



DESCRIPTION OF THE OVA AND OVIPOSITIONAL STRATEGIES OF SIX STERRHINE TAXA FROM MADRID, INCLUDING COMPARATIVE DATA WITH OTHER SPECIES OF THIS SUBFAMILY (LEPIDOPTERA: GEOMETRIDAE: STERRHINAE)

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ABSTRACT

Original data are presented which describe ova of the following six taxa in the Sterrhinae Meyrick, 1892: *Idaea litigiosaria* (Boisduval, 1840), *Idaea sericeata calvaria* Wehrli, 1927, *Idaea ochrata albida* (Zerny, 1936), *Idaea incisaria* (Staudinger, 1892), *Idaea cervantaria* (Millière, 1869) and *Scopula (Glossotrophia) asellaria dentatolineata* Wehrli, 1926. Subsequent analysis of SEM imaging provides data related to the chorion structure, as well as that associated with the strategies adopted by females at oviposition under laboratory conditions; comparative data are provided of other European sterrhines.

Key words: Lepidoptera; Geometridae; Sterrhinae; ova; morphology; biology; egg positioning.

RESUMEN

Descripción de los huevos y de las estrategias de puesta de seis taxones de Sterrhinae de Madrid, con datos comparativos de otras especies de la subfamilia (Lepidoptera: Geometridae: Sterrhinae)

Se presentan datos inéditos que describen los huevos de los siguientes taxones de Sterrhinae Meyrick, 1892: *Idaea litigiosaria* (Boisduval, 1840), *Idaea sericeata calvaria* Wehrli, 1927, *Idaea ochrata albida* (Zerny, 1936), *Idaea incisaria* (Staudinger, 1892), *Idaea cervantaria* (Millière, 1869) and *Scopula (Glossotrophia) asellaria dentatolineata* Wehrli, 1926. Se ofrece un análisis pormenorizado de las imágenes MEB en cuanto a la estructura del corión se refiere, además de una descripción de las estrategias de la puesta adoptadas por parte de las hembras en condiciones de laboratorio. Se ofrecen datos comparativos con otras especies europeas de Sterrhinae.

Palabras clave: Lepidoptera; Geometridae; Sterrhinae; huevos; morfología; biología; ubicación.

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Introduction

In the Ennominae, the largest of the four major Geometrid subfamilies (45% of world taxa: Scoble & Hausmann, 2007), females of several species, for example, *Siona lineata* (Scopoli, 1763) lay eggs in batches

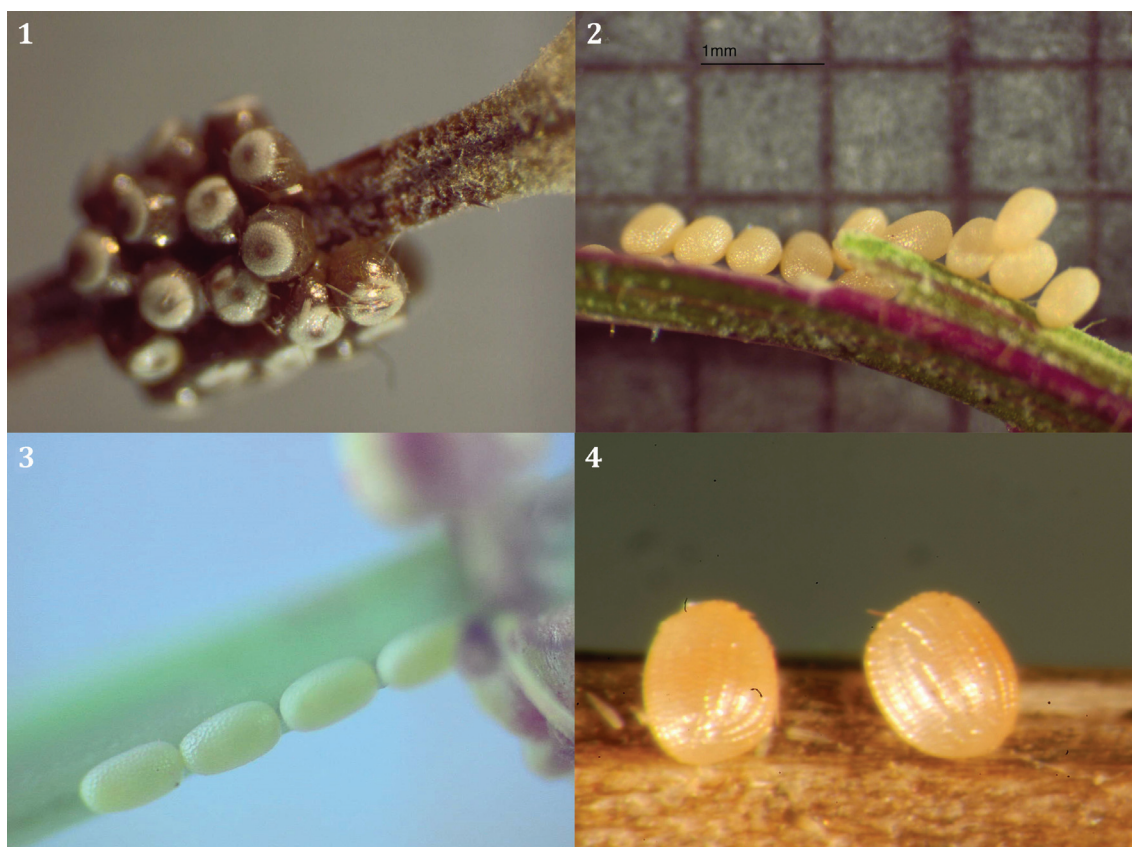
which can be described as short 'chains' on the margins of blades of grass (Ebert *et al.*, 2003), this strategy resembles that of a related species *Aspitates ochrearia* (Rossi, 1794), also laying eggs batches in quite extensive 'chains' of several individual ova on plant material (King, personal observation), meanwhile, females

of *Comptosia jourdanaria* (Serres, 1826) oviposit in ‘ring-like’ clusters exposed on the stems of its food-plant (Fig. 1). In the Sterrhinae (11% of world Geometrid taxa: Scoble & Hausmann, 2007), females are not known to adopt either of these strategies, eggs either being scattered whilst the female is in flight, for example, *Idaea ochrata* (Scopoli, 1763) (Rennwald, 1993) or *I. macilentaria* (Herrich-Schäffer, 1847) (King, personal observation), or laid individually, or in small clusters, for example, *I. longaria* (Herrich-Schäffer, 1852) (Fig. 2).

