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THE *QUERCUS* FEEDING *STIGMELLA* SPECIES OF THE WEST PALAEARCTIC: NEW SPECIES, KEY AND DISTRIBUTION (LEPIDOPTERA: NEPTICULIDAE)

Nieukerken, E. J. van & R. Johansson, 2003. The *Quercus* feeding *Stigmella* species of the West Palaearctic: new species, key and distribution (Lepidoptera: Nepticulidae). – Tijdschrift voor Entomologie 146: 307-370, tables 1-3, figs. 1-179. [ISSN 0040-7496]. Published 1 December 2003.

The species of the *Stigmella ruficapitella* group occurring in the Western Palaearctic and feeding on *Quercus* are reviewed. We recognise 19 species, five of which are described as new: *Stigmella fasciata* **sp. n.** on *Quercus pubescens* from Slovenia, Croatia, Greece and Turkey, *S. cocciferae* **sp. n.** on *Q. coccifera* from Greece, Turkey and Israel, *S. kasyi* **sp.n.** from Afghanistan, possibly feeding on *Quercus baloot*, *S. bicuspidata* **sp. n.** from Turkey (host unknown) and *S. karsholti* **sp. n.** on *Q. canariensis* from Tunisia. *Stigmella ilicifoliella* (Mendes, 1918) **comb. n., stat. rev.** is removed from synonymy with *S. suberivora* (Stainton, 1869), it occurs in France, Spain and Portugal, partly sympatric with *S. suberivora* on *Quercus rotundifolia, Q. ilex* and *Q. suber*. *Stigmella nigra* Dufrane, 1955 is synonymised with *S. ilicifoliella. S. suberivora, S. ilicifoliella, S. szoecsiella* (Borkowski, 1972), *S. macrolepidella* (Klimesch, 1978), *S. zangherii* (Klimesch, 1951), *S. dorsiguttella* (Johansson, 1971), *S. trojana* Z. & A. Laštůvka, 1998 and *S. eberhardi* (Johansson, 1971) are redescribed. A new diagnostic character on the forewing underside is described for male *S. svenssoni* (Johansson, 1971). Data on distribution and biology are given for all species, keys are given for males and for male and female genitalia. All known hostplants are listed, including several new records. The fauna on evergreen oaks, counting three species, is poor compared to that on deciduous oaks and compared to the genus *Ectoedemia*. The Eastern Mediterranean region, with about five endemic species, has a more diverse fauna than the Western part, were only three endemic species occur.

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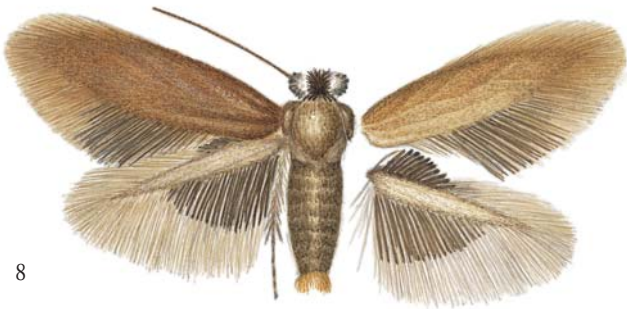
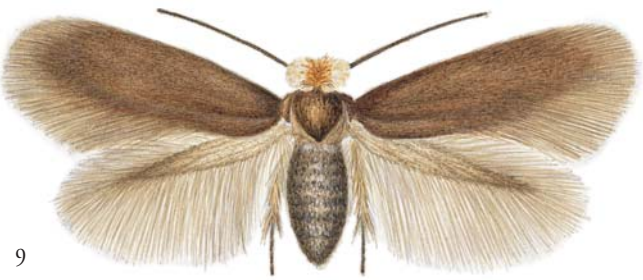
Oaks (*Quercus* species) harbour an enormous diversity of herbivorous insects, and in Europe there are more insects on oaks than on any other tree (Southwood 1961). Leafminers are among the commonest insects on oaks: Hering (1957) recognised about 200 species in Europe, the majority being Lepidoptera. Identification of these leafminers has often been difficult and many taxonomic changes have occurred since Hering's work, making identification often almost impossible.

Within the Nepticulidae, the approximately 26 leafmining species of *Ectoedemia* Busck, 1907 (s. str.) and the few barkmining species in *Ectoedemia (Zimmermannia)* Hering, 1940 feeding on *Quercus* have been revised previously (Van Nieukerken 1985, see Laštůvka & Laštůvka 1998 for one or two additional species). The species of *Stigmella*, all belonging to the *Stigmella ruficapitella* group in the sense of Johansson & Nielsen (1990), have always given identification problems, until the junior author provided their first critical revision (Johansson 1971). All the northern European species, including the four non *Quercus* feeders in this group, were completely treated by Johansson & Nielsen, including colour illustrations of adults.

In material from the Mediterranean region and Middle East we found five hitherto undescribed species, either reared from *Quercus*, or believed to be *Quercus* miner. Also, since Johansson (1971), many new data on the other species of the *ruficapitella* group have become available, and some new species had been described, especially from the Mediterranean region. In this paper we therefore describe the new species, in-





Figs. 1-9. *Stigmella* spp., dorsal aspect; wing underside at right side (3, 5, 6, 8). – 1, *S. fasciata* ♂, paratype, Greece, Kalavrita; 1a, underside wings, paratype, Turkey, 2, *S. fasciata* ♀, holotype, abdomen reconstructed; 3, *S. suberivora*, ♂, Italy, Itri; 4, *S. suberivora*, ♀, Italy, Itri; 5, *S. ilicifoliella*, ♂, Spain, Cadalso de los Vidrios; 6, *S. cocciferae* ♂, paratype, Greece, Kos, Asfendiou; 7, *S. cocciferae* ♀, paratype, Greece, Kos, Asfendiou; 8, *S. kasyi* ♂, holotype, abdomen reconstructed; 9, *S. kasyi* ♀, Afghanistan, abdomen reconstructed. All on same scale, ca 11×.

clude keys to all western Palaearctic *Quercus* (and *Castanea*) mining *Stigmella* species and give additional data on the other oak mining species. Species not treated by Johansson & Nielsen (1990) are redescribed. With the above mentioned works on *Ectoedemia,* it is now possible to identify all western Palaearctic Nepticulidae, feeding on *Quercus* and *Castanea*.

Material and methods

Material

We studied material from a wide range of sources, museums, private collections and material collected by ourselves. For the collections we use the abbreviations from Samuelson et al. (2001) with the following additions:

- AL Collection A. Laštůvka (Prostejov, Czech Republic)
- AV Collection A. Vives-Moreno (Madrid, Spain)
- BÅB Collection B.Å. Bengtsson (Färjestäden, Sweden)
- CG Collection C. Gielis (Lexmond, Netherlands)
- CVDB Collection C. van den Berg (Hoogland, Netherlands)
- GB Collection G. Baldizzone (Asti, Italy)
- GD Collection G. Derra (Reckendorf, Germany)
- HS Collection H. Steuer (Bad Blankenburg, Germany)
- HW Collection H. W. van der Wolf (Nuenen, Netherlands)
- JJ Collection J. Junnilainen (Vantaa, Finland)
- JCK Collection J.C. Koster (Callantsoog, Netherlands)
- JHK Collection J. H. Kuchlein (Wageningen, Netherlands)
- JL Collection J. A.W. Lucas (Rotterdam, Netherlands)
- MC Collection M. F. V. Corley (Faringdon, United Kingdom)
- MHNM Museum d'Histoire Naturelle de Marseille (France) (containing collection of the late R. Buvat)
- PT Collection P. Triberti (Verona, Italy)
- RJ Collection R. Johansson (Växjö, Sweden), to be deposited in ZMUC
- RS Collection R. Sutter (Bitterfeld, Germany)
- VZ Collection V. Zolotuhin (Uljanovsk, Russia)
- WB Collection W. Biesenbaum (Velbert-Langenberg, Germany)

We provide only detailed material lists for the new species and the rare species, the many records of the commoner species, especially in northern Europe are summarised, except for the faunistical interesting records, which are cited in full. A complete listing of material and literature records, including coordinates, is available as an Excel file upon request from the senior author or from his website (http://www.naturalis.nl/nieukerken). Material lists are arranged alphabetically by country and locality; when applicable, the province name is given as first item in the locality. Depositories are only given after the last record in a row, when more than one record refer to the same collection. Unpublished records we received from colleagues are listed under 'Additional records' when they are of faunistic interest, otherwise they are only used for the maps.

Maps

We provide distribution maps, prepared with DMAP 7.0 (Morton 2000). For these maps we have used the examined material supplemented with records from previous revisions (Borkowski 1972, Johansson 1971), the data from the original descriptions, databases provided by B. Gustafsson (Sweden), L. Aarvik (Norway, including all Norwegian records) and J. Buszko (Poland), records provided by M. F. V. Corley, A. and Z. Laštůvka and S. Whitebread and those post 1971 publications that we could find with reliable records based on adults. Also the few publications accompanied by genitalia figures prior to 1971 (here cited under the correct species) have been used. The references to these are included in the above mentioned Excel file. For *S. basiguttella* we also accepted records on the basis of mines and older records, and the British records of the common species may include some records which were based on leafmines; for the more critical species we have excluded all records that were clearly based on mines alone. UTM coordinates or longitude/latitude when not given on labels or in references, were mainly derived from a few major internet gazetteers and one atlas (IGN 1997-2003, NIMA 2003, Ordnance-Survey 2003, Times 2000) and further supplemented by a number of sources, including the map collection of EvN. Most maps show the approximate distribution of (some) hostplants as shaded area, see below.

Preparation and illustrations

Genitalia preparations were embedded in Euparal or Canada balsam, following the methods described in Van Nieukerken et al. (1990). Photographs of genitalia were taken with a Zeiss AxioCam digital camera attached to a Zeiss Axioskop H, using Carl Zeiss AxioVision 3.0.6 software. Drawings of genitalia were prepared by RJ with a simple microscope and updated with the help of photographs taken by a Zeiss Axioskop H. Watercolours of adults were made by RJ using diffuse natural light; in some specimens abdomens were reconstructed, in figures 27 and 34 the left wings were not drawn, but digitally mirrored. Several watercolours and genitalia figures used here were published previously by Johansson & Nielsen (1990).

Descriptions

Species fully described by Johansson & Nielsen (1990) are not redescribed, except *S. suberivora*, but diagnostic characters are provided and new information is given when applicable. All other species are described in full. Measurements are given in tables 2-4, when the number of observations is four or higher, we provide also mean and standard deviation. Measurements of genitalia were recently obtained from digital images, using AxioVision, 20× objective for male genitalia and usually 10× for females. Some older measurements were taken with an eyepiece graticule, with a precision of about 5µm. Capsule length was measured from middle of vinculum to middle of uncus, excluding any projections; valva length from tip of posterior process to ventral edge, not the sublateral process; aedeagus length was measured from the sclerotized tube, excluding any protruding vesica parts. Bursa length is measured from cloaca to anterior tip. Forewing length was measured from tip of cilia to attachment on thorax, usually at magnification of 20×. Antennal segment counts include scape and pedicel. See also some observations below.

All synonyms are given, references only to original descriptions and most relevant references, most of them post-1971. Morphological terms follow Van Nieukerken et al. (1990).

Hostplants

Nomenclature of Fagaceae follows Govaerts & Frodin (1998), deviating names in recent European treatments (Amaral Franco 1990, Schwarz 1993) are given in the hostplant list (table 1). Hostplant records of reared material, seen by us, have been provided with two asterisks (**); records of material seen by us, based either on possible mines or by inference on the basis of collected adults in pure stands of a single oak species, have been provided with a single asterisk (*). All other records are provided with a reference. Literature records prior to 1971 are neglected, except for *S. basiguttella*, or those for which the identity has been confirmed later by material. Records of unidentified *Stigmella* mines on oak species for which we have no other records, are given in the hostplant list. The distribution maps of *Quercus* are reconstructed from maps in Jalas & Suominen (1976), Menitskij (1984) and Rikli (1942-1943).

Remarks on structure and identification

Externals

Adult males are usually characteristic and can often be identified on externals alone. Some characters may vary, and in doubtful cases genitalia should always be examined, especially in areas where the fauna is less well known. The wing pattern varies from completely and uniformly dark, usually with some shine and a somewhat purplish tip, to dark wings with a variation of pale pattern. To judge colour, specimens should be viewed under natural daylight, or in the case of microscope lights it is advisable to use a blue filter. The colour of older collection material has almost always faded into a paler tinge.

Most males show some kind of special or androconial scales, although they may be rather indistinct. Most conspicuous are the spatulate scales extending into the hindwing fringe of several of the species; these may be upcurved in prepared material and are then more difficult to measure. The length of these scales is an important character to separate *S. atricapitella* and *ruficapitella*.

All species except *fasciata* have distinct anal tufts, inserted on strongly sclerotized plates on segment 8, which can best be observed in genitalia slides; sometimes these plates remain attached to the genitalia rather than the abdomen when the genitalia are severed from the abdomen. The colour of these tufts may also be diagnostic. The external genitalia (valves) are usually covered with scales of the same colour as the tufts.

Females can hardly be identified on externals, with the exception of *S. fasciata*. *Stigmella macrolepidella* and *S. roborella* can be recognized by a rather pointed ovipositor. Red-headed species can more or less be grouped by the number of antennal segments: the evergreen oak feeders have more segments than the deciduous oak feeders (table 2).

Genitalia

The value of genitalia characters is obvious, but also in genitalia variation can occur. In the male genitalia we observed especially variability in length of the vinculum (e. g. in *S. roborella*) and shape of the valva. In the females the shape and size of the accessory sac can vary, and this is probably partly an effect of maturation: virgin females probably have the sac still collapsed but after mating it extends fully and spines can be more spread out. Examples of these are shown here in *S. karsholti* and *S. samiatella*. In addition the shape can be influenced by the preparation technique: the very thin structures of the bursa can then also collapse.

In general specimens from South Europe of widespread species are often smaller than specimens from North Europe: this also affects the genitalia and can lead to a smaller numbers of spines in the accessory sac.

Measurements

Microlepidopterists rarely use measurements as diagnostic characters, although we find them helpful in some cases. Counting the number of antennal segments can be useful as a rough check for recognizing species, also to separate them from species in other groups (see above). Here *S. suberivora* and *S. ilicifoliel-*

la show a significant difference in the number of segments, especially when the ratio with forewing length is taken. Although wingspan or alar expanse is a frequently used measure, it cannot be measured as exactly as forewing length, because it depends on the way of mounting; it is only used here as a rough indication. Forewing length is defined as the length from the wing base at costa to the tip of the fringe (see table 2).

Measurements of genitalia can be rather characteristic. The error in measurements is, depending on magnification, in the order of 5 µm. Measurements are usually taken from mounted genitalia; because the viewing angle depends on the way of mounting (aedeagus included in capsule or not, amount of squashing), there is an extra amount of uncertainty. It is also not always easy to decide where to start the measurement (i.e. tip of aedeagus). In really squashed slides we did not measure the widths, because the genitalia tend to spread in lateral direction. The lengths remain relatively intact.

We have hardly measured female genitalia, except in the case of separating the similar species of the *suberivora* group. It is often difficult to determine markers from where to measure, and the tender structures often collapse more or less during preparation.

Mines, larvae and hostplant

The species described here make relatively similar leafmines. Characters of leafmines (egg-position, length, width of frass) depend on habits of the female, the larva, but also on leaf thickness, host species and external factors such as weather conditions. This makes many characters variable and identification on the characters of the mine alone often unreliable. The only species with very distinctive mine forms are *Stigmella fasciata* and *S. basiguttella*; records of these species can usually be accepted on the basis of mines alone. Still it is clear that the other species also tend to make different mines, and with experience it is sometimes possible to predict more or less what species will emerge. However, since existing descriptions show contradicting statements, e. g. regarding the egg position of *S. samiatella,* and since a thorough statistical analysis of the characters of mines of which the identity is established with 100% certainty (by rearing or larval characters) is still lacking, we find it unwise to give records on the basis of vacated mines only. In some countries, particularly the British Isles, the Netherlands and Poland, tradition has been to identify oak mines on the basis of vacated mines alone and single characters such as egg position. Although this may be correct in a fair proportion of cases, we think that many of such records, particularly of rarer species, need to be viewed with care. The leading British specialist, the late A. M. Emmet, was at first also very critical to identifications based on mines (Emmet 1976a), but later (Emmet 1985) he wrote: 'I have written that the *atricapitella* group cannot be identified reliably on the evidence of mines alone: it is now possible to do so in many instances'. He may have been right, and undoubtedly had a lot of field experience in the British Isles. However, the characters he used are not well circumscribed and probably not always applicable to other geographical areas. We have therefore excluded records of the rarer species in Britain based on mines alone from the maps. We would suggest that authors illustrating leafmines (e.g. on the internet!) indicate whether the identification was based on reared adult, larval characters or mine form only. If reared, then an illustration of the adult and its genitalia would be helpful.

Hostplant identity cannot be used as an identification character for the species on deciduous oaks or chestnut, because all species of *Quercus* and *Castanea* appear to have a variable fauna and no strictly monophagous *Stigmella* are known on these hosts. Still, it seems that most records on *Castanea* are indeed correctly identified as *S. samiatella*; previous records of *S. ruficapitella* or *S. atricapitella* have either been proven wrong or are doubtful, because they were based on mines alone. The only other species recorded with certainty from *Castanea* is *S. basiguttella*. Larval characters may be diagnostic, but are only described for most northern species, except *S. samiatella* (Gustafsson & Van Nieukerken 1990).

Taxonomy

Stigmella ruficapitella group

Nepticula ruficapitella group: Johansson 1971: 241.
Nepticula hemargyrella group: Johansson 1971: 241.
Nepticula atricapitella group: Emmet 1976a: 239.
Stigmella ruficapitella group: Puplesis 1984: 583, Puplesis 1985: 150, Kemperman et al. 1985: 40, Van Nieukerken 1986b: 13, Johansson & Nielsen 1990: 224, Puplesis 1994: 155; Van Nieukerken & Liu 2000: 151.
Stigmella hemargyrella group: Van Nieukerken 1986b: 13; Puplesis 1994: 150.
Stigmella suberivora group: Kemperman et al. 1985: 47.
Stigmella castanopsiella group: Puplesis 1984: 583, Puplesis 1985: 150, Puplesis 1994: 164.

Diagnosis

There are no fool-proof characters for recognizing members of this group, but uniformly coloured males, with strong anal tufts inserted on well sclerotized plates belong here. In Europe the only species which may be confused with these are: *S. paradoxa* (Frey, 1858), *S. inopinata* A. & Z. Laštůvka, 1990, both in the *S. paradoxa* group and *S. lonicerarum* (Frey, 1857) within the *S. ruficapitella* group. The species of the *S. thuringiaca* group also have similar tufts, but these species are much smaller, and usually more greyish, with less shine. Also the rather similar *S. tristis*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Figs. 10-17. *Stigmella* spp., dorsal aspect. – 10, *S. basiguttella* ♀, lectotype; 11, *S. basiguttella* ♂, Germany, Lüneburger Heide; 12, *S. macrolepidella* ♂, paratype, Greece, Rhodos Kremasti; 13, *S. macrolepidella* ♀, paratype, Greece, Rhodos Kremasti; 14, *S. svenssoni* ♂, Sweden, Högsby; 15, *S. szoecsiella,* ♂, Italy, Vasto, abdomen reconstructed; 16, *S. zangherii,* ♂, Hungary, Törökbálint; 17, *S. zangherii,* ♀, Hungary, Törökbálint; All on same scale, ca 13×.


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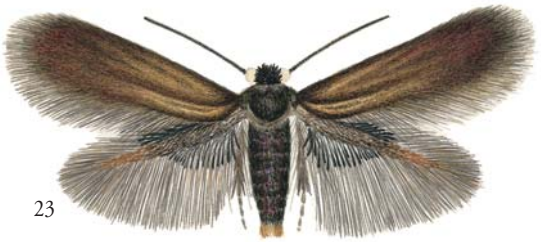
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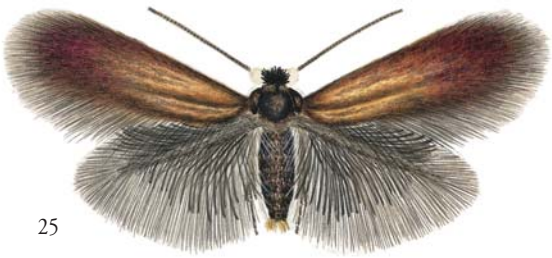
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Figs. 18-26. *Stigmella* spp., dorsal aspect. – 18, *S. dorsiguttella* ♂, Sweden, Högsby, paratype; 19, *S. dorsiguttella* ♀, Sweden, Högsby, holotype; 20, *S. trojana* ♂, paratype, Greece, Thesprotika; 21, *S. trojana* ♀, paratype, Greece, Kozani; 22, *S. bicuspidata* ♂, holotype, abdomen reconstructed; 23, *S. ruficapitella* ♂, Sweden, Växjö; 24, *S. ruficapitella* ♀, Sweden, Växjö; 25, *S. atricapitella* ♂, Germany, Bremen; 26, *S. atricapitella* ♀, Germany, Bremen. All on same scale, ca 13×.

Table 1. List of hostplants of Western Palaearctic species of the *Stigmella ruficapitella* group feeding on Fagaceae. Only certain records are provided, sources are given under the respective species. The hosts and the *Stigmella* species are given in alphabetic order, synonyms of hosts in recent European literature are included.

Hostplant	*Stigmella* species
Castanea Miller	
C. *sativa* Miller	*basiguttella, samiatella*
Quercus L.	
Q. baloot Griff.	*kasyi*
Q. canariensis Willd. (= Q. mirbeckii Durieu)	*karsholti*
Q. castaneifolia C. A. Mey	*basiguttella*
Q. cerris L.	*atricapitella, basiguttella, roborella, ruficapitella, szoecsiella, zangherii*
Q. coccifera L.	*cocciferae, suberivora*
Q. faginea Lam.	*Stigmella* sp. [vacated mines and larvae in Tunisia, Spain, EvN]
Q. frainetto Ten.	*basiguttella*, *Stigmella* sp. (as *ruficapitella* and *samiatella*) (Buhr 1940, Draghia 1975, Popescu-Gorj & Draghia 1966)
Q. ilex L. (= Q. ilex ssp. ilex)	*eberhardi, ilicifoliella, suberivora*
Q. ithaburensis Decne ssp. *ithaburensis*	*macrolepidella*?
Q. ithaburensis ssp. *macrolepis* (Ktsch.) Hedge & Yalt. (= Q. aegilops L., Q. ehrenbergii Kotschy, Q. macrolepis Kotschy)	*basiguttella, macrolepidella, samiatella, zangherii*
Q. petraea (Mattuschka) Liebl.	*atricapitella, basiguttella, dorsiguttella, eberhardi, roborella, ruficapitella, samiatella*
Q. pubescens Willd. (= Q. humilis Mill.)	*atricapitella, basiguttella, eberhardi, fasciata, roborella, ruficapitella, samiatella, zangherii*
Q. pyrenaica Willd.	*atricapitella, basiguttella, eberhardi*
Q. robur L. subsp. *robur*	*atricapitella, basiguttella, dorsiguttella, eberhardi, roborella, ruficapitella, samiatella, svenssoni*
Q. robur subsp. *pedunculiflora* (K. Koch) Menitsky (= Q. pedunculiflora K. Koch)	*Stigmella* sp. (as *samiatella*) (Popescu-Gorj & Draghia 1966)
Q. rotundifolia Lam. (= Q. ilex subsp. ballota (Desf.) Samp. in Bol., Q. ilex subsp. rotundifolia (Lam.) T. Morais)	*ilicifoliella, suberivora*
Q. rubra L.	*basiguttella, roborella* [incidentally]
Q. suber L.	*eberhardi, ilicifoliella, suberivora, zangherii*
Q. trojana Webb	*szoecsiella, trojana, zangherii*

(Wocke, 1862) in the *S. ruficapitella* group is smaller, and occurs only far away from oaks, in the northern tundra. Moreover, most males of the *ruficapitella* group have conspicuous androconial scales. For the only fasciate species here treated, see under *S. fasciata*. Females of the uniformly coloured species resemble many other uniform European *Stigmella* of the *S. paradoxa, oxyacanthella, thuringiaca, ulmivora* and *pomella* groups.

