



The *Elachista dispunctella* (Duponchel) complex (Lepidoptera, Elachistidae) revisited, with exceptional level of synonymy

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Abstract

The *E. dispunctella* and *E. triseriatella* complexes *sensu* Traugott-Olsen are merged. The newly delineated *E. dispunctella* complex is re-defined and diagnosed. Until now, a total of 64 species has been assigned to this species complex. The taxonomy of the constituent species has been obscure owing to their identities based on unvalidated traits, in particular subtle differences on branching points of forewing veins. The taxonomy of the *E. dispunctella* complex is revised on the basis of new material, new and reevaluated information obtained from morphology and biology, as well as from the standard barcode region of COI, with at least partial barcode data derived from 194 recently collected specimens and 33 holotypes. As a result, the number of species considered valid is markedly reduced, with only 19 species now recognized. The following 43 new synonymies are established: *Elachista dispunctella* (Duponchel, 1843) = *E. cahorsensis* Traugott-Olsen,

1992, **syn. nov.**, *E. imbi* Traugott-Olsen, 1992, **syn. nov.**, *E. karsholti* Traugott-Olsen, 1992, **syn. nov.**, *E. mannella* Traugott-Olsen, 1992, **syn. nov.**, *E. multipunctella* Traugott-Olsen, 1992, **syn. nov.**, *E. pocopunctella* Traugott-Olsen, 1992, **syn. nov.**, *E. povolnyi* Traugott-Olsen, 1992, **syn. nov.**, *E. punctella* Traugott-Olsen, 1992, **syn. nov.**, *E. hallini* Traugott-Olsen, 1992, **syn. nov.**, *E. intrigella* Traugott-Olsen, 1992, **syn. nov.**, *E. skulei* Traugott-Olsen, 1992 and *E. niels-pederi* Traugott-Olsen, 1992, **syn. nov.**; *E. tribertiella* Traugott-Olsen, 1985 = *E. toveella* Traugott-Olsen, 1985, **syn. nov.**, *E. baldizonella* Traugott-Olsen, 1985, **syn. nov.**, *E. veletaella* Traugott-Olsen, 1992, **syn. nov.**, *E. bazaella* Traugott-Olsen, 1992, **syn. nov.** and *E. louiseae* Traugott-Olsen, 1992, **syn. nov.**; *E. parvula* Parenti, 1978 = *E. minusculella* Traugott-Olsen, 1992, **syn. nov.** and *E. blancella* Traugott-Olsen, 1992, **syn. nov.**; *E. maboulella* Chrétien, 1915 = *E. catalunella* Traugott-Olsen, 1992, **syn. nov.**, *E. gerdmaritella* Traugott-Olsen, 1992, **syn. nov.** and *E. gielisi* Traugott-Olsen, 1992, **syn. nov.**; *E. glaseri* Traugott-Olsen, 1992 = *E. rikkeae* Traugott-Olsen, 1992, **syn. nov.**, *E. totanaensis* Traugott-Olsen, 1992, **syn. nov.**, *E. olemartini* Traugott-Olsen, 1992, **syn. nov.**, *E. bengtssoni* Traugott-Olsen, 1992, **syn. nov.**, *E. senecai* Traugott-Olsen, 1992, **syn. nov.**, *E. wadielhiraensis* Traugott-Olsen, 1992, **syn. nov.**, *E. rissaniensis* Traugott-Olsen, 1992, **syn. nov.** and *E. michelseni* Traugott-Olsen, 1992, **syn. nov.**; *E. hispanica* Traugott-Olsen, 1992 = *E. vivesi* Traugott-Olsen, 1992, **syn. nov.**, *E. cuencaensis* Traugott-Olsen, 1992, **syn. nov.**, *E. vanderwolfi* Traugott-Olsen, 1992, **syn. nov.**, *E. amparoae* Traugott-Olsen, 1992, **syn. nov.**, *E. varensis* Traugott-Olsen, 1992, **syn. nov.**, *E. luqueti* Traugott-Olsen, 1992, **syn. nov.**, *E. occidentella* Traugott-Olsen, 1992, **syn. nov.** and *E. clintoni* Traugott-Olsen, 1992, **syn. nov.**; *E. berndtiella* Traugott-Olsen, 1985 = *E. casascoensis* Traugott-Olsen, 1992, **syn. nov.**; *E. triseriatella* Stainton, 1854 = *E. contisella* Chrétien, 1922, **syn. nov.**, *E. gregori* Traugott-Olsen, 1988, **syn. nov.**, and *E. lerauti* Traugott-Olsen, 1992, **syn. nov.**; *E. elsabella* Traugott-Olsen, 1988 = *E. svenssoni* Traugott-Olsen, 1988, **syn. nov.**; *E. galactitella* (Eversmann, 1844) = *E. madridensis* Traugott-Olsen, 1992, **syn. nov.** *E. deresyensis* Traugott-Olsen, 1988 is resurrected as a valid species, **stat. rev.** Evidence from DNA barcodes suggests that there may exist further species, but in the absence of distinct morphological differences, they are not formally described as new.

Key words: *Elachista*, *Aphelosetia*, *Elachista dispilella* group, morphology, integrative taxonomy, wing venation, species delimitation, species delineation, DNA barcodes

Introduction

Taxonomically, some species clusters within the Elachistinae (Lepidoptera: Gelechioidea: Elachistidae) are among the most troublesome groups of Lepidoptera. This is due to the paucity of external diagnostic characters and similarity of genitalia, the latter of which are generally considered of high diagnostic value in Lepidoptera taxonomy. These troubles are highlighted in the European *Elachista dispunctella* complex, introduced and defined by Traugott-Olsen (1992). The complex was considered to include 54 species, all occurring in Palearctic region (Kaila 1997). Centres of the species diversity are in Spain and Austria. Elsewhere in Europe the reported diversity is lower, and east of Turkey only one species has been recorded. With no explicit reasoning, this complex was treated separately from the *E. triseriatella* Stainton complex by Traugott-Olsen (1988). These species complexes are merged here due to the absence of any distinguishing features and are collectively called the *E. dispunctella* complex.

Traugott-Olsen (1985, 1992) realized that there are more species than recognized in the *E. dispunctella* group. Due to the external similarity and scarcity of obvious differences in the male genitalia in the constituent species, Traugott-Olsen (1988, 1992) considered the wing venation the most reliable feature for these features were used explicitly as the primary basis to divide taxa into different sections. Subsequently, other characters were searched for to distinguish species within the sections. This led to a situation where identical-looking specimens were placed in different sections and described as different species. Externally, the coloration of the underside of the wings and subtle differences in the male genitalia were used as additional features to differentiate species. The typological species concept followed by Traugott-Olsen did not include intraspecific variation, and led to the recognition and formal description of 27 morpho-species based on a single species.

Albrecht & Kaila (1997), using geometric morphometrics, refuted the taxonomic significance of the kind of variation in wing venation that Traugott-Olsen (1992) used in the establishment of his species sections. The details of wing venation, like inception points of single veins, were shown to be examples of intraspecific variation, often far exceeding that used as diagnostic in defining species sections by Traugott-Olsen (1992). Asymmetry between the right and left wings of the same individual often equalled that between individuals (Albrecht & Kaila 1997). Even though no species of the *Elachista dispunctella* complex was included in that study, one species of the closely related *E. dispilella* complex was included. Following Traugott-Olsen's (1992) guidelines, a population sample of

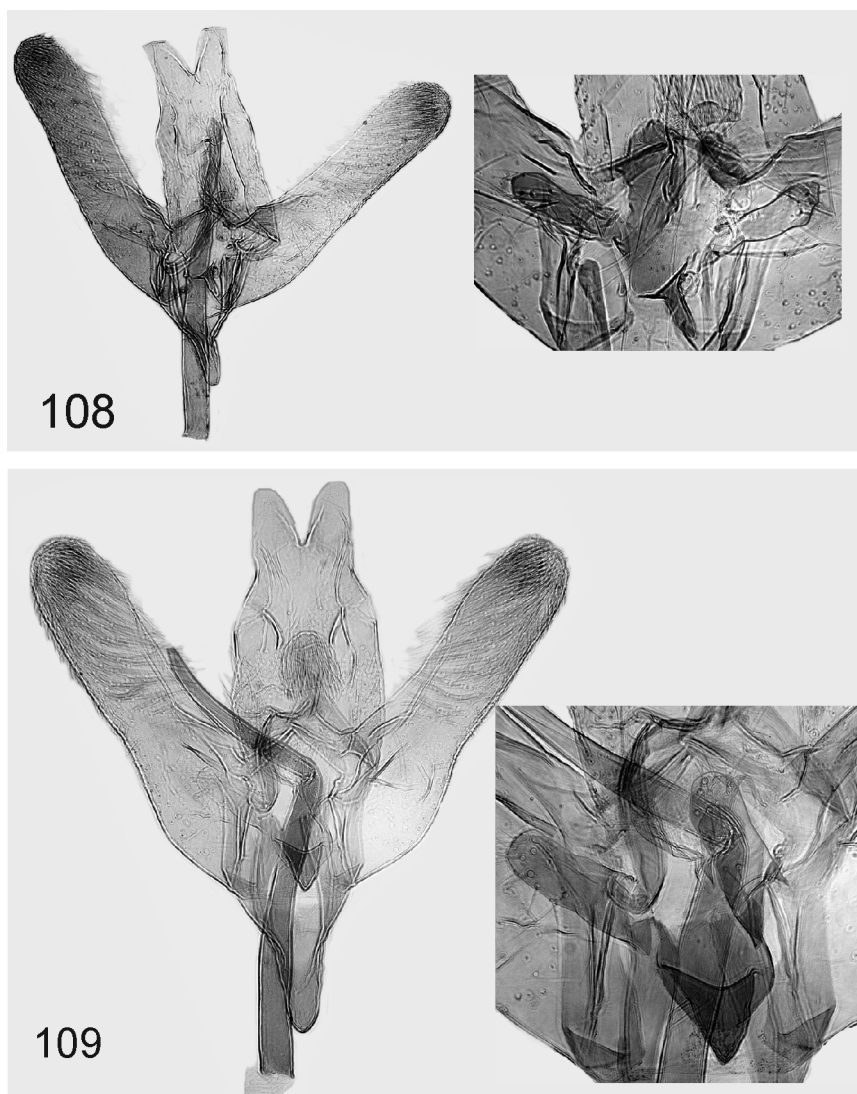
Nupponen leg., L. Kaila prep. 5358, 5359, DNA samples 11419–21 Lepid. Phyl., same locality, 15.VII.2010, 1 ♂, T. Nupponen leg., L. Kaila prep. 5357, DNA sample 15478 Lepid. Phyl. (Coll. Nupponen); Prov. Granada, Sierra Nevada, 700 m, 8.VI.1975, 1 ♂, M. & W. Glaser leg., L. Kaila prep. 5823 (SMNK); Granada, Sierra Nevada, 1900 m, 27.VII.2003, 1 ♂, T. Nupponen leg., DNA sample 11422 Lepid. Phyl., 2050 m, 20 km SE Granada, 28.VII.2003, 1 ♂, T. Nupponen leg., L. Kaila prep. 5361, DNA sample 11427 Lepid. Phyl. (Coll. Nupponen); Granada, Pico Veleta, N. side, 1600 m, 18.VI.1989, 1 ♂, B. Å. Bengtsson leg., Bengtsson prep. 3358 (Coll. Bengtsson); Prov. Huesca, 42°01'30"N, 0°31'52"E, Estenja, 700 m, 8.IX.2001, 1 ♂, B. Skule & C. Hviid leg., L. Kaila prep. 4293 (ZMUC); Prov. Teruel, 48°28'08"N, 1°37'57"W, Puerto de Orihuela, 1650 m, 23.VIII.2001, 1 ♂, B. Skule & C. Hviid leg., L. Kaila prep. 4698 (ZMUC); Prov. Zaragoza, 4 km N Tosos, 400 m, 28.IV.1997, 1 ♂, P. Skou leg., L. Kaila prep. 4696 (ZMUC).