Peterson (1962) published descriptions of five Nearctic sterrhines out of 40 geometrids he worked on three amongst the *Idaea* Treitschke, 1825: *I. demissaria* (Hübner, 1831), *I. taturata* (Walker, 1861) and *I. flavescens* (Hulst, 1896), in addition to *Scopula aemulata* (Hulst, 1896) and *Leptostales pannaria* (Guenée [1858]). According to Peterson (1962), both *I. demissaria* and *I. flavescens* lay at random (ova yellow changing to orange), morphologically, these species’ ova have ‘six prominent ridges’ as well as ‘conspicuous transverse striae’; on the other hand, the (vivid red) ova of *I. taturata* are laid vertically adhered to the substrate (axis not parallel to substrate)

whose surface ‘is covered uniformly with small hexagonal pits’. In this latter species, Peterson (1962) emphasised its unique characters quite unlike others in the *Idaea*, indeed amongst the geometrids as a whole. The reddish-green eggs of *S. aemulata* are laid individually vertically their surface having ‘distinct longitudinal ridges with faint transverse striae’. *L. pannaria* lays greenish-yellow ova, these being relatively ‘elongated’ with a roughened surface and indistinct longitudinal rows. Peterson (1968) includes data of two additional species: *S. enucleata* (Guenée, 1857) whose egg is yellowish-white and having a surface ‘with indented longitudinal ridges extend (ing) lengthwise from pole to pole with about 20 distinct cross striae between them’ deposited randomly, and *S. inductata* (Guenée, 1858) whose somewhat adhesive ova are ‘light cream to near white (with) sixteen faint slightly indented ridges extend (ing) from the obtuse end to the smaller rounded end with very few or no cross striae between them’.

Salkeld (1983) described the ova of nine sterrhine species: two species in *Idaea*: *I. demissaria* (Hübner, 1831) and *I. dimidiata* (Hufnagel, 1767), and four species in the genus *Scopula* Schrank,



Figs. 1-4.— Egg batch of 1) *Comptosia jourdanaria*, El Goloso, Madrid; 2) *Idaea longaria*, ♀ 2.X.12, Cantoblanco, Madrid; 3) *Lythria sanguinaria*, ♀ V.11, El Goloso, Madrid; 4) *Idaea litigiosaria*, ♀ 31.V.09, El Goloso, Madrid; photo: José Martín Cano.

Figs. 1-4.— Puestas de 1) *Comptosia jourdanaria*, El Goloso, Madrid; 2) *Idaea longaria*, ♀ 2.X.12, Cantoblanco, Madrid; 3) *Lythria sanguinaria*, ♀ V.11, El Goloso, Madrid; 4) *Idaea litigiosaria*, ♀ 31.V.09, El Goloso, Madrid; imagen tomada por José Martín Cano.

Table 1.— European Sterrhinae: Ovipositional strategies (Wiltshire, 1962; Salkeld, 1983; Rennwald 1993; Sannino & Espinosa, 1999, 2002; Ebert & Steiner, 2001; King, personal observations).

Tabla 1.— Estrategias empleadas por los Sterrhinae europeos en la puesta (Wiltshire, 1962; Salkeld, 1983; Rennwald, 1993; Sannino & Espinosa, 1999, 2002; Ebert & Steiner, 2001; King, observaciones personales).

Taxa	Strategy observed	Material	Bibliography
<i>Cleta ramosaria</i> (Villers, 1789)	Ova laid either individually or in twos on fragments of dry plant material.	2 ♀♀ 15.IV.07, Tres Cantos	G.E. King <i>leg.</i>
<i>Idea flaveolaria</i> (Hübner, [1809])	Ova scattered in box in late afternoon, presumably laid at random whilst in flight.	♀ 13.VII.14, Tetti Gaina, fraz. Valdieri, 1057 m, Cuneo, Italy, G.E.King <i>leg.</i>	
<i>Idea muricata</i> (Hufnagel, 1767)	Deposited in short rows or groups (Ebert & Steiner, 2001).	Ebert & Steiner (2001).	
<i>Idea litigiosaria</i> (Boisduval, 1840) (Fig. 4)	Ova laid in twos on the substrate (see text) (Fig. 4).	♀ 31.V.09, El Goloso, G.E.King <i>leg.</i>	
<i>Idea mediaria</i> (Hübner, 1819)	Laid individually on substrate (fragments of dry plant material).	♀ 21.VI.08, Ciempozuelos, G.E.King <i>leg.</i>	
<i>Idea sericeata calvaria</i> Wehrli, 1927	Facultative: Laid scattered or laid ova individually on the leaves and the stem of a sprig (see text).	♀ 19.VI.01, Los Santos de la Humosa; ♀♀ 16.V.03, 5.VI.10, Ciempozuelos, G.E.King <i>leg.</i>	
<i>Idea macilentaria</i> (Herrich-Schäffer, 1847)	Ova scattered presumably in flight within the confines of a container.	Various ♀♀ <i>ex larvae</i> , Alpedrete, 987 m, Madrid, G.E.King <i>leg.</i>	
<i>Idea ochrata</i> (Scopoli, 1763)	Ova scattered by females in flight (Rennwald, 1993).	Rennwald (1993).	
<i>Idea ochrata albida</i> (Zerny, 1936)	Ova scattered (but see text).	See text.	
<i>Idea figuraria</i> (Bang-Haas, 1907)	Small sample (n=5) but suggests ova laid individually. One ovum deposited on 'hirsute' flowers of <i>Trifolium hirtum</i> ; one laid on upper surface of polygonale leaf, also at base of container (2 females in different containers).	2 ♀♀ 12.VI.13, Cantoblanco, G.E.King <i>leg. et det.</i> (gen. prep. 3879, 3880).	
<i>Idea laevigata</i> (Scopoli, 1763)	Ova laid individually or in groups 2-6 units in filaments of Poaceae flower, not laid in <i>Rumex acetosella</i> flowers. One observation indicates row laid (9 units). Not laid with axis horizontal to substrate.	♀ 5.VI.10, Ciempozuelos; ♀ 19.VI.12, Madrid, G.E.King <i>leg. et det.</i>	
<i>Idea incisaria</i> (Staudinger, 1892)	Ova laid individually or in twos or threes or up to 12 units on substrate varying from silk threads to fragments of dry plant material). Occasionally eggs individually laid on walls of container.	♀ 20.V.06, Ciempozuelos; ♀ 23.VI.08, Madrid; ♀ 10.V.14, El Regajal, Aranjuez; ♀ 17.V.14, El Goloso, G.E.King <i>leg. et det.</i>	
<i>Idea calunetaria</i> (Staudinger, 1859)	Ova laid in untidy groups, for example on flowers of <i>Trifolium</i> .	♀ 15.IX.12, Cantoblanco, G.E.King <i>leg. et det.</i> (3840)	
<i>Idea bigladiata</i> Herbulot, 1975	Facultative: Ova laid randomly scattered in presence of flowers of <i>Lavendula</i> and <i>Thymus</i> leaves; or laid on walls of container and not on plant material provided (<i>Thymus</i> , <i>Rumex acetosella</i>).	♀ 18.V.06, Canillejas, (GK290MA); ♀ 29.V.10, Ciempozuelos, G.E.King <i>leg. et det.</i> (3693).	
<i>Idea longaria</i> (Herrich-Schäffer, 1852) (Fig. 2)	Ova laid on substrate individually or in small untidy groups (Fig. 2), on occasion the eggs are laid in a more regular fashion, for example, following a leaf margin.	♀ 25.IX.07 (GK537MA); ♀ 9.X.09; ♀ 2.X.12, Cantoblanco (3842); ♀ 21.VI.08, Ciempozuelos (GK1142MA) G.E.King <i>leg. et det.</i>	
<i>Idea seriata canteneraria</i> Boisduval, 1840	In clumps or in rows of several ova (Sannino & Espinosa, 2002).	Sannino & Espinosa (2002).	
<i>Idea mancipiata</i> (Staudinger, 1871)	Ova laid in small groups or in twos adhered to the substrate; axis horizontal to substrate, <i>Rumex acetosella</i> , for example.	♀ 5.VI.09 (3516); ♀ 21.VI.11; ♀ 26.VI.12; ♀ 18.VIII.12, Cantoblanco, G.E.King <i>leg. et det.</i>	
<i>Idea dimidiata</i> (Hufnagel, 1767)	Ova laid 'along edges of substrate, singly and in groups' (Salkeld, 1983). 'Heaps' of ova laid (>10) on lignified strands of <i>Polygonum aviculare</i> which had come away on being cut.	♀ 26.VII.13 Salkeld (1983). Woodley, Berkshire, 80 m, UK, G.E.King <i>leg. et det.</i>	