The genitalia are more characteristic, in particular the presence of a manica, a long aedeagus with many large cornuti of variable size, uncus with two horns, usually far apart and gnathos also with separated horns. Females are usually recognized by a tergum 8 with two furrows and, except the first five species treated here, by a strongly developed accessory sac with spines or other sclerotizations and a reduced or absent corpus bursae.

Description

Adults uniformly brown, often with shining wingtips, or wings with metallic fascia and bright shining colours; some species with a more extensive pale pattern. Scape sometimes with dark edge, especially in eastern Palaearctic species. Males often with extensive androconial scales on hindwing, either long spatulate scales extending into fringe, or special yellow or blackish scales on wing surface only. Males with long and distinct abdominal tufts, usually inserted on well sclerotized plates.

Male genitalia with bilobed uncus, and bilobed gnathos, rarely with anterior processes. Valva usually with distal pointed process, inner lobe variable. Aedeagus usually with large and spinose manica; vesica with large number of distinct and often large cornuti.

Female genitalia usually with well developed accessory sac, in many species with additional sclerotizations, often in the form of many spines, at cost of an

almost reduced flimsy bursa; in species with a complete bursa, the accessory sac is heavily folded, without spines. Ductus spermathecae usually clearly coiled (4-13 convolutions) after a long straight part, in species with reduced bursa entering the accessory sac at the posterior end. Tergum 8 often with two longitudinal depressions.

Biology

The caterpillars are leafminers, almost exclusively of Fagaceae, in Western Palaearctic one feeds on *Fagus* (*S. hemargyrella* (Kollar, 1832)), the 19 species discussed here on *Quercus*, some of these feed also on *Castanea.* European *Castanea sativa* has no monophagous specialists. See table 1 for a survey of the hosts. Most records are from *Quercus robur* and *Q. pubescens*: eight species feed on each. In Eastern Palaearctic some species feed also on other fagaceous genera: *Castanopsis* and *Lithocarpus*. Few species feed on other hosts: *Betula* (*S. tristis*), *Lonicera* (*S. lonicerarum* and *S. monticulella* Puplesis, 1984) and *Acer* (*S. speciosa* (Frey, 1857) and *S. kuznetzovi* Puplesis, 1994). Leafmines are invariably gallery mines with a central line of frass of variable width. Larvae vacating the mine before pupation through a slit in the upper epidermis. Larvae spin a tough flat, silken cocoon amongst leaf-litter or in the soil. Mines are illustrated in detail by Borkowski (1972), Johansson & Nielsen (1990), Patočka (1980) and A. & Z. Laštůvka (1997) and photographs are provided by Ellis (2003), Dickerson et al. (2003) and Gustafsson (2003). It is not clear in most sources whether the illustrated mines are identified by reared adults, but we think that this is certainly the case in the publications by Borkowski and Johansson & Nielsen and the website by Gustafsson.

Life-history. – Usually bivoltine, but some species are univoltine in the north and have probably more generations in the south. Adults are active flyers, and are amongst the most frequent Nepticulidae taken during light collecting, often far away from nearest oak trees. For photographs of some live adults see website by Kimber (1999-2003).

Distribution

In Palaearctic largely following the distribution of oaks (shown in several maps, e.g. fig. 164, 168), which is divided into a western Palaearctic region, with southeast extension into the Elbrus mountains in Iran and to the east reaching the Urals; and an eastern part, from Japan, eastern Siberia (Primorye) and China westwards in a narrow zone along the Himalayas, and reaching East Afghanistan (fig. 167). *S. kasyi* actually belongs more to the eastern than western Palaearctic fauna; it is described here for convenience. The group also occurs in southeast Asia (positive records from Nepal and Vietnam), but is hardly studied there. Outside the range of Fagaceae, *S. tristis* represents the group in arctic regions of Europe, and probably will also be found in Siberia.

Taxonomic history

The oak mining *Stigmella* have puzzled all authors prior to Johansson (1971). He was the first to revise all on the basis of their genitalia. Very few genitalia figures had been published before 1971. Johansson treated ten *Quercus* feeding species and *S. tristis* (Wocke, 1862), which feeds on *Betula*. Since then, three more oak-mining species were described (Borkowski 1972, Klimesch 1978, Z. & A. Laštůvka 1998). Johansson also recognized a *S. hemargyrella* group (for one species), which was enlarged by Van Nieukerken (1986b) to include the non-*Quercus* feeding species *S. hemargyrella* (on *Fagus*), *S. speciosa* (on *Acer*) and *S. lonicerarum* (on *Lonicera*). Johansson & Nielsen (1990) combined the *S. hemargyrella* and *ruficapitella* groups tentatively into one *S. ruficapitella* group, because monophyly of the *hemargyrella* group seemed doubtful. Kemperman et al. (1985) described the Japanese species on oak, and divided them into a *S. suberivora* group and *S. ruficapitella* group, mainly based on the female genitalia and also recognized a new *S. caesurifasciella* group. Puplesis (1994) and Diškus & Puplesis (2003), recognized the *S. hemargyrella* group, *S. ruficapitella* group and *S. castanopsiella* group. Van Nieukerken & Liu (2000) revised the Eastern Palaearctic oak-feeding species, and recognized thirteen species, twelve in an enlarged *S. ruficapitella* group and one in the *S. caesurifasciella* group.

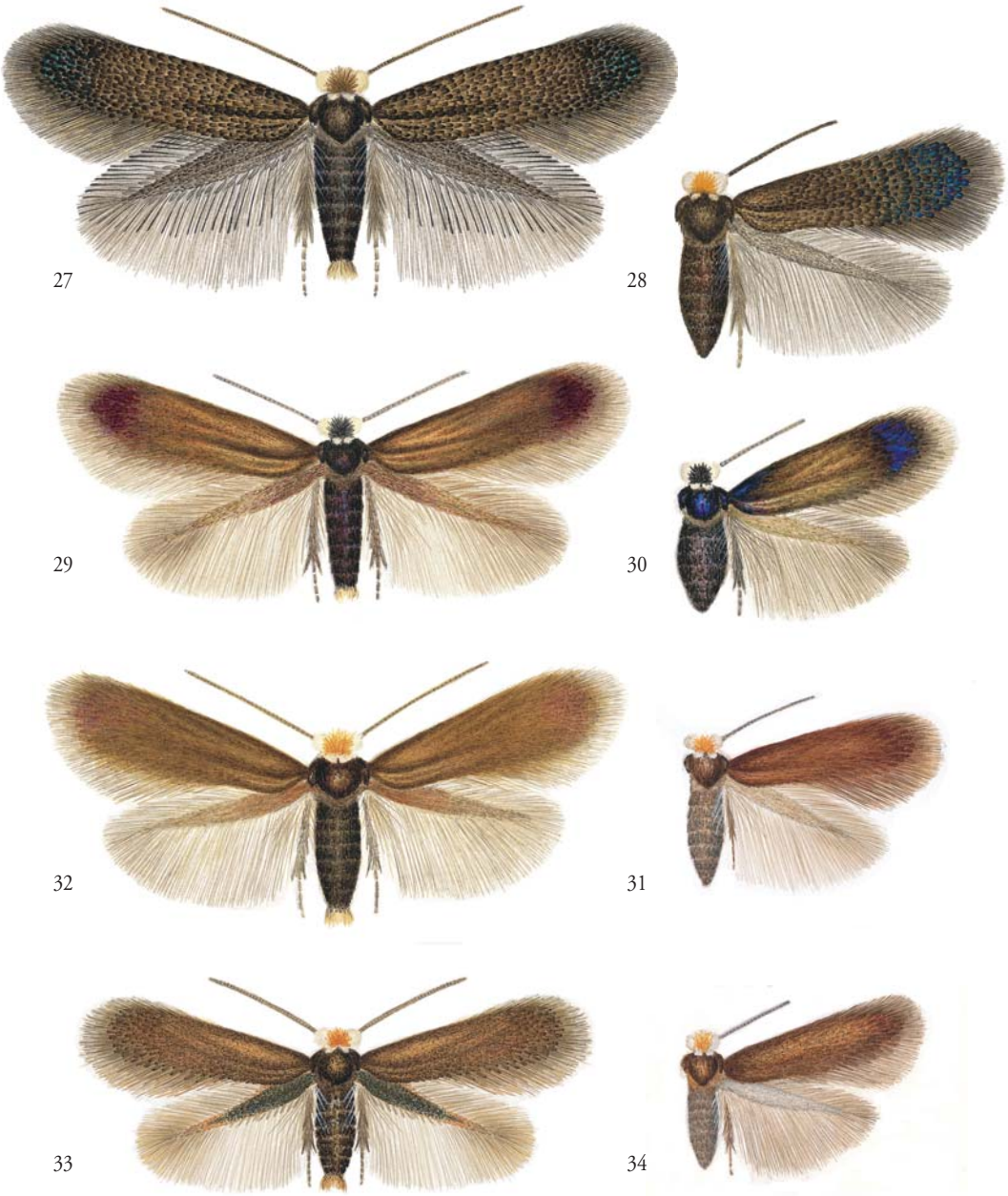
Here we also view the group in the wide sense of Van Nieukerken & Liu (2000). Apart from the *Quercus* feeding species, it also includes in the western Palaearctic *S. tristis*, feeding on *Betula*, *S. hemargyrella* (on *Fagus*), *S. speciosa*, *S. kuznetsovi* (both on *Acer*) and *S. lonicerarum* (on *Lonicera*). These were fully treated by Johansson & Nielsen (1990) or Puplesis (1994).

Checklist of western Palaearctic *Quercus* feeding *Stigmella*

Stigmella Schrank, 1802

S. *ruficapitella* group

1. *S. fasciata* **sp. n.** 321
2. *S. suberivora* (Stainton, 1869) 322
3. *S. ilicifoliella* (Mendes, 1918) **comb. n., stat. rev.** 326
4. *S. cocciferae* **sp. n.** 329
5. *S. kasyi* **sp. n.** 331
6. *S. basiguttella* (Heinemann, 1862) 332
7. *S. macrolepidella* (Klimesch, 1978) 333
8. *S. svenssoni* (Johansson, 1971) 334
9. *S. szoecsiella* (Borkowski, 1972) 335
10. *S. zangherii* (Klimesch, 1951) 336



Figs. 27-34. *Stigmella* spp., dorsal aspect. – 27, *S. karsholti* ♂, paratype; 28, *S. karsholti* ♀, paratype; 29, *S. samiatella*, ♂, Sweden, Högsby; 30, *S. samiatella*, ♀, Sweden, Kullaberg; 31, *S. samiatella*, ♀ (red-headed), Greece, Kos, Asfendiou; 32, *S. roborella* ♂, Sweden, N. Åreda; 33, *S. eberhardi* ♂, paratype, Italy, Andora-Conna; 34, *S. eberhardi*, ♀, paratype, Italy, Castelforte. In figs. 27 and 34 the left wings are digitally mirrored right wings. All on same scale, ca 13×.

Figs. 35-36. *Stigmella* spp., male forewing underside. – 35, *S. svenssoni*, Sweden, Sandhammaren, showing special scales in 'fish-bone' pattern; 36, *S. roborella*, Netherlands, Winterswijk, scale cover 'normal'.

Key to males

1. Forewing with distinct narrow silvery fascia; scape edged bluish grey; underside of forewing with a reflexed row of spatulate metallic androconial scales along dorsum ..... 1. *S. fasciata*
– Forewing without distinct fascia, colour pattern absent or very indistinct, not metallic; scape not edged except in one unicolorous species from Afghanistan; such androconial scales lacking 2
2. Hindwing with distinct spatulate androconial scales extending into costal and dorsal fringe, at least half length of dorsal cilia 3
– Hindwing without distinct and long androconial scales; if androconial scales are present, they are confined to the disk of the hindwing and only extend a short distance into the fringe, or there are narrow spatulate scales along costa only 9
3. Frontal tuft dark brown or black 4
Frontal tuft yellow or yellowish orange 7
4. Scape edged with bluish grey, large species from Afghanistan ..... 5. *S. kasyi*
Scape uniformly white, European or Mediterranean species 5
5. Forewing coarsely scaled, strongly shining bronze brown with purplish iridescence. Androconial scales relatively narrow and inconspicuous ..... 16. *S. karsholti*
Forewing smoothly scaled, much darker golden brown, iridescence less conspicuous. Androconial scales contrasting black and relatively wide 6
6. Androconial scales at most one third length of cilia, forming triangular patch in dorsal cilia, antenna with 30-35 segments ..... 14. *S. ruficapitella*
– Androconial scales longer, at most two-thirds length of cilia, antenna with 30-35 segments ..... 15. *S. atricapitella*
= Androconial scales longer, at most two-thirds length of cilia, antenna with 39-50 segments ..... 3. *S. ilicifoliella* [rare dark headed form]
7. Androconial scales not reaching tip of hindwing. Eastern Mediterranean species ..... 4. *S. cocciferae*
– Androconial scales reaching tip of hindwing. Western Mediterranean species 8
[Note: pale-headed *karsholti* may key out here, check couplet 5.]
8. Male genitalia very broad, valvae bulging, often visible without dissection. In all western Mediterranean countries ..... 2. *S. suberivora*
– Male genitalia not extremely broad, valvae not bulging; in southern France and Iberian Peninsula ..... 3. *S. ilicifoliella*
9. Forewings with more or less extensive pale pattern, occasionally completely pale, sometimes pattern reduced to a basal spot or dorsal stripe 10
– Forewings completely unicolorous dark 14
10. Hindwings distinctly yellow or brown, covered with small androconial scales; frontal tuft pale or dark 11
– Hindwings usually grey or pale ochreous yellow, no androconial scales or very few; frontal tuft black 12
11. Frontal tuft pale. Pattern on forewing usually only a narrow dorsal stripe. Hindwings either yellow or brown ..... 11. *S. dorsiguttella*

– Frontal tuft dark, often black. Pattern on forewing variable, usually some pale spots. Hindwings distinctly yellow to almost cream white .... 10. *S. zangherii*

12. Forewing primarily white with some dark spots; frontal tuft brownish to black. Abdomen pale, almost white. Only known from eastern Mediterranean ..... 7. *S. macrolepidella*
– Forewing primarily dark with variable extension of pale pattern, usually confined to basal spot or dorsal stripe. Abdomen darker 13

13. Forewing with variable pattern, usually a basal spot present. Hindwing grey, without spatulate scales. Widespread species ..... 6. *S. basiguttella*
– Forewing dark, along dorsum pale, no basal spot. Hindwing ochreous yellow; along costa with narrow spatulate scales (often hidden under forewing). Eastern Mediterranean species ..... 11. *S. trojana*

14. Frontal tuft dark, at least on vertex, usually black 15
– Frontal tuft yellow or yellowish orange 19

15. Hindwing with deep yellow or ochreous yellow androconial scales, forewing underside with distinct yellow patch ..... 10. *S. zangherii*
– Hindwing grey or brownish, without androconial scales or with rather indistinct ones, forewing underside without such patch 16

16. Hindwing along costa with narrow spatulate scales (often hidden under forewing), species of Greece and Turkey 17
– Hindwing costa without spatulate scales, widespread species 18

17. Hindwing greyish. Forewing usually with a pale stripe along dorsum, underside with basal pale area ..... 12. *S. trojana*
– Hindwing bronze brown. Forewing variable, underside covered with brown scales, no pale area .. .. 13. *S. bicuspidata*

18. Forewing usually with indications of a pale basal spot and paler area in middle, hindwing grey ..... 6. *S. basiguttella*
– Forewing uniform dark. Hindwing distinctly brown ..... 17. *S. samiatella*

19. Hindwing completely pale grey without any androconial scales 20
– Hindwing yellow or brownish, covered with minute androconial scales 21

20. Forewing underside with thin layer of scales arranged in 'fish-bone' pattern (fig. 35). Large species, forewing length 2.8-3.3 mm; hindwing without androconial scales ..... 8. *S. svenssoni*
– Forewing underside with normal layer of darker scales, all directed towards tip (fig. 36); medium-sized species, forewing length 2.2-3.1 mm; hindwing usually with (not very conspicuous) brown androconial scales ..... 18. *S. roborella*
– Forewing underside with normal layer of darker scales, all directed towards tip; smaller species, forewing length 2.1-2.3 mm; hindwing without androconial scales ..... 9. *S. szoecsiella*

21. Hindwing with thick cover of distinctly yellow, ochreous yellow or pale brown androconial scales. Forewing underside with patch of similar scales to ⅔. Unicolorous form of: ..... 11. *S. dorsiguttella*
– Hindwing brown or dark bronze. Forewing underside with uniformly dark scale cover 22

22. Hindwing with distinct dark bronze androconial scales with bluish iridescence, tip of hindwing yellowish brown; spatulate scales absent ..... 19. *S. eberhardi*
[Note: on Sicily *S. roborella* may have very similar androconials.]
– Hindwing bronze brown; costa with narrow spatulate scales ..... 13. *S. bicuspidata*
= Hindwing brown, androconial scales not very conspicuous; wingtip concolorous; spatulate scales absent ..... 18. *S. roborella* ..... or rare pale-headed 17. *S. samiatella*

Identification of females

Because the females of many species can be extremely similar, checking of genitalia is usually needed. Instead of providing a key, we give some external characters for initial sorting. The female of *bicuspidata* is unknown.

Head with dark frontal tuft:
6. *S. basiguttella,* 7. *macrolepidella,* 10. *zangherii,* 12. *trojana,* 15. *atricapitella,* 17. *samiatella.*

Head with pale yellow or orange frontal tuft:
1. *S. fasciata,* 2. *suberivora,* 3. *ilicifoliella,* 4. *cocciferae,* 5. *kasyi,* 8. *svenssoni,* 9. *szoecsiella,* 11. *dorsiguttella,* 14. *ruficapitella,* 16. *karsholti,* southern European 17. *samiatella*, 18. *roborella,* 19. *eberhardi.*

Silver fascia present:
1. *S. fasciata.*

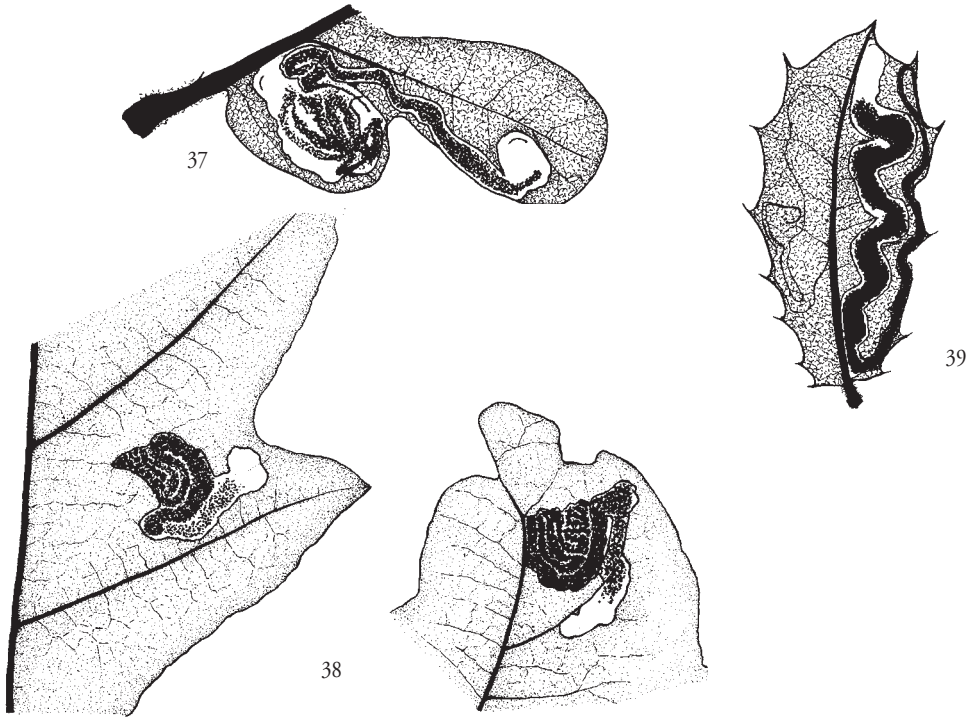
Pale non-metallic pattern often present:
6. *S. basiguttella,* 7. *macrolepidella,* 10. *zangherii,* 11. *dorsiguttella,* 12. *trojana.*

Abdomen ending in rather pointed ovipositor:
7. *S. macrolepidella,* 18. *S. roborella.*

Key to male genitalia

1. Aedeagus basally considerably widened; vesica curved, bearing extremely long curved cornuti in basal part, following curvature of vesica (figs. 65, 67, 69, 72, 75, 96, 102, 104, 108, 110, 112) 2

- Aedeagus not or slightly widened in basal part; vesica without distinct curvature or curved in zigzag pattern, cornuti not long and curved 6
2. Uncus with posterior processes very close together (fig. 66) ..... 10. *S. zangherii*
- Uncus with posterior processes widely apart 3
3. Aedeagus with spinose manica present; aedeagus about 1.5×-1.6× as long as wide (fig. 65) .... 9. *S. szoecsiella*
– Aedeagus without spinose manica; aedeagus twice as long as wide or longer 4
4. Valva with inner lobe distinctly bicuspidate and pointed (figs. 74, 76) ..... 13. *S. bicuspidata*
– Valva with inner lobe rounded 5
5. Uncus lobes narrow, widely apart; valva with short distal process, inner lobe exceeding it (figs. 68-70); yellow or brown androconial scales on hindwing and forewing underside very conspicuous ..... 11. *S. dorsiguttella*
– Uncus lobes almost triangular, approximated; distal process of valva exceeding inner lobe (figs. 71-73); androconial scales on hindwing or forewing underside hardly visible ..... 12. *S. trojana*
6. Uncus lobes extremely widely separated, bearing many long setae; gnathos also with widely separated processes, joined by very thin bar, longer than one process. Overall genitalia aspect very different from other species (figs. 40-43, 90) .... 1. *S. fasciata*
– Uncus lobes not so far apart, without setae; gnathos processes separated by bar of normal thickness, shorter than one process 7
7. Vesica basally with a curved band of broad spiny cornuti with serrate bases; manica very large, covering ⅔ to complete aedeagus (figs. 44, 47, 49) 8
– Cornuti in vesica never with serrate bases; manica usually not so large 10
8. Manica covering aedeagus almost completely 9
– Manica covering distal ⅔ of aedeagus; capsule and valvae not extremely widened (figs. 48, 49, 52) ..... 4. *S. cocciferae*
9. Capsule and valvae extremely broad; valva externally with field of small papillae (figs. 44, 45, 50) ..... 2. *S. suberivora*
– Capsule and valvae not extremely broad; valva with field of hairlike setae (figs. 46, 47, 51)..... ..... 3. *S. ilicifoliella*
10. Manica ventrally with a large round patch of hundreds of papillate setae (figs. 54, 55); capsule and valvae very broad ..... 5. *S. kasyi*
– Manica, if present, with rather indistinct fine spines; capsule usually not particularly broad 11
11. Aedeagus very long (more than 550 µm) and cylindrical, about twice as long as capsule 12
– Aedeagus much shorter (less than 560 µm), 1-1.5x as long as capsule; cylindrical or anteriorly widened 13
12. Manica absent; vesica with very long cornuti from base almost to tip, surrounded by many smaller cornuti; at posterior tip of aedeagus a few strong spines. Capsule relatively narrow; inner lobe of valva regularly curved (figs. 97, 98) .... 6. *S. basiguttella*
– Distinct spinose manica present; anterior half of aedeagus only with small blunt cornuti, posterior half with slightly longer spinose cornuti, at tip a blunt lobe. Capsule broader; valva with inner lobe pronounced (figs. 81, 82, 115, 116) .... 16. *S. karsholti*
13. Aedeagus with three groups of cornuti which are widely separated (figs. 117, 119) 17. *S. samiatella*
– Aedeagus almost completely filled with cornuti, sometimes in different groups, but without empty space between 14
14. Cornuti in aedeagus in three well defined, separated groups of different shape, on a more or less contorted vesica in a zigzag pattern (figs. 121, 125); aedeagus anteriorly distinctly widened 15
– Cornuti filling aedeagus almost completely; different forms overlapping; aedeagus anteriorly not or hardly wider than posteriorly 16
15. Valva with inner lobe pointed, resulting in a valva with two pointed ends; aedeagus with slight curvature in vesica (figs. 120-123) ..... 18. *S. roborella*
– Valva with inner lobe rounded; aedeagus with distinctly contorted vesica (figs. 87, 88, 124, 125) ..... 19. *S. eberhardi*
16. Aedeagus anteriorly with a few straight and long cornuti of ⅓ to ½ aedeagus length 17
– Aedeagus anteriorly with small cornuti, longest cornuti (posteriorly) not more than ¼ aedeagus length 18
17. Aedeagus anteriorly with 4 strong, slightly curved, cornuti of ½ aedeagus length; uncus lobes each bilobed (figs. 61-63, 99) .... 7. *S. macrolepidella*
– Aedeagus anteriorly with several straight cornuti of at most ⅓ aedeagus length; uncus lobes simply pointed (figs. 100, 101) ..... 8. *S. svenssoni*
18. Manica conspicuous, almost twice as wide as aedeagal tube. Aedeagus posteriorly with a single big tooth at right side; about 30-40 long cornuti at left side (figs. 105, 106) ..... 14. *S. ruficapitella*
– Manica inconspicuous, only slightly wider than aedeagal tube. Aedeagus posteriorly with a big tooth accompanied by several smaller ones at right side; about 15-20 long cornuti at left side (figs. 113, 114) ..... 15. *S. atricapitella*



Figs. 37-39. Leafmines of *Stigmella* spp. – 37, *S. fasciata*, two intertwined mines, *Quercus pubescens*, Slovenia, from these holotype was reared; 38, *S. fasciata*, two mines on *Quercus* cf. *pubescens*, Greece, Parnis Oros; 39, *S. cocciferae*, mine on *Quercus coccifera*, on left side old mine of *Ectoedemia* cf. *caradjai* (Groschke).