Diagnosis. *E. berndtiella* is characterized by the large, elongate juxta lobes that are longer than uncus lobes, different from any other species in the *E. dispunctella* complex. The phallus is bent, acute-tipped, and stout. The female is unknown.

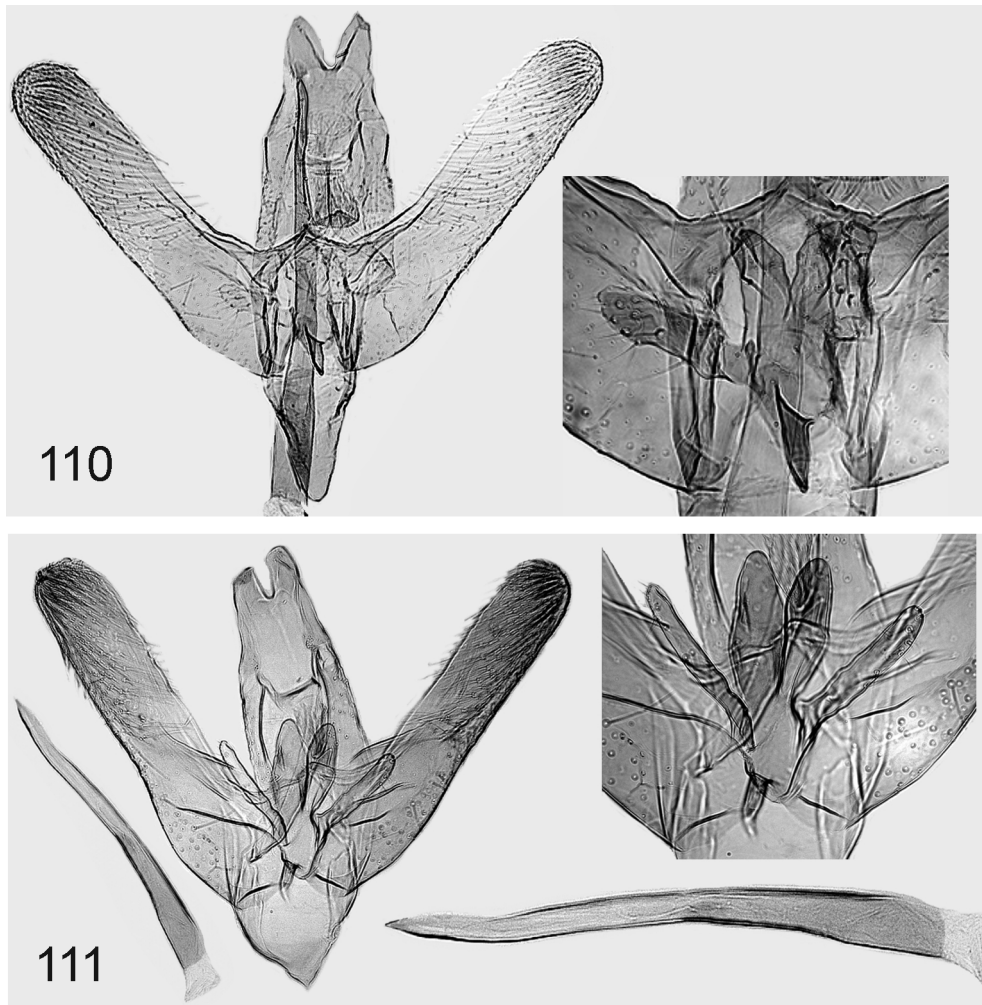
Biology. *E. berndtiella* inhabits xerothermic limestone habitats. The immature stages are unknown.

Distribution. France, Germany, Italy, Spain.

Remarks. *E. berndtiella* is referred to as OTU 7 in Mutanen *et al.* (2015).



FIGURES 108–109. Male genitalia of *Elachista* *E. hispanica*. 108. *E. varensis* Traugott-Olsen, holotype. 109. *E. occidentella* Traugott-Olsen, holotype.



FIGURES 110–111. Male genitalia of *Elachista* spp. 110. *E. hispanica* Traugott-Olsen, holotype of *E. clintoni* Traugott-Olsen. 111. *E. berndtiella* Traugott-Olsen, Spain (L. Kaila prep. 4691).

***Elachista triseriatella* Stainton, 1854**

Figs. 48–50, 114–116, 140

Elachista triseriatella Stainton, 1854: 261.

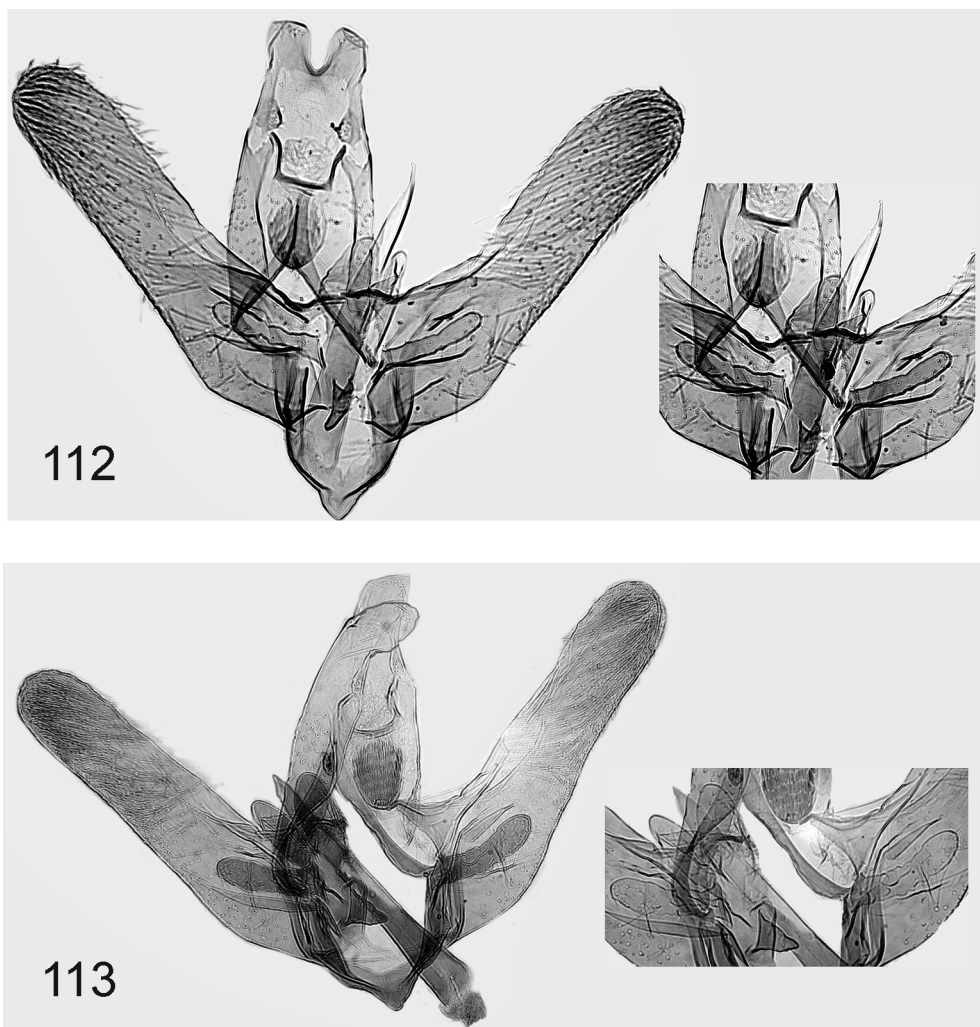
Elachista contisella Chrétien, 1922: 121. **Syn. nov.**

Elachista gregori Traugott-Olsen, 1988: 297. **Syn. nov.**

Elachista lerauti Traugott-Olsen, 1992: 252. **Syn. nov.**

Material studied. Type material. Holotype ♂ of *E. gregori*: labelled: Holotype [rounded with red margin]; Genital praeparat nr. B.24.11.86 sex: ♂ *E.* Traugott-Olsen; Hainburger Berge, Austria inter. 26.5.1962 W. Glaser. *Elachista gregorella* [sic] n. sp. det. *E.* Traugott-Olsen; gen. prep. B.24.11.86. *E.* Traugott-Olsen, Holotype, Coll. Glaser. LNK. (SMNK). **Other material. Denmark:** Kergårda, P17, W.J. 16.VI.1 ♂ P. Falck leg., DNA sample 22227 (Coll. P. Falck); HO, WJ 6.VI.1992 1 ♂ 1 ♀ P. Falck leg., L. Kaila prep. 3465, 5774, DNA samples 21437, 21438 Lepid. Phyl. (Coll. Kaitila). **Great Britain:** Devon, Petit Tor Point, Torquay, SX927663 VC3, 3.VII.1987, 1 ♂, J. Tabell prep. 4697, R. J. Heckford leg. (Coll. Tabell). **Latvia:** Tal., Slitere, Vaide, 21.6.2000, 1 ♂, N. Savenkov leg., J. Tabell prep. 4755 (Coll. Tabell). **Slovakia:** 1 km N. Muráň, 12.VI.1987, 1 ♂, B. Bengtsson leg., Bengtsson prep. 2699 (Coll. Bengtsson); Slov. kras-Zádiel, 27.V.2001, 1 ♂, Z. Tokár leg., L. Kaila prep. 5440, DNA sample 21349 (Coll. Tokár); 8, Hliník. 2.H.46, 1 ♂, J. Patocka leg., L. Kaila prep. 3067 (ZMUC). **Spain:** Granada, Sierra Nevada, 1.5 km S Puerto de la Ragua, 2000 m, 7.VI.2010, 1 ♂, 1 ♀, J. Tabell leg. & Coll., DNA sample 16252

Lepid. Phyl.; 8.VI.2010, 14 ♂, 4 ♀, (two pairs in copula), J. Tabell prep. 4639, 4685, L. Kaila 5743, 5744, DNA samples 16250–1 (Coll. Tabell, MZH); Granada, Sierra Nevada, 2900 m, 20 km SE Granada, 12.VII.2010, 1 ♂, T. Nupponen leg., L. Kaila prep. 5705, DNA sample 15483 (Coll. Nupponen).



FIGURES 112–113. Male genitalia of *Elachista berndtiella* Traugott-Olsen. 112. Holotype. 113. *E. casascoensis* Traugott-Olsen, holotype.