Table 1.— (Continued)

Taxa	Strategy observed	Material	Bibliography
<i>Idaea cervantaria</i> (Millière, 1869)	Ova are laid in a neat row, for example, on the outer margin of a leaf (see text). Further observations include 'small groups' on <i>Thymus lacaitae</i> ; rows of various units on seed pod of <i>Lepidium subulatum</i> and <i>Reseda stricta</i> .	♀ 13.VI.04; ♀ 13.V.06; ♀ 26.IV.08; ♀ 15.V.08, Ciempozuelos, G.E.King <i>leg. et det.</i>	
<i>Idaea contiguarua</i> (Hübner, 1799)	Ova in groups tied up in silken strands suspended from vegetation (Ebert & Steiner, 2001).	Ebert & Steiner (2001).	
<i>Idaea aversata</i> (Linnaeus, 1758)	Heaps of ova laid on Poaceae stem; some oviposited in twos.	♀ 21.VII.13, Earley, Berkshire, 80 m, UK, G.E.King <i>leg. et det.</i>	
<i>Scopula andalusiarua</i> Wagner, 1935	Ova laid individually in confines of container, mainly on the sides, with a few deposited on <i>Salsola vermiculata</i> .	♀ 21.VI.08, Ciempozuelos, G.E.King <i>leg. et det.</i>	
<i>Scopula ornata</i> (Scopuli, 1763)	Ova deposited individually on underside of leaf (Ebert & Steiner, 2001).	Ebert & Steiner (2001).	
<i>Scopula turbulentaria</i> (Staudinger, 1870)	Deposited in small groups (< 4) (Sannino & Espinosa, 1999).	Sannino & Espinosa (1999).	
<i>Scopula marginepunctata</i> (Goeze, 1781)	Ova deposited individually on underside of leaf (Ebert & Steiner, 2001).	Ebert & Steiner (2001).	
<i>Scopula imitaria</i> (Hübner, 1799)	Ova deposited singly on sides of container.	♀ 7.VI.14, El Goloso, G.E.King <i>leg. et det.</i>	
<i>Scopula minorata</i> (Boisduval, 1833)	Deposited either singly or in small groups on various substrates (container, plant material, for example, <i>Rumex crispus</i>).	♀ 7.X.07 (GK506MA); Wiltshire (1962). ♀ 13.X.07 (GK535MA), Ciempozuelos, G.E.King <i>leg. et det.</i>	
<i>Scopula</i> (<i>Glossotrophia</i>) <i>rufomixtaria</i> (Graslin, 1863)	Deposited singly on either plant fragments, or on the sides of container even if <i>Gypsophila struthium</i> not included, however, once available ova are laid on plant.	♀ 31.V.08 Ciempozuelos, G.E.King <i>leg. et det.</i>	
<i>Scopula</i> (<i>Glossotrophia</i>) <i>asellaria dentatolineata</i> Wehrli, 1926	Ova laid in rows of four or five at base of container (not on sprig) in presence of food-plant <i>Antirrhinum majus</i> ova or laid in 'disorganised piles' (< 4) still in presence of food-plant.	2 ♀♀ 22.V.10; ♀ 29.V.10, Ciempozuelos, G.E.King <i>leg. et det.</i>	
<i>Timandra comae</i> Schmidt, 1931	Ova laid individually on <i>Polygonum aviculare</i> .	♀ 15.VIII.10, Sant'Ana di Valdieri fraz. Valdieri, 981 m, Cuneo, Italy, G.E.King <i>leg. et det.</i>	
<i>Rhodometra sacraria</i> (Linnaeus, 1767)	Ova deposited usually individually, but also in twos, often associated with <i>Polygonum aviculare</i> which can include leaves (upper surface), stem or exposed roots; other material includes inner surface of container, silk threads and paper.	♀ 12.IX.10, El Goloso; Skule (1980). ♀ 24.X.12, Madrid, G.E.King <i>leg. et det.</i>	
<i>Casilda consecraria</i> (Staudinger, 1871)	Normally laid singly, sometimes in small groups, either on leaves or flowers of <i>Limonium dichotomum</i> or on other substrates, for example, sides of container.	♀ 26.IV.08; 2 ♀♀ 13.VI.10, Ciempozuelos, G.E.King <i>leg. et det.</i>	
<i>Lythria sanguinaria</i> (Duponchel, 1848)	Ova deposited in short rows (> 4) on dry vegetation, such as that of <i>Rumex acetosella</i> (Polygonaceae), or singly at base of container.	2 ♀♀ 21.IV.13, ♀ 15.IV.14; ♀ 15.V.14, Tres Cantos, G.E.King <i>leg. et det.</i>	

1802: *S. limboundata* (Haworth, 1809), *S. junctaria* (Walker, 1861), *S. quadrilineata* (Packard, 1876) and *S. inductata* (Guenée, 1858), as well as a species of *Cyclophora* Hübner, 1822: *C. pendulinaria* (Guenée, 1858). Salkeld (1983) does not establish any synapomorphy with reference to the ova of the sterrhines. However, amongst the Cosymbini Prout, 1911 and

the Timandrini Stephens, 1850, these could include circular-shaped polygonal cells ('areolae' according to Downey & Allyn, 1984) without there being a regular pattern as such; in the rosette at the anterior pole one finds a uni-cellular polygonal row which surrounds the pole. In amongst the *Scopula* analysed, the positioning of the polygonal cells follows

a ‘columnar pattern’; in addition in the chorion itself, the cell margins are ‘steep’ rather than ‘gentle’.