Key to female genitalia

Note: female of *S. bicuspidata* unknown.

1. Bursa consisting of a distinct corpus bursae and a more heavily sclerotized and folded accessory sac (figs. 56-60); no spines or sclerotizations in bursa 2
– Bursa consisting of a heavily sclerotized accessory sac with spines and or other sclerotizations (figs. 77-80, 131-145); corpus bursae absent or reduced to flimsy unsclerotized sac, usually disappearing during preparation 5
2. Ductus spermathecae with extremely long straight part (exceeding bursa length), at most 2 convolutions (fig. 56) ..... 1. *S. fasciata*
– Ductus spermathecae with shorter straight part and 4 or more convolutions 3
3. Bursa 2-4× as long as accessory sac; ductus spermathecae with 4.5-6.5 convolutions (figs. 57-59); European species 4
– Bursa less than 1.5× as long as accessory sac; ductus spermathecae with 6 convolutions (fig. 60); species from Afghanistan ..... 5. *S. kasyi*
4. Ductus spermathecae with ca 6.5 convolutions, ratio bursa /accessory sac 3.5-3.8 .....2. *S. suberivora*
– Ductus spermathecae with 4.5 convolutions, ratio bursa /accessory sac 2.3-3 ..... 3. *S. ilicifoliella*
= Ductus spermathecae with 6-7 convolutions, ratio bursa /accessory sac 2.4-2.6 ..... 4. *S. cocciferae*
5. Accessory sac with large sclerotized plate and several small triangular spines (fig. 133) ..... 8. *S.svenssoni*
– Accessory sac with spines only, usually larger and of different sizes 6
6. Spines in accessory sac confined to posterior half 7
– Spines covering accessory sac completely, or leaving only small portion anteriorly open 12
7. Spines in two groups inserted on two bulbous lobes, pointing anteriorly; all spines of about similar length (figs. 80, 138) ..... 12. *S. trojana*
– Spines dispersed, not in two groups on lobes; if on lobes then spines of different sizes present 9
9. Ductus bursae distinctly coiled (figs. 144, 145) 10
– Ductus bursae not coiled, accessory sac distinctly elongate, 2× as long as wide or longer (figs. 139, 140) 11
= Ductus bursae not coiled, accessory sac almost

globular (figs. 78, 134) ..... 9. *S. szoecsiella*
10. Ductus with about one complete coil; anteriorly spines slightly longer than posteriorly (fig. 144); abdominal tip (ovipositor) pointed ... 18. *S. roborella*
– Ductus forming two coils; different spines throughout (figs. 89, 145); abdominal tip wider .... 19. *S. eberhardi*
11. All spines small, not on a rounded lobe; a small chitinized plate posteriorly (fig. 139) .... 14. *S. ruficapitella*
– Spines of different length, the longer ones on a rounded lobe; accessory sac anteriorly with some more or less sclerotized folds, no chitinized plate (fig. 140) ..... 15. *S. atricapitella*
12. Small spines arranged on a long narrow coiled band; anteriorly also an extra group of spines (figs. 85, 86) ..... 17. *S. samiatella*
– Spines not on such a band, when coiled than spines longer 12
13. Ductus spermathecae with many convolutions, more than 10; accessory sac with spines all over distal ⅔, a dense band at right hand side in dorsal view (figs. 83, 84) ..... 16. *S. karsholti*
– Ductus spermathecae with up to 5 convolutions; accessory sac with less cover by spines 14
14. Four species with different distribution of spines and shape of accessory sac, check figures: .....fig. 131, 6. *S. basiguttella*
– .....fig. 136, 11. *S. dorsiguttella*
= .....figs. 77, 132, 7. *S. macrolepidella*
≡ .....figs. 79, 135¸ 10. *S. zangherii*

1. ***Stigmella fasciata*** sp. n.
(figs. 1, 2, 37, 38, 40-43, 56, 90, 126, 146, 164)

Type material. – Holotype ♀, SLOVENIA: 7 km SE Piran: Cedle, 300 m, 12.x.1983, J. J. Boomsma & E. J. van Nieukerken, *Quercus pubescens* VU no 83444KE2 e.l. 24.v.1984, genitalia slide VU no 1964 (RMNH). – Paratypes 4♂, 1♀: GREECE: 2♂, Akhaia, Kalávrita, 20.vi.1997, A. Laštůvka (AL, RMNH); 1♂, Evro, Kavisos 100 m, 22-23.viii.1985, A. Moberg (NRMS). – TURKEY, 1♂, 1♀, Adana, Taurus, 4 km NE Feke, 1000 m, 7.ix.1983, Gg. Derra (GD).

Other material: leafmines. – SLOVENIA, 2 mines (of which holotype was reared). – GREECE: 6 vacated mines, Attika, Parnís Oros, 8 km N Dhekélia, 29.ix.1980, Menken & van Nieukerken, *Quercus cf. pubescens* (RMNH).

Additional records (A. & Z. Laštůvka, in litt.). – CROATIA: 2♀, Dalmacia, Oračac, 12.vii.2000 and 23.viii.2001; 25.vii.2003, 3 larvae on *Q. pubescens*; 2001-2003, many empty mines. – GREECE: 1♂, Lakonia, Krokees, 16.vi.1997; 1♂, Arkadia, Pigadakia, 22.vi.1996; 1♀, Argolis, Skotini, 20.vi.1998.

Diagnosis

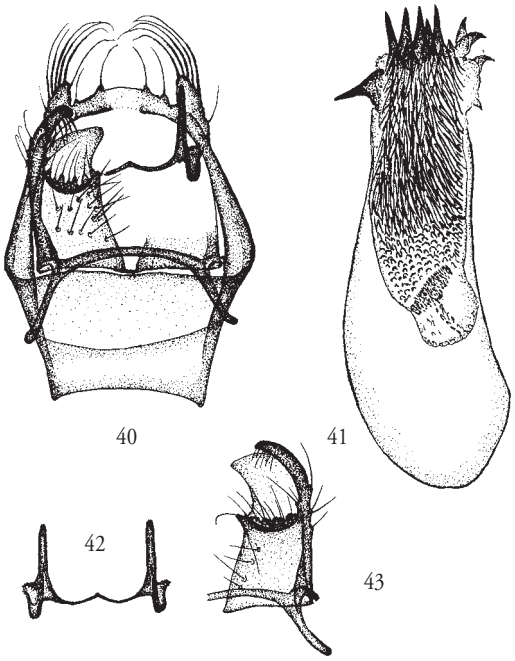
Differs from all other western Palaearctic oak mining *Stigmella* by presence of fascia and distinct cilia-line, male in addition by peculiar androconial scales on forewing underside and dark edged scape. Female can only be confused with other European *Stigmella* with fascia and cilia-line: *S. freyella* (Heyden, 1858), which has a dark head and paler cilia, *S. malella* (Stainton, 1854), which has a much straighter, unconstricted fascia and *S. hemargyrella* which is much larger. Further the male genitalia are highly diagnostic, not resembling any other species. Female genitalia rather similar to *suberivora, ilicifoliella* and *cocciferae,* but these have the ductus spermathecae with more than 4 convolutions, whereas *fasciata* has only 2.

Description

Male (fig. 1). – Forewing length 1.95-2.35 mm, wingspan 4.3-5.0 mm. Head: frontal tuft ochreous, collar dark brown; scape white, edged with dark bluish grey; antenna with 26-29 segments, yellowish grey. Thorax dark copper brown. Forewing: basal half dark copper-brown with weak metallic reflections; fascia postmedial, very narrow, consisting of only a few silvery scales; distal to fascia coarsely scaled, dark copper brown to fuscous; cilia-line distinct; cilia grey-brown; underside grey-brown with a long reflexed row of spatulate lead-grey to silver androconial scales along dorsum (fig. 1), covering an elongate pocket. Hindwing: dark brown to fuscous, along costa and dorsum with bluish black androconial scales extending over cilia to at most one third, near frenulum longer and broader; underside of hindwing and androconial scales grey-brown. Abdomen almost black, no visible anal tufts; no sclerotized plates.

Female (fig. 2). – Forewing length 2.05-2.15 mm, wingspan 4.5 mm. Head: frontal tuft ochreous, collar yellowish white [almost missing in holotype]; scape yellowish white. Antenna shining fuscous, with 24? segments. Thorax fuscous. Forewing with basal half fuscous, weakly shining; fascia postmedial, shining silver, constricted in middle; distal to fascia coarsely scaled, fuscous; cilia-line distinct; terminal cilia grey-brown; underside dark grey-brown. Hindwing grey-brown, with weak bronze reflections; cilia grey-brown; underside dark grey-brown. Abdomen removed for dissection, reconstructed in fig. 2.

Male genitalia (figs. 40-43, 90). – Measurements: see table 3. Vinculum anteriorly only slightly concave. Uncus with very widely separated horns with many long curved setae. Gnathos with long, very widely separated posterior processes, connected by a very thin, curved bar. Valva with short distal process, and prominent inner lobe; inner margin almost straight; ventrally a transverse ridge with setae; sublateral processes about ½ transtilla length. Aedeagus with vesica in dis-



Figs. 40-43. *Stigmella fasciata*, male genitalia, Turkey, slide EvN 2610. – 40, Capsule; 41, aedeagus; 42, gnathos; 43, valva, dorsal aspect.

tal ⅔ of aedeagus, covered with many needle-shaped cornuti and a group of larger ones distally; manica absent.

Female genitalia (figs. 56, 126, 146). – T8 with two slight indentations laterally, no grooves. Bursa well visible, total length 787 µm, walls thin, without pectinations. Accessory sac more strongly sclerotized, without pectinations, about ⅓ bursa length. Ductus spermathecae with about 2 convolutions after a long straight part with minute granulation.

Biology

Hostplant. – *Quercus pubescens***.

Leafmine (figs. 37, 38). – Egg on leaf underside, usually 2-3 (or more) eggs are deposited close by, rarely only one. Mine starting as extremely contorted gallery, doubling back several times, closely following earlier track, so that mine forms a brown dot; frass brown and dispersed, almost filling mine completely; last part of mine running away from dot. Not all the eggs hatch or young larvae die, so that in a sample of 86 leaves with mines, A. Laštůvka (in litt.) observed two complete mines in 50%, three in 10% and only one in 40% of the leaves. In the case of 2-3 mines, they are usually intertwined closely in the early part (fig. 37).

Life-history. – Larvae found in July and October, adults from June to September.

Distribution (fig. 164)

South-east Europe: Slovenia, Croatia, Greece and Turkey.

Remarks

The male is described on the basis of four specimens, two of which are badly damaged. They are considered to belong to the same species as the female holotype, because both sexes were collected together in Turkey, and clearly belong to the same species-group. We prefer, however, to select the reared female as holotype.

This species is very different from all other Western Palaearctic species in the *S. ruficapitella* group, but shares several characters with Eastern Palaearctic species (Van Nieukerken & Liu 2000), which more often have a fascia. The mine is almost indistinguishable from that of *S. fervida* Puplesis, 1984, except that the latter has the egg on leaf upperside and is usually laid singly.

Etymology

An adjective: *fasciatus*: with band, because it is the only species in the oak mining group in Europe with a fascia on forewing; here in female form in concordance with female gender of *Stigmella*.

2. ***Stigmella suberivora*** (Stainton)
(figs. 3, 4, 44, 45, 50, 57, 91, 127, 147, 165)

Nepticula suberivora Stainton, 1869: 228. Lectotype ♂ (designated by Johansson 1971: 246): FRANCE [Alpes Maritimes]: Cannes, *Quercus suber*, yellow larvae, 9.iii.1867, e.l. 8.iv.1867, Stainton (BMNH) [examined].

Nepticula aureocaputella [lapsus] Millière, 1870: 174. Syntypes: FRANCE: Cannes, v and vi, Millière. [probably lost] (synonymized by Van Nieukerken & Johansson 1987).

Nepticula aureocapitella Millière, 1870: 216 [justified emendation].

Nepticula ilicivora Peyerimhoff, 1871: 413. Lectotype ♀ (designated by Johansson 1971: 248): FRANCE [Alpes Maritimes:] Midi de la France, *Quercus ilex*, [iii. 1870], Peyerimhoff (MNHN) [examined] (synonymized by Johansson 1971: 246).

Nepticula suberivora; Petersen 1930: 52, fig. 27 (male genitalia), Johansson 1971: 246, Borkowski 1972: 773.

Stigmella suberivora; Beirne 1945: 197, fig. 11 (male genitalia), Emmet 1976a: 241, Johansson & Nielsen 1990: 227, A. & Z. Laštůvka 1997: 103.

Diagnosis

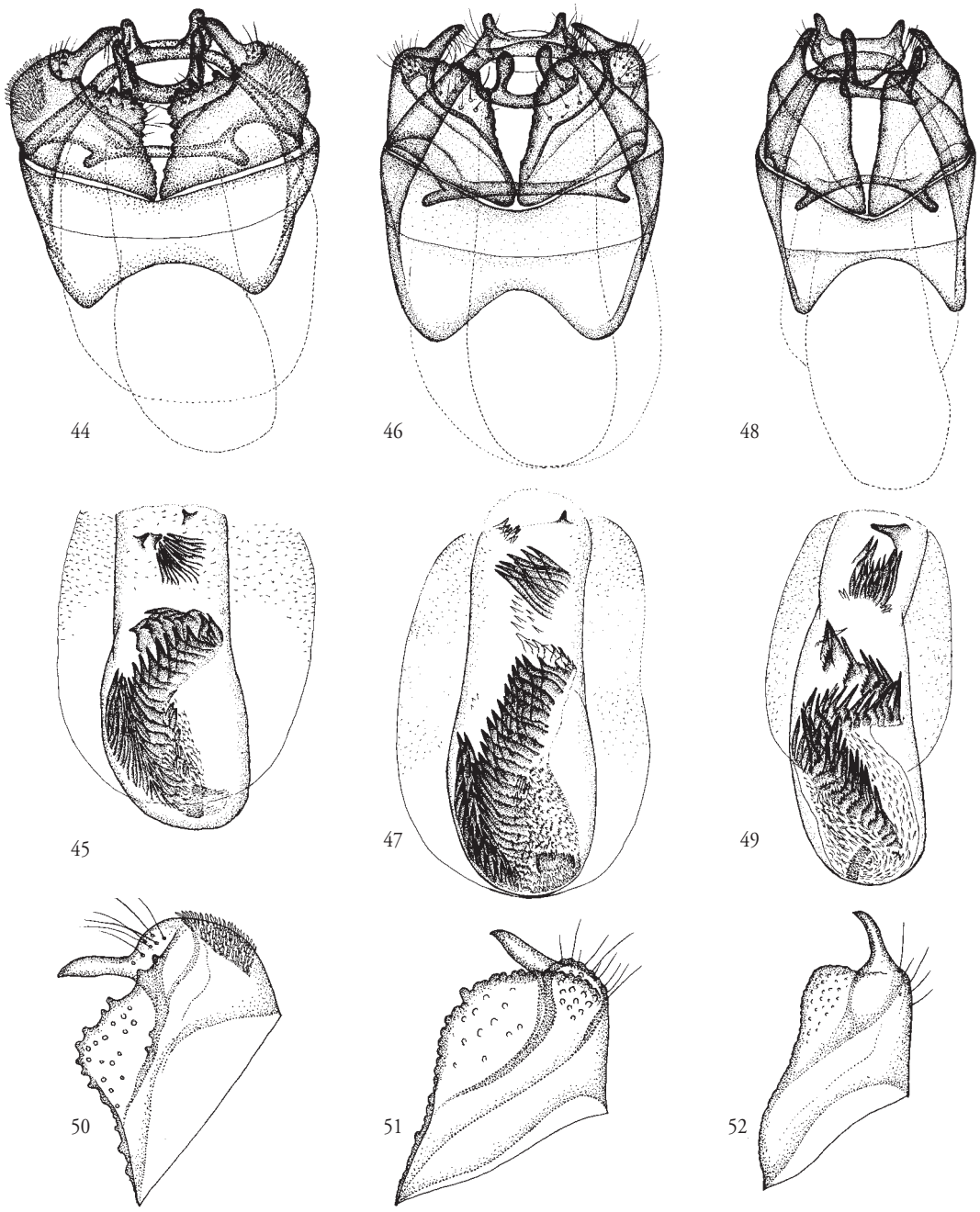
Males characterised by combination of long spatulate androconial scales and pale head colour, but almost inseparable from *ilicifoliella* and *cocciferae*. The very broad genitalia with 'bulging' valvae separate *suberivora* from both; with some experience this can be seen without dissection; otherwise *suberivora* has significantly fewer antennal segments than *ilicifoliella* (30-45), with a small overlap, and *S. cocciferae* has no

Table 2. Measurements of adult *Stigmella*. Mean, standard deviation and sample size are given in brackets, for sample size 3 or smaller only sample size is provided.

	♂ forewing length	♀ forewing length	♂ antennal segments	♀ antennal segments
S. fasciata	2.0-2.4 mm (2.2±0.2, 4)	2.1-2.2 mm (2)	28-29 (2)	24?
S. suberivora	2.2-3.3 mm (2.7±0.3, 19)	2.3-3.5 mm (2.8±0.4, 10)	30-45 (37.5±3.7, 17)	33-40 (35.0±2.4, 7)
S. ilicifoliella	2.5-3.0 mm (2.7±0.2, 20)	2.5-2.9 mm (2.7±0.2, 10)	39-50 (44.1±3.2, 14)	33-40 (3)
S. cocciferae	2.2-3.2 mm (2.7±0.3, 25)	2.2-2.9 mm (2.5±0.2, 10)	36-49 (42.8±3.6, 18)	30-37 (33.8±2.3, 9)
S. kasyi	3.5 mm (1)	3.8 mm (1)	53 (1)	48 (1)
S. basiguttella	1.8-2.6 mm (2.2±0.2, 10)	2.0-2.5 mm (2.3±0.2, 6)	28-37 (32.8±3.8, 5)	23-27 (24.6±1.8, 5)
S. macrolepidella	1.8-2.1 mm (2.0±0.1, 5)	1.8-2.1 mm (2.0±0.1, 8)	31-41 (37.1±3.3, 7)	25-31 (27.1±1.9, 14)
S. svenssoni	2.8-3.3 mm (3.1±0.2, 5)	2.9-3.1 mm (3.0±0.1, 6)	33-37 (3)	25-29 (26.8±1.5, 6)
S. szoecsiella	2.1-2.3 mm (3)	2.2-2.3 mm (2)	33 (2)	25 (1)
S. zangherii	2.0-2.4 mm (3)	1.8-2.3 mm (2.1±0.1, 9)	31-38 (35.2±2.7, 5)	25-28 (26.4±1.1, 5)
S. dorsiguttella	2.1-2.7 mm (2.4±0.2, 7)	2.1-2.6 mm (2.4±0.2, 4)	33-35 (34.0±0.8, 4)	25-26 (3)
S. trojana	2.1-2.3 mm (2.2±0.1, 5)	2.0-2.3 mm (2.1±0.1, 8)	34-36 (35.0±1.0, 5)	21-26 (23.9±1.8, 7)
S. bicuspidata	2.1-2.2 mm (2)	-	32 (1)	-
S. ruficapitella	2.3-2.8 mm (2.6±0.2, 14)	2.2-2.7 mm (2.5±0.2, 13)	30-35 (33.4±1.9, 11)	23-27 (25.5±1.5, 12)
S. atricapitella	2.1-2.6 mm (2.3±0.1, 14)	2.1-2.8 mm (2.4±0.2, 10)	30-35 (32.1±1.4, 12)	25-29 (26.3±1.5, 9)
S. karsholti	2.8-3.3 mm (3.0±0.2, 7)	2.5-2.9 mm (2.7±0.1, 8)	37-44 (41.5±2.9, 7)	30-33 (31.0±1.1, 8)
S. samiatella	2.4-3.3 mm (2.8±0.3, 17)	2.1-2.8 mm (2.5±0.2, 12)	28-33 (30.6±1.6, 11)	24-28 (25.5±1.0, 11)
S. roborella	2.2-3.1 mm (2.8±0.3, 14)	2.0-2.9 mm (2.6±0.2, 12)	33-43 (38.1±2.9, 9)	28-31 (28.6±1.1, 7)
S. eberhardi	2.3-3.1 mm (2.6±0.3, 9)	2.1-2.6 mm (2.3±0.2, 12)	33-40 (36.9±2.7, 7)	25-31 (26.4±1.9, 9)

Table 3. Measurements of male genitalia of *Stigmella*. Mean, standard deviation and sample size are given in brackets, for sample size 3 or smaller only sample size is provided.

	capsule length	capsule ratio l:w	valva length	aedeagus length	aedeagus l:w	ratio aed:caps l
S. fasciata	249-302 µm (2)	1.2-1.2 (2)	144-177 µm (2)	316-320 µm (2)	2.4-2.8 (2)	1.1-1.3 (2)
S. suberivora	295-347 µm (325.9±24.1, 6)	0.8-1.0 (0.85±0.07, 6)	208-238 µm (224.6±9.9, 6)	408-441 µm (427.2±12.7, 6)	2.4-2.9 (2.65±0.18, 6)	1.2-1.5 (1.32±0.10, 6)
S. ilicifoliella	327-377 µm (348.6±12.8, 10)	1.0-1.2 (1.13±0.06, 10)	211-254 µm (233.3±17.1, 10)	380-508 µm (443.2±34.4, 10)	2.4-3.2 (2.84±0.27, 10)	1.1-1.4 (1.27±0.09, 10)
S. cocciferae	250-385 µm (324.2±44.1, 8)	1.0-1.2 (1.09±0.12, 5)	215-279 µm (246.8±22.8, 7)	448-568 µm (482.5±39.5, 8)	2.6-3.5 (3.11±0.39, 5)	1.4-1.8 (1.51±0.18, 8)
S. kasyi	410 µm (1)	1.0 (1)	296 µm (1)	549 µm (1)	2.0 (1)	1.3 (1)
S. basiguttella	276-338 µm (299.9±19.5, 8)	0.9-1.3 (1.11±0.15, 7)	218-245 µm (231.4±9.3, 8)	546-656 µm (597.5±47.4, 7)	2.9-3.9 (3.39±0.39, 6)	1.8-2.3 (2.00±0.14, 7)
S. macrolepidella	210-249 µm (233.2±17.0, 4)	1.3-1.3 (3)	163-207 µm (183.3±21.7, 4)	313-369 µm (339.7±30.0, 4)	2.7-3.4 (2.93±0.31, 4)	1.3-1.5 (1.46±0.07, 4)
S. svenssoni	273-339 µm (3)	0.9-1.1 (3)	233-261 µm (3)	364-426 µm (3)	1.7-1.9 (3)	1.2-1.4 (3)
S. szoecsiella	268-297 µm (3)	1.1-1.3 (3)	188-225 µm (3)	354-359 µm (3)	1.5-1.6 (3)	1.2-1.3 (3)
S. zangherii	300-319 µm (3)	1.1-1.2 (3)	216-236 µm (3)	357-376 µm (3)	1.5-1.8 (3)	1.2-1.2 (3)
S. dorsiguttella	285-287 µm (2)	1.0-1.1 (2)	207-216 µm (2)	436-475 µm (2)	2.2-2.3 (2)	1.5-1.7 (2)
S. trojana	278-293 µm (2)	1.1-1.2 (2)	207-229 µm (2)	413-477 µm (2)	2.0-2.1 (2)	1.5-1.6 (2)
S. bicuspidata	257-303 µm (3)	1.2-1.3 (2)	188-206 µm (3)	398-460 µm (3)	1.9-2.1 (2)	1.5-1.6 (3)
S. ruficapitella	305-327 µm (318.9±9.7, 4)	1.1-1.1 (3)	193-222 µm (211.2±13.3, 4)	437-487 µm (468.1±22.1, 4)	2.6-2.8 (3)	1.3-1.5 (3)
S. atricapitella	240-307 µm (3)	0.9-1.2 (3)	162-207 µm (3)	304-412 µm (3)	2.0-3.3 (3)	1.3-1.4 (3)
S. karsholti	300-352 µm (3)	0.9-1.2 (2)	219-246 µm (3)	658-696 µm (3)	3.7-3.9 (3)	1.9-2.2 (3)
S. samiatella	261-323 µm (302.8±25.2, 5)	1.0-1.3 (1.14±0.12, 5)	207-227 µm (222.5±8.5, 5)	475-554 µm (518.2±34.4, 5)	4.1-6.0 (4.78±0.89, 4)	1.5-2.1 (1.73±0.26, 5)
S. roborella	283-320 µm (297.9±14.6, 6)	1.0-1.3 (1.16±0.10, 6)	191-232 µm (211.5±13.4, 6)	441-481 µm (458.8±16.8, 6)	2.1-2.8 (2.47±0.32, 4)	1.4-1.7 (1.54±0.11, 6)
S. eberhardi	265-294 µm (280.5±9.3, 9)	1.0-1.3 (1.13±0.11, 7)	183-204 µm (192.5±7.5, 9)	436-501 µm (458.5±20.1, 9)	2.2-2.6 (2.40±0.14, 8)	1.5-1.8 (1.64±0.08, 9)



Figs. 44-52. *Stigmella* spp., male genitalia, capsule (44, 46, 48), aedeagus (45, 47, 49) and valva, dorsal aspect (50-52). – 44, 45, 50, *S. suberivora*, Italy, slides RJ2278+1758 (50); 46, 47, 51, *S. ilicifoliella*, Spain, slide RJ1754; 48, 49, 52, *S. cocciferae*, Greece, Kos, slide RJ 1725.

androconial scales in distal 1/5 of hindwing.

