Hypoxystis pluviaria* (Fabricius) IS resident in Finland, *Cataclysmes rigua* (Hübner) and *Apocheima hispidaria* (Denis & Schiffermüller) are NOT recorded in Finland (the map of the latter has been carefully drawn to exclude the northern part of the country thus indicating exact knowledge on its distribution), and the arctic, Eurosiberian *Timandra rectistrigaria* (Eversmann) certainly does NOT occur in Finland, Norway or Sweden, with a disjunct distribution in southern Sweden as is carefully drawn, etc. The errors are so numerous for one country alone that it must be

assumed that similar errors are common regarding other countries' distributions also, perhaps indicating that no proof-reading of the maps has been done.

- Several recent advances on the higher classification of the Geometridae are largely ignored and no arguments are presented for why this is so. These include, for example, the proposed new generic concepts of the Macariini (Scoble & Krüger 2002), the Scopulini (Sihvonen 2005), the demonstrated Sterrhinae association of the Lythriini (Öunap et al. 2008), the Gnophini association of *Cleorodes* (Viidalepp et al. 2007), and the *Timandra* association of *Timandra rectistrigaria* (Eversmann) (Sihvonen & Kaila 2004).
- Incorrect and inconsistent spellings occur, eg. *Leucobrephos middendorffii* for *L. middendorffii*, *Phaiogramma etruscaria* for *P. etruscaria*.
- The reference list is very short for a book of this magnitude. Original research articles have not been cited, apart from one self-citation of an article describing a new form.
- Many European taxa do not have a separate entry in the book, neither are they mentioned in the index. Some of these are briefly mentioned in the text, but in seemingly random places, e.g. *Limeria macraria* Staudinger, 1982, under *Brachyglossina hispanaria* (Püngeler, 1913), and *Eupithecia sardoa* Dietze, 1910, under *E. pusillata* (Denis & Schiffermüller, 1775). Further, some species would have benefited from a separate entry as they are newly discovered in Europe, for example *Lithostege fissurata* Mabilbe (Hausmann & Seguna 2005).
- Cross-referencing of taxa is sometimes confusing. For example, under *Macaria artesiaria* (Denis & Schiffermüller) Leraut writes: 'Several *Isturgia* and *Perigune* [are similar]' but no reference is given to *Macaria ichnusae* Govi & Fiumi. Under *M. ichnusae* (not illustrated) he writes that '*Macaria artesiaria* is [similar]'
- Leraut questions the validity of *Timandra griseata* Petersen (not indexed in the book) and *Timandra comae* Schmidt as separate species (p. 786). I would have appreciated an analytical approach to this much discussed issue, where the author could have presented concrete, material-based counter arguments, as have the proponents of this hypothesis (e.g. Kaila & Albrecht 1994, Öunap et al. 2005).
- This appears to be the first monograph that does not illustrate the genitalia for the species-rich Sterrhinae genera *Scopula* Schrank and particularly *Idaea* Treitschke. The identification of these moths is sometimes impossible without such additional information. This omission is puzzling because the genitalia of numerous taxa of other subfamilies are widely illustrated.

This leads my review to the topic of publishers' responsibility. What roles have the publisher and the publishing editor played in producing this book? Has the publishing editor accepted the manuscript for publication without any critical comments and without familiarising himself with its content? The scientific level of this book is likely to reflect badly on the publisher, N.A.P. Editions, France.

The examples above show only the various categories of questionable conclusions and errors, and they are repeated throughout the book. Given my experience in the administration of research funding in Europe, this publication will not help to dispel the persistent image that taxonomy is an old-fashioned, non-scientific discipline. To conclude, the taxonomic changes (new synonymies, new combinations, status revisions) proposed by Leraut will need to be carefully reconsidered by subsequent authors, particularly in cases where no data on examined material are provided. Actually some preliminary work has already been done (Hausmann 2009). The evidence supporting the descriptions of new taxa is rather slim in some instances, and those will also need to be evaluated carefully. I hope that the author and the publisher will learn from these critical remarks and consider them when preparing the next volume of the *Moths of Europe*, announced for 2010 on the internet.