Young (2006) gave a full description of the ovum of *S. perlata* (Walker, 1861) from southern Australia; pointing out the egg as being ‘marked on all surfaces by flat, quadrate cells arranged longitudinally on wider lateral sides, with length-wise walls relatively broad, elevated, forming prominent length-wise ribs; transverse walls non-elevated, barely discernible; cells on anterior pole irregular polygons, concave with moderately broad walls overlain with a very narrow shallow reticulum. Aeropyles very inconspicuous, slightly elevated, openings very small, distributed on anterior pole only. Chorion smooth, overlaid with a mesh-like reticulum’.

The bibliography which deals with the European, and by extension, Mediterranean, Sterrhine ova or egg deposition is not extensive, with data in Salkeld (1983), Ebert & Steiner (2001), Sannino & Espinosa (1999, 2002), in addition to King (2014) (*Lythria sanguinaria* (Duponchel, 1848) (Fig. 3) (see Table 1). Hausmann *et al.* (2007) include a SEM image of the ovum of the Macaronesian species: *I. nigra* Hausmann & Bläsius, 2007.

This present paper aims to provide original morphological data of the ova of the relatively poorly-known Mediterranean sterrehine fauna of a limited number of taxa, in addition to data of the ovipositional strategies adopted under laboratory conditions; comparative data are also given for other European species.

The sterrehines are an interesting moth sub-family, especially in the Mediterranean region where they are well-represented faunistically (Hausmann, 2004). This is due to their adaptation to the prolonged summer drought, with most species spending an

inordinate length of time in the larval stages, as well as to their ability to deal with desiccated or otherwise sub-standard vegetation. Additionally, the majority of species adopt phenological strategies to cope with the harsh climate (Covell, 1983; Hausmann, 2004), for example, species which are monovoltine tend to emerge in early May allowing the larvae to feed up slowly over the summer as low plant foliage senesces, taking advantage of new plant growth available once rains arrive in the late autumn. This is the case with *Idaea ochrata albida* (Zerny, 1936), additionally, females of this taxon scatter their ova whilst in flight, leaving the neonates to find food sources at ground level (Rennwald, 1993; Hausmann, 2004).

Material and methods

Female moths were generally taken at rest during the day in a variety of anthropogenically altered locations in Madrid (or Zaragoza) (Table 2) (railway stations, for example) (*I. incisaria*, *I. longaria*, *I. cervantaria*), or captured, having been disturbed during the day, or at dusk, with a standard butterfly net (*I. litigiosaria*). Only one taxon is diurnal (*I. sericeata calvaria*) (Hausmann, 2004). One taxon: *S. (G.) asellaria dentatolineata* was taken at rest on gypsum outcrops.

Female sterrehine moths are not demanding in terms of conditions to be adopted in the laboratory when referring to oviposition requirements (Friedrich, 1986); nevertheless, contact with plant material (stems, flowers, roots) does facilitate the event (Ebert & Steiner, 2001; Hausmann, 2004). Regarding *I. incisaria* (Staudinger, 1892), *I. longaria* and *I. cervantaria* (Millière, 1869), these taxa laying ova individually or in rows or small heaps, or even on the

Table 2.— Localities in Madrid (and Zaragoza) which provided females (and ova as a result).

Tabla 2.— Localidades en Madrid (además de Zaragoza) en las cuales se capturaron las hembras con los huevos obtenidos como resultado.

Locality	Altitude	UTM	Characteristics
Canillejas (Madrid municipality)	600 m	30TVK47	Tagus valley: Urban area city ‘park’ on gypsym soils with successional vegetation.
Cantoblanco (Madrid municipality)	720 m	30TVK48	Refers to the railway station, which tends to attract moths to its lights in from anthropogenically-degraded <i>Quercus ilex</i> light woodland in the immediate vicinity.
Cerros de Vallecas (Madrid municipality)	600 m	30TVK46	Tagus valley: anthropogenically-degraded area of gypsym soils.
Ciempozuelos (Madrid)	600 m	30TVK44	Tagus valley: anthropogenically-degraded area of gypsym soils; some <i>Quercus coccifera</i> .
El Goloso (Madrid municipality)	720 m	30TVK48	Anthropogenically-degraded <i>Quercus ilex</i> light woodland.
El Regajal (Aranjuez municipality)	600 m	30TVK42	Tagus valley: <i>Quercus ilex</i> - <i>Q. coccifera</i> light woodland; gypsym soils.
Los Santos de la Humosa (Madrid)	600 m	30TVK57	Tagus valley: anthropogenically-degraded area of gypsym soils.
Tres Cantos (Madrid)	720 m	30TVK48	Anthropogenically-degraded <i>Quercus ilex</i> light woodland.
Valdespartera (Zaragoza municipality)	215 m	30TXM70	Urban area, successional vegetation on gypsym soils (Ebro valley).

walls of a plastic container (King, 2013). *I. ochrata* is different in that the female drops the ova whilst in flight so that they scatter, which reflects what they do in the wild (Rennwald, 1993). Females of *Scopula (Glossotrophia) rufomixtaria* (Graslin, 1863) and *Scopula (Glossotrophia) asellaria dentatolineata* (Wehrli, 1926) tend to ignore sprigs of the food-plant provided and lay eggs individually or in small groups or even clusters, on the walls of the plastic container, although the presence of the plant could be acting as a stimulant to produce eggs. On the other hand, both *Rhodometra sacraria* (Linnaeus, 1767) and *Casilda consecraria* (Staudinger, 1871), do lay individually or in twos or threes on the food-plant provided, especially on the flowers (King, 2013). Ova thus obtained were kept at ambient room temperature with no special requirements until the moment of eclosion (incubation times refer to time taken from moment of oviposition until first neonates were noted, with the rider that not all ova eclose at once, but over several days).

Eggs collected were stored in 70% ethanol in *Eppendorf* vials.