Females very similar to all other pale-headed species, including some outside this group.

Male genitalia with capsule broader than long, valvae bulging and with field of papillae externally. Female genitalia with ductus spermathecae with ca 6.5 convolutions, ratio bursa /accessory sac 3.5-3.8, larger than in *ilicifoliella.*

Description

Male (fig. 3). – Forewing length 2.2-3.3 mm, wingspan 4.8-7.1 mm. Head: frontal tuft from almost white or ochreous to yellowish orange, collar pale grey to dark grey-fuscous, occasionally a few yellowish scales. Scape pale yellow. Antenna slightly darker, 3/5 of forewing length, with 30-45 segments, ratio to forewing length 12-16 segments/mm. Thorax and forewing unicolorous dark bronze brown, at base and on thorax almost bluish black in fresh specimens, a faint purplish lustre at apex; terminal cilia concolorous, underside bronze-brown. Hindwing coarsely scaled, dark grey-brown, dorsum with long dark brown to bluish black androconial scales, extending into fringe, the longest near base, approximately ¾ of cilia length; along basal half of costa long curved, spatulate bluish-black androconial scales, the longest as long as or longer than the shortest dorsal androconial scales; underside grey brown, cilia dark grey. Abdomen dark grey brown, with conspicuous yellowish to orange anal tufts inserted on well sclerotized plates, and very broad genital capsule, easily visible without dissection.

Female (fig. 4). – Forewing length 2.3-3.5 mm. Antenna with 33-40 segments, ratio to forewing length 11-14 segments/mm. As male, but collar yellowish white to pale yellow, hindwing grey, androconial scales absent, abdomen dark grey-brown, without anal tufts.

Male genitalia (figs. 44, 45, 50, 91). – Measurements: see table 3. Capsule very wide, wider than long or just as wide as long. Vinculum anteriorly slightly bilobed. Uncus with widely separated horns. Gnathos with widely separated posterior processes, often converging towards tip. Valva with pointed distal process less than ⅓ valva length, pointing inwards, inner margin forming a distinct lobe, ventral outer lobe bulging and covered with field of densely placed minute papillae; sublateral processes very short, or almost absent. Aedeagus with vesica with a more or less curved group of cornuti in basal half; this band comprises about 20-30 large cornuti with serrated bases and many small spinelike cornuti; more distally there is a group of ca 10-12 long needle-shaped cornuti and one or a few larger near phallotrema; manica covering aedeagus almost completely, except anteriormost part, covered with small spines and pectinations.

Female genitalia (figs. 57, 127, 147). – T8 with ca 18-23 setae. Bursa length 1170-1606 µm, 3.5-3.8× as long as accessory sac . Bursa distally covered with minute pectinations, difficult to see (observed with Differential Interference Contrast only); accessory sac anteriorly with pectinations only. Ductus spermathecae with 6.5 (n=3) convolutions.

Biology

Host plants. – *Quercus coccifera***, *Q. ilex***, *Q. rotundifolia***, *Q. suber***.

Leafmine. – Egg deposited on leaf upperside. Mine a broad gallery, filled with frass, usually transparent, but in very thick leaves difficult to see. Usually much wider and longer than the gallery mines of *Ectoedemia* species (*E. ilicis* (Mendes, 1910), *E. haraldi* (Soffner, 1942), *E. heringella* (Mariani, 1939) and *E. algeriensis* Van Nieukerken, 1985), which differ also by the larvae feeding with venter upwards and showing their ganglia and differently shaped headcapsule. Larva of *S. suberivora* yellow, and with dorsum upwards as all other species in this group. For a detailed description see Gustafsson & Van Nieukerken (1990).

Life-history. – Larvae have been collected from December to April and in Britain again in July-August, bivoltine, but more generations in Mediterranean possible. Adults have been collected from April to October.

Distribution (fig. 165)

Widespread in western Mediterranean: Portugal, Spain, Southern France, along Atlantic coast northwards to France: Bretagne, Italy, Corsica, Sardinia, Sicily (new record), Adriatic coast: Slovenia (A. & Z. Laštůvka 1997), Croatia, Bosnia (Skala 1937) and in North Africa in Algeria and Tunisia (new records); introduced and established in southern England. Records of leafmines in Mallorca (J. Klimesch in litt.) probably belong to this species. To be expected in Morocco and Malta. Occurs from sea level up to 1700 m in Aurès, Algeria.

Remarks

Because of the discovery of a second species, hidden amongst material of *S. suberivora* (*S. ilicifoliella*, see below), the identity of the various synonyms of *suberivora* had to be re-evaluated. The male lectotype of *S. suberivora* was illustrated by the junior author (Johansson 1971) and there is no doubt about its identity. The lectotype of *Nepticula ilicivora* Peyerimhoff is a poorly preserved female, with a genitalia slide; however, the slide does not show the main distinguishing character, the ductus spermathecae. Overall it agrees better with *suberivora*, and male specimens in the old French collections in Paris, labelled as *ilicivora* are all *suberivora*. *Nepticula aureocapitella* Millière was synonymised by us (Van Nieukerken & Jo-

hansson 1987) on the basis of several non-type specimens which included *S. suberivora* and *S. eberhardi*. We choose the first to avoid change of names; the material does not include any *S. ilicifoliella*. Only the name *Stigmella ilicivora* ssp. *nigra* Dufrane has to be removed from synonymy with *suberivora*; below it is synonymised with *S. ilicifoliella*.

Material examined. – 98♂, 59♀. – ALGERIA: 1♀, Aurès, near Arris, 32 km SSE Batna, 1700m, 28.iv.1980, *Q. rotundifolia*, e.l. 7-9.vi.1980, E. J. van Nieukerken & G. Bryan (ZMAN). – CROATIA: 1♀, Zadar, 0-60m, 7.iii.1890, *Q. ilex*, e.l. 20.iv.1970, G. Deschka (SMNK). – FRANCE: 1♂, Alpes Hte Provence: les Mées, 3-8.viii.1985, G.R. Langohr (JL); 1♂, Alpes Maritimes: Cannes, *Q. ilex*, Constant, '9', '37' (as *aureocapitella*); 2♂, Cannes, *Q. ilex*, Constant (as *ilicivora*) (MNHN); 3♀, Cannes, ii-iii.1887, *Q. ilex*, e.l. 9.v.1887, Walsingham (as 'type *anypopta* Joannis') (BMNH); 1♀, Cannes, Saint Raphael, 7.iii.1890, *Q. ilex*, e.l. 20.iv.1890, Walsingham (BMNH); 1♂, Cannes, Valescure, 07.iii.1890, *Q. ilex*, e.l. 03.v.1890, Walsingham (BMNH); 1♂, Bouches-du-Rhône: 3 km W La Ciotat: La Grande Tête, Route des Crêtes, 11.ii.1991 *Q. ilex*, e.l. 21.iii.1991, E. J. van Nieukerken (RMNH); 2♀, between Cassis and Cuges-les-Pins: Roquefort, 04.iii.1984, *Q. ilex*, e.l. 12-14.v.1984, R. Buvat (ZMAN); 1♂, Charente: Angoulème, e.l. iv.1941, J. Sofner (RJ); 1♀, Hérault: St. Pons-de-Thomières, 2 km SE: Tombeilles, 20.ii.1991, *Q. ilex*, e.l. 5.vi.1991 E. J. van Nieukerken (RMNH); 1♂, 1♀, Var: Massif de l'Esterel, 20.vii.1979 G.R. Langohr (JL); 1♂, Vaucluse: Pertuis, 10.vii.1991, A. & Z. Laštůvka (AL); 1♀, Viens, 14.viii.1974, R. Buvat (MNHM). – FRANCE, CORSICA: 1♂, Castirla, 12 km N Corte, 400m, 20.vi.1994, B. Skule & P. Skou (ZMUC). – GREAT BRITAIN: 2♂, 1♀, Dorset: Poole, 22.v.1941, W. Fassnidge (ZMAN); 1♂, Poole, 17-20.v.1940, S.N.A. Jacobs (BMNH); 2♂, 8♀, Gr London: Lambeth: Brockwell Park, 27.iii.1980, *Q. ilex*, e.l. 15-23.iv.1980, E. J. van Nieukerken & A. M. Emmet (ZMAN, RMNH); 2♂, 2♀, London: Brockwell Park, *Q. ilex*, e.l. 15-18.iii.1975, A. M. Emmet (BMNH). – ITALY: 1♂, Testico, 16.vii.1966, E. Jäckh; 4♂, Caserta: Baia Domizia, 25.vii.1972, R. Johansson; 8♂, Baia Domizia, 7.viii.1972, R. Johansson; 1♀, Baia Domizia, 7.viii.1972, R. Johansson; 1♂, Baia Domizia, 3.vii.1969, R. Johansson (; 1♀, Latina: Monti Aurunci, 5 km N Itri, 600m, 24-30.vi.1969, R. Johansson; 2♂, Monti Aurunci, 6 km N Itri, 600m, 15.viii.1972, R. Johansson (RJ); 1♀, Savona: C. di Cadibona, 335m, 20.iv.1971, G. Baldizzone (GB); 1♀, Trieste: Sistiana Mare, 0-60m, 7.iii.1890, *Q. ilex*, e.l. 24.iv.1970 G. Deschka (SMNK). – ITALY, SARDINIA: 7♂, Bacu Trotu, Ortuabis, 800m, 23.viii. 1978, 03.ix.1978, 23.vi.1979, G. Derra (GD, RMNH); 10♂, 8♀, Mt. Istiddi, 700m, 19+28.v.1975, 30.vi.1976, 13.viii. 1977, 1.ix.1978, G. Derra (RMNH, GD); 4♂, 2♀, Palolu, Meana-Sardo, 6.viii.1977, G. Derra (GD); 1♂, Nuoro: 10 km W Dorgali, 26.vii.1999, P. Triberti (PT); 1♂, Belvi, 650m, 20.vii.1984, J. H. Kuchlein (JHK); 1♂, Belvi surroundings, 700m, 7.x.1975, F. Hartig (MRSN); 2♂, Belvi, Mt. Istiddi, 900m, 9.vi.1977, F. Hartig (MRSN); 5♂, 2♀, F. Cedrino, 5 km SW Galtelli, 16.vii.1999, P. Triberti (PT,RMNH); 4♂, 8♀, Mamoiada, 25.vii+30-31.vii.1983, J. H. Kuchlein (JHK, RMNH); 1♀, Seúi, 1100, 20.vii.1983, J. H. Kuchlein (JHK); 3♂, 4♀, Villanova-Strisaili, 1-15.viii.1983, 11-12+25.vii. 1984, J. H. Kuchlein (JHK). – ITALY, SICILY: 3♂, 1♀, Palermo: Cefalù, 500m, 9.vii.2000, P. Triberti (PT,RMNH). – SPAIN: 1♂, Cantabría: Picos de Europa: Camaleño, 520m, 25.vii. 1986, Mixed oak forest and meadows; at light ML or dusk, van Nieukerken & Richter (RMNH); 1♂, 1♀, Cordoba: 7 km NE Santiago de la Espada, 1400m, 23.ix.1995, H.W. van der Wolf (HW); 1♂, Murcia: 4 km NW Aledo, 26.ix.2001, C & F K Gielis (RMNH); 1♀, Málaga, Ariate, 12 km E Rhonda, Casa Alta, 500m, 03.viii.1990, E. Traugott-Olsen (ZMUC); 2♂, Málaga, Camino de Cesares, 500m, 9.vii.1973, E. Traugott-Olsen (ZMUC); 1♂, Málaga, Camino de Istan, 200m, 08. vii.1973, E. Traugott-Olsen (ZMUC); 1♂, Málaga, Camino de Ojen, 150m, 17.iv.1980, E. Traugott-Olsen (ZMUC); 1♂, Camino de Ronda, Urb. Madronal, Loma de Colmenas, 14.viii.1988 E. Traugott-Olsen (ZMUC); 7♂, Camino de Ronda, Urb. Madronal, Loma de Colmenas, 500m, 3.ix. 1988, E. Traugott-Olsen (ZMUC, RMNH); 1♂, Marbella, El Mirador, 14.iv.1971, E. Traugott-Olsen (ZMUC); 1♀, Ronda, 29.iii.1979 *Q. coccifera*, e.l. v.1979, E. J. van Nieukerken (ZMAN); 1♂, Valencia: Gilet, 21.iv.1989, *Q. coccifera*, e.l. 15. v.1989, J. C. Koster (JCK). – TUNISIA: 1♂, 7 km S Ain Draham, les Chênes, 22.iii.1986, *Q. suber*, e.l., O. Karsholt (ZMUC); 6♂, 4♀, Ain Draham area, 05.v.1988-18.v.1988, O. Karsholt (ZMUC, RMNH).

Additional unpublished records (A. & Z. Laštůvka in litt.). – CROATIA: Dalmacia, Oračac; Istria, Rabac. – FRANCE: Bouches-du-Rhône, Aix en Provence; Vaucluse, Pertuis. – ITALY; Catanzaro, Santa Caterina dell Iónio; La Spezia, Levanto. – ITALY, SICILY: Acate; Solarino. – PORTUGAL: Algarve, Lagoa da Nave, Salir (M. F. V. Corley *in litt*); Beira Baixa, Zebreira; Beira Alta: Serra da Estrella, Covilha; Serra da Estrella, Penhas de Saude.– SPAIN: Cádiz, Alcalá del valle; Castellon, Cuevas de Vinrona; Cuenca, Boniches; Cuenca, Gabaldón; Gerona, Anglés; Granada, Diezma; Granada, El Molinillo; Huelva, Bonares; Teruel, Albarracín; Teruel, Montalbán; Teruel, Segura de los Baños; Teruel, Vivel del Rio; Toledo, Robledo del Buey.

3. *Stigmella ilicifoliella* (Mendes) **comb. n., stat. rev.** (figs. 5, 46, 47, 51, 58, 92, 93, 128, 148, 166)

Nepticula sp.; Mendes 1913: 26.

Nepticula ilicifoliella Mendes, 1918: 127. Syntypes: SPAIN: Salamanca, Feb. 1912/1913 larvae on *Quercus ilex*, adults in May-June, Mendes (depository unknown) [not examined].

Nepticula ilicifoliella; Agenjo 1964: [unnumbered page 2 of appendix].

Stigmella ilicivora nigra Dufrane, 1955: 192. Holotype ♂: PORTUGAL: e.l. 16.vi.1930, *Quercus ilex* [Mendes?] ex coll. Joannis, genitalia slide EvN3450 (KBIN) [examined], **syn. n.**

Diagnosis

Almost inseparable from the sympatric *S. suberivora*, except for the much narrower male genitalia, which can be seen without dissection with some experience. Males also have significantly longer antennae than *suberivora*, but there is some overlap, in females the difference is less obvious. Valvae not bulging, without field of papillae, but with a field of many setae, genitalia capsule longer than wide. Female genitalia with ductus spermathecae with 4.5 convolutions, ratio bursa /accessory sac 2.3-3, smaller than in *suberivora*; usually more setae on T8.

Description

Male (fig. 5). – Forewing length 2.5-3.0 mm, wingspan 6.0-6.6 mm. Head: frontal tuft from almost white or ochreous to yellowish orange, occasionally black, collar pale grey to dark grey-fuscous. Scape pale yellow. Antenna slightly darker, 3/5 of forewing length, with 39-50 segments, ratio to forewing length 15-19 segments/mm. Thorax and forewing unicolorous dark bronze brown, at base and on thorax almost bluish black in fresh specimens, a faint purplish lustre at apex; terminal cilia concolorous, underside bronze-brown. Hindwing coarsely scaled, dark grey-brown, dorsum with long dark brown to bluish black androconial scales, extending into fringe, the longest near base, approximately ¾ of cilia length; along basal half of costa long curved, spatulate bluish-black androconial scales, the longest as long as or longer than the shortest dorsal androconial scales; underside grey brown, cilia dark grey. Abdomen dark grey brown, with conspicuous white to pale yellowish anal tufts inserted on well sclerotized plates; genital capsule not particularly broad, valvae with dense tuft of hairs.

Female. – Forewing length 2.5-2.9 mm. Antennae with 33-40 segments, ratio to forewing length 12-16 segments/mm. As male, but collar yellowish white to pale yellow, hindwing grey, androconial scales absent, abdomen dark grey-brown, without anal tufts.

Male genitalia (figs. 46, 47, 51, 92, 93). – Measurements: see table 3. Capsule longer than wide or almost as long as wide. Vinculum anteriorly slightly bilobed. Uncus with widely separated horns. Gnathos with widely separated posterior processes with club-shaped tips. Valva with pointed distal process less than ¼ valva length, pointing slightly inwards(fig. 46, 51); inner margin forming a rounded lobe, ventral outer lobe pronounced, but not as bulging as in *suberivora*, covered with field of dense setae, but no papillae (fig. 46); sublateral processes short. Aedeagus with vesica with a more or less curved group of cornuti in basal half; this band comprises about 20-30 large cornuti with serrated bases and many small spinelike cornuti; more distally there is a group of ca 7-12 long needle-shaped cornuti and a few near phallotrema; manica covering aedeagus almost completely, except anteriormost part, covered with small spines and pectinations.

Female genitalia (figs. 58, 128, 148). – T8 with ca 25-50 setae. Bursa length 1062-1204 µm, 2.3-3.0× as long as accessory sac . Bursa distally covered with minute pectinations, difficult to see (observed with Differential Interference Contrast only); accessory sac anteriorly with pectinations only. Ductus spermathecae with 4.5 (n=3) convolutions.

Biology

Hostplants. – *Quercus ilex***, *Q. rotundifolia***, *Q. suber***.

Leafmine. – The few mines studied are similar to *suberivora*, but all almost invisible because they are covered by an uneaten part of the leaf parenchyma; this was also described by Mendes (1913, 1918). It is not yet clear if this character will always separate *ilicifoliella* from *suberivora*, or whether it depends on the rather thick leaves of *Q. rotundifolia* in which we (and Mendes) found the mines.

Life-history. – Larvae have been collected in February and March. Adults have been collected from June to early September, voltinism unknown.

Distribution (fig. 166)

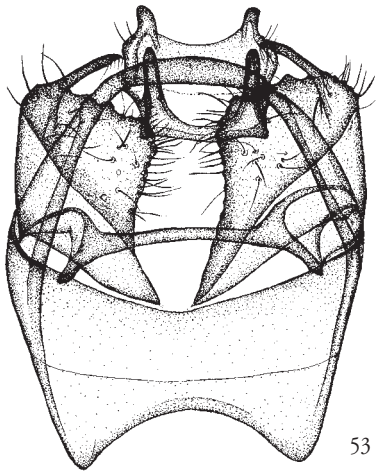
Widespread in Portugal and Spain, particularly inland, but probably less common than *suberivora*. In France (new record) known from old specimens along the Atlantic coast near Bordeaux and in the Hérault and the Côte d'Azur near Cannes; to be expected along the Italian Riviera and in North Africa. Often sympatric with *S. suberivora*. Frequently found in mountains; recorded from sea level up to 2200 m in the Sierra Nevada.

Remarks

Although several earlier authors considered more than one species of this group to be feeding on evergreen oaks, in the last decades only one species was recognized and other names were considered to be synonyms (Johansson 1971). The names *ilicivora* and *aureocapitella* are treated above, but other authors still considered the possibility of more species. Joannis (1909) wondered whether specimens with dark abdomen might belong to a different species, but still kept them in *Nepticula ilicivora* Peyerimhoff. Constant also considered material with larger mines on *Quercus suber* as a different species. Such material, belonging to the species under discussion, is present in the Lhomme and Ragonot collections in Paris and labelled with 'suber gr. m.' and 'sp. n. Cst.' (plus a pink triangle, which stands for coastal area of Alpes Maritimes, near Cannes, see Boursin 1936). We think that gr. m. stands for 'grande mine'. We have not been able to find any paper by Constant with this information, but a manuscript name suggested by him (*suberoidella*) has still entered the literature (Le Marchand 1946, Skala 1938), although the source of this remains unknown.

We consider that this species, which we only discovered when working on this paper, should be named *ilicifoliella* Mendes. After its original description, this name has only once been cited, in a checklist (Agenjo 1964). It is unclear why everybody, including ourselves, have overlooked this name. Possibly it was – incorrectly – considered a misspelling of *N. ilicis* Mendes.

The identity of *ilicifoliella* is based on the following facts:



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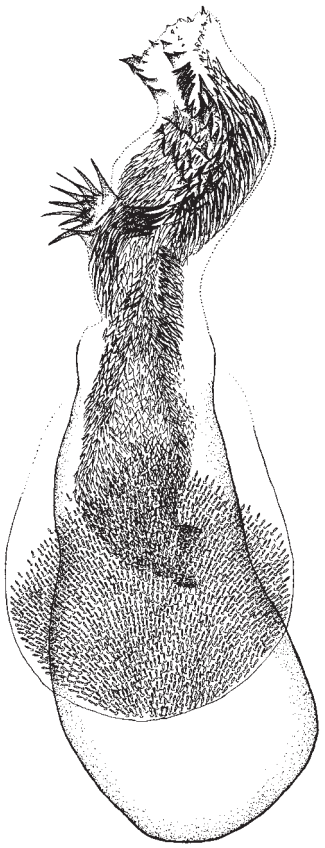

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Figs. 53-55. *Stigmella kasyi*, male genitalia, holotype, slide RJ1528. – 53, Capsule; 54, aedeagus, vesica partly everted; 55, detail of spines on manica.

1. Mendes (1913) described an unknown species (*Nepticula* sp.) from *Quercus ilex* in São Fiel (Portugal), with a dark abdomen (darker than typical '*ilicivora* Peyer.'), and with almost invisible mines, only visible when held against the light. He believes it likely to be a new species ('Provavelmente é uma especie inedita').

2. Mendes (1918) described *Nepticula ilicifoliella* n. sp. from Salamanca very briefly, translated as follows:

'I will describe it briefly. End of May and early June. Caterpillar: on Holm-oak (*Q. ilex*) during the whole month of February. One can discover the mine by the prominence on the underside of the leaf.'