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No. 1: p. 1–84: 15. 05. 2009; No. 2: p. 85–162: 16. 11. 2009

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- Book reviews. **32**(1): 11–12, 38, 83, 84; **32**(2): 128, 158–162.

Index of taxonomica changes

- amaniensis* Maes, 1997 (*Ethiobotys*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 72
- ankolae* Maes, 1997 (*Ethiobotys*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 72
- baltica* A. Šulcs & I. Šulcs, 1983 (subsp. of *Aristotelia coeruleopictella*), **stat. n.**; now *Aristotelia baltica* – Karsholt, O. & Savenkov, N. 2009(16.xi.): **32**(2): 94.
- bryalis* Hampson, 1918 (*Lamprosema*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 72

- camerounensis* Maes, 1997 (*Ethiobotys*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 72
- Crypsitya* Meyrick, 1894 (Crambidae), **stat. rev.** No synonym of *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 72
- delicatalis* South [in Leech], 1901 (*Pyrausta*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 70
- elutalis* Kenrick, 1917 (*Pyrausta*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 72
- epipaschialis* Hampson, 1912 (*Nacoleia*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 72
- Ethiobotys* Maes, 1997 (Crambidae), **syn. n.** of *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 72
- falsaria* Alphéraki, 1892 (*Atomorpha*), **LT** – Trofimova, T. A. 2009. (15.v.): **32**(1): 57
- flavicolor* Munroe & Mutuura, 1968 (*Pronomis*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 71
- hasanensis* (Kirpichnikova, 1998) (*Opsibotys*) – **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 66
- lippensi* Maes, 1997 (*Ethiobotys*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 72
- luteorubralis* (Caradja, 1916) (*Pyrausta*) – **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 66
- notabilis* **sp. n.** (*Agdistis*) – Gielis & Karsholt 2009(16.xi.): **32**(2): 140.
- obtusalis* (Yamanaka, 1987) (*Perinephela*) – **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 66
- Palaeopsyche* **gen. n.** (Psychidae) – Sobczyk, T. & Kobbert, M. J. 2009 (15.v.): **32**(1): 17
- pancaliella* Staudinger, 1871 (*Gelechia*), **LT**; now: *Aristotelia* – Karsholt, O. & Savenkov, N. 2009 (16.xi.): **32**(2): 95.
- perlinii* Turati, 1914 (*Psodos*), **LT**; **stat. n.**; now: *Psodos bentelii perlinii* – Erlacher, S. & Junghans, C. 2009 (15.v.): **32**(1): 48
- profusalis* Warren, 1896 (*Opsibotys*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 71
- Pronomis* Munroe & Mutuura, 1968 (Crambidae), **syn. n.** of *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 70
- punctistrigaria* Christoph, 1893 (*Atomorpha*), **LT** – Trofimova, T. A. 2009. (15.v.): **32**(1): 59
- ruwenzoriensis* Maes, 1997 (*Ethiobotys*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 72
- secundum* **sp. n.** (*Palaeopsyche*) – Sobczyk, T. & Kobbert, M. J. 2009 (15.v.): **32**(1): 17
- shafferi* (Speidel & Hanigk, 1990) (*Algedonia*) – **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 66
- subfumalis* Munroe & Mutuura, 1971 (*Tenerobotys*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 71
- subfumalis continentalis* Munroe & Mutuura, 1971 (*Tenerobotys*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 71
- teneralis* Caradja, 1939 (*Hapalia*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 71
- teneralis tsinlingalis* Munroe & Mutuura, 1971 (*Tenerobotys*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 71
- Tenerobotys* Munroe & Mutuura, 1971 (Crambidae), **syn. n.** of *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 71
- transversum* **sp. n.** (*Palaeopsyche*) – Sobczyk, T. & Kobbert, M. J. 2009 (15.v.): **32**(1): 20
- Udonomeiga* Mutuura, 1954 (Crambidae), **syn. n.** of *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 71
- vicinalis* South [in Leech], 1901 (*Pyrausta*), **comb. n.**; now: *Anania* – Tränkner, A.; Li, H. & Nuss, M. 2009. (15.v.): **32**(1): 72

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