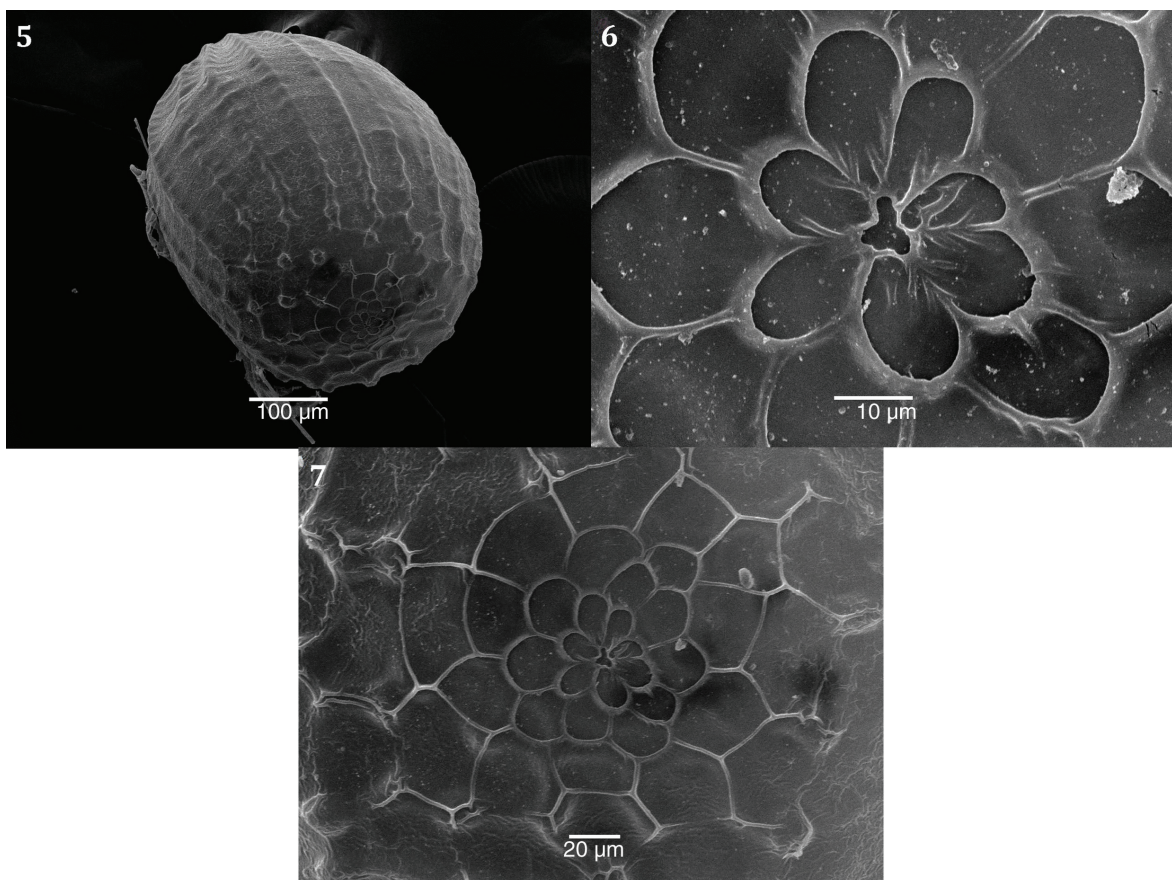
Images obtained by SEM involved attaching the eggs (70-100% ethanol gradient beforehand) on to carbon adhesive discs which were adhered to *stubs* (those already hatched could be attached directly to

the carbon discs without having gone through different alcohol gradients), these were then subject to being bathed in gold using a *Quorum Q150TS*, the images themselves being taken with a SEM model *Amray 1810* (10 kV). Images were taken either at the Universidad de Concepción (Chile) or at the Universidad Autónoma de Madrid.

Results

Idaea litigiosaria (Boisduval, 1840):

♀ 31.V.09, El Goloso (Madrid, 720 m). Ova laid in twos on the substrate (dry straw) in horizontal position, that is to say, with the micropyle positioned parallel to substrate (n=12) (Syme, 1961; Young, 2006) (Fig. 4); incubation period: 6.VI.09 (6 days); ♀ 17.V.14, El Goloso, ova eclosed 24.V.14; 7 days) (n=2) (females). Ovum 'elongated' globe, poles rounded; chorion surface is relatively smooth formed by 'lop-sided square-shaped' cells that finish in relatively pronounced longitudinal ridges (Fig. 5); micropyle (Fig. 6) surrounded by a rosette composed of primary cells (6) in the shape of 'petals', and much more oval secondary cells (11) (Fig. 7) (Syme, 1961; Young, 2006).



Figs. 5-7.— *Idaea litigiosaria* ovum, ♀ 31.V.09, El Goloso, Madrid: 5) latero-ventral view; 6-7) rosette, micropyle.

Figs. 5-7.— Huevo de *Idaea litigiosaria*, ♀ 31.V.09, El Goloso, Madrid: 5) vista latero-ventral; 6-7) roseta, micropilo.

Idaea sericeata calvaria Wehrli, 1927:

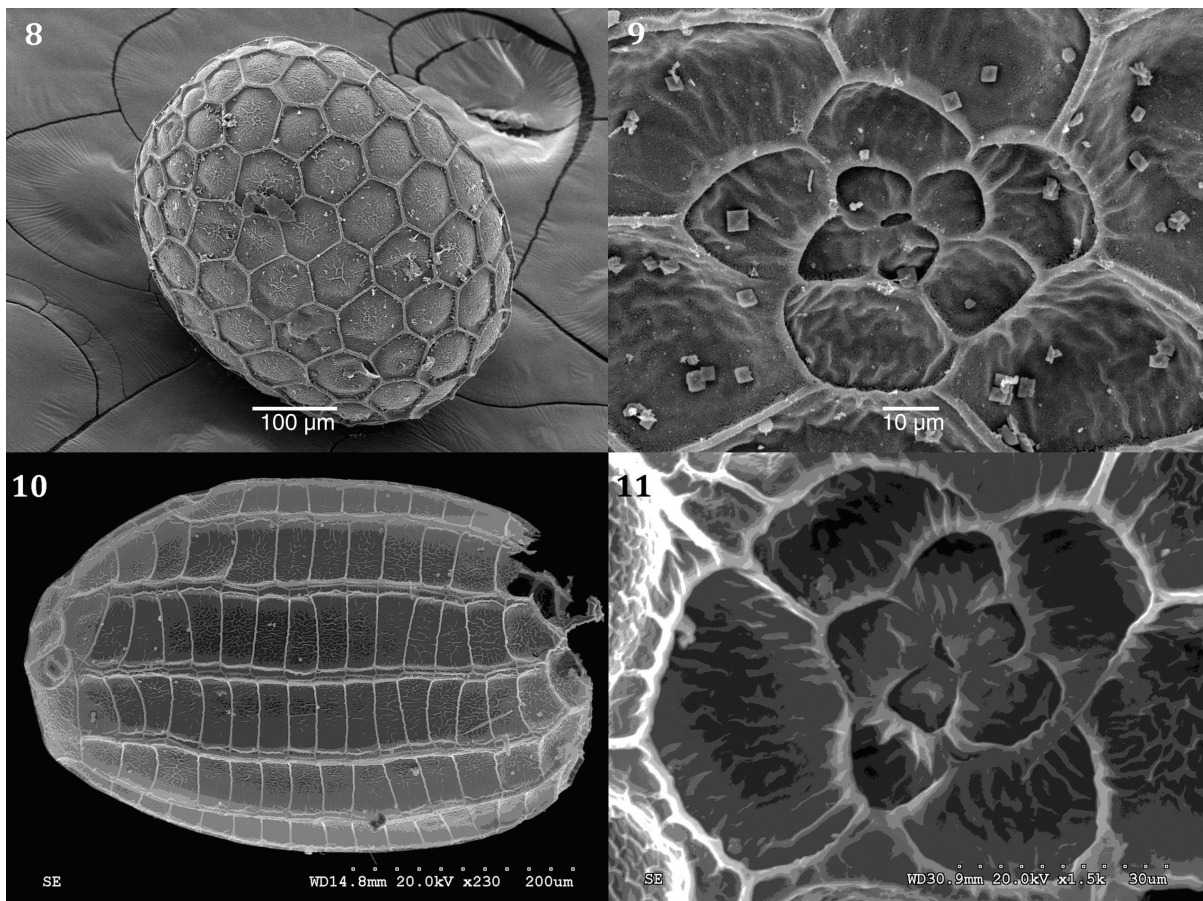
♀ (larva, 13.IV.08, Tres Cantos, Madrid, 720 m); pairing obtained in captivity x ♂ 31.V.08, Ciempozuelos, Madrid, 600 m). Laid loosely in a plastic container at ambient temperature without special requirements (n=20) ♀♀ (n=2): 19.VI.01 (Los Santos de la Humosa, Madrid, 600 m; ♀ 16.V.03 (Ciempozuelos); incubation period: 6 days. Egg laying strategy in this taxon seems to be facultative (see below): ♀ (5.VI.10, Ciempozuelos) laid ova individually on the leaves and the stem of a sprig of *Medicago sativa* (Papilionaceae).