Although he does not refer to his earlier paper, he almost certainly was naming here the unknown species from *Quercus ilex*. This is indicated by the mine character, and the fact that all the other species known to him from this oak , were also mentioned in both papers. Despite the fact that the brief description is based on the mine, the name is available, since descriptions based on 'the work of an animal' published before 1930 are available (ICZN, article 1.2.1, 13.3.3).

3. Dufrane (1955) mentioned a male *'Stigmella ilicivora*' with a dark abdomen from Portugal, which he received from J. de Joannis. Dufrane described this specimen as subspecies *nigra* of *S. ilicivora*.

4. Mendes had frequent contact with Joannis, and sent him material regularly (Luisier 1944, Zerkowitz 1946). There are remnants of the original collection of Mendes in the monastery of Sante Tirso and in the high school of Castelo Branco (partly destroyed), but mostly without name labels and probably without the types (E. Maravalhas in litt., September 2003). Most likely the types of *Nepticula ilicifoliella* must therefore be considered lost. Up to now, Joannis material has served several times as type material of Mendes' Nepticulidae (e. g. *Nepticula ladaniphila* Mendes, 1910, see Van Nieukerken 1983). In the Joannis collection there are five specimens labelled 'Q. ilex Portugal 4 juillet' which we think were sent to him by Mendes. Probably Mendes and Joannis discussed the possibility of a second species on *Quercus ilex*. These specimens are conspecific with the holotype of *nigra*, which most likely also belongs to the material Joannis got from Mendes. The year 1930, given by Dufrane, may be a mistake, and it is not cited on the original label in Joannis' handwriting, as is the usual case in Joannis material; 1930 may have been the year Dufrane received the specimen. Mendes was expelled from Portugal as Jesuit, and lived in Spain afterwards and finally in Brasil (Luisier 1944, Zerkowitz 1946). He therefore could not have collected a Portuguese specimen after 1910, unless it was presented to him by someone else (when living in Spain, he lived some time near the border with Portugal). The Portuguese material serves for establishing the identity, but cannot be regarded as types,

because *Nepticula ilicifoliella* was clearly described from Spain (Salamanca).

On the evidence presented here, we consider *Stigmella ilicifoliella* (Mendes) to be the valid name for this species, with which we synonymise *S. nigra* Dufrane.

We have not been able to confirm the character 'dark abdomen', mentioned by Mendes, Joannis and Dufrane. Both *S. suberivora* and *ilicifoliella* are somewhat variable in this respect, and fresh specimens usually have much darker abdomens than faded collection material.

Material examined. – 43♂, 24♀. – FRANCE: 10♂, 4♀ [pink triangle=Alpes Maritimes: Cannes] 'suber, gr. m.' [*Quercus suber*, Grande mine], decades 16-20 [1.vi-15.vii, 19th Century] [Constant], colls. Ragonot and Lhomme, partly labelled as 'sp. n. Constant' (MNHN); 1♂, Gironde, Pessac, e.l. 17.v.1929, *Quercus ilex*, Le Marchand (MNHN); 1♂, Hérault, St. Pons, ix.1904, Chrétien (MNHN). – SPAIN: 3♂, Albacete, Biencervida, 1000m, 16.vi.1986, P. Skou (RJ); 1♂, Barcelona, La Llacuna, Anoia, 28.viii.2000, E. Requena (RMNH); 1♀, Barcelona, San Marti de Tous, Anoia, 29. vii.2000, E. Requena (RMNH); 2♂, 2♀, Burgos, Ibeas de Juarros, 884m, 23.vii.1985, A. Vives Moreno (AV, RMNH); 2♂, 1♀, Cantabría, Picos de Europa: Camaleño, 520m, 25.vii. 1986, van Nieukerken & Richter (RMNH); 1♂, Cuenca, Cuenca, 900m, 16.vii.1986, C. Gielis (CG); 2♂, Granáda, 20 km ENE of Granada, 23.vii.1986, C. Gielis (RMNH, CG); 1♀, Granáda, N 342, Rio Baza, 7-9.vii.1985, G. Baldizzone & E. Traugott-Olsen (ZMUC); 1♀, Granáda, Puerto de Mora, 22.vii.1986, C. Gielis (CG); 9♂, 11♀, Madrid, Cadalso de los Vidrios, 2 km W, 7.viii.1986, van Nieukerken & Richter (RMNH); 2♂, Madrid, Lozoya, 3 km E., 1100m, 02.iii.1997, leafmines, *Quercus rotundifolia*, e.l. 11.v.1997-16.v.1997, E. J. van Nieukerken (RMNH); 1♀, Málaga, 4 km NE Igualeja, Serrania de Ronda, 1100m, 7.ii.1984, leafmines, *Quercus rotundifolia*, e.l. 8.iii.1984, E. J. van Nieukerken (RMNH); 2♂, Málaga, Camino de Istán, 28.vi.1972, 8.vii.1973, E. Traugott-Olsen (ZMUC); 1♂, Murcia, Sierra d'Espuña, C.F. de las Alquerias, 800m, 04.iv.1997, H. W. van der Wolf (coll. van der Wolf); 1♂, Teruel, Noguera, 1500m, 11.vii.1986, C. Gielis; 1♂, Teruel, Sierra Alta, 10.vii.1985, C. Gielis (CG). – PORTUGAL: 1♂, holotype of *nigra*; 3♂, 2♀, [Beira Baixa: Sao Fiel], 4.vii, *Quercus rotundifolia* [as *ilex*], [Mendes], coll. Joannis (MNHN); 1♂, Covao do Boi, Serra da Estrela, 1870m, 4.ix.2001, M. F. V. Corley (MC).

Additional records. – PORTUGAL: 1♂, Algarve, N. of Alportel, 6.ix.1991 M. F. V. Corley (in litt.); 1♂ (black-headed), Algarve, Messines de Baixo, 25.vi.2002; 1♀, Beira Alta, Covilha, 21.vi.2002; 3♂, Sétubal, Marateca, 100m, 24.vi.2002. – SPAIN: 2♂, Cadiz, Alcala del Valle, 11.vii.1993; 1♂, Granáda, Diezma, 29.vi.2003; 3♂, Granáda, El Molinillo, 28.vi.1992; 2♂, Granáda, Sierra de Guillimona, 29.vi. 2001, 1♂, Granáda, Sierra Nevada, Puerto de la Ragua, 2200 m, 8.vii.1993; 1♂, Málaga, Jimena de Líbar, 500m, 27.vi.2003 (all A. & Z. Laštůvka in litt.).

4. ***Stigmella cocciferae*** sp. n.

(figs. 6, 7, 39, 48, 49, 52, 59, 94, 95, 129, 149, 166)

Nepticula sp.; Amsel & Hering 1931: 141 [records of mines on *Quercus coccifera*].

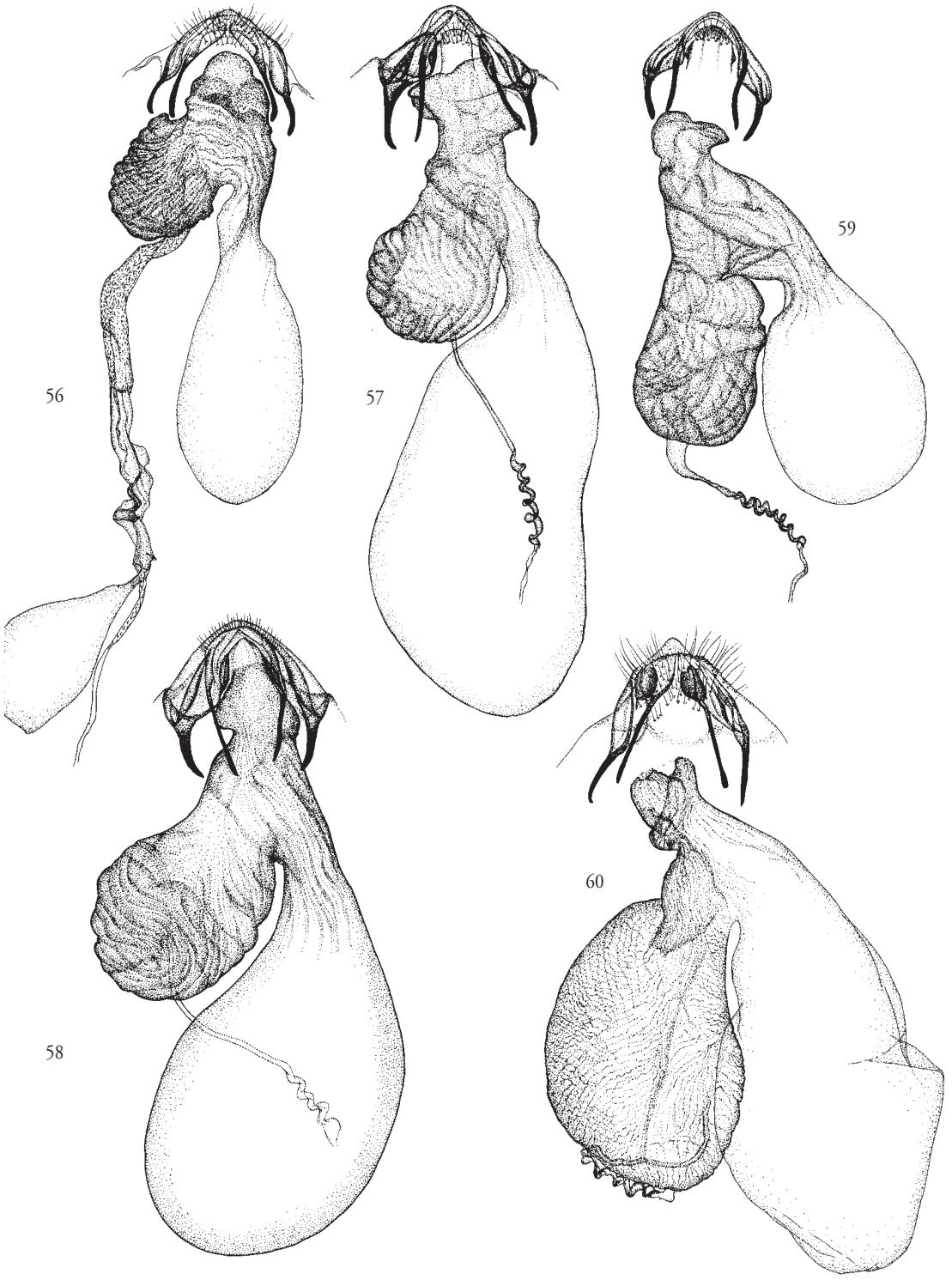
Type material. – Holotype ♂: GREECE, Arákhova (Voiotía), cult. terraces, olive & almond, 950 m, 38.29N-22.35E, 27-29.ix.1980, at light, S. B. J. Menken & E. J. van Nieukerken. genitalia slide VU 0813 (RMNH).

Paratypes: 33♂, 10♀. – GREECE (mainland): 1♂, 4♀, same data as Holotype (RMNH); 2♀, Akhaia, Kalávrita, 20.vi.1997, A. Laštůvka (AL); 1♂, Argolis: Akhladokambos, 18 km E of Tripolis, 5.x.1982, Gg. Derra (GD); 2♂, Ioánnina: Asprángeli, 10.vi.1997, Laštůvka (AL); 2♂, 1♀, Ioánnina: 10 km NE Geroplatanos by Konitsa, 800, 24.vii.1990, M. Fibiger; 1♂, Ioánnina, 4 km SW Geroplatanos, 800, 12.vii. 1998, D. Nilsson & B. Skule; 1♂, Lakonia: 5 km S Monemvasia, 16.v.1987, G. Christensen (ZMUC); 1♂, Lakonia: Taygetos, 1000-1200 m, 12.vi.1979, MV, Gozmány & Christensen (TMAB); 1♂, Messinia: Kardhamíli, gorge with maquis, 18. ii.1990, *Quercus coccifera*, e.l. 21.iii.1990, E. J. van Nieukerken; 1♀, Voiotia: Parnassos Oros, Arakhova surr., 800m, 28.ix.1993, Lingenhöhle (RMNH). – GREECE, KOS: 4♂, 1♀, Kos, Asfendiou, 5-12.x.1988, R. Johansson (RJ, ZMUC); 1♂, Kos, 5 km E of town Kos, 1.x.1988, R. Johansson (RJ). – GREECE, KRITI: 1♂, Iraklion: Potamies monastery, 19.iv.1989, R. Johansson (RJ). – GREECE, SAMOS: 1♀, I. Samos, Kokkari, 10m, 22.vi.1996, R. Sutter (RS). – ISRAEL: 1♂, Kirjat-Anawim (Qiryat Anawim), Jerusalem, 2.v. 1930, H. G. Amsel (LNKD). – TURKEY: 1♂, Ankara: 20 km NW Kizilcahamam, 1200 m, 24.vii.1986, M. Fibiger (RJ); 6♂, Antalya: Antalya 20 km W, 28.iv. 1996, K. Nupponen & J. Junnilainen (RMNH, JJ); 1♂, Antalya: Bucak, 35 km S, 850m, 14.v.2000, J. Junnilainen (JJ); 1♂, Içel [Mersin]: 5 km NW Erdemli, 200m, 16.vii.1986, M. Fibiger, (ZMUC); 1♂, Içel (Mersin): Güzeloluk, NW Erdemli, Taurus, 1400 m, 16.vii.1986, M. Fibiger (RJ); 4♂, Isparta: Isparta, 20 km SE, 14.v.2000, J. Junnilainen (RMNH, JJ); 1♂, Izmir: 30 km NW Bergama, 500-750m, 10-12. v.1993, O. Karsholt (ZMUC); 1♂, Konya: 20 km SE Hadim, Taurus, 1800 m, 14.vii.1986, M. Fibiger (RJ).

Additional records (A. & Z. Laštůvka in litt.). – GREECE: 4♂, 2♀, Pieria, Leptokaria, 22.vi.1997; 3♂, Messinia, Kardamili, 19.vi.1997; 6♂, Lakonia, Apidia, 15.vi.1997; 2♂, Voiotia, Khairona, 13.vi.1998. – TURKEY-IN-EUROPE: Kemerburgaz, el. 25.iv.1975, G. Deschka (AL).

Diagnosis

Very similar to Western European *S. ilicifoliella*. The latter usually is darker and has the androconial scales extending to tip of hindwings, whereas *cocciferae* has no androconial scales in distal ¼; further androconials in *S. cocciferae* paler and shorter than in *ilicifoliella*. Male genitalia: in *S. ilicifoliella* the capsule and valvae are markedly wider than in *cocciferae* and gnathos horns are club-shaped; in *S. ilicifoliella* the manica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covers the aedeagus almost completely and in *cocciferae* only distal ⅔. Female genitalia very similar to *S. suberivora* and *ilicifoliella*, but bursa in *suberivora* and *ilicifoliella* much longer compared to accessory sac than in *cocciferae*.

Description

Male (fig. 6). – Forewing length 2.2-3.2 mm, wingspan 4.9-7.0 mm. Head: frontal tuft yellowish orange, collar fuscous. Scape pale yellow. Antenna dark bronze brown, ¾ of forewing length, with 36-49 segments, ratio to forewing length 13-19 segments/mm. Thorax and forewing unicolorous dark bronze brown, weakly shining; terminal cilia concolorous, slightly paler at tip; underside bronze-brown. Hindwing coarsely scaled, fuscous, distal ¼ brown, basal ¾ of dorsum with long dark grey-brown androconial scales, extending into fringe, the longest near base, approximately ⅔ of cilia length; along basal half of costa long curved, spatulate bluish-black androconial scales, the longest as long as or longer than the shortest dorsal androconial scales; underside grey brown, cilia dark grey. Abdomen dark grey brown, with pale yellowish anal tufts inserted on well sclerotized plates.

Female (fig. 7). – Forewing length 2.2-2.9 mm, wingspan 4.9-6.2 mm. Antenna with 30-37 segments, ratio to forewing length 12-15 segments/mm. As male, but collar pale yellow, hindwing grey, androconial scales absent, abdomen dark grey, without anal tufts.

Male genitalia (figs. 48, 49, 52, 94, 95). – Measurements: see table 3. Capsule relatively narrow compared to related species. Vinculum bilobed anteriorly. Uncus with widely separated horns. Gnathos with long, widely separated posterior processes. Valva with pointed distal process less than ¼ valva length, in lateral view medial (fig. 52); inner margin almost straight with almost rectangular distal angle; sublateral processes about ⅓ transtilla length. Aedeagus with vesica with a more or less curved group of cornuti in basal half; this band comprises about 35-40 large cornuti with serrated bases and many small spinelike cornuti; more distally there is a group of ca 12 long needle-shaped cornuti and one larger near phallotrema; manica covering distal ⅔ of aedeagus, covered with small spines and pectinations.

Female genitalia (figs. 59, 129, 149). – T8 with more than 20 setae. Bursa well visible, total length 1050-1120 µm, 2.4-2.6× as long as accessory sac; walls thin, without pectinations. Accessory sac more strongly sclerotized, without pectinations. Ductus spermathecae with ca 6-7 convolutions.

Biology

Hostplant. – *Quercus coccifera***. It was twice reared from this host and in Greece otherwise always collected near *Q. coccifera*, often with vacated mines.

Leafmine (fig. 35). – A broad gallery with broad frass, egg on leaf upperside. Similar to that of *S. suberivora*.

Life-history. – Probably bivoltine, or even with more generations. Larva collected in February, adults flying in April-July and September-October.

Distribution (fig. 166)

Widespread in Eastern Mediterranean: mainland Greece, Aegean islands, Crete, Turkey and Israel. Occurs from sea level up to 1800 m in Taurus. To be expected in Cyprus, Syria and Lebanon. It seems to occur completely vicariantly with *S. suberivora*, of which the closest records are in south Croatia (Zadar). No records of either species are known between northern Greece and Zadar.

Etymology

A noun in genitive case: named after the foodplant *Quercus coccifera*.

5. ***Stigmella kasyi*** sp. n.
(figs. 8, 9, 53-55, 60, 96, 130, 150, 167)

Type material. – Holotype ♂: AFGHANISTAN, 25 km. N Barikot, Nuristan, 1800 m, 12-17.vii.1963, Kasy & Vartian, genitalia slide RJ 1528 (NHMW).

Material excluded from type series. – 1♀, AFGHANISTAN: Paghman, 30 km NW Kabul, 2500 m, 20+24.vii.1965, Kasy & Vartian (NHMW).

Diagnosis

Male externally resembling other species with spatulate androconial scales, but much larger, larger number of antennal segments than any species in this group. Otherwise, the black head and edged scape and paler forewings separate it from *S. suberivora, ilicifoliella* and *cocciferae*. The black-headed *S. atricapitella* and *ruficapitella* have no edged scape. Female very similar to all other red-headed species, except for large size and large number of antennal segments. Male genitalia characterized by numerous cornuti and very specially shaped spines on manica Female genitalia recognized by large size of accessory sac (bursa less than 1.5× as long as accessory sac) and number of convolutions.

Figs. 56-60. *Stigmella* spp., female genitalia. – 56, *S. fasciata*, holotype, slide EvN/VU 1964; 57, *S. suberivora*, Tunisia, slide RJ 1667; 58, *S. ilicifoliella*, Spain, slide RJ2275A; 59, *S. cocciferae*, Greece, Kos, slide RJ1726; 60, *S. kasyi*, Afghanistan, slide Mus. Vind. 5408.

Description

Male (fig. 8). – Forewing length 3.45 mm. Wingspan 7.5 mm. Head: frontal tuft dark grey brown, collar grey-brown. Scape white, with broad distal bluish grey edge, almost half scape width. Antenna grey brown, ¾ of forewing length, with 53 segments. Thorax and forewing unicolorous pale bronze brown, slightly darker at basal ¼ of costa; terminal cilia slightly paler; underside pale grey-brown, cilia pale grey; at second ⅓ of dorsum a large brush of brown androconial hair-scales, arising from edge, approximately as long as cilia. Hindwing pale yellowish grey, grey-brown androconial scales on dorsum extending into fringe, approximately ⅔ of cilia length; along basal third of costa with broad grey-brown androconial scales, the longest as long as hindwing width; underside pale grey. Abdomen removed for dissection (reconstructed in fig. 8). Anal tufts inserted on well sclerotized plates.

Female (fig. 9). – Forewing length 3.8 mm. Wingspan 8.6 mm. Frontal tuft yellowish brown; collar pale yellowish. Scape pale yellowish, with some pale grey-brown scales. Antenna with 48 segments. Otherwise as in male, except for secondary sexual characters. Abdomen removed for dissection.

Male genitalia (figs. 53-55, 96). – Measurements: see table 3. Vinculum anteriorly bilobed. Uncus with widely separated horns. Gnathos with widely separated posterior processes. Valva with thin and long pointed distal process; inner margin slightly concave with almost rectangular distal corner; sublateral processes about ⅓ transtilla length. Aedeagus very long; vesica with numerous small and needle-shaped cornuti; a group of longer needle-shaped cornuti visible at left side (the vesica is somewhat everted in holotype, position therefore different compared to in situ slides); manica not very large, ventrally covered with a special type of papillate spines.

Female genitalia (figs. 60, 130, 150). – T8 not well visible in single slide, probably with longitudinal depressions. Bursa well visible, total length 1250 µm, 1.5× as long as accessory sac; walls thin, without pectinations. Accessory sac more strongly sclerotized, without pectinations. Ductus spermathecae with 6 convolutions.

Biology

The male was taken in July in extensive forests of *Quercus baloot*, which we presume to be the hostplant (cf. Kasy 1965). *Q. baloot* belongs to the species group of *Q. ilex*.

Distribution (fig. 167)

Only known from eastern Afghanistan.

Remarks

The female is believed to belong to the same species on the following grounds: it agrees very well in external features, in particular in the large size (one of the largest known *Stigmella* species) and the colour of the forewings. Further both male and female show a close relationship to *S. suberivora, ilicifoliella* and *cocciferae*, and are currently the only specimens of this species group known from Afghanistan. However, the locality Paghman on the label of the female is quite different from the type-locality; Paghman is a dry mountain northwest of Kabul, and no *Quercus* is noted in the list of plants of that locality (Kasy 1967). Three *Quercus* species (*Q. baloot, Q. semecarpifolia* Smith and *Q. dilatata* Royle) occur in Afghanistan (Menitskij 1984), all confined to the wetter extreme east of the country, some large valleys and southern slopes of the Hindu Kush mountain ranges, relatively far away from Kabul (see fig. 167).

This specimen was collected in 1965, on an expedition which also included collecting in the *Quercus* forests of Nuristan (Kasy 1967). It is therefore possible that the female was accidentally mislabelled, but it is also possible that planted oaks occur closer to Paghman or that the female was a vagrant. Since the possibility exists that the female is not conspecific with the male after all, we have excluded it from the type-series.

Etymology

A noun in genitive case. It is an honour to dedicate this species to the late Dr. Friedrich Kasy (1920-1990, see Fischer 1991), to whom we owe much for his careful collecting of many Nepticulidae both in the Middle East and in Austria, and his kind support of our work.

6. ***Stigmella basiguttella*** (Heinemann)
(figs. 10, 11, 97, 98, 131, 151, 168)

Nepticula basiguttella Heinemann, 1862: 258. Lectotype ♀: GERMANY: Br[aun]schw[eig], Eichen e.l. [*Quercus*], Heinemann, Genitalia slide on pin (LMHG) [examined].

Stigmella cerricolella Klimesch, 1946: 160. Syntypes: ITALY: Ferrania (Ligur. Appenin), xi.1944, larvae on *Quercus cerris*, e.l. 20.iv-5.v.1945, Klimesch (ZSMG) ['paratype' examined].

Nepticula basiguttella; Petersen 1930: 46, fig. 9 (male genitalia), Johansson 1971: 253, Borkowski 1972: 779, Klimesch 1978: 243.

Nepticula basiguttella cerricolella; Johansson 1971: 253, Borkowski 1972: 781.

Stigmella basiguttella; Beirne 1945: 198, fig. 14 (male genitalia), Emmet 1976a: 244, Johansson & Nielsen 1990: 229, Puplesis 1994: 158, A. & Z. Laštůvka 1997: 105.

Diagnosis

One of the most variable species of the group, but always with dark head. The amount of pale patches on

the forewings varies, but usually the basal spot is present and frequently the middle part of the wing is slightly paler to almost white. Similar species are, in the males, *S. trojana* and *bicuspidata*, which have narrow spatulate androconials along hindwing costa, *S. macrolepidella*, which usually is much paler, including a pale abdomen and *S. samiatella*, which has uniform forewings and brown hindwings. Females may in addition resemble those of *S. atricapitella* and *S. zangherii*.