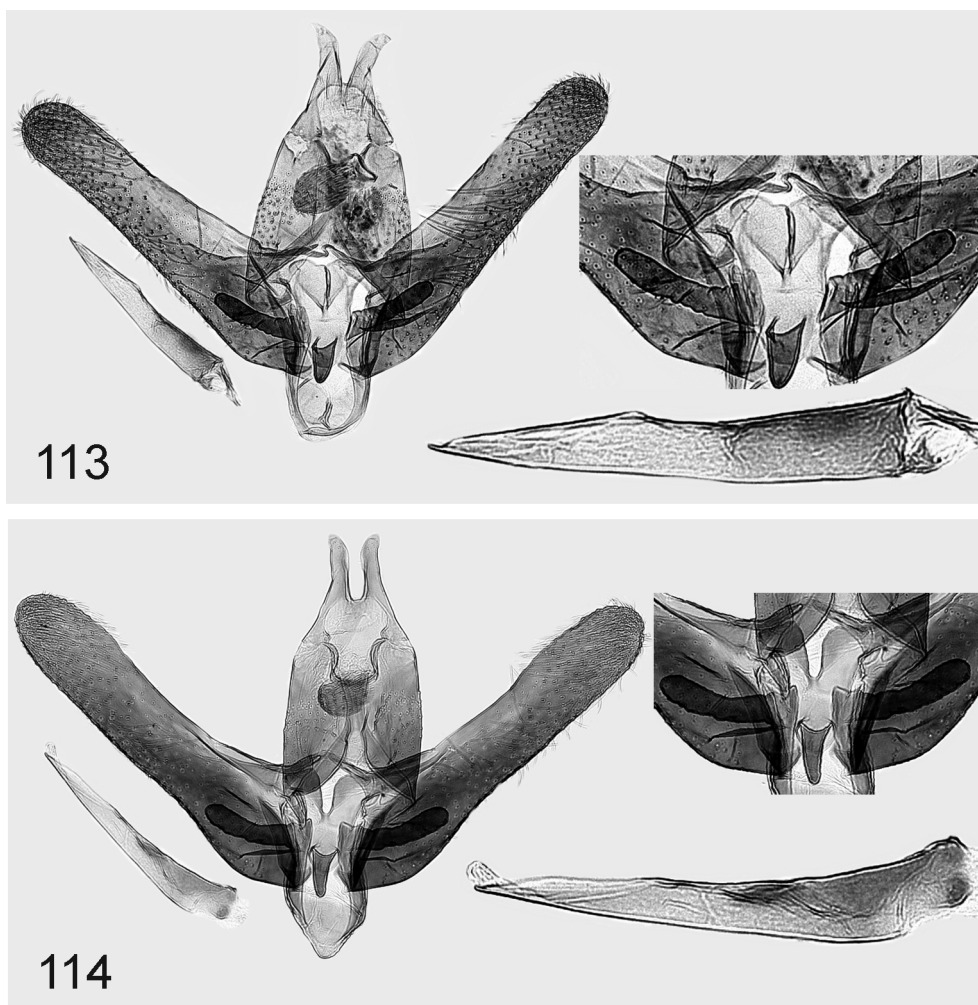
Diagnosis. *E. triseriatella* is a small species, usually with pale grey (sometimes white) forewing ground colour. The male genitalia are characterized by the narrow uncus lobes, and the distinctly sclerotized, parallel-sided and rather long digitate process. The female genitalia have a characteristic signum, consisting of two longitudinal, dentate rows. In the characterization of *E. triseriatella*, Traugott-Olsen (1988) depicts the signum of *E. gregori* as such, but that of *E. triseriatella* as a single dentate sclerotization. This seems to be a misinterpretation, as Bland (1996) illustrates the signum of a British *E. triseriatella* as consisting of two rows. *E. triseriatella* has a characteristic sclerotization laterad of ostium bursae. *E. oukaïmedenensis* has also such a sclerotization, but it is much broader than in *E. triseriatella*.

Biology. In Britain, *E. triseriatella* inhabits open grasslands, both coastal and inland (Heckford 2010). In Denmark it has been found in coastal sand dunes (P. Falck and O. Karsholt, personal communication). The larva may be a leaf-miner within the leaves of *Festuca ovina* L. (for a review, see Heckford 2010).

Distribution. Austria, Denmark, France, Germany (Biesenbaum 1995), Great Britain, Latvia, Slovakia, Spain.

Remarks. The holotype of *E. triseriatella* is depicted by Traugott-Olsen (1988), that of *E. contisella* by Parenti (1972), and that of *E. lerauti* by Traugott-Olsen (1992). These types, as well as the holotype of *E. gregori*, are identical to *E. triseriatella* and here considered conspecific. The artificial distinction of the *E. dispunctella* and *E. triseriatella* groups by Traugott-Olsen (1988, 1992) is flagshipped by this species, which appears to occur under

two names in both publications. The record from Germany (as *E. gregori* in Biesenbaum 1995) has not been checked, but is reliable on the basis of illustration of the genitalia of a German specimen (Biesenbaum 1995). *E. triseriatella* is referred to as OTU 5 in Mutanen *et al.* (2015).



FIGURES 114–115. Male genitalia of *Elachista triseriatella* Stainton. 114. England (J. Tabell prep. 4687). 115. Spain (J. Tabell prep. 4639).

***Elachista andorraensis* Traugott-Olsen, 1988**

Elachista andorraensis Traugott-Olsen, 1988: 308.

Material studied. No specimens examined.

Distribution. Andorra.

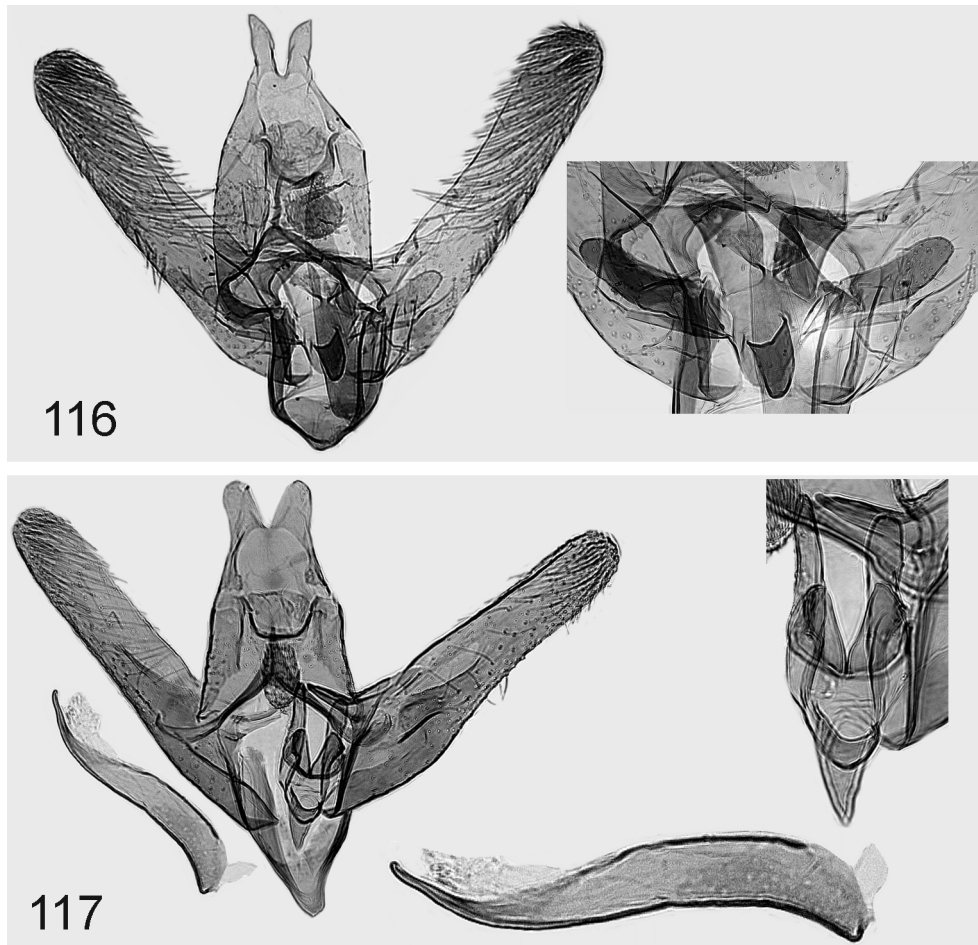
Remarks. The species was described on the basis of a single male with incomplete genitalia. It is close to, if not conspecific with, *E. triseriatella* based on those characters that remain (see Traugott-Olsen 1988). Its status can be established only with further material from the type locality (Andorra).

***Elachista elsabella* Traugott-Olsen, 1988**

Figs. 51–52, 117–119, 141–144

Elachista elsabella Traugott-Olsen, 1988: 302.

Elachista svenssoni Traugott-Olsen, 1988: 300. **Syn. nov.**

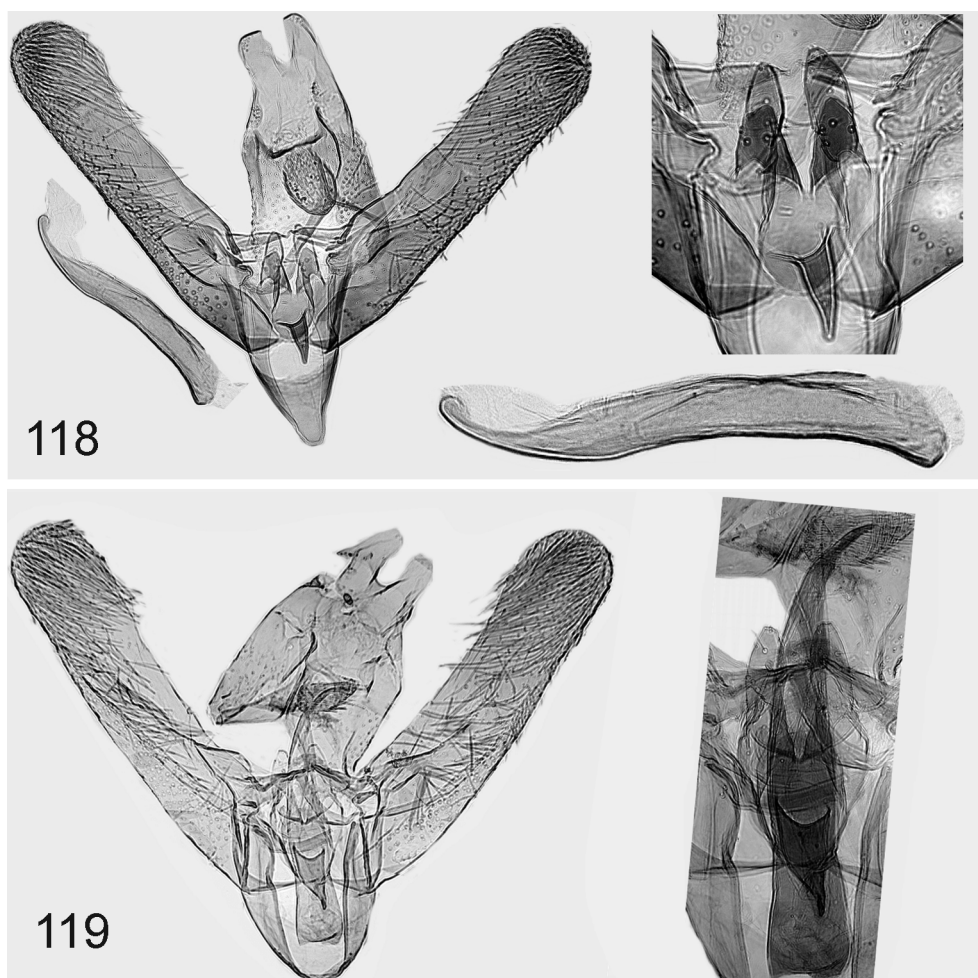


FIGURES 116–117. Male genitalia of *Elachista* spp. 116. *E. triseriatella* Stainton, holotype of *E. gregori* Traugott-Olsen. 117. *E. elsaeella* Traugott-Olsen, Sweden (L. Kaila prep. 3463).