Colour shiny lemon-yellow; egg laid in horizontal position; micropyle positioned parallel to substrate when not laid loosely; roundish in form somewhat flattened (n=2) (Fig. 8), surface with polygonal cells slightly irregular being highly pronounced at their margins suggesting 'fish net'; rosette composed of primary cells (4) and secondary cells (5) which surround the micropyle (Fig. 9) (Syme, 1961; Young, 2006).

Idaea ochrata albida (Zerny, 1936):

♀ 2.vi.12, El Goloso: ovum oval shape, somewhat flattened, poles rounded, pronounced ridges, cells take shape of 'elongated' rectangles some more regular than others (Fig. 10), the micropyle is almost 'triangular' surrounded by secondary cells in form of 'petals' of different shapes (Fig. 11).

Females oviposit ova at random loosely so that eggs accumulate at base of plastic container (see previous comments) (n=5: ♀ 5.VI.99, Valdespartera, Zaragoza, 200 m; ♀ 17.VI.00, Ciempozuelos; ♀ 26.V.06, Canillejas, t. m Madrid, 600 m; ♀ 19.VI.04, Ciempozuelos; ♀ 2.VI.12, El Goloso) however, one occasion witnessed an egg laid on substrate (in horizontal position with micropyle parallel to substrate) (*Thymus* sprig) although the same female (♀ 19.VI.04) laid rest of eggs loosely. Incubation period according to conditions in captivity is highly variable: 5-13 days (n=6). Females obtained 1998-2006: Huesca, Zaragoza, Madrid.



Figs. 8-11.— 8) *Idaea sericeata calvaria*, ♀ 31.V.08, Ciempozuelos, Madrid, ovum: latero-ventral view; 9) *Idaea sericeata calvaria*, ♀ 13.IV.08 ex larva, Tres Cantos, Madrid, ovum: rosette, micropyle. 10) *Idaea ochrata albida*, ♀ 14.VI.08, El Goloso, Madrid, eclosed chorion, lateral view; 11) *Idaea ochrata albida*, ♀ 2.VI.12, El Goloso, Madrid, ovum: rosette, micropyle.

Figs. 8-11.— 8) *Idaea sericeata calvaria*, ♀ 31.V.08, Ciempozuelos, Madrid, huevo: vista latero-ventral. 9) *Idaea sericeata calvaria*, ♀ 13.IV.08 ex larva, Tres Cantos, Madrid, huevo: roseta, micropilo. 10) *Idaea ochrata albida*, ♀ 14.VI.08, El Goloso, Madrid, corión eclosionado, vista lateral. 11) *Idaea ochrata albida*, ♀ 2.VI.12, El Goloso, Madrid, huevo: roseta, micropilo.

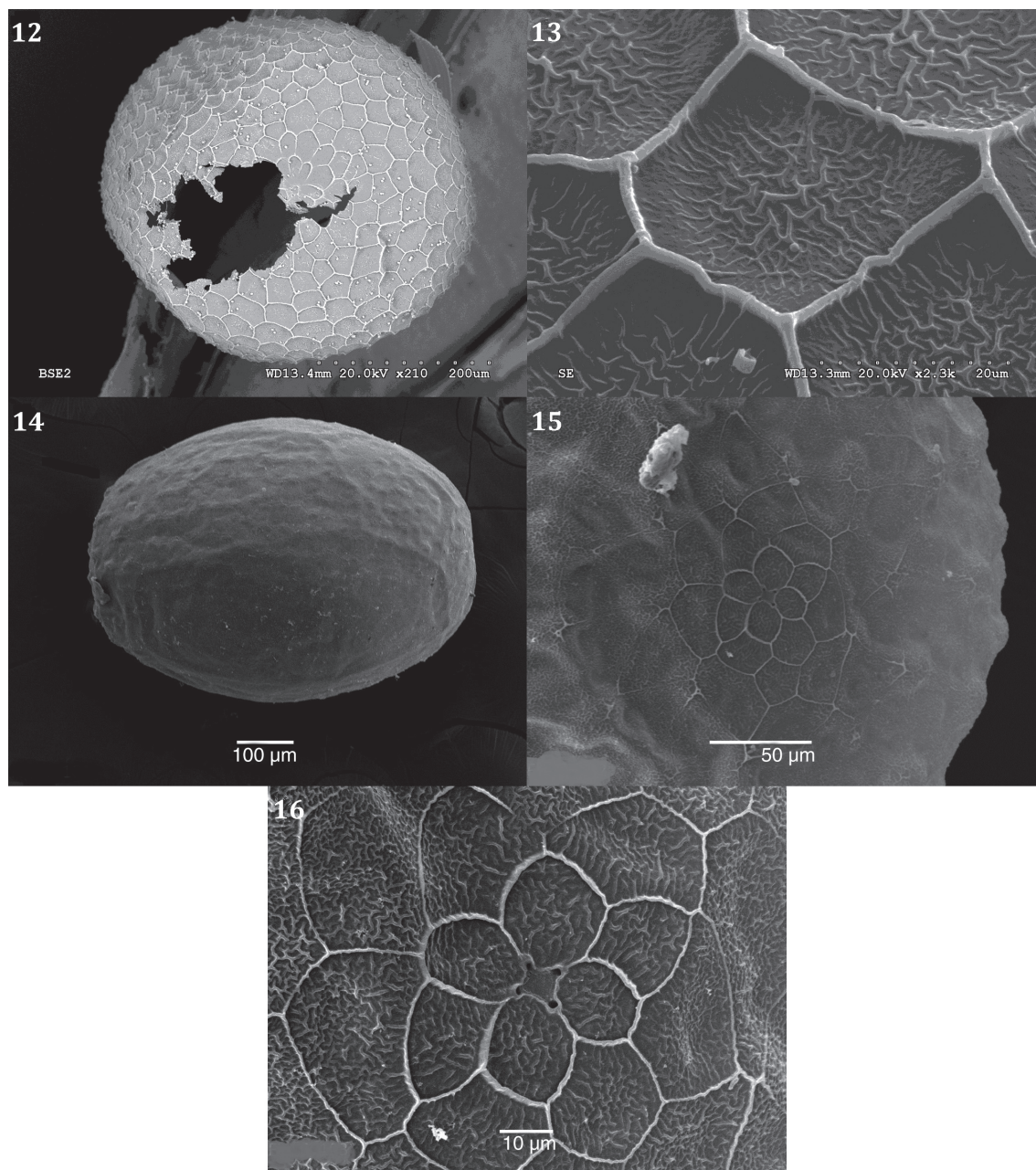
Idaea incisaria (Staudinger, 1892):