Male genitalia (measurements see table 3) characterized by the extremely long and straight aedeagus with some large cornuti at phallotrema, and absence of manica. Female genitalia by the characteristic arrangement of spines in the accessory sac.

Biology

Hostplants. – *Castanea sativa**, *Quercus castaneifolia* (Laštůvka & Huemer 2002), *Q. cerris***, *Q. frainetto* (Buhr 1940), *Q. ithaburensis* subsp. *macrolepis* (Klimesch 1978), *Q. petraea***, *Q. pubescens***, *Q. pyrenaica** (Mendes 1913), *Q. robur***, *Q. rubra**. The record on *Q. castaneifolia* is based on light-collected specimens in forests with only this oak present.

Leafmine. – Very characteristic gallery, completely filled with neatly contorted green frass, becoming brown after the larva has left the mine. Egg invariably on upperside of leaf, usually close to or on a vein. Larva bright green, described in detail by Gustafsson & Van Nieukerken (1990). This is the only widespread species that can always be recognised by mines and larvae, thus also vacated mines give reliable records.

Life-history. – Bivoltine, or possibly with more generations in Mediterranean. Larvae found from June to November, adults May-early September.

Distribution (fig. 168)

The most widespread species in the group, almost following the distribution of *Quercus*: throughout Europe, North Africa and Southwest Asia up to northern Iran (Laštůvka & Huemer 2002, and one specimen cited below). No positive records yet from Albania, Belarus, Bosnia, Ireland or Latvia. New records from Azerbaijan, Georgia and Tunisia. Highest altitude: 1900 m (Sierra Nevada).

Remarks

In their analyses of allozymes, Cronau & Menken (1990) found the presence of two isolated forms in three Dutch populations of *basiguttella*, which they considered to be two different, cryptic species. Up to now, we have not seen any other evidence of two distinct species, despite the great variability in colour pattern. Further research on these populations is needed, preferably using DNA markers in addition to detailed morphological research.

Material examined. – 74♂, 33♀, 4 adults, various leafmines. – AUSTRIA: 1♀. – AZERBAIJAN: 2♂, 20 km E Lerik, 4.vii.1964, A. Zagulaev; 6♂, 5♀, Lenkoran, env., 7.viii. 1987, Ivinskis (ZIN). – BELGIUM: 1♂, 7♀. – CROATIA: 1♂, Krk, Kampelje, 17.viii.2001, G. Baldizzone; 2♀, Krk, Str. Krk-Vrbnik, 23.vii.1988+30.vii.1990, G. Baldizzone (GB); 1♂, Krk, Misucaynica, 17.vi.1976, E. Jäckh; 2♂, Krk, Vrbnik, 19+27.vi.1976, E. Jäckh (USNM); 3♂, Velebit, 17 km E Karlobag, 26.vi.1983, B.Å. Bengtsson (BÅB). – FRANCE: 2♂, 2 adults. – GEORGIA: 4♂, Lagodekhi, 13-14.vii.1986, S. Seksyaeva & S. Sinev; 4♂, ibid., 30.viii.1986, M. Kozlov (ZIN). – GERMANY: 1♂, 1♀. – GREECE: 1♀, Ioánnina, 10 km NE Geroplatanos by Konitsa, 800m, 24.vii.1990, M. Fibiger; 1♂, Larissa, Olympos, 700-2100m, 21-26.v.1990, O. Karsholt (ZMUC); leafmines: Evritanía, 4 km W Palaiokastron, 21.ix.1980, *Quercus petraea*, Menken & van Nieukerken; Evvoia, Dhírfis Oros, 11+12.ix.1980, *Castanea sativa* + *Quercus pubescens*, Menken & van Nieukerken; Fthiotis, 1-2 km W Timfristós village, 20.ix.1980, *Castanea sativa*, Menken & van Nieukerken (RMNH, ZMAN). – HUNGARY: 1♀. – IRAN: 1♂, 79 km E Azad Shahr (as Shah-Passand), 26.v.1974, Exp. Mus. Vindob.(NMW). – ITALY: 5♂, 1♀. – NETHERLANDS: 17♂, 7♀, 2 adults. – PORTUGAL: 1♀, Beira Alta, Caldas de Manteigas, 850m, 4.ix.2001, M. F. V. Corley (MC); Leafmines, Tras-os-Montes, PN Montesinho, 8 km N Vinhais, 27-30.vii.2001, *Quercus pyrenaica*, E.J. van Nieukerken (RMNH). – POLAND: 1♀. – RUSSIA: 2♂, Borisovka, Les na Vorskle res., at light, 27.vi+ 19.viii.1985, Krivochatskij (ZIN); Leafmines, Kalmykia, 160 km W Elista, 20 km SW Yashalta, 25.ix.2000, *Quercus robur*, V. Zolotuhin (VZ). – SLOVAKIA: 2♂. – SPAIN: 1♂, Granada, Cherin, 26.v. 1999, J. Junnilainen (JJ); 1♂, Granáda, Sierra Nevada, Ruta de Veleta, 1900m, 21.viii.1984, M. Kavin & P. Skou; 1♂, Málaga, Camino de Ronda, Urb. Madronal, Loma de Colmenas, 3.ix.1988, E. Traugott-Olsen (ZMUC); 4♂, 1♀, Salamanca, San Miguel de Valero N, 3 km S of Linares de Riofrio, 850m, at light 2.viii.1986, van Nieukerken & Richter (RMNH); 1♂, Segovia, Riazza, 3.viii.1986, C. Gielis; 1♂, Teruel, Noguera, 1500m, 11.vii.1986, C. Gielis (CG). – SWEDEN: 3♂, 3♀. – TUNISIA: 6♂, 1♀, Ain Draham area, 5.v. 1988-18.v.1988, at light, O. Karsholt (ZMUC, RMNH). – TURKEY: Adana, Taurus, 4 km NE Feke, 1000m, 7.ix.1983, G. Derra (GD).

Additional records (A. & Z. Laštůvka, *in litt.*). – GREECE: 1♂, Ioannina, Kepessovo, 13.vi.1996; 1♂, Kastoria, Aposkepos, 11.vi.1996. – MACEDONIA: Trojáci; Istibani. – SPAIN: 3♂, Cáceres, Piornal, 1200m, 20.vi.2003; 3♂, Cuenca, Boniches, 1200m, 17.vi.2002; 2♂, 2♀, Teruel, Montalbán, 1000m, 16.vi.2002; 15.vi.2003; 3♂, Toledo, Robledo del Buey, 800m, 18.vi.2002.

7. ***Stigmella macrolepidella*** (Klimesch)
(figs. 12, 13, 61-63, 77, 99, 132, 152, 169)

Nepticula macrolepidella Klimesch, 1978: 257. Holotype ♂: GREECE: Rhodos, Rodini, Mine on *Quercus macrolepis*, 22.ix.1972, Zucht Nr. 1054, e.l. 15.x.1972, Klimesch (ZSMG) [paratypes examined].

Stigmella macrolepidella; Van Nieukerken 1986b: 13, Z. & A. Laštůvka1998: 318.

[*Nepticula ruficapitella*; Amsel & Hering 1931: 140 (empty mines on *Q. ithaburensis* ssp. *ithaburensis*, misidentification, most likely this species)].

Diagnosis

The palest and one of the smallest species, pale pattern usually predominant, also abdomen almost completely white. Male can only be confused with specimens of *S. trojana* or *basiguttella* with extensive pale pattern. The darker females can also be confused with *S. zangherii* or *dorsiguttella* (the latter are pale-headed!), but they have a darker abdomen and usually a darker wing pattern; the ovipositor of *macrolepidella* is also pointed. Male genitalia very characteristic with the long cornuti anteriorly, the bilobed uncus processes and shape of valva. Female genitalia with spines in posterior half of accessory sac, rather similar to *S. szoecsiella*, but ovipositor pointed.

Description

Male (fig. 12). – Forewing length 1.8-2.1 mm, wingspan 3.9-4.7 mm. Head: frontal tuft bicolorous: on crown almost black, on frons yellowish white; collar white. Scape white. Antenna white, relatively long, almost ¾ forewing length, with 31-41 segments. Thorax and forewing ground colour yellowish white, partly covered with coarse dark brown scales, leaving extensive pale patches, in particular a basal spot, a large costal spot before middle and an elongated dorsal stripe beyond midlength, but occasionally almost completely dark, cilia pale yellow; underside grey-brown with darker margins, no androconial scales. Hindwing grey, no androconial scales. Abdomen almost completely yellowish white to grey, with whitish anal tufts inserted on well sclerotized plates, genitalia narrow.

Female (fig. 13). – Forewing length 1.8-2.1 mm; wingspan 3.8-4.6 mm. Antenna shorter, with 25-31 segments. As male, but forewing usually with more distinct pattern than male, abdomen pale, with remarkable protruding ovipositor, no anal tufts.

Male genitalia (figs. 61-63, 99). – Measurements: see table 3. Vinculum anteriorly slightly bilobed. Uncus with posterior processes well separated, each bilobed. Gnathos with separated slender posterior processes. Valva without distal process, inner margin with a slight bulge in middle, valval tip at inner side dentate, ending in ca 2 teeth; sublateral processes less than half transtilla length. Aedeagus cylindrical; vesica with ca 3-4 long and strong cornuti anteriorly, slightly curved at tip, of about half aedeagus length, a large number of smaller cornuti and in posterior half longer needle like ones; near phallotrema one big triangular tooth at right side; manica small, only covering distal ⅓ of aedeagus, covered with small spines.

Female genitalia (figs. 77, 132, 152). – Apophyses long and slender, forming a protruding ovipositor. Accessory sac almost globular, in posterior half with 3-4 more or less wrinkled sclerotizations set with numerous spines of varying size; ductus spermathecae with 4-5 convolutions after a long straight part.

Biology

Hostplants. – *Quercus ithaburensis* subsp. *macrolepis***, in Israel, possibly on *Q. ithaburensis* subsp. *ithaburensis* (see below).

Leafmine. – A contorted gallery, initially filled with frass, later leaving clear margins. Egg on leaf upperside.

Life-history. – Bivoltine or with more generations. Larvae found in September; adults found in May, June, August and reared in September-October.

Distribution (fig. 169)

Greece: North, Peloponnesos (Z. & A. Laštůvka 1998), Rodos, Turkey (new record), possibly Israel: Haifa (as Waldheim) (Amsel & Hering 1931), who recorded empty mines on *Q. ithaburensis* subsp. *ithaburensis* (as *Q. aegilops*).

Material examined. – 15♂, 25♀. – GREECE: 6♂, Evro, 35 km N Alexandropolis, Kirki, 20-21.viii.1985, A. Moberg (NRMS); 4♂, 6♀, Rhodos Kremasti, 3.ix.1973, *Quercus macrolepis*, e.l. 15.ix.1973-26.ix.1973, J. Klimesch (RMNH, RJ); 3♂, 13♀, Rhodos, 5 km S. Rhodos C., 26-30.viii.1991, R. Johansson (RMNH, RJ). – TURKEY: 2♀, Izmir, 30 km NW Bergama, 500-750m, 10-12.v.1993, O. Karsholt (ZMUC); 2♂, 4♀, Içel, 10 km S Gülnar, 750m, 30.vi.1993, O. Karsholt (ZMUC, RMNH).

Additional records (A. & Z. Laštůvka, in litt.). – GREECE: 9♂, 4♀, Messinia, Pirgos, 13.vi.1998; 4♂, 5♀, Lakonia, Skoutari, 16.vi.1998.

8. ***Stigmella svenssoni*** (Johansson)
(figs. 14, 35, 100, 101, 133, 153, 170)

Nepticula svenssoni Johansson, 1971: 249. Holotype ♀: SWEDEN: Skåne, Hallaröd, 24.vi.1961, I. Svensson, genitalia slide IS 4762 (MZLU) [examined].
Nepticula svenssoni; Borkowski 1972: 774.
Stigmella svenssoni; Emmet 1976a: 243, Johansson & Nielsen 1990: 231, Puplesis 1994: 159, A. & Z. Laštůvka 1997: 106.

Diagnosis

Male with pale grey hindwing without any androconial scales, which separates it from similar *S. roborella*. It is also usually larger and more coarsely scaled than *S. roborella* and *szoecsiella*. A previously undescribed diagnostic character is found on the underside of the forewing of the male (fig. 35): in the basal ½ of the wing the scale cover is thin, the scales are arranged in some sort of fish-bone pattern, and in the middle of this runs an oblique row of small scales. In the similar species (such as *S. roborella:* fig. 36 the scaling is thick, and all scales have their tips in the direction of the wingtip.

Male genitalia (measurements: see table 3) characterised by relatively short aedeagus, with long curved cornuti anteriorly. Female genitalia with sclerotized plate in accessory sac and some very small spines pos-

teriorly; ductus spermathecae long, with about 10 convolutions.

Biology

Hostplant. – *Quercus robur***.

Leafmine. – A long, relatively wide gallery with variable width of frass in second half, often dispersed, sometimes linear. Egg on leaf underside. Probably not or hardly possible to separate from *S. samiatella* and some *ruficapitella*, but in recent years British authors claim that mines can reliably be separated. However, no clear description of the diagnostic characters has been given. Larva yellow, described in detail by Gustafsson & Van Nieukerken (1990) who noted a diagnostic character: 2 setal pairs on abdominal segment 9, in contrast to the other species with yellow larvae of which the larva is known, which have 3 pairs.

Life-history. – In northern Europe and Britain believed to be univoltine with occasional partial second generation (Emmet 1976b, 1988, Johansson & Nielsen 1990), more to the south probably bivoltine. Larvae collected in July-October, occasionally November, adults from May to August, one exceptional finding of a female in an unusually warm January in Germany (see material).

Distribution (fig. 170)

Widespread in northern half of Europe, but localised: Norway, Sweden (type locality), Finland, Denmark (Buhl et al. 1981), Latvia (Puplesis 1994), Netherlands (Van Nieukerken 1982), Germany (Segerer 1997, Steuer 1998), Slovakia (Tokár et al. 2002), Hungary, France (new record); two isolated records in southern Europe: northern Italy and northern Greece (new record). From Ireland only leafmines recorded (Emmet 1981), up to now no adults found (K. Bond in litt.). Apparently commoner in the northern and western parts of its distribution area.

Remarks

The previous record from France (Leraut 1997, Van Nieukerken 1996) was a mistake, no material was known to us. The specimen recorded here was found under *S. ruficapitella* in the Le Marchand collection (MNHN) in January 2003.

The closest relative of *S. svenssoni* is most likely the eastern Palearctic *S. aladina* Puplesis (Van Nieukerken & Liu 2000): the female genitalia are almost inseparable, and the special scales on the forewing underside also show some resemblance.

Material examined. – 6♂, 9♀. – DENMARK: 1♂, Bornholm, Sorthat, 4.vii.1980, O. Karsholt (ZMUC). – FINLAND: 1♂, Turku: Puissalo, 27.vi.1970, J. Kyrki (ZMUC). – FRANCE: 1♂, Calvados, Le Vernay, *Quercus robur*, e.l. 9.v.1907, Le Marchand (MNHN).– GREAT BRITAIN: 3♀, Cumbria, Armside Knott, *Quercus,* e.l. 1-9.v.1980, A. M. Emmet (RMNH). – GREECE: 1♀, Evro: 35 km N Alexandropolis, Kirki, 20-21.viii.1985, A. Moberg (NRMS). – LATVIA: 1♂, 17.vi.1982, Savenkov (ZIAN). – NETHERLANDS: 1♀, Gelderland: Hulshorst, 27.iv.1944, L. Vári (ZMAN); 1♂, Noord-Holland: [Callantsoog], Zwanenwater, 28.vi.1984, at light; 1♀, ibid., 10.vi.1985, at light; 1♀, ibid., 1.viii.1989, *Quercus robur*, e.l. 05.iv.1990; 1♀, ibid., 14.vi.1986, all leg. J.C. Koster (JCK). – SWEDEN: 1♂, Sk, Sandhammaren, 8.vi.1974, I. Svensson (RMNH); 1♀ holotype.

Additional records. – GERMANY: 1♀, Bayern, Regensburg, Asenberg, 9.i.1991 on trunk of *Quercus robur*, H. Kolbeck (ZSMC, A. Segerer, in litt.).

9. ***Stigmella szoecsiella*** (Borkowski)
(figs. 15, 64, 65, 78, 102, 134, 154, 171)

Nepticula szoecsiella Borkowski, 1972: 776. Holotype ♂: HUNGARY: Budapest, *Quercus cerris*, e.l. 28.vii.1955, J. Szőcs, genitalia slide Bork. 936 (TMAB) [examined].
Stigmella szoecsiella; Van Nieukerken 1986b: 13, A. & Z. Laštúvka 1997: 108, Z. & A. Laštúvka 1998: 318.

Diagnosis

Male similar to *S. svenssoni* and *S. roborella*, but smaller, hindwings darker than in *svenssoni* and paler than in *roborella*; special scaling of forewing underside or hindwings absent. Female very similar to other pale headed species, small.

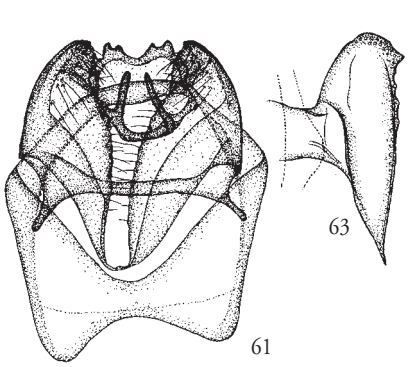
Male genitalia characterised by widened anterior part and curved vesica; separated from similar species *S. dorsiguttella*, *trojana*, *bicuspidata* by presence of a distinct manica and the relatively shorter aedeagus. Female genitalia similar to those of *S. macrolepidella*, but ovipositor less pointed.

Description

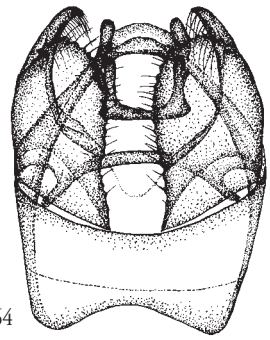
Male (fig. 15). – Forewing length 2.1-2.3 mm, wingspan 4.7-5.0 mm. Head: frontal tuft yellow to orange, ferrugineous; collar yellowish white. Scape yellowish white. Antenna grey brown, ⅔ of forewing length, with 33 segments. Thorax and forewing dark bronzy brown, with purplish sheen; terminal cilia concolorous, slightly paler at tip; underside dark brown, scales normal. Hindwing pale grey. Abdomen not studied, with anal tufts (colour unknown) inserted on well sclerotized plates.

Female. – Forewing length 2.2-2.3 mm; wingspan 4.8-5.2 mm. Antenna with ca 25 segments. As male, abdomen not studied.

Male genitalia (figs. 64, 65, 102). – Measurements: see table 3. Vinculum anteriorly slightly bilobed. Uncus with widely separated, rather short horns. Gnathos with long, widely separated posterior processes. Valva with pointed distal process less than valva length; inner margin almost straight, ending in rounded lobe; sublateral processes about ¼ transtilla length. Aedeagus short, basally widened, flask-shaped; vesica with


61

63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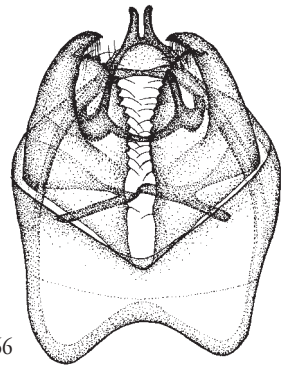
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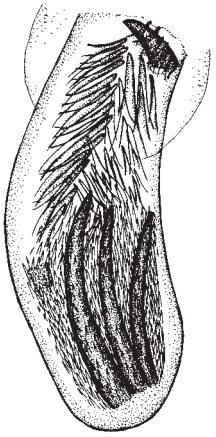
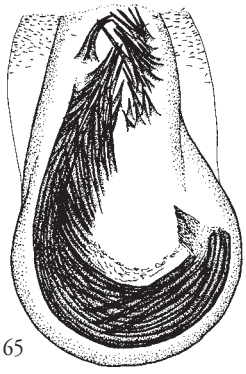

62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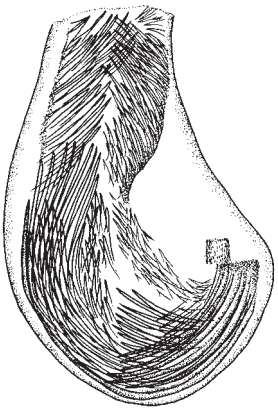

67

single coil anteriorly, with group of very long curved cornuti in basal half and many small ones; distally a small group of ca 15-20 needle like cornuti at right side and a few at left, near phallotrema; manica present, covering distal half of aedeagus, covered with small spines and pectinations.

Female genitalia (figs. 78, 134, 154). – Accessory sac with many longer spines posteriorly; none anteriorly; ductus spermathecae with 3-3.5 convolutions, ca twice as long as bursa.

Biology

Hostplants. – *Quercus cerris***, *Q. trojana* (A. & Z. Laštůvka 1997).

Leafmine. – A gallery with thin frass first and dispersed frass later, very similar to that of *S. zangherii.* Egg on leaf upperside. Larva yellow.

Life-history. – Larvae found in July and September, adults in June-August.

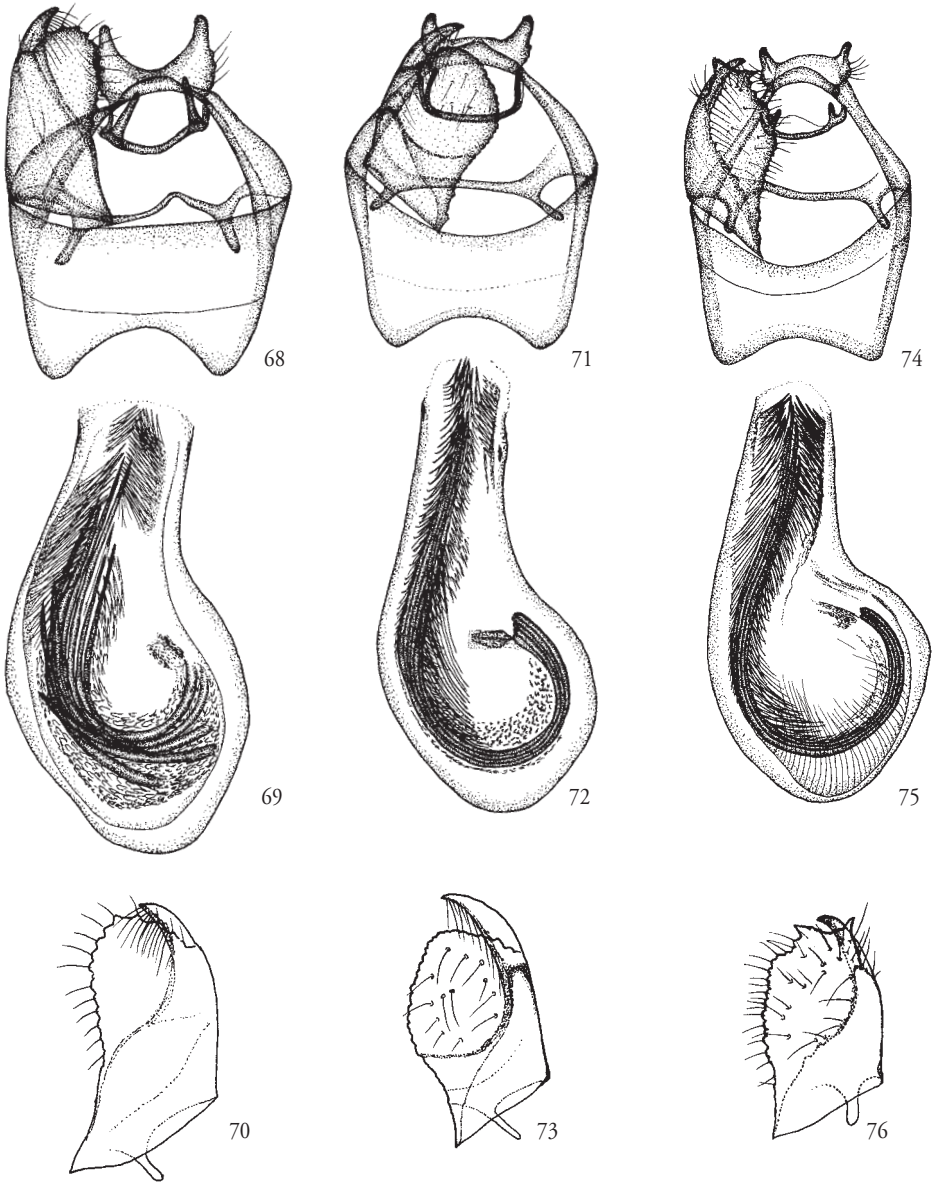
Distribution (fig. 171)

A rare species with very few records: Hungary, Italy (new record), Greece (Z. & A. Laštůvka 1998), Turkey (new record). The record from the Ukraine (Crimea) by Puplesis (1994) is based on misidentified *S. dorsiguttella,* q. v. Highest altitude 1700 m in Turkey.