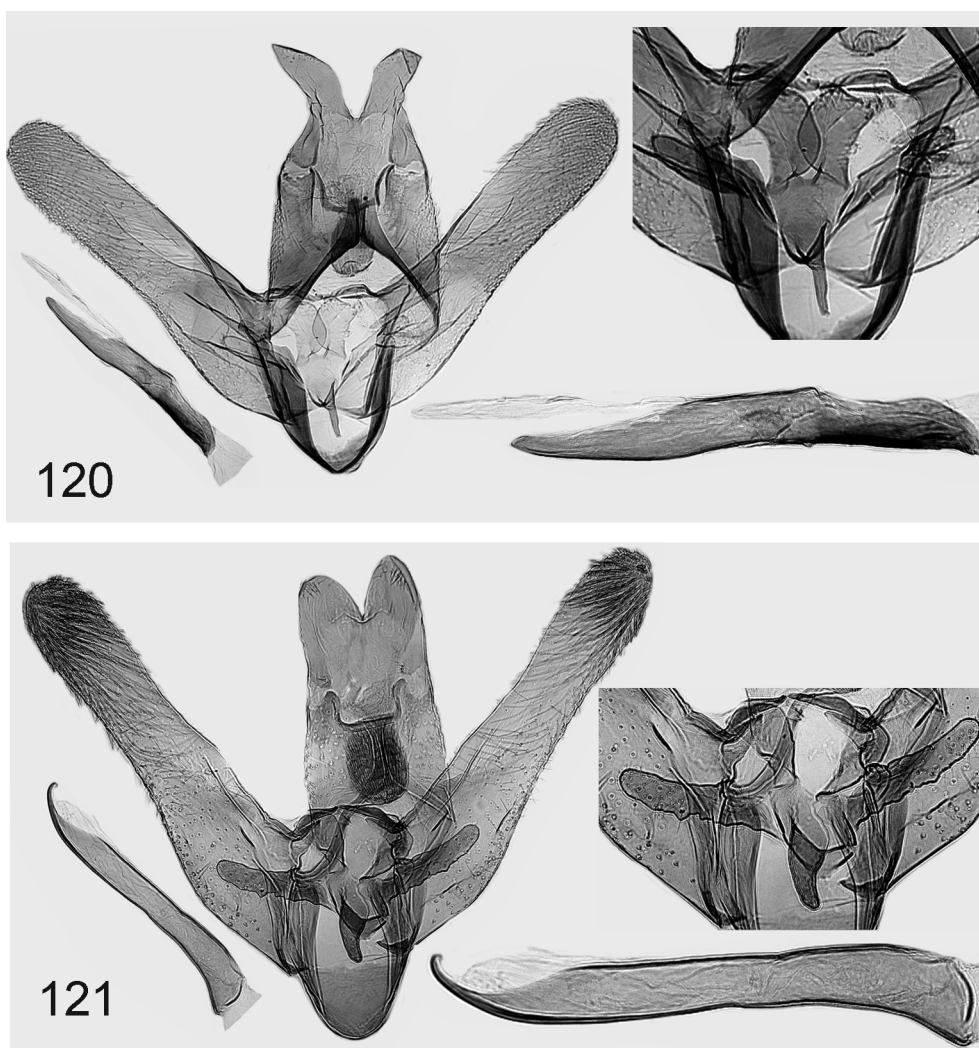
Material studied. Type material. Holotype ♂ of *E. svenssoni* labelled: Austr[ia] Mn [Mann]; Holotype [rounded with red margin]; *Elachista svenssoni* n. sp. det. E. Traugott-Olsen; Akvarel 28.11.86 E. Traugott-Olsen; Genital praeparat nr. K. 9.9.86 sex: ♂ E. Traugott-Olsen; DNA sample 16864 Lepid. Phyl. Coll. (NHMW).

Paratype ♂ of *E. svenssoni*: Austria superior, Klaus, 6.V.1956 J. Klimesch leg. Paratype [rounded with red margin]; Genital praeparat nr. H.4.8.86 sex: ♂ E. Traugott-Olsen *Elachista svenssoni* n. sp. det. E. Traugott-Olsen; DNA sample 16864 Lepid. Phyl. (NHMW). **Other material. Austria:** Austria superior, Hinterstoder, 12.VI.1938, 1 ♂, J. Klimesch leg., L. Kaila prep. 5838 (ZSM); Austria superior, Schön b. Klaus, 7.V.1950, 1 ♂, J. Klimesch leg., W. Hackman prep. 597 (MZH); Klaus, 12.VI.1932, 1 ♂, L. Kaila prep. 3939 (MZH); A/N Eichkogel S. Mödling, 48°03'N, 16°17'E, Tag, pannonische Halbtrockenrasen, Hecken, 320 m, 3.VII.2006, 1 ♂, P. Buchner leg., DNA sample 16993 Lepid. Phyl., 14.VII.2006, 2 ♂, P. Buchner leg., 2823 Pitten 386, L. Kaila prep. 5454, DNA sample 16096, 16998 Lepid. Phyl., 15.IX.2006, 1 ♂, P. Buchner leg., DNA sample 16994 Lepid. Phyl. (Coll. Buchner); A/N, 48°19'N, 16°643'E, Bisamberg, Licht, verbuschende Halbtrockenrasen, miscwald, 320 m, 24.VIII.2007, 1 ♂, P. Buchner leg., DNA sample 16997 Lepid. Phyl. (Coll. Buchner); A/N, 47°45'N, 16°15'E, 3 km SSW Katzelsdorf/L Auwald Halbtrockenrasen, Wiesenbrache, 290 m, 17.IV.2004, 2 ♂, P. Buchner leg., L. Kaila prep. 5453, DNA sample 16991, 16992 Lepid. Phyl. (Coll. Buchner). **Greece:** Florina Vatochorion, 17.V.1985, 2 ♂, P. Grotenfelt leg., L. Kaila prep. 4272, 5031 (MZH); Peloponnesos, Arkadia Vitina, 24.VI.1981, 1 ♂, P. Grotenfelt leg., L. Kaila prep. 4719 (MZH). **Hungary:** 47°80.534'N, 19°98.786'E, Gyöngyös, Sár-hegy, 350 m, 30.VIII.2011, 1 ♂, Z. Tokár leg., DNA sample 2140 Lepid. Phyl. (Coll. Tokár); 47°10'22"N, 17°58'04"E, Veszprem County, 10 km N Veszprem, 300 m, 29.VI.2002, 1 ♂, B. Skule & H. Hviid leg., L. Kaila prep. 4303 (ZMUC). **Italy:** 44°17'N, 7°23'E, Prov. Cuneo, Valdieri N., RN Junip. phoe., 900–1000 m, 1.VIII.2010, 1 ♂, P. Huemer leg., DNA sample 20828 (TLMF). **Romania:** 46°22'58"N, 23°34'44"E, Rimetea reg., 29–31.V.2009, 1

♂, O. Karsholt leg., L. Kaila prep. 5931 (Coll. ZMUC); **Slovakia:** Bojnice, 14.V.1996, 1 ♂, I. Richter leg., L. Kaila prep. 5476, DNA sample 21403 Lepid. Phyl. (Coll. Tokár); Černochovej, 2.V.2003, 1 ♂, I. Richter leg., I. Richter prep. 7353 (Coll. Tokár); Dlh Ves, 28.IV.2000, 1 ♀, I. Richter leg., L. Kaila prep. 5748 (Coll. Tokár); Dol. Vestenic, Šiare, 24.VIII.2007, 1 ♂, I. Richter leg., I. Richter prep. 12110 (Coll. Tokár); Kašvár, 24.VIII.2002, 1 ♂, Z. Tokár leg., L. Kaila prep. 5478, DNA sample 21405 (Coll. Tokár); Kozarovce, 29.VIII.2011, 1 ♂, F. Kosorin leg. (Coll. Tokár); Plešivec, 25.VII.2000, 1 ♂, I. Richter leg., L. Kaila prep. 5841 (Coll. Tokár); Plešivecka plan., 7.VIII.2001, 1 ♂, Z. Tokár leg., L. Kaila prep. 5484, DNA sample 21418 Lepid. Phyl. (Coll. Tokár); Rybník, 24.VIII.2007, 1 ♂, Kosorin leg., 11.V.2008, 1 ♂, L. Kaila prep. 5740, 18.VII.2008, 1 ♂, all F. Kosorin leg. (Coll. Tokár); Rybník-Cajkov, 24.IV.2010, 1 ♂, 18.VII.2010, 1 ♀, F. Kosorin leg., L. Kaila prep. 5749 (Coll. Tokár); Rybník v lese, 26.VI.2010, 1 ♂, F. Kosorin leg. (Coll. Tokár); Slov. kras-Hrhov, 4.V.2002, 1 ♂, Z. Tokár leg., L. Kaila prep. 5485, DNA sample 21419 (Coll. Tokár); Slov. kras-Turňa, 7.VII.2001, 2 ♂, Z. Tokár leg., L. Kaila prep. 5479, Tokár prep. 8038, DNA sample 21406 Lepid. Phyl. (Coll. Tokár); NP. Slovenský kras, Hrdná stráň, 13.VII.2002, 1 ♂, 6.VIII.2011, 1 ♂, Z. Tokár leg. (Coll. Tokár); NP. Slovenský kras, Krkavčie skaly, 18.V.2002, 1 ♂, Z. Tokár leg., L. Kaila prep. 4378 (Coll. Tokár); Slovensk kras Plešivec, 12.V.2006, 1 ♀, Z. Tokár leg. (Coll. Tokár); Slov. kras-Vidov, 27.VI.2001, 1 ♂, Z. Tokár leg., L. Kaila prep. 5477, DNA sample 21401 Lepid. Phyl. (Coll. Tokár), 6.VIII.2001, 1 ♂, Z. Tokár leg., L. Kaila prep. 5483, DNA sample 21417 Lepid. Phyl. (MZH); Veľk vrch, 25.IV.1997, 1 ♂, I. Richter leg., L. Kaila prep. 5844 (Coll. Tokár); Vidov, 1.VIII.1999, 1 ♂ I. Richter leg., L. Kaila prep. 5745, 27.IV.2000, 1 ♀, I. Richter leg., L. Kaila prep. 5746 (Coll. Tokár); Vtáčnik Žarnov, 22.VII.2006, 1 ♂, I. Richter leg., L. Kaila prep. 5840 (Coll. Tokár). **Sweden:** Sm. Högsby, 21.VI.1975, 1 ♂, R. Johansson leg., L. Kaila prep. 3464 (MZH); Ög: Tidersrum, Bön, 4.VI.1996, 1 ♂, I. Svensson. leg., L. Kaila prep. 3463 (MZH); Ög: Kolmården, UTM 33V WF8203, 29.VIII.1993, 1 ♂, I. Svensson leg. (Coll. Kaitila).



FIGURES 118–119. Male genitalia of *Elachista elsabella* Traugott-Olsen.. 118. Austria (L. Kaila prep. 5453). 119. *E. svenssoni* Traugott-Olsen, holotype.



FIGURES 120–121. Male genitalia of *Elachista* spp. 120. *E. arenbergeri* Traugott-Olsen (Tunisia, L. Kaila prep. 5265). 121. *E. deresyensis* (Turkey, L. Kaila prep. 3568).

Diagnosis. *Elachista elsabella* is a variable species, both regarding its size, the width of the valva and the length of the digitate process. The extent of variation of these male genitalia characters is shown in Figs. 117–119. The variation is continuous and appears to be similar throughout the distribution range, thus not diagnostic between *E. elsabella* and *E. svenssoni*. The male genitalia are characterized by the broad and bent phallus that has a hook-shaped apex. The phallus is similar also in *E. galactitella*, *E. deresyensis* and *E. oukaimedenensis*. The males of these species can be identified from each other as follows; *E. galactitella* has unicolorous forewings, whereas the forewings are speckled in *E. deresyensis* and *E. oukaimedenensis*. The juxta lobes are reduced in *E. oukaimedenensis*, whereas they are developed in *E. galactitella* and *E. deresyensis*. The uncus lobes are twice as long as broad in *E. galactitella*, whereas they are as long as broad in *E. deresyensis*. In the females of *E. oukaimedenensis* and *E. triseriatella* the areas laterad of the ostium bursae are sclerotized; the signum of *E. triseriatella* consists of two longitudinal, dentate rows, that of other species is a single dentate plate. Within the *E. dispunctella* complex, the female genitalia of *E. elsabella* most closely resemble those of *E. deresyensis*, both having the colliculum shaped as a short, sclerotized band. The ductus bursae of *E. elsabella* is membranous, that of *E. deresyensis* is anteriorly granulate with longitudinal ribs.