♀ 30.v.02, Cantoblanco, Madrid, 720 m. Female oviposits in neat rows on fragments of plant material (horizontal with micropyle parallel to substrate, or more randomly (observations: ♀ 23.VI.08, Madrid capital (Hortaleza, casco urbano, 725 m), slide preparation: GK1143MA, deposited UAM Col. GEK). Egg ovoid form within distinct poles; rosette in proximity to micropyle composed of 'elongated' cells taking shape of 'petal' (Fig. 12); chorion cells take form of

irregular rhomboids with very well-defined ridges (n=1) (Fig. 13). Incubation period according to conditions in captivity is rather variable: 4-10 days (n=5) (females).

Idaea cervantaria (Millière, 1869):

♀ 26.IV.08, Ciempozuelos, Madrid. Ova are laid in a neat row, for example, on the outer margin of a leaf of *Antirrhinum majus* (♀ 13.V.06, Ciempozuelos): egg 'gold' in colour; surface relatively 'smooth' (Fig. 14)



Figs. 12-16.— *Idaea incisaria*, ♀ 30.V.02, Cantoblanco, Madrid, 12) eclosed chorion, dorsal view and 13) reticulated chorion walls. 14-16) *Idaea cervantaria* ovum, ♀ 26.IV.08, Ciempozuelos, Madrid: 14) lateral view; 15) dorsal view, rosette, micropyle; 16) rosette, micropyle.

Figs. 12-16.— *Idaea incisaria*, ♀ 30.V.02, Cantoblanco, Madrid, 12) corión eclosionado, vista dorsal y 13) paredes reticuladas del corión. 14-16) Huevo de *Idaea cervantaria* ♀ 26.IV.08, Ciempozuelos, Madrid; 14) vista lateral; 15) vista dorsal de roseta y micropilo; 16) roseta, micropilo.

with a distinct patterning of 'blunt' triangle-shaped cells (Fig. 15), poles are 'flattened' (Fig. 14), rosette formed of primary cells in shape of 'petals' (4) and secondary cells (6) ($n=1$) (Figs. 15, 16); micropyle 'square-shaped'. Incubation period: 6-7 days ($n=4$) (females).

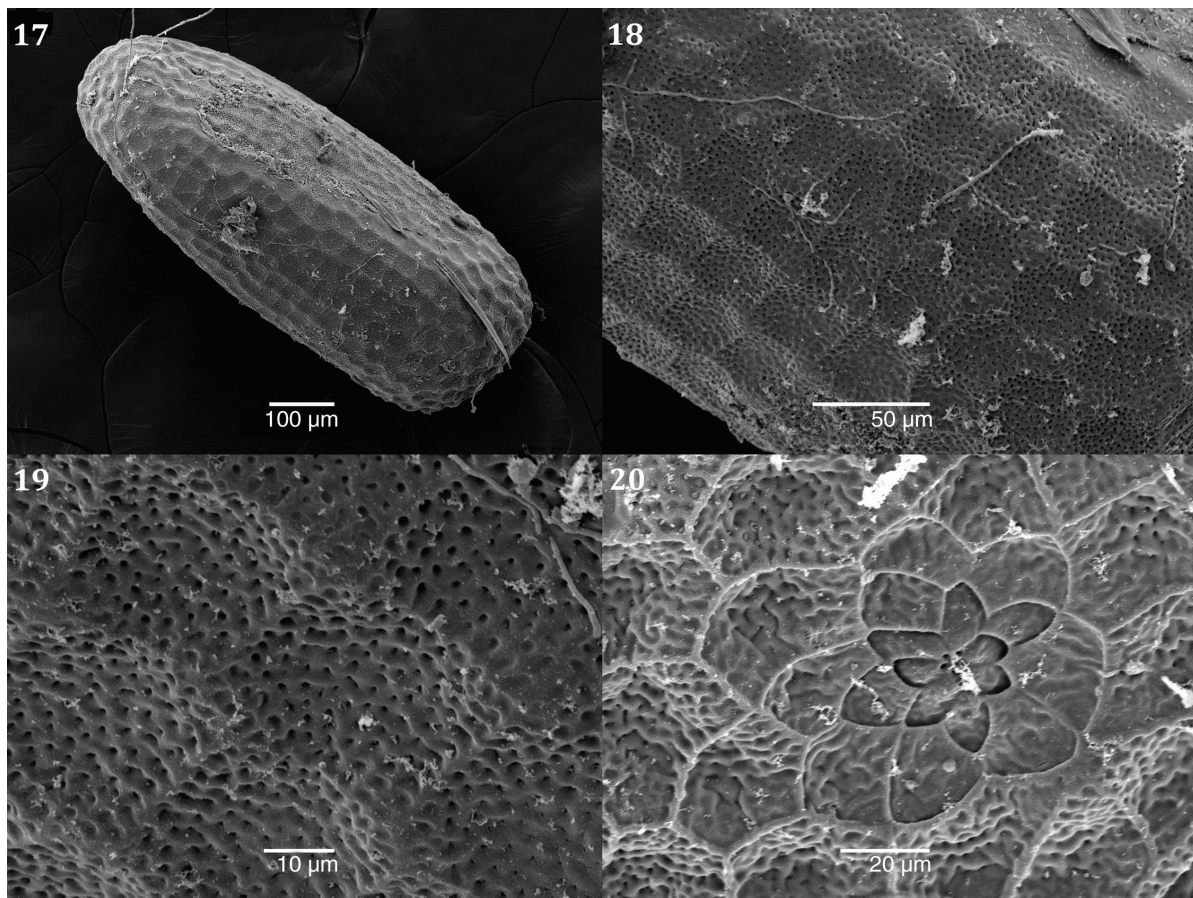
Scopula (Glossotrophia) asellaria dentatolineata Wehrli, 1926:

Eggs are laid in rows of four or five at base of container (not on sprig) in presence of food-plant *Antirrhinum majus* (2 ♀♀ 22.V.10; Ciempozuelos); ♀ 29.V.10 ova were laid in small piles also with food-plants; on being laid eggs are greenish-white changing to orange with numerous pink spots of varying size on chorion ($n=10$); axis horizontal to substrate; somewhat 'flattened' and 'lengthened', anterior pole more rounded (Fig. 17); numerous aeropyles give impression of porous surface, cells 'square-shaped' (Figs. 18, 19); rosette clearly defined, formed by series of five primary cells and secondary cells around micropyle (Fig. 20). Incubation period: 7 days [2 ♀♀ 22.v.10, Ciempozuelos: larvae eclosed: 29.V.10= ($n=2$)].

Discussion and conclusions

Original data have been provided on the structure of the ova of six sterrhine taxa, in addition, biological data have been given which deal with ovipositional strategies in relation to the substrate. With reference to three taxa: *I. litigiosaria*, *I. sericeata calvaria* and *I. ochrata albida* data were available (Chrétien, 1899a, 1899b; Kristensen, 1966; Rennwald, 1993; Ebert & Steiner, 2001), although with the latter taxon this data referred to the nominotypical *I. ochrata* (Scopoli, 1763).

OVIPOSITIONAL STRATEGIES: The little data that is available on the strategies adopted by European sterrhines is summarised in Table 1 which includes observations of 34 taxa with 21 (=61.8%) in the tribe Sterrhini Meyrick, 1892. Although the data available may be an artifact having been influenced by the conditions under which females were kept in captivity, there are three categories which can be recognised: ova scattered, ova laid individually, or ova laid in groups of varying units. It can be seen (Table 1) that only the Sterrhini are known to 'scatter' their ova



Figs. 17-20.— *Scopula asellaria dentatolineata* ovum, ♀ 5.v.05, Ciempozuelos, Madrid: 17) lateral view; 18) cells, lateral view; 19) pitted surface; 20) rosette, micropyle.

Figs. 17-20.— Huevo de *Scopula asellaria dentatolineata*, ♀ 5.v.05, Ciempozuelos, Madrid: 17) vista lateral; 18) celdas, vista lateral; 19) superficie agujereada; 20) roseta, micropilo.

including six taxa for which there are data available: *I. flaveolaria*, *I. sericeata calvaria*, *I. macilentaria*, *I. ochrata*, *I. ochrata albida* and *I. bigladiata*, of these six taxa, four taxa seem to be facultative (see Table 1) in terms of whether they ‘scatter’ their ova or adhere them to a substrate. In addition, all these taxa are diurnal exclusively, or combine nocturnal and diurnal flight patterns (Ebert & Steiner, 2001; Hausmann, 2004; King, personal observations), with the possible exception of *C. ramosaria* a diurnal species which adheres ova to a substrate (Table 1). In the Scopulini Duponchel, 1845, it would appear that most species oviposit individually, although only eight European species are detailed in Table 1. Nevertheless, Peterson (1968) mentions two Nearctic species that do oviposit at random (see text above).

Oviposition strategies would reflect how the neonate would be expected to find food, as well as what plant and in what condition it might be expected to be (Zalucki *et al.*, 2002), in this way, if the female scatters its ova (as is the case with the two taxa in this study) larvae would take advantage of geophytes in a generalised way, and by the time eclosion occurs we can also expect senescence to be already advanced in plants that we would expect them to attack. Sterrhines are solitary feeders, so the fact that some taxa do oviposit in groups, albeit in neat rows on dry stalks (as is the case with three taxa in this study), would suggest that it is not so much larval feeding strategies but energy saving by the egg-laying female that is the overriding factor. Those that lay in more limited numbers, *I. litigiosaria* (two to three), or individually (or in limited groups or clusters) (*S. asellaria dentatolineata*), presumably do so in order to avoid overcrowding, or in the case of the latter taxon, because it is oligophagous attacking a limited number of scrophulariats (or labiates), *Antirrhnum majus*, for example; in the wild state, imagines are to be found in the vicinity of this latter plant, so presumably lay on it (King & Viejo Montesinos, 2010).

Table 3.— The six sterrhine taxa and morphological categories of the eggs according to Salkeld (1983).

Table 3.— Categorías morfológicas de los huevos de seis taxa de Sterrhinae, según Salkeld (1983).

Taxa	‘netted’ chorion	‘ridged’ chorion
<i>Idaea litigiosaria</i> (Boisduval, 1840)		x
<i>I. sericeata calvaria</i> Wehrli, 1927	x	
<i>I. ochrata albida</i> (Zerny, 1936),		x
<i>I. incisaria</i> (Staudinger, 1892),	x	
<i>I. cervantaria</i> (Millière, 1869)	x	
<i>Scopula</i> (<i>Glossotrophia</i>) <i>asellaria dentatolineata</i> Wehrli, 1926	x	

MORPHOLOGY OF THE OVA: According to Salkeld (1983) (Table 3 groups the six taxa analysed in this paper in the same way) the chorion of *Idaea* ova can be divided into two categories: ‘netted’ and ‘ridged’; the same author also stated that oviposition mode does not correlate with the chorion category. Salkeld (1983) indicated that the eggs of *Scopula* (of the four species he analysed) follow the same, or very similar, chorion pattern the only taxon in this genus analysed in the present paper, *S. asellaria dentatolineata*, does not belong to the ‘ridged’ chorion group, but in a general way, to Salkeld’s ‘netted’ category. The chorion of *I. cervantaria* also exhibits a less ‘pronounced’ ‘nettedness’. The recently described *I. nigra* (Hausmann *et al.*, 2007), which included a SEM image of the ovum, might be included in the category of ‘ridged’ chorion, although it should be stated, that the particular form it shows would require a more detailed analysis, i.e. that it does not follow the pattern established by Salkeld (1983).

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