Material examined. – 3♂, 2♀. – GREECE: 1 ♀, Ioannina, 4 km SW Geroplatanos, 800m, 12.vii.1998, D. Nilsson & B. Skule (ZMUC). – HUNGARY: 1♂, Holotype; 1 ♀ paratype, Szár, *Quercus cerris,* e.l. 5.iv.1965, J. Szőcs. – ITALY: 1♂, Chieti, Vasto, Fiume Sinello, 19.vii.1998, P. Triberti (PT). – TURKEY, 1♂, Nigde: 40 km NW Nigde, Sivrihisar pass, 1700m, 4.viii.1989, Fibiger & Esser (ZMUC).

10. ***Stigmella zangherii*** (Klimesch)
(figs. 16, 17, 66, 67, 79, 103, 104, 135, 155, 172)

Nepticula zangherii Klimesch, 1951a: 61. Syntypes 4♂: ITALY: Farrazano near Meldola (Forli), ca 60 m, 28.viii. 1949, at light, P. Zangheri (ZSMG) [not examined].



Figs. 61-76. *Stigmella* spp., male genitalia, capsule (61, 64, 66, 68, 71, 74), aedeagus (62, 65, 67, 69, 72, 75) and valva, lateral (63) or dorsal aspect (70, 73, 76). – 61-63, *S. macrolepidella*, Greece, Rhodos, slide RJ 1786+2268 (63); 64, 65, *S. szoecsiella*, Italy, slide EvN3345; 66, 67, *S. zangherii*, Turkey, slides RJ 1751, RJ2260 (aedeagus); 68-70, *S. dorsiguttella*, Greece, slide RJ 1750; 71-73, *S. trojana*, Greece, paratype, slide EvN3374; 74-76, *S. bicuspidata*, holotype, slide EvN 3278.

Nepticula zangherii; Szőcs 1968: 229 (description female and biology), Johansson 1971: 249, Borkowski 1972: 775.
Stigmella zangherii; Zangheri 1969: 1014, Van Nieukerken 1986b: 13, A. & Z. Laštůvka 1990: 187, 1997: 107.
[*Nepticula subnitidella* sensu Zeller 1848: 305. Misidentification.]
[*Trifurcula minimella* Rebel, 1926: (110) partim. Misidentification.]

Diagnosis

Males recognised by head black on crown and distinct yellow to cream androconial scales on hindwing and forewing underside. *S. dorsiguttella* has similar but darker androconials and a pale head. Females resemble *S. basiguttella, S. trojana* and to a lesser extent *S. macrolepidella*.

Male genitalia easily recognised by closely placed uncus lobes, otherwise rather similar to *S. dorsiguttella, trojana* and *bicuspidata*. Female genitalia characterized by the accessory sac, almost completely covered with small spines and one group of larger spines.

Description

Male (fig. 16). – Forewing length 2.0-2.4 mm, wingspan 4.2-5.5 mm. Head: frontal tuft brown to black, on frons white to ochreous; collar yellowish white. Scape white. Antenna brown, of ⅔ forewing length, with 31-38 segments. Thorax and forewing dark brown, usually with a pale patch at tornus, but sometimes pale pattern becoming predominant; underside with elongate patch of deep yellow to ochreous white androconial scales, only wingtip without. Hindwing covered on both sides with deep yellow to ochreous white androconial scales. Abdomen dorsally brown, ventrally almost yellowish white, with yellowish white anal tufts inserted on well sclerotized plates.

Female (fig. 17). – Forewing length 1.8-2.3 mm; wingspan 3.9-4.9 mm. Antenna with 25-28 segments. As male, but androconial scales and anal tufts absent. Ovipositor slightly pointed.

Male genitalia (figs. 66, 67, 103, 104). – Measurements: see table 3. Vinculum anteriorly bilobed. Uncus with posterior horns close together, almost parallel or forming a 'V'. Gnathos with separated posterior processes, usually converging towards tip. Valva with short, curved distal process, about 1/6 of valva length; inner margin evenly curved, not forming a distinct lobe; sublateral processes less than half transtilla length. Aedeagus anteriorly very broad; vesica with single coil anteriorly, some very long and strong curved cornuti following the coil, a large number of smaller cornuti alongside these long ones, following the curvature of the vesica; distally in groups arranged left and right; manica absent.

Female genitalia (figs. 79, 135, 155). – Accessory sac with many small spines with short point and fewer long spines posteriorly; ductus spermathecae with about 6 convolutions.

Biology

Hostplants. – *Quercus cerris***, *Q. ithaburensis* subsp. *macrolepis* (A. & Z. Laštůvka 1997), *Q. pubescens* (Borkowski 1972), *Q. suber, Q. trojana*, (A. & Z. Laštůvka 1997).

Leafmine. – A gallery with narrow frass first, later often dispersed. Egg on leaf upperside. Mine not to be distinguished from *S. szoecsiella* and various other species. Larva yellow.

Life-history. – Bivoltine, larvae recorded in June, late August and October, adults from May to September.

Distribution (fig. 172)

Widespread in south-eastern Europe and Turkey, in the north up to the Czech Republic and Slovakia (Laštůvka & Laštůvka 1990), in the west a single specimen from south eastern France (Borkowski 1972), further known from eastern Austria (A. & Z. Laštůvka 1997), Hungary, Italy, Sicily, Slovenia, Croatia, Yugoslavia, Greece (A. & Z. Laštůvka 1997) and Turkey (new record). From sea level up to 1800m in Turkey.

Material examined. – 22♂, 20♀. – AUSTRIA: 1♀, Niederösterreich, Hof am Leithagebirge, 4 km S Mannersdorf, 16.x.1992, *Quercus cerris*, e.l. 23.iii.1993, E. J. van Nieukerken (RMNH). – CROATIA: 1♂, Krk, Kampelje, 17. viii.2001, G. Baldizzone (GB); 1♂, Krk, Misucaynica, 30. vi.1976, E. Jäckh; 1♂, Krk, Vrbnik, 29.vi.1976, E. Jäckh (USNM). – CZECH REPUBLIC: 1♀, Moravia, Lednice, 2.5 km S, 'Liechtenstein' forest, 3.x.1992, leafmines, *Quercus cerris*, e.l. 23.iii.1993, E. J. van Nieukerken (RMNH). – GREECE: 1♂, Evro, 35 km N Alexandropolis, Kirki, 20-21.viii.1985, A. Moberg (NRMS).– HUNGARY: 1♂, 1♀, Törökbálint, 14.vi. 1974, *Quercus cerris*, e.l. 29.vi.1974, J. Szőcs (RJ). – ITALY: 1♀, L'Aquila, Parce Naz. d'Abruzzo, Valle F. Sangro, Casoni, versante Nord, 1100m, 13.vii.1998, P. Triberti (PT); 1♂, Latina, Monti Aurunci, 5 km N Itri, 850m, 4-11. viii.1972, R. Johansson; 1♂, Latina, Monti Aurunci, 6 km N Itri, 600m, 15.viii.1972, R. Johansson (RJ); 1♂, Potenza, Mte Vulture, dint. Laghi di Monticchio, 850m, 17.v.1967, F. Hartig; 1♂, ibidem, 750m, 16.v.1966, F. Hartig; 1♂, ibidem, 4.v.1968, F. Hartig (MRSN). – SLOVAKIA: 1♀, Volkovce, 4 km NW Kozárovce, 7.x.1992, leafmines, *Quercus cerris*, e.l. 23.iii.1993, E. J. van Nieukerken (RMNH). – TURKEY: 8♂, 13♀, Adana, Taurus, 4 km NE Feke, 1000m, 7.ix.1983, G. Derra (GD, RMNH); 2♂, 1♀, Isparta, Aksehir 30 km SW, Sultan Daglari, 1500m, 30-31.viii.1997, K. Nupponen & J. Junnilainen (JJ, RMNH); 2♂, Içel [Mersin], Güzeloluk NW Erdemli, 1400m, 16.vii.1986, M. Fibiger; 1♀, Nigde, 40 km NW Nigde, Sivrihisar pass, 1700m, 4.viii. 1989, Fibiger & Esser (ZMUC).

Additional records (A. & Z. Laštůvka, in litt.). – CROATIA: Istra, Rabac; Dalmacia, Zadar and Oračac. – GREECE: 2♂, Kastoria, Eptahori, 12.vi.1996; 4♂, 3♀, Preveza, Thesprotiko, 11.vi.1997; 6♂, 5♀, Etolia, Skourtou, 12.vi.1997; 4♂, 4♀, Lakonia, Nea Marathea, 19.vi.1996. – ITALY: Campania, San Salvatore Telesino; Firenze, San Benedetto in Alpe; Albáno di Lucania. – ITALY, SICILY: Castelbuono; Francavilla and Ficussa. – SLOVENIA: Maribor. – YUGOSLAVIA: Crna Gora, Petrovac.

11. ***Stigmella dorsiguttella*** (Johansson)
(figs. 18, 19, 68-70, 106, 108, 136, 137, 156, 173)

Nepticula dorsiguttella Johansson, 1971: 251. Holotype ♀, SWEDEN: Småland, Högsby, 22.vi.1970, R. Johansson, Genitalia slide RJ1035 (RJ) [examined].
Nepticula dorsiguttella; Borkowski 1972: 778.
Stigmella dorsiguttella; Pröse 1984: 107, Johansson & Nielsen 1990: 232, Puplesis 1994: 161, A. & Z. Laštůvka 1997: 109.
[*Stigmella szoecsiella*; Puplesis 1994: 160. Misidentification.]

Diagnosis

Males of *S. dorsiguttella* are usually immediately recognized by the combination of a pale head and the very conspicuous yellow to orange scaling of hindwing. In some specimens this scaling may, however, be more brownish (perhaps as a result of ageing), then it more closely resembles *S. eberhardi*, which has still darker brown bronze scales on hindwing. On the underside of the forewing *dorsiguttella* has a distinct patch of androconials reaching about ⅔, whereas *eberhardi* has a uniform cover of dark brown scales. The forewing of *dorsiguttella* usually has a pale stripe along dorsum (hence its name). Males of *S. zangherii* could be confused because of similar, but usually paler androconials, but the head in *zangherii* is usually black. Females resemble most other pale-headed species, but *dorsiguttella* is the only one with a pale dorsum.

Male genitalia (measurements see table 3) very similar to those of *S. trojana* and *bicuspidata*, the short valval process and wide aedeagus are characteristic. Female genitalia characterised by the almost globular bursa with longer spines mostly at one side, and a group distally in ductus; ductus spermathecae with about 5 convolutions.

Biology

Hostplants. – *Quercus petraea***, *Q. robur***.

Leafmine. – A relatively short gallery, usually with thin frass line, dispersed in last part. Egg position unknown. Larva yellow, described in detail by Gustafsson & Van Nieukerken (1990).

Life-history. – The few known larvae were found in July, August and September, adults collected from May to September, probably bivoltine in the south and univoltine in the north.

Distribution (fig. 173)

Widespread but very local in central, eastern and southern Europe and southwestern Asia: southeastern Sweden, Germany (Pröse 1984, here for the first time recorded from Rheinland-Pfalz), Poland (Buszko 1987), Czech Republic (A. & Z. Laštůvka 1990), Slovakia (A. & Z. Laštůvka 1991), Austria (Kasy 1983), France, Portugal (new record), Spain (new record), Italy (new record), Slovenia and Croatia (A. & Z. Laštůvka 1997), Ukraine (Puplesis 1994), Greece (new record) and Turkey (new record). In the north occurring in warm places only. Highest altitude: 2400 m in Turkey.

Remarks

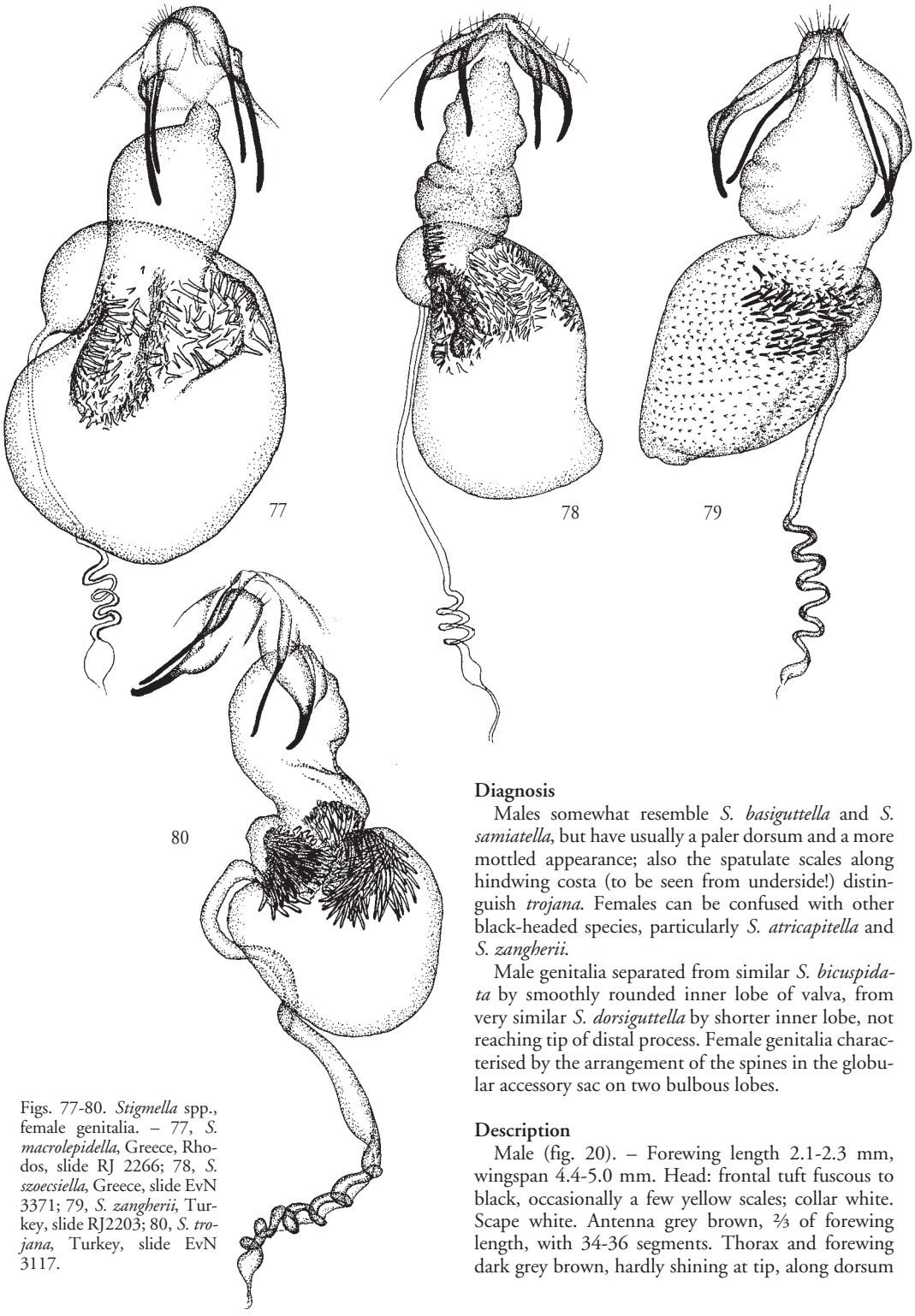
Puplesis (1994: 160) and Budashkin (1988) identified Crimean specimens with dark hindwings as *S. szoecsiella*. However, the male genitalia depicted by Puplesis are indistinguishable from *S. dorsiguttella*, and *S. szoecsiella* also has no androconials.

Material examined. – 29♂, 16♀. – AUSTRIA: 2♂, Niederösterreich: Glaslauterriegel, Gumpoldskirchen, 1.viii. 1975, 22.viii.1981, F. Kasy (NMW); 1♂, 1♀, Niederösterreich: Hundsheimer Berg S., 17.vi+8.vii.1980, F. Kasy (NMW). – CROATIA: 1♂, Sucurac, Dalmatia, ix.1923, Novak (NMW) [misidentified paralectotype of *Trifurcula minimella* Rebel]. – CZECH REPUBLIC: 1♀, Moravia, Detkovice, 28.viii. 1989, *Quercus petraea*, e.l. iii.1990, A. Laštůvka; 1♂, Moravia, Milovice, 10.ix.1980, *Quercus robur*, e.l. iii.1981, A. Laštůvka (RMNH). – FRANCE: 1♂, Drôme, Les Prés, 2 km N. Valdrôme, 800m, 21.viii.2002, at light, E. J. van Nieukerken (RMNH). – GERMANY: 1♂, Bayern, Münnerstadt, Dianonruh, Unterfranken, 26.vi.1986, H. Hacker (GD); 6♂, 1♀, Bayern, Stettfeld, Unterfranken, Kohlberg, 9.vi.1977, 2.vi.1978, G. Derra (GD, RMNH); 1♂, Rheinland-Pfalz, Bad Münster/Stein, NSG Rotenfells, 4.v.2003, W. Biesenbaum (WB); 1♀, Thüringen, Bad Blankenburg, Buntsandstein, 16.viii. 1968, H. Steuer; 1♀, Thüringen, Bad Blankenburg, Muschelkalk, 19.vii.1989, H. Steuer (HS).– GREECE: 1♂, 3♀, Evro: 35 km N Alexandropolis, Kirki, 500m, 20-21. viii.1985, M. Fibiger, A. Moberg (ZMUC, NRMS); 1♀, ibid., 8.vii.1986, M. Fibiger (RJ); 1♂, Thessaloniki: 12 km NW Gumenissa, 1100m, 26.vii.1986, M. Fibiger (RJ). – ITALY: 1♀, Torino: Pralormo, Mad. d. Spina, 321m, 24.vi.1991, G. Delmastro (GB). – PORTUGAL: 1♀, Alentejo: Galegos, Portalegre, 16.ix.1995, M. F. V. Corley (MC). – SLOVAKIA: 3♂, 1♀, Viniansky hrad, 31.vii.1993, 17.vii.2000, Z. Tokár; 1♀, NR Kasvár, 10.vii.1993, Z. Tokár (RMNH). – SPAIN: 1♂, Teruel, near Puerto de Orihuela, 1600m, 28.viii.1984, P. Skou & M. Kavin (ZMUC). – SWEDEN: 3♂ paratypes, 1♀ holotype, Småland, Högsby, 22.vi.1970, R. Johansson; 1♂, same data but 21.vi.1975; 1♂, Småland, Skoghult, 17.vi. 1972, R. Johansson; 1 ♂, Öland, Högsrum, 15.vi.1974, R. Johansson (RJ). – TURKEY: 1♂, 1♀, Agri, Tahir Gecidi, 2400 m, 18.ix.1985, G. Derra (GD). – UKRAINE: 7♂, Crimea, Karadag, 20 km W. of Feodosia, 13.viii.1985, 12-21.vii. 1987, Budashkin, R. Puplesis (ZIAN) [partly misidentified as *S. szoecsiella*].

Additional records (A. & Z. Laštůvka, in litt.). – GERMANY: Rheinland-Pfalz, Eisenberg. – GREECE: Kalavrita. – SPAIN: 1♂, Granada, El Molinillo, 1200m, 28.vi.1992.

12. ***Stigmella trojana*** Z. & A. Laštůvka
(figs. 20, 21, 71-73, 80, 109, 110, 138, 157, 174)

Stigmella trojana Z. & A. Laštůvka, 1998: 313. Holotype ♂: GREECE: Kozani, Galani, ex larva 1997, Raupe 9.vi.1997, *Quercus trojana* (AL) [paratypes examined].



Figs. 77-80. *Stigmella* spp., female genitalia. – 77, *S. macrolepidella*, Greece, Rhodos, slide RJ 2266; 78, *S. szoecsiella*, Greece, slide EvN 3371; 79, *S. zangherii*, Turkey, slide RJ2203; 80, *S. trojana*, Turkey, slide EvN 3117.

Diagnosis

Males somewhat resemble *S. basiguttella* and *S. samiatella*, but have usually a paler dorsum and a more mottled appearance; also the spatulate scales along hindwing costa (to be seen from underside!) distinguish *trojana*. Females can be confused with other black-headed species, particularly *S. atricapitella* and *S. zangherii*.

Male genitalia separated from similar *S. bicuspidata* by smoothly rounded inner lobe of valva, from very similar *S. dorsiguttella* by shorter inner lobe, not reaching tip of distal process. Female genitalia characterised by the arrangement of the spines in the globular accessory sac on two bulbous lobes.

Description

Male (fig. 20). – Forewing length 2.1-2.3 mm, wingspan 4.4-5.0 mm. Head: frontal tuft fuscous to black, occasionally a few yellow scales; collar white. Scape white. Antenna grey brown, ⅔ of forewing length, with 34-36 segments. Thorax and forewing dark grey brown, hardly shining at tip, along dorsum

usually paler, almost white; terminal cilia concolorous, slightly paler at tip; underside dark grey brown, with basal elongate yellowish grey, pale spot of indistinct androconial scales. Hindwing pale grey, along dorsum in basal third with long spatulate androconial scales, inserting in patch on underside forewing; usually only visible from underside. Abdomen dark grey, with pale yellowish anal tufts inserted on well sclerotized plates.

Female (fig. 21). – Forewing length 2.0-2.3 mm; wingspan 4.5-4.9 mm. Antenna with 21-26 segments. As male, but patch underside forewing and androconial scales absent; forewing sometimes completely unicolorous; abdomen dark grey, without anal tufts.

Male genitalia (figs. 71-73, 109, 110). – Measurements: see table 3. Vinculum anteriorly slightly bilobed. Uncus with widely separated conical and curved horns. Gnathos with long slender, widely separated posterior processes. Valva with pointed distal process, slightly less than valva length; inner margin forming a distinct inner lobe, which does not reach to tip of distal process; sublateral processes short, less than ¼ transtilla length. Aedeagus long and anteriorly widened; vesica with single coil anteriorly, several very long and strongly curved cornuti following the coil, with several associated small cornuti, more posteriorly with rows of shorter spines at both sides, distally also a row at right hand side of aedeagus; manica absent.

Female genitalia (figs. 80, 138, 157). – Accessory sac with many longer spines posteriorly, all directed anteriorly, inserted on two cushion-shaped bulbous lobes; ductus spermathecae with 5 convolutions, at least 2× as long as bursa.

Biology

Hostplant. – *Quercus trojana***; since the record in Turkey is outside the range of *Q. trojana* (see fig. 174), it probably also feeds on another oak.

Leafmine. – A gallery, according to the original description not different from *S. zangherii* or *S. szoecsiella*, which feed on the same host, egg position not noted. Larva yellow.

Life-history. – Probably bivoltine, larvae found in June, adults emerging almost immediately in June; also found in July and October.

Distribution (fig. 174)

Northern Greece and Turkey (new record). From sea level up to 2400 m in Turkey.

Material examined.– 3♂, 8♀: GREECE: 5♀, Ioannina, 10 km NE Geroplatanos, by Konitsa, 24.vii.1990, M. Fibiger (ZMUC, RMNH); 1♂, Grevená, Miliá, 8.vi.1998, A. & Z. Laštúvka (AL); 1♂, 2♀ (paratypes), Kozani, Galáni, 10.vi.1997, *Quercus trojana*, e.l. vi.1997, A. & Z. Laštúvka (RMNH, AL); 1♂ (paratype), Préveza, Thesprotiko, 14.vi.1996, A. & Z. Laštúvka (AL). – TURKEY: 1♀: Agri, Tahir Gecidi, 2400 m, 10.x.1985, G. Derra, Gen. slide EvN 3117 (GD).