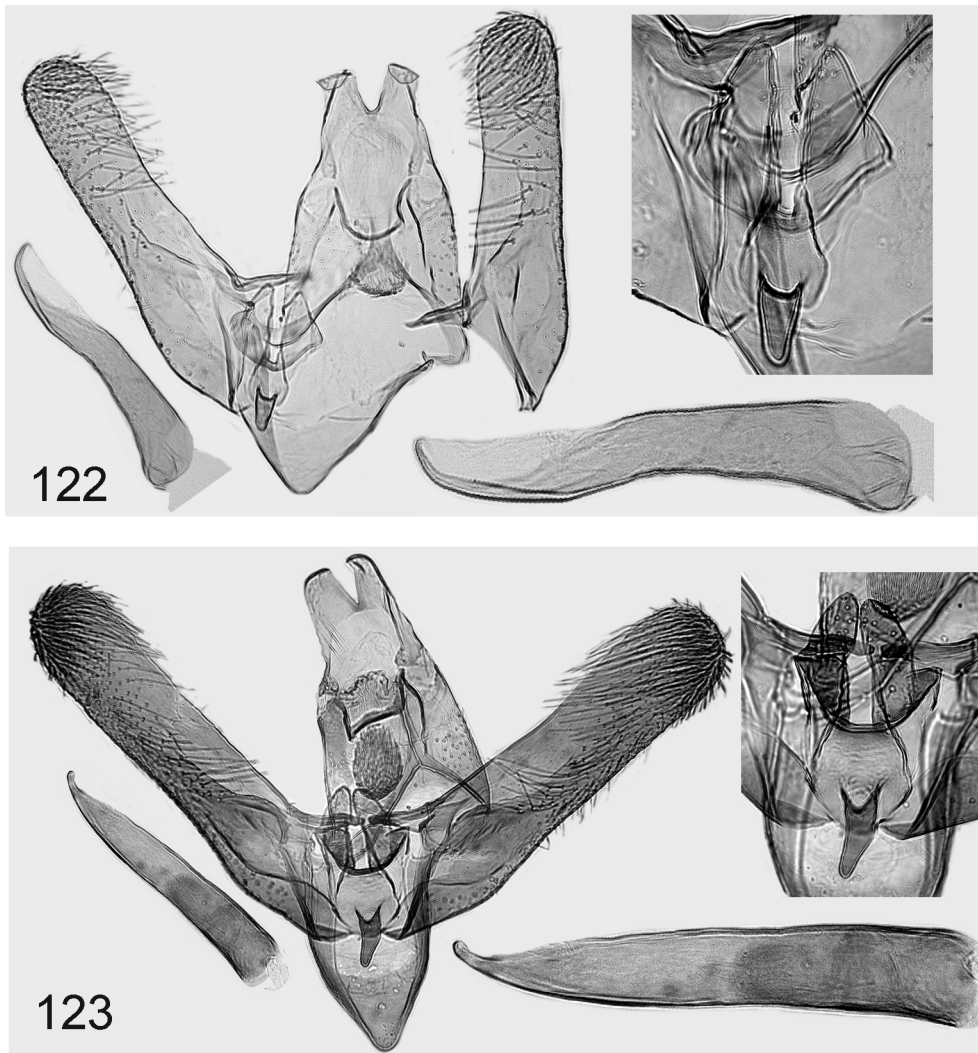
Biology. *E. elsabella* has a long flight period in Central Europe, probably partly depending on the exposition and elevation of collecting site. In Slovakia it is at least bivoltine, as specimens from the same localities have been captured in May and in August. Adults are active during the daytime and at dusk, and attracted to light at night.

Distribution. Austria, Greece, Hungary, Italy, Romania, Slovakia, Sweden.

Remarks. *E. elsabella* is referred to as OTU 2 in Mutanen *et al.* (2015). The barcodes of Swedish ('typical'

elsaella) and Central European specimens ('*svenssoni*') are clustered together with the distance between these of only 0.6–0.7%. In the absence of any evidence to the contrary, these populations are considered conspecific, and *E. svenssoni* a synonym of *E. elsaella*.

In the data of Mutanen *et al.* (2015) there is a taxon (i.e., OTU 3) whose barcode differs distinctly (3.7%) from *E. elsaella*. It is known from Croatia (Tribunj, 27.VI.2003, 1 ♂, Z. Tokár leg. & Coll., L. Kaila prep. 5475, DNA sample 21402 Lepid. Phyl.) and northern Italy. It seems to differ also by morphology from *E. elsaella*, but the limits of variation as compared to other close species is not known. The material available does not allow drawing conclusions on its taxonomic status.



FIGURES 122–123. Male genitalia of *Elachista oukaimedenensis* Traugott-Olsen. 122. holotype. 123. Spain (L. Kaila prep. 5496).

***Elachista arenbergeri* Traugott-Olsen, 1988**

Figs. 53, 120, 145

Elachista arenbergeri Traugott-Olsen, 1988: 307.

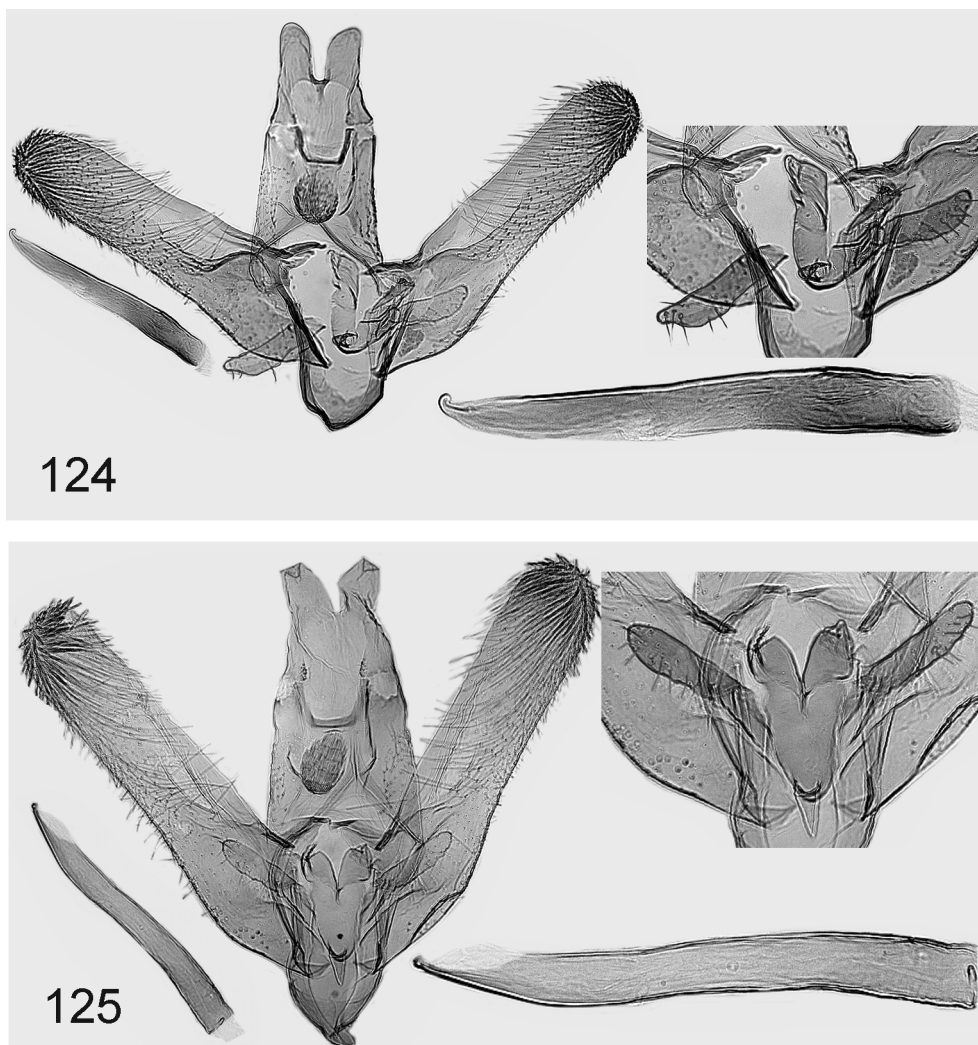
Material studied. Type material. Paratype ♂: Tunisia, 20 km W El Kef 18.–19.VII.1979 1 ♂ M. & E. Arenberger leg. (ZMUC). **Tunisia:** 10 km NW Kasserine, Djebel Chambi N., 18.XI.2009, 4 ♂, T. Nupponen leg., L. Kaila prep. 5306–7, DNA samples 15321–4 (Coll. Nupponen, 1 ♂ in MZH). ‘Mauretania’, Tunisia, Sud, Oase Metouia (Gabes), 28.IX–10.X.1980, 10 ♂, M. u. W. Glaser leg, L. Kaila prep. 5574, 5575, 5583, 5585 (SMNK); Sud, Oase Tozeur, 28.IV–11.V.1981, 1 ♂, 1 ♀, M. u. W. Glaser leg., L. Kaila prep. 5582, 5584 (SMNK).

Diagnosis. *E. arenbergeri* is a large species, white or pale yellow, often with ochreous dusting forming irregular, longitudinal stripes. The male genitalia are characteristic, with large, distolaterally pointed uncus lobes, as in species of the *E. dispilella* complex (cf. Traugott-Olsen 1990, Kaila *et al.* 2015). Unlike them, it has no cornuti. In addition, the corpus bursae contains no signum, and the ductus bursae is gradually widened anteriorly.

Biology. Unknown.

Distribution. Tunisia, Morocco.

Remarks. *E. arenbergeri* is referred to as OTU 6 in Mutanen *et al.* (2015).



FIGURES 124–125. Male genitalia of *Elachista galactitella* Eversmann. 124. Ural (L. Kaila prep. 3347). 125. Italy (L. Kaila prep. 4752).

***Elachista deresyensis* Traugott-Olsen, 1988 stat. rev.**

Figs. 54–55, 121, 146

Elachista deresyensis Traugott-Olsen, 1988: 308.

Material studied. Turkey: Ürgüp, 19–21.VII.1998, 7 ♂, 1 ♀, 5 km NW Ürgüp, 17.VI.1999, 1 ♂ J. Junnilainen leg. (Coll. J. Junnilainen and MZH).

Diagnosis. *E. deresyensis* is a medium-sized species of the *E. dispunctella* complex, with white forewing, scattered with brown tips of scales. The male genitalia are similar to those of *E. galactitella*, but the uncus lobes of *E. deresyensis* are broader than in *E. galactitella*, as long as wide; those of *E. galactitella* are twice as long as wide. The female genitalia are similar to those of *E. elsabella*, both having a small colliculum with distinct sclerotized

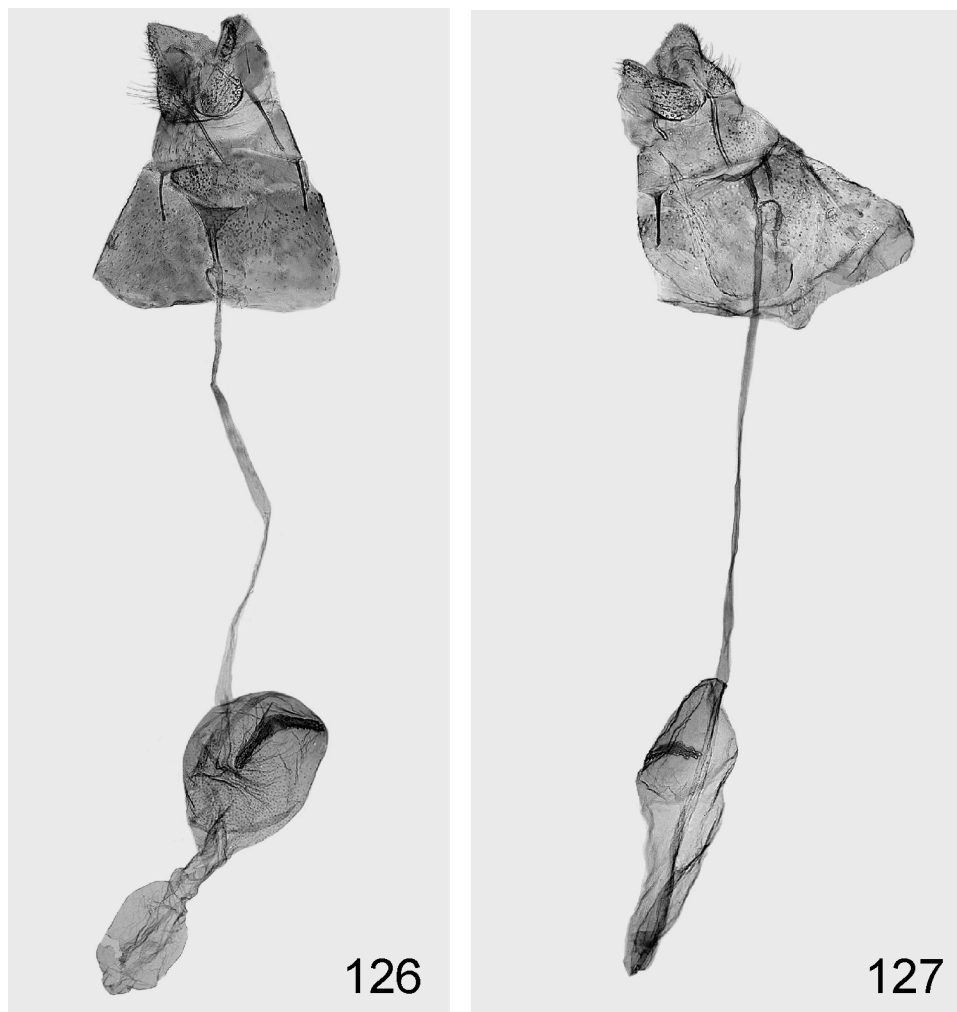
band. The anterior part of the ductus bursae is granulose with longitudinal ribs in *E. deresyensis*, smooth in *E. elsarella*.

Biology. Unknown.

Distribution. Turkey.

Remarks. Kaila (1999a) synonymized *E. deresyensis* with *E. galactitella* (Eversmann). Examination of new material suggests that the above synonymy is unjustified, and *E. deresyensis* is here re-instated as a valid species.

There is a sample of 29 males collected from Turkmenistan: Central part of the Kopetdagh Mts., 15 km W from Firyuza (now Poevryuze), Mt. Dushak, [2100 m a.s.l., mountain xerophytous belt, *Juniperus* tree savana-like forest], by light trap, VII 1990 V.V. Dubatolov leg. (SZMN, MZH); this taxon closely resembles *E. deresyensis*; externally its forewing maculation is black rather than brown, and in the male genitalia the valva is broader and the incision between uncus lobes deeper. Even though the external appearance seems to differ consistently from *E. deresyensis*, there is some variation in the width of the valva, similar to *E. elsarella*. Due to the limited material and unknown female for the Turkmenian taxon, it is not formally named here.



FIGURES 126–127. Female genitalia of *Elachista* spp. 126. *E. dispunctella* (Austria, L. Kaila prep. 5724). 127. *E. parvula* (Greece, L. Kaila prep. 5804).

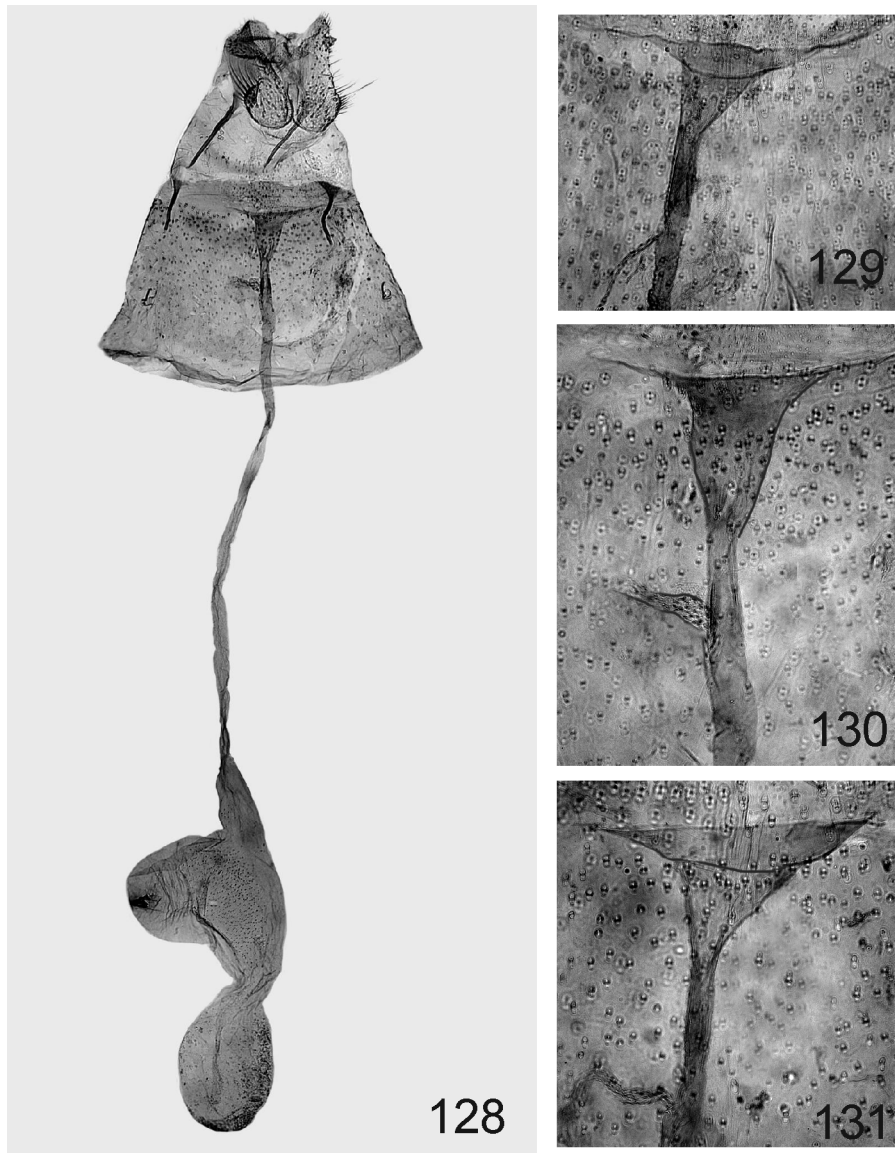
***Elachista oukaimedenensis* Traugott-Olsen, 1988**

Figs. 56, 122–123, 147

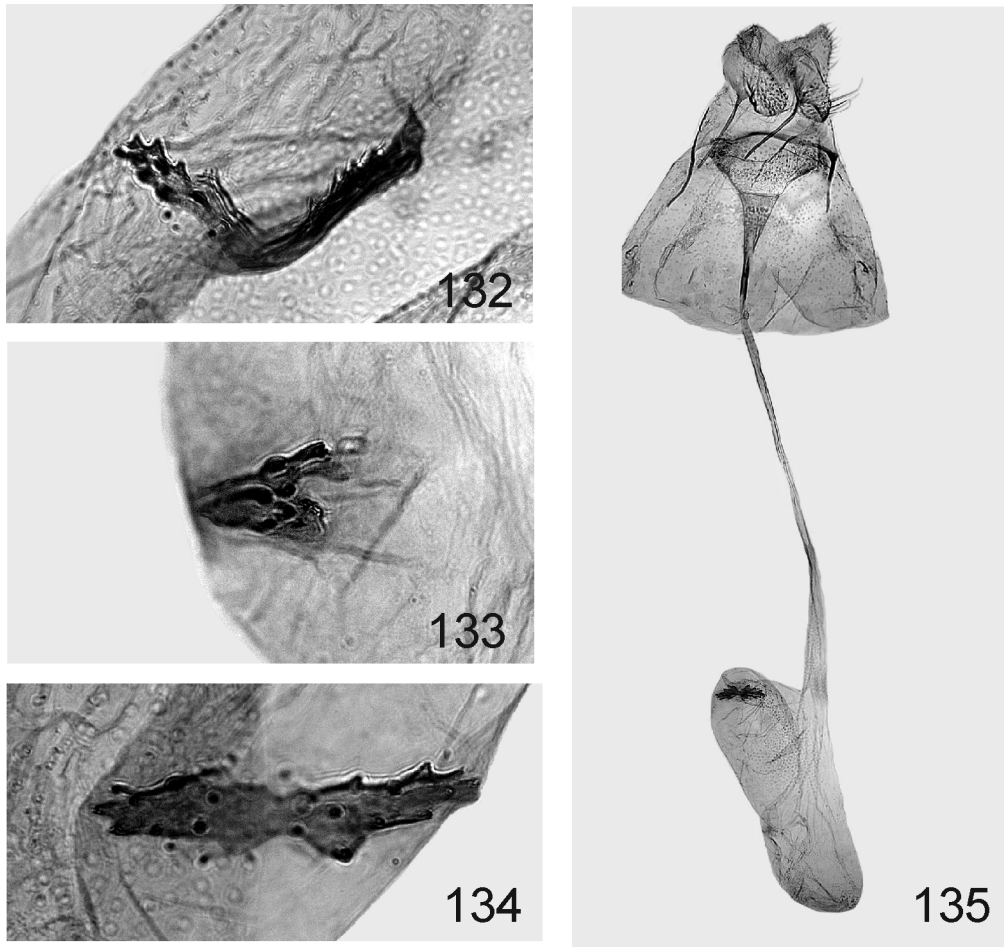
Elachista oukaimedenensis Traugott-Olsen, 1988: 309.

Material studied. Type material. Holotype ♂ labelled: 10.7.1975, Marokko. Hoher Atlas, 4 km östl. Oukaim'den,

2200 m. F. Kasy leg.; Holotype [rounded with red margin]; *Elachista triseriatella* Stt. det. U. Parenti; prep. gen. n. 2723 U. Parenti ♂; *Elachista oukaimdensis* [sic] det. E. Traugott-Olsen; DNA sample 16866 Lepid. Phyl. (NHMW). **Other material. Spain:** 10 km NNW Albatera, 450 m, 15.V.2009, 1 ♂, J. Tabell leg., L. Kaila prep. 5496, DNA sample 21432 (MZH); Alicante, route 8 km N of Albatera env., 300 m, 27.IV.2009, 1 ♂, Z. Tokár leg., DNA sample 19992 Lepid. Phyl. (Coll. Tokár); 3 km SW Miguel de Salinas, 23.IV.2009, 3 ♂, J. Tabell leg., L. Kaila prep. 5497, DNA sample 21433 Lepid. Phyl. (MZH, Coll. Tabell), 16.IV.2009, 5 ♂, J. Tabell prep. 4443 (Coll. Tabell); 23.IV.2009, 10 ♂, Tabell prep. 4321, 4405, 4413, 4444 (Coll. Tabell); 8.V.2009, 1 ♀, Tabell prep. 4435 (Coll. Tabell); San Miguel de Salinas 3 km E, 18.IV.2009, 11 ♂, 1 ♀, J. Tabell leg. & Coll., Tabell prep. 4436, 4442, 4447, 4594, DNA sample 05587 Lepid. Phyl. (Coll. Tabell); 1.V.2009, 4 ♂, 1 ♀, J. Tabell prep. 4296, 4412, 4438, 4445, DNA samples 05568, 05585 Lepid. Phyl. (Coll. Tabell); 7.V.2009, 3 ♂, J. Tabell prep. 4313, 4427–8, DNA sample 05584 (Coll. Tabell); Alicante, 11 km NNW Albatera, 500 m, 12.V.2009, 1 ♂, J. Tabell leg. & Coll., J. Tabell prep. 4377, DNA sample 05569 Lepid. Phyl.; 10 km NNW Albatera, 450 m, 15.V.2009, 1 ♂, Tabell prep. 4318 (Coll. Tabell); 7 km NNW Albatera, 200 m, *Lygeum spartum*, 16.III.2010, em. 10.IV.2010, 1 ♂, Tabell prep. 4674 (Coll. Tabell); Murcia, Sierra Espuña, 1400 m, 3.IX.2000, 1 ♂, H. W. v.d. Wolf leg., L. Kaila prep. 3921 (MZH); Prov. Granada, Sierra Alfacar, 1300 m, 20.IX.1973, 2 ♂, M. u. W. Glaser leg., L. Kaila prep. 5818, 5820 (SMNK).