13. ***Stigmella bicuspidata*** sp. n.
(figs. 22, 74-76, 111, 112, 174)

Type material. – Holotype ♂: TURKEY: Prov. Nigde: 40 km NW Nigde, Sivrihisar pass, 1700m, 4.viii.1989, Fibiger & Esser, genitalia slide EvN 3278 (ZMUC). – Paratypes, 2♂: TURKEY 1♂, Gümüshane: Pirnakapan, 1800m, 19.vii.1989, Fibiger & Esser, genitalia slide EvN 2848 (ZMUC); 1♂, Adana: Taurus, 4 km NE Feke, 7.ix.1983, G. Derra, genitalia slide EvN 2781 (GD).

Diagnosis

Externally most similar to *S. trojana*, which usually has a paler hindwing and a distinct paler area on forewing underside. Males separated from other similar species, such as *basiguttella* and *samiatella* by the narrow spatulate scales along hindwing costa.

Female unknown.

Male genitalia resembling *S. dorsiguttella, S. szoecsiella* and *S. trojana*. It differs from *szoecsiella* by the absent manica, from *trojana* by the shape of valva and uncus and from *dorsiguttella* by narrower uncus lobes and shape of valvae.

Description

Male (fig. 22). – Forewing length 2.1-2.2 mm, wingspan 4.9-5.0 mm. Frontal tuft yellow to black on vertex and paler lower down, scape and collar white, antenna with 32 segments. Thorax and forewings bronze brown. Hindwing grey, along costa with narrow spatulate androconials, usually only visible from underside; underside forewing grey brown. Anal tufts not studied, inserted on well sclerotized plates.

Female. – Unknown.

Male genitalia (figs. 74-76, 111, 112). – Measurements: see table 3. Vinculum anteriorly hardly excavated. Uncus with widely separate, curved processes. Gnathos with relatively short, widely separated posterior processes. Valva with rather long pointed distal process, hidden behind posterior lobe of inner margin; inner margin convex, distally with pronounced bicuspidate lobe; sublateral processes about ¼ transtilla length. Aedeagus long and anteriorly widened; vesica with single coil anteriorly, with wrinkled surface, several very long and strongly curved cornuti following the coil, with several associated small cornuti, more posteriorly with rows of shorter spines at both sides; manica absent.

Biology

Host and immature stages unknown. Adults found from July to September.

Distribution (fig. 174)

Only known from Turkey, from three widely separate localities.

Etymology

An adjective, bicuspidatus: with two teeth, because of the valva with two teeth-shaped points. Here in female form because of gender of *Stigmella*.

14. ***Stigmella ruficapitella*** (Haworth)
(figs. 23, 24, 105, 106, 139, 158, 175)

Tinea ruficapitella Haworth, 1828: 586. Lectotype ♀: ENGLAND: [London], Stainton Coll., B.M. ♀ genitalia slide No. 14862. (designated by Johansson 1971: 256) [examined].
Nepticula ruficapitella; Petersen 1930: 45, fig. 5 (male genitalia), Johansson 1971: 255, Borkowski 1972: 784.
Stigmella ruficapitella; Emmet 1976a: 239, Johansson & Nielsen 1990: 233, Puplesis 1994: 155, A. & Z. Laštůvka 1997: 110.
[*Nepticula samiatella*; Herrich-Schäffer 1855: 348 (partim, male), Petersen 1930: 46, fig. 8 (male genitalia), Beirne 1945: 198, fig. 13 (male genitalia), misidentification.]
[*Stigmella atricapitella*; Beirne 1945: 198, fig. 13 (male genitalia), misidentification.]

Diagnosis

Males easily recognised by combination of black head and the distinct patch of relatively short androconial scales on hindwing: only in basal half and reaching ⅓ into the fringe, the other species with similar androconials (*S. atricapitella, suberivora, ilicifoliella, cocciferae*) have these scales much longer and extending over most of hindwing. Female resembling other red-headed species with uniform forewings: *S. suberivora, ilicifoliella, cocciferae, kasyi, szoecsiella, svenssoni, roborella, eberhardi*; it can be distinguished from the most common *roborella* by the blunt abdomen versus the pointed one in *S. roborella*; most other red-headed species have more antennal segments (23-27 in *S. ruficapitella*), except *S. szoecsiella* and *dorsiguttella*, there is some overlap with *S. svenssoni*.

Male genitalia (measurements see table 3): manica conspicuous, almost twice as wide as aedeagus. Female genitalia: accessory sac an elongated pear-shaped sac, with wrinkled walls, many short spines confined to patch in posterior part, in top inserted on a distinct sclerotization; ductus spermathecae with 5 convolutions.

Biology

Hostplants. – *Quercus cerris* (Szőcs 1977), *Q. petraea***, *Q. pubescens* (Borkowski 1972), *Q. robur***. Most abundant on *Q. robur* and *petraea*. Records on *Castanea* (Buhr 1940) require confirmation, such mines may well belong to *S. samiatella*.

Leafmine. – A gallery with frass first in narrow midline, later in a broad band. Egg usually on leaf upperside, but also found on underside. A Dutch sample of 158 specimens, shown to belong to one species by their allozymes, had 78% of eggs on leaf upperside (Cronau & Menken 1990: published under the name *samiatella*, but here believed to be *ruficapitella,* see below); all over leaf, but less so against veins. Larva yellow, described by Gustafsson & Van Nieukerken (1990).

Life-history. – Bivoltine, larvae June to November, most abundant in October; adults April-June and July-September, one of the earliest flying oak mining species, often just before the opening of leaves.

Distribution (fig. 175)

Throughout northern and central Europe, but almost absent in the Mediterranean region with the exception of Mount Olympus in Greece and Trieste. In the North and West one of the commonest species. Recently recorded from Russia (Shmytova 2002). New records from Bosnia and Greece. Highest altitude on Mount Olympus, but without exact altitude known.

Remarks

The species identified by Cronau & Menken (1990) as *samiatella* in their allozyme analysis, is most likely *S. ruficapitella* (see under *samiatella*). Descriptions under the name *ruficapitella* prior to 1971 very often refer to *S. roborella*. However, the male genitalia under that name, illustrated by Beirne (1945), belong to *S. hemargyrella*.

Material examined. – 98♂, 74♀. – AUSTRIA: 1♀. – BELGIUM: 7♂, 8♀. – BOSNIA: S. of Han Knezica, ca 11 km N of Prijedor, 17.x.1983, *Quercus robur*, e.l. 15.iv.1984, E. J. van Nieukerken & J.J. Boomsma (RMNH). – FRANCE: 5♂, 5♀. – GERMANY: 8♂, 19♀. – GREAT BRITAIN: 2♂, 1♀. – GREECE: Larissa, Olympos, 700-2100m, 21-26.v.1990, O. Karsholt (ZMUC, RMNH). – HUNGARY: 2♀. – LATVIA: 4♂, 2♀. – LITHUANIA: 4♂, 1♀. – NETHERLANDS: 56♂, 33♀. – SLOVAKIA: 3♂. – SWEDEN: many, not counted. – UKRAINE: 4♂, Kiev, 17-25.viii.1934, Lebedev (SIZK).

15. ***Stigmella atricapitella*** (Haworth)
(figs. 25, 26, 113, 114, 140, 159, 176)

Tinea atricapitella Haworth, 1828: 585. Syntype ♀: ENGLAND: [London], Stainton coll. (BMNH) [examined; abdomen absent, poorly preserved].
Nepticula discrepans Sorhagen, 1922: 44. Holotype leafmine: GERMANY: Hamburg, vii, *Quercus*, Sorhagen [destroyed] (synonymised by Van Nieukerken & Johansson 1987).
Nepticula atricapitella; Herrich-Schäffer 1855: 347; Johansson 1971: 253, Borkowski 1972: 782.
Stigmella atricapitella; Emmet 1976a: 239, Johansson & Nielsen 1990: 234, Puplesis 1994: 156, A. & Z. Laštůvka 1997: 111.
[*Stigmella samiatella*; Vári 1950: 180 [partim], 183, fig. 1 (female genitalia). Misidentification.]

Diagnosis

Male very characteristic by black head and long androconials on hindwing, reaching to ⅔ of fringe along

most of hindwing. Only rare dark-headed specimens of the evergreen oak miners (only known from *S. ilicifoliella*) could be confused, but they have usually longer antennae with more segments (30-35 in *S. atricapitella*, 39-50 in *ilicifoliella*).

Females very similar to *S. samiatella* and the rarer, uniformly coloured *S. basiguttella* or *trojana*.

Male genitalia (measurements see table 3): manica inconspicuous, narrow. Female genitalia: an elongated accessory sac with some more or less sclerotized folds is characteristic; spines of different length, the longer ones on a rounded lobe; ductus spermathecae with 5 convolutions.

Biology

Hostplants. – *Quercus cerris* (Szőcs 1977), *Q. petraea***, *Q. pubescens***, *Q. pyrenaica***, *Q. robur***. A specimen reared from *Castanea sativa* (Agassiz 1988) proved to be misidentified *S. samiatella* (J. Langmaid in litt. 2003). In the Czech Republic only found on *Q. pubescens* (A. & Z. Laštůvka in litt.).

Leafmine. – A contorted gallery, frequently near leaf margin and confined to small area; frass usually in a narrow line, often broader in second part. Egg on either side of leaf. Larva pale yellow or almost white, prothorax with dark coloured sclerites (always?), which may help in distinguishing the mine from the similar *S. roborella* (see photographs in Huisman et al. 2001). Larva described in detail by Gustafsson & Van Nieukerken (1990).

Life-history. – Bivoltine with larvae in June-July, September-November, and adults from May to early October.

Distribution (fig. 176)

Throughout Europe, with a more or less Atlantic-Mediterranean distribution type: becoming rarer or absent in the North, with only very scattered records in southwestern Scandinavia. The records in Lithuania are outliers in that respect: it is very scarce in that country (R. Puplesis in litt., Diškus 2003), but it may have been overlooked in Poland. In the northern part of its range usually in warm places, isolated oaks or forest margins; in the south one of the commonest species. No positive records from Albania, Belarus, Bosnia, Finland, Latvia, Moldova, Poland or Russia. New (or confirmed) records from Bulgaria, Georgia, Italy: Sicily, Macedonia, Portugal, Turkey and Yugoslavia. Records from Estonia (Jürivete et al. 2000) should be checked, if they are based on Petersen (1930), they are wrong. The latter author illustrated male *ruficapitella* under this name. Occurs also as the only oak feeding species commonly on Madeira, most likely an introduced insect (Aguiar & Karsholt in press). Highest altitude: 2400 m in Turkey.

Remarks

Because of the poor condition of the single remaining syntype, the identity of *S. atricapitella* was settled by Johansson (1971) in favour of current practice. This follows Herrich-Schäffer (1847-1855), who described *Nepticula atricapitella* as the British species with long androconial scales.

Material examined. – 116♂, 68♀, 2 adults. – AUSTRIA: 7♂, 8♀. – BELGIUM: 3♂, 2♀. – BULGARIA: 2♂, Burgas, 40 km SE, Ropotamo, 26-27.vi.2001, J. Junnilainen (JJ, RMNH). – CROATIA: 18♂, Krk, 1975-2001, E. Jäckh, G. Baldizzone (USNM, GB, RMNH). – FRANCE: 16♂, 9♀, 2 adults. – GERMANY: 2♂, 5♀. – GEORGIA: 5♂, Lagodekhi, 300m, 21-22.vii, 20-30.viii.1986, Kozlov, Seksyaeva, Sinev (ZIN). – GREAT BRITAIN: 1♂. – GREECE: 1♂, 8♀, Evro, 35 km N Alexandropolis, Kirki, 500m , 20-21.viii.1985, A. Moberg (NHRS); 8♂, 12♀, Larissa, Olympos, 700-2100m, at light, 21-26.v.1990, O. Karsholt (ZMUC, RMNH). – ITALY: 16♂, 7♀. – LITHUANIA: 2♂, 3♀. – NETHERLANDS: 3♂, 6♀. – PORTUGAL: 1♂, Beira Alta, Caldas de Manteigas, 850m, 7.ix.2001, M. F. V. Corley (MC). – PORTUGAL, MADEIRA: 1♂, Santana, 600m, 3.viii.1999, E.E.G. van Riel (CVDB). – SLOVAKIA: 2♂, 2♀. – SPAIN: 2♂, 2♀, Cadiz, San Roque, 26.vii.1986, C. Gielis (CG, RMNH); 1♂, Málaga, Camino de Ronda, Urb. Madronal, Loma de Colmenas, 3.ix.1988, E. Traugott-Olsen (ZMUC); 2♂, Salamanca, San Miguel de Valero N, 3 km S of Linares de Riofrio, 850m, 2.viii.1986, at light, van Nieukerken & Richter (RMNH). – TURKEY: 1♂, 3♀, Adana, Taurus, 4 km NE Feke, 1000m, 7.ix.1983, G. Derra; 2♂, 1♀, Agri, Tahir Gecidi, 2400m, 18.ix.1985, G. Derra (GD, RMNH); 6♂, Içel [Mersin], Güzeloluk NW Erdemli, 1400m, 16.vii.1986, M. Fibiger (RJ). – UKRAINE: 1♂, Crimea, Jalta env., Mys Martyan, 29.viii.1989, Kornilov; 14♂, Crimea, Karadag, 20 km W. of Feodosia, 13.vii.1985, 28.vii.1986, 3-21.vii.1987, Budashkin, R. Puplesis (ZIN).

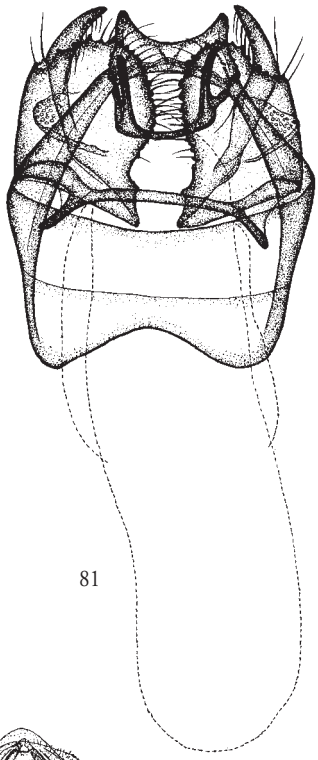
Additional records (A. & Z. Laštůvka in litt.). – CROATIA: Dalmacia, Oračac and Makarska. – GREECE: 3♂, 3♀, Seres, Kalokastro, 24.vi.1997; 2♂, 4♀, Akhaia, Kalavrita, 23.vi.1996. – ITALY, SICILY: Sortino, Solarino, Francavilla, Mandanici, Ficussa. – MACEDONIA: 2♂, 1♀, Negotino, 8.vi.1997. – SPAIN: 1♀, Málaga, Jimena de Líbar, 27.vi.2003. – YUGOSLAVIA: Crna Gora, Budva.

16. ***Stigmella karsholti*** sp. n.
(figs. 27, 28, 81-84, 115, 116, 141, 142, 160, 169)

Type material. – Holotype ♂: TUNISIA, Ain Draham area, 5-18.v.1988, Zool. Mus. Copenhagen Exp. [O. Karsholt leg.], genitalia slide EJvN 3148 (ZMUC). – Paratypes: 7♂, 8♀: TUNISIA: 7♂, 6♀, same data as holotype, genitalia slides ♂: EJvN3147, RJ1660, ♀: EJvN3157, 3160, 3164, RJ1661, 1772 (ZMUC, RMNH, RJ); 2♀, 7 km S Ain Draham, Les Chênes, 22.iii.1986, mines on *Quercus mirbeckii*, genitalia slide 3183 [O. Karsholt leg.] (ZMUC).

Diagnosis

A large species; male externally superficially resembling *S. samiatella* or occasionally some other species, but androconials very characteristic. Female resem-



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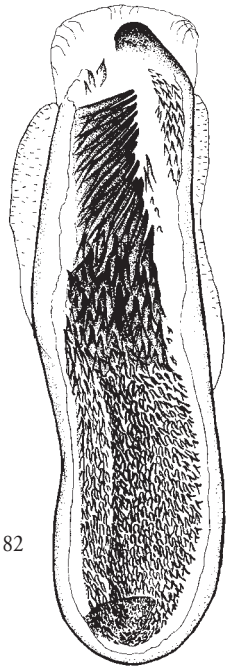

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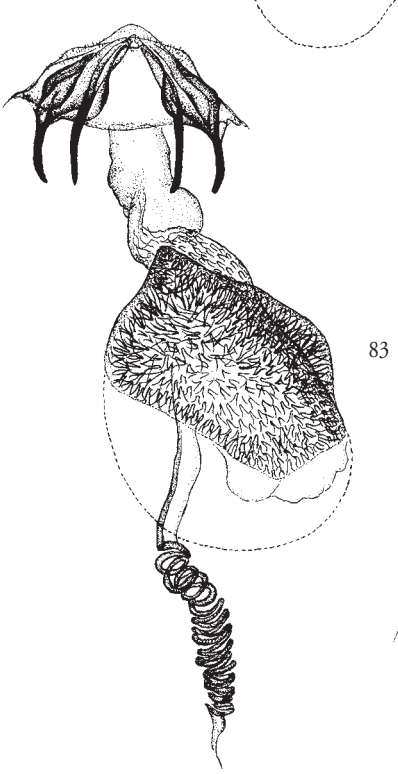

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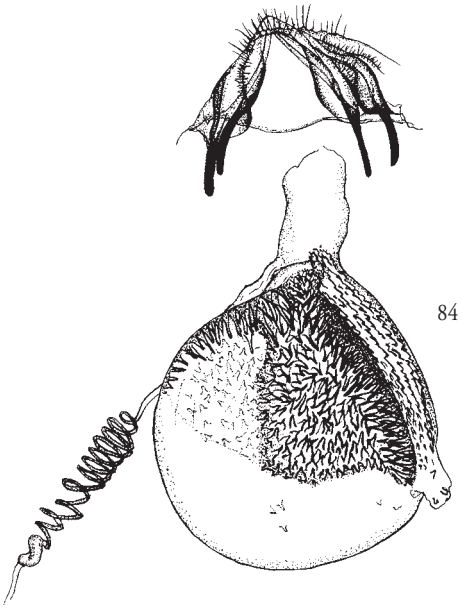

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Figs. 81-84. *Stigmella karsholti*, genitalia, Tunisia, paratypes. – 81, Capsule, slide RJ1660; 82, aedeagus, slide RJ1660; 83, female genitalia, partly collapsed accessory sac, slide RJ1661; 84, female genitalia, slide EvN3164.

bling other pale headed species, but more coarsely scaled, larger and with more antennal segments than other deciduous oak feeders. Male genitalia characterized by very long aedeagus, only comparable to that of *S. basiguttella*, but even longer, and terminal large spines absent. Female genitalia very characteristic.

Description

Male (fig. 27). – Forewing length 2.8-3.3 mm, wingspan 6.5-6.8 mm. Head: frontal tuft ochreous, on vertex darker grey-brown; collar almost white. Scape white. Antenna pale grey brown, ⅔ of forewing length, with 37-44 segments. Thorax dark bronze brown. Forewing dark bronze brown, more coarsely scaled and darker towards the tip, some of the scales with strong purplish or bluish iridescence; terminal cilia concolorous; underside bronze-brown, slightly darker along costa; from ⅓ to ⅔ of dorsum a brush of long dark fuscous hair-scales. Hindwing coarsely scaled, grey-brown, dorsum with dark grey-brown androconial scales, extending into fringe to at most half cilia length; in addition dark hair-scales of approximately same length as cilia; along costa two types of spatulate androconial scales: very short ones, shorter than hindwing width and longer ones, approximately as long as dorsal cilia; underside grey brown. Abdomen dark grey brown, with pale yellowish anal tufts inserted on well sclerotized plates.

Female (fig. 28). – Forewing length 2.5-2.9 mm, wingspan 5.7-6.6 mm. Antenna about half forewing length, with 30-33 segments. Head yellow, otherwise as male except for androconial scales.

Male genitalia (figs. 81, 82, 115, 116). – Measurements: see table 3. Vinculum anteriorly slightly bilobed. Uncus with two, almost triangular, widely separate processes. Gnathos with long, widely separated posterior processes. Valva with pointed distal process about ⅓ valva length; inner margin sinuous, distally with pronounced inner lobe; sublateral processes about ⅓ transtilla length. Aedeagus very long (longest in the group), aedeagal tube with strongly sclerotized distal lobe at right side, resembling large cornutus; vesica with many cornuti, in basal half only small cornuti, in distal half longer needle-shaped cornuti, forming a group at left side, distalmost at right side a group of smaller ones; manica covering distal ⅔ of aedeagus, covered with small spines and pectinations.

Female genitalia (figs. 83, 84, 141, 142, 160). – Bursa reduced, not visible in preparations. Accessory sac strongly sclerotized in distal half, globular (in slides often collapsing), distal ½ to ⅔ covered with spines; opening to ductus bursae in anterior part, ductus curving almost 180°; ductus also covered with spines. Ductus spermathecae coiled, with about 11-12 convolutions.

Biology

Hostplant. – *Quercus canariensis*** (= *Q. mirbeckii*).

Leafmine. – Unknown, the mines from which the females were reared, have not been preserved (O. Karsholt, pers. comm.).

Life-history. – The larva was taken in March, all adults in May.

Distribution (fig. 169)

Only known from northern Tunisia in the extensive oak forests near Ain Draham.

Etymology

A noun in genitive case, named after its collector Ole Karsholt of the Zoological Museum in Copenhagen. It is a pleasure to name this species after our friend Ole, who has supported both of us in many ways and with whom cooperation is always a pleasure.

17. ***Stigmella samiatella*** (Zeller)
(figs. 29-31, 85, 86, 117-119, 143, 161, 177)

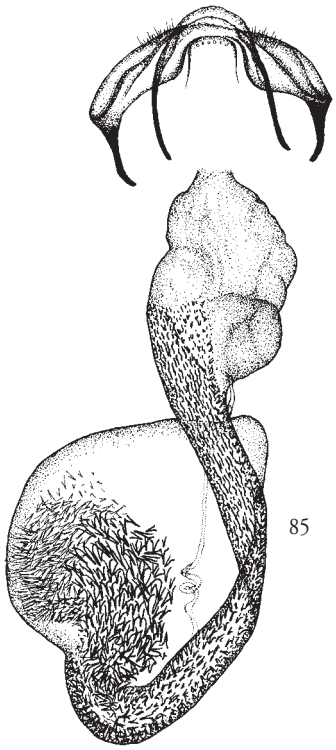
Lyonetia samiatella Zeller, 1839: 215. Lectotype ♀: POLAND: [Glogow = Glogau], Zeller Coll., Walsingham Collection 101203, B.M. ♀ genitalia Slide No. 14831 (BMNH) (designated by Johansson 1971: 256) [examined].
Nepticula samiatella; Johansson 1971: 256, Borkowski 1972: 789, Klimesch 1978: 245.
Stigmella samiatella; Klimesch 1951b: 56, fig. 46 (male genitalia), Emmet 1976a: 244, Johansson & Nielsen 1990: 235, Puplesis 1994: 157, A. & Z. Laštůvka 1997: 112.

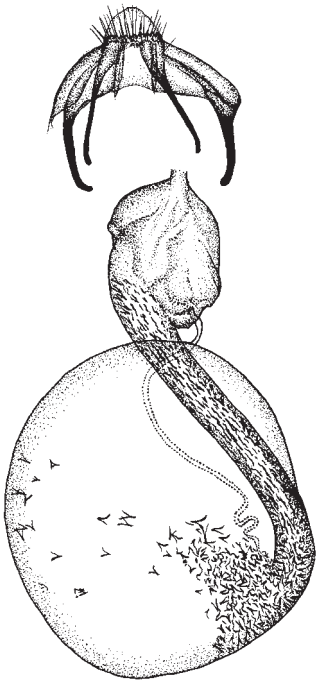
Diagnosis

Male recognised by combination of dark head, uniform brownish forewings and distinctly brown hindwing. *S. basiguttella* can be very similar when the pale pattern is obsolete, but usually a remnant of the basal spot can be observed and in the middle of the wing, *S. basiguttella* is almost always paler and has always a grey hindwing. *S. trojana* and *bicuspidata* superficially resemble *samiatella*, but have narrow spatulate scales along hindwing dorsum, see also *S. karsholti*. More problematic are the occasional pale headed *S. samiatella* (fig. 31), which occur more frequently in southern Europe. These are very similar to *S. roborella* and less so to *S. eberhardi*, which usually has darker hindwings.

Females are inseparable from *S. atricapitella* and can to some extent be confused with *S. basiguttella, trojana or zangherii* when the forewing is