FIGURES 128–131. Female genitalia of *Elachista mabouella*, all from Spain. 128. L. Kaila prep. 5729. 129–131. Ostium bursae. 129. L. Kaila prep. 5728. 130. L. Kaila prep. 7529. 131. L. Kaila prep. 5730.



FIGURES 132–135. Female genitalia of *Elachista* spp. 132–134. Signum of *E. maboulella*, all from Spain. 132. L. Kaila prep. 5728. 133. L. Kaila prep. 7529. 134. L. Kaila prep. 5730. 135. *E. disemiella* (Spain, L. Kaila prep. 5720).

Diagnosis. *E. oukaïmedenensis* is externally similar to many other species of the *E. dispunctella* complex. The male genitalia are closest to those of *E. elsabella*, but the juxta lobes are well developed in *E. elsabella*, whereas they are almost entirely reduced in *E. oukaïmedenensis*. The female genitalia are characteristic, with broad sclerotizations laterad of ostium bursae. Only the female of *E. triseriatella* has such sclerotizations, but they are much narrower than in *E. oukaïmedenensis*.

Biology. Host plant of larva is *Lygeum spartum*.

Distribution. Spain, Morocco.

Remarks. *E. oukaïmedenensis* is referred to as OTU 1 in Mutanen *et al.* (2015).

***Elachista galactitella* (Eversmann, 1844)**

Figs. 57–58, 124–125, 148

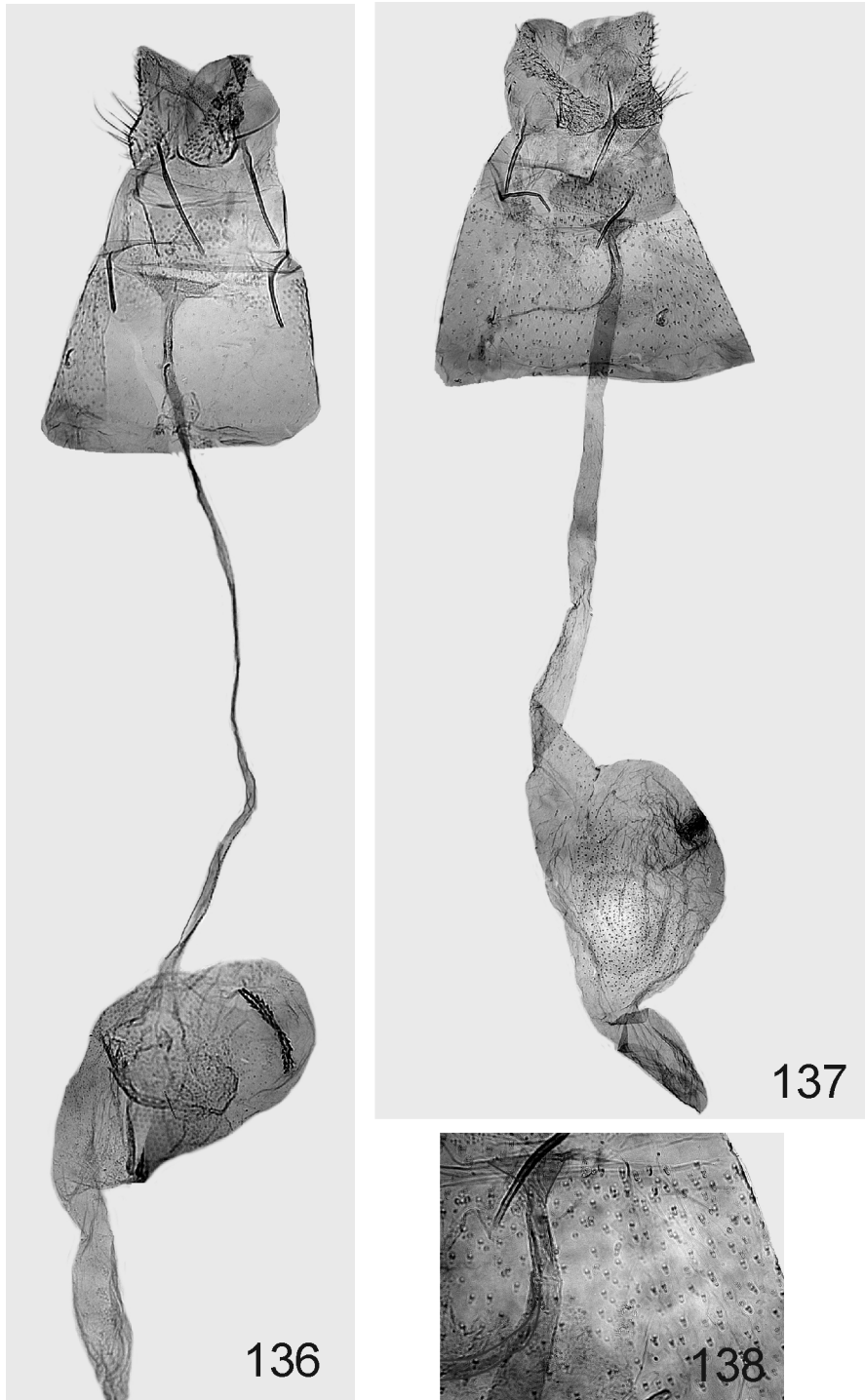
Oecophora galactitella Eversmann, 1844: 595.

Elachista galacticella, incorrect subsequent spelling.

Elachista bustilloi Traugott-Olsen, 1988: 306; Parenti (2001).

Elachista madridensis Traugott-Olsen, 1992: 202. **Syn. nov.**

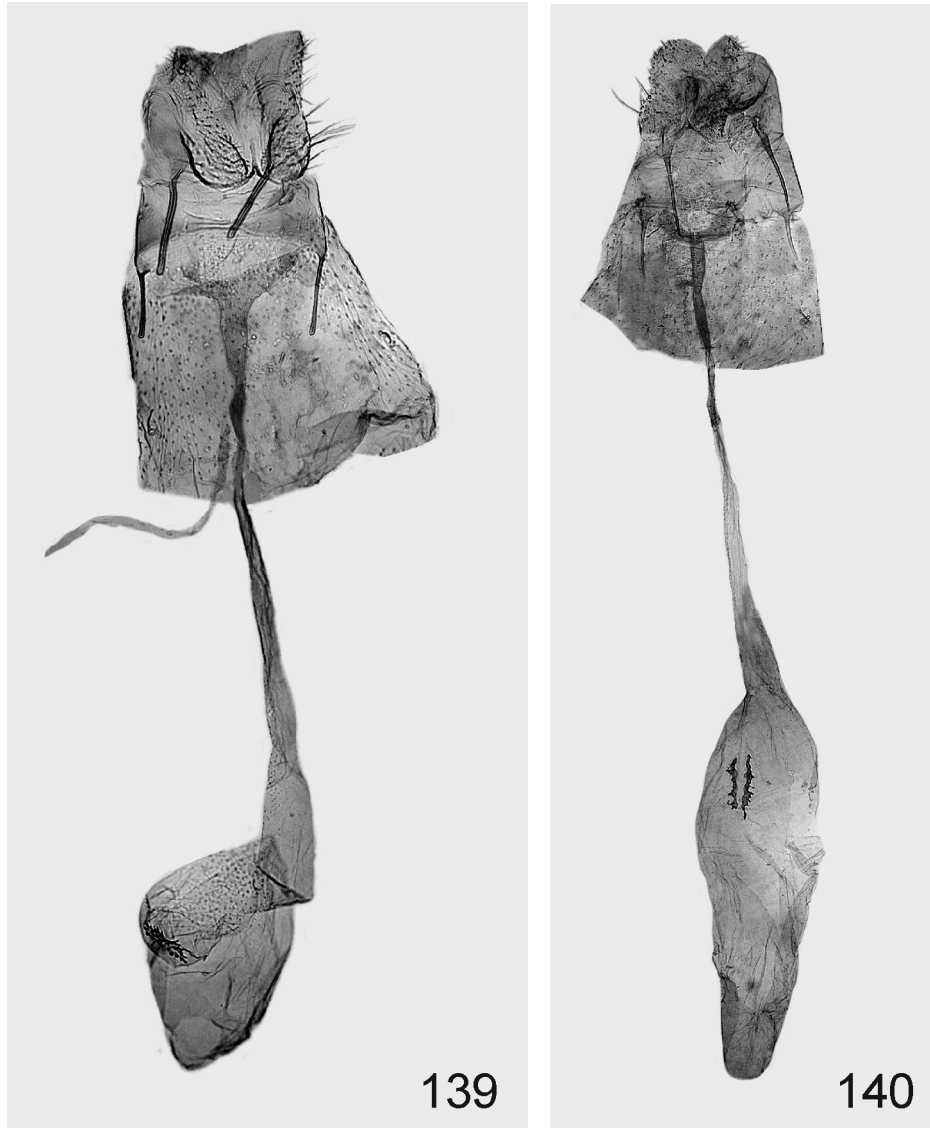
Material studied. Type material. Holotype ♂ of *E. madridensis* labelled: Type [rounded with red margin]; Wing praeparat nr. a.4.11.89 sex: ♂ *E.* Traugott-Olsen; Campo Real, Madrid, 640 m, 2-7-1982 A. Vives leg. *Elachista madridensis* sp. n. det. E. Traugott-Olsen; Holotipo [red]; MNCN Cat. Tipos No 11371 [red]; MNCN Prep. Gen. No 60980 [the preparate contains a pair of wings, the specimen was originally without abdomen] MNCN_Ent No



FIGURES 136–138. Female genitalia of *Elachista* spp. 136. *E. tribertiella* (Spain, L. Kaila prep. 5576). 137–138. *E. glaseri*. 137. Spain, L. Kaila prep. 5727. 138. Ostium bursae (L. Kaila prep. 5727).

Cat. 42116 (MNCN, Madrid). **Other material. France:** Gallia mer. Provence, La Bessee, 1100 m, M. u. W. Glaser leg. [no date]; L. Kaila prep. 5809 (SMNK); Provence, 4 km N Eyguians, 12.VI.1989, 1 ♂, B. Å. Bengtsson leg., Bengtsson prep. 3370 (Coll. Bengtsson). **Italy:** Prov. Calabria, Monte Pollino, 3 km N of Civita, 800 m, 31.V–1.VI.2005, 5 ♂, 1 ♀, P. Skou leg. L. Kaila prep. 4752, 4753, 4754 (prep. 4752 in MZH, 4753, 4754 in ZMUC); Sesvenne valley, Laatsch, 4.VII.2004, 1 ♂, J. Junnilainen leg., L. Kaila prep. 5078 (MZH); 7.VII.2004, 3 ♂, J. Junnilainen leg. & Coll.; Bolzano, above Laatsch, steep open slope, 1180 m, 46°40'43"N, 10°31'38"E, uvl, 10.VII.2004, 5 ♂, B. Landry & P. Schmitz leg. (MHNG); Valle d'Aosta, Dint. Ozein, Aymavilles (Aosta), 1250 m, 5.VII.1989, 1 ♂, U. Parenti leg., J. Tabell prep. 4457 (Coll. Tabell); 14.VI.1990, 1 ♀, (Coll. Tabell); V. d'Aosta,

Ozein (Aymavilles, AO), 1250 m, *Stipa pennata*, A143, 13–22.VI.1994, 3 ♂, 1 ♀, P. G. Varalda leg. (Coll. Tabell); **Russia:** S. Ural, Verbljushka, 10.VI.1998, 1 ♂, T. & K. Nupponen leg. (L. Kaila prep. 3347, MZH), 14.VII.1998, 2 ♂, 15.VII.1998, 1 ♂, K. Nupponen leg., 19.VI.1999, 2 ♂, T. & K. Nupponen leg. (Coll. Nupponen), S. Ural, Orenburg district, Donskoje village 6 km S, mount Verbljushka, 27.VI.2003, 1 ♂, K. Nupponen leg. (MZH); 28.VI.2003, 2 ♂, K. Nupponen leg., J. Tabell prep. 4382, DNA samples 16258–9 Lepid. Phyl. (Coll. Tabell). **Switzerland:** Ws., 600 m, Leuk-Pfynwald, 6.VI.2001, 5 ♂, 9.VI.2001, 1 ♂, 25.VIII.2001, 1 ♂, Landry & Merz leg. (MHNG, MZH).



FIGURES 139–140. Female genitalia of *Elachista* spp. 139. *E. hispanica* (Spain, L. Kaila prep. 5733). 140. *E. triseriatella* (Denmark, L. Kaila prep. 5774).

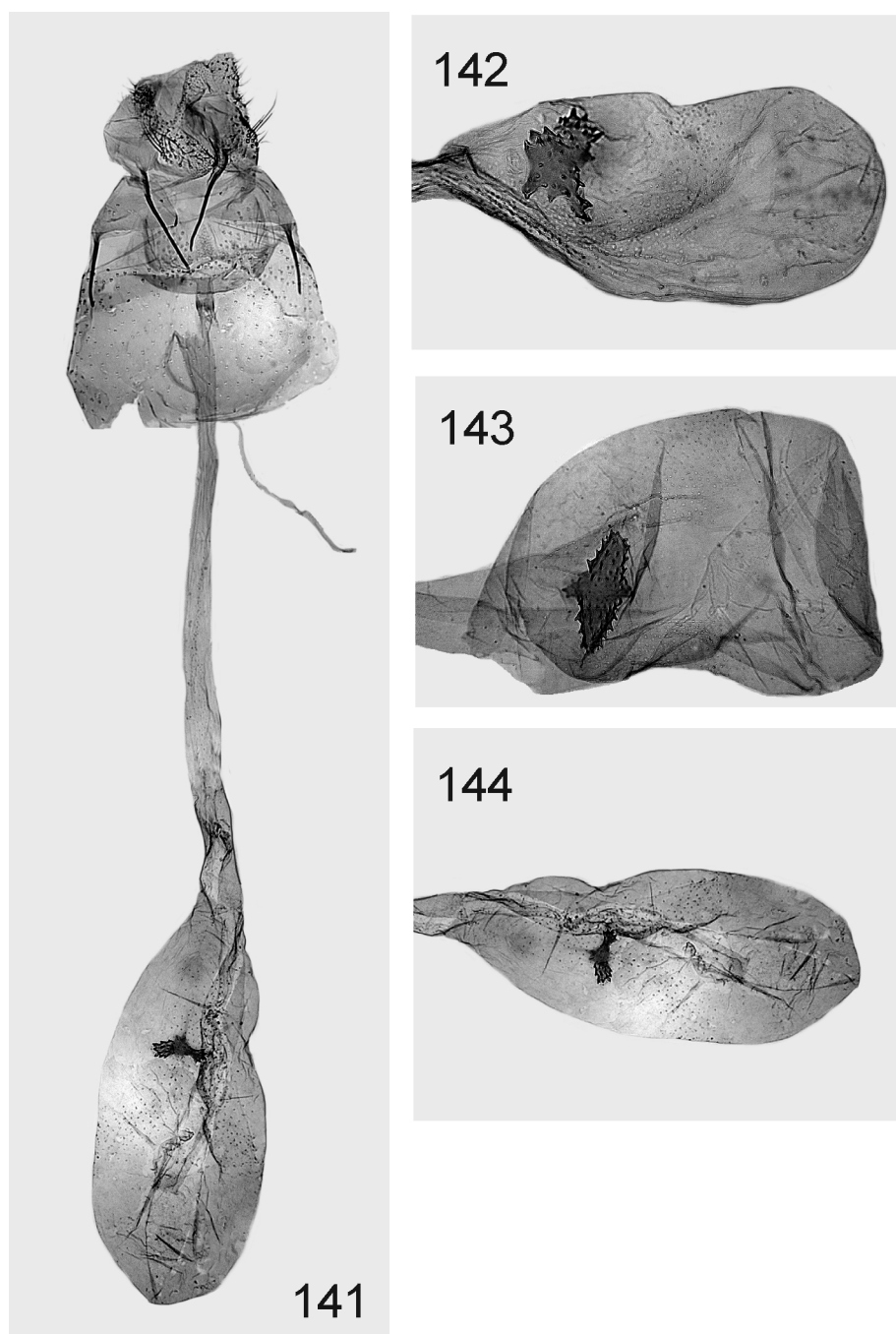
Diagnosis. Forewing of *E. galactitella* is shiny white. It most resembles *E. kalki* Parenti, which is more stout-bodied with broader wings. Their genitalia are entirely different (cf. Kaila 2005). The male genitalia are similar to those of *E. deresyensis*, but differ by the width of uncus lobes: they are twice as long as broad in *E. galactitella*, about as long as broad in *E. deresyensis*. The female genitalia most resemble those of *E. elsarella*. They differ by the size of antrum which is significantly larger in *E. galactitella*. It also lacks a sclerotized band typical of *E. elsarella*.

Biology. This species has been reared in an ex ovo experiment on *Stipa pennata* L. (Poaceae) in the laboratory (Parenti 2004).

Distribution. France, Italy, Spain, Russia and Switzerland. Parenti (2001) also mentions Turkey. This record is based on the erroneous synonymy of *E. deresyensis* and *E. galactitella* by Kaila (1999a).

Remarks. *E. galactitella* is referred to as OTU 4 in Mutanen *et al.* (2015). The synonymy of *E. bustilloi*

Traugott-Olsen and *E. galactitella* Eversmann was established by Parenti & Domínguez (1995) and again by Parenti (2004) with a somewhat more detailed account. The single known specimen of *E. madridensis* was collected together with the holotype of *E. bustilloi*. The *E. madridensis* specimen lacks an abdomen. Its external appearance is identical to that of *E. galactitella* (*E. bustilloi*, a synonym of it) with a shiny white forewing. *E. madridensis* is considered a synonym of *E. galactitella*.

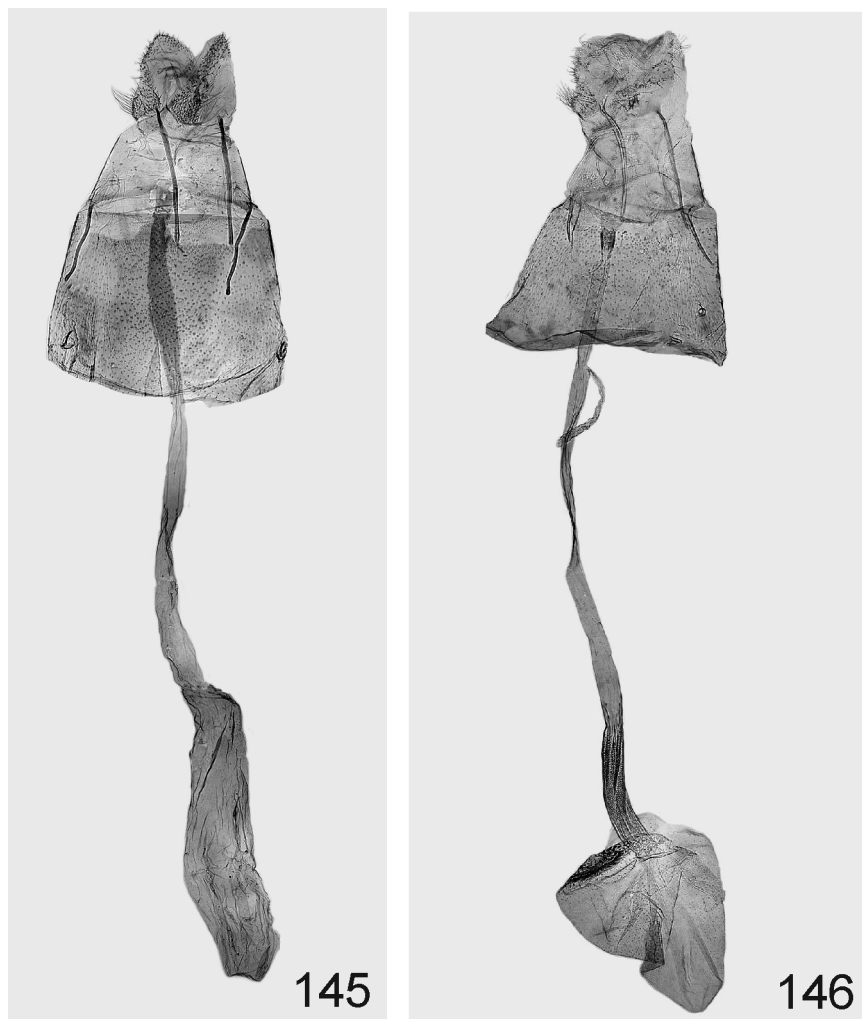


FIGURES 141–144. Female genitalia of *Elachista elsabella*, all from Slovakia. 141. L. Kaila prep. 5749. 142–144. Corpus bursae. 142. L. Kaila prep. 5746. 143. L. Kaila prep. 5748. 144. L. Kaila prep. 5749.

Discussion

The present study attempts to clarify a case where species delineation has relied upon characters not suitable for this purpose, resulting in spurious taxonomy with tens of taxa, that morphological and barcoding evidence suggests

to be synonyms. There are other cases like the present one where species have been grossly overplit because of the lack of larger series of specimens to measure intraspecific variation and access to barcoding methodology to test species concepts (e.g. Huemer & Karsholt 2010). The taxonomic problems with these groups, even if quite extreme, are a manifest of the difficulty of the species taxonomy in the Gelechioidea. Despite the cases of taxonomically oversplit groups, a more general pattern is the opposite, i.e. the existence of a vast number of undescribed species in this superfamily. The deficient literature on Gelechioidea, especially in the tropics, thus likely severely underestimates the number of species (e.g. Novotny *et al.* 2010; Kaila *et al.* 2011). In several families of this very species-rich superfamily species are difficult to identify due to their superficial similarity. Recent examples of groups with considerable increase in numbers of species that have been recognized due to thorough taxonomic scrutiny are Adamski (2005, 2013) for Glyphidocerinae and Blastobasidae, respectively; Kaila (2011a) for Australian Elachistinae; Hodges (1999) and Huemer & Karsholt (2010) for groups of Gelechiidae; and Landry (1991) and Bengtsson (2014) for Scythrididae. In general, the lack of externally obvious diagnostic features together with the necessity of time-costly dissection of the genitalia has caused the taxonomic work to lag far behind the collecting of samples.



FIGURES 145–146. Female genitalia of *Elachista* spp. 145. *E. arenbergeri* (Tunisia, L. Kaila prep. 5584). 146. *E. deresyensis* (Turkey, L. Kaila prep. 5805).

DNA barcoding, now routine, has proven to be quite effective in screening rough taxonomic pattern in large samples of organisms. The use of it has also been vital in the present study. The vast number of nominal taxa with subtle or no detected differences have made the identification of many specimens virtually impossible using genitalic characters together with the literature. Even though a reasonable species concept gradually took shape for a majority of the taxa by examination of large numbers of genital dissections, the support of, and congruence with,

the results of extensive DNA barcoding gave more strength to the conclusions, and considerably helped in resolving some taxonomic issues as well as associating males and females. Nevertheless, all issues could not be reliably studied in-depth in this study, either due to the paucity of material available or due to the lack of morphological differences between markedly differing haplotypes. Only with better samples and more information may their status be elucidated in the future.



FIGURES 147–148. Female genitalia of *Elachista* spp. 147. *E. oukaimedenensis* (Spain, J. Tabell prep. 4674). 148. *E. galactitella* (Italy, L. Kaila prep. 4754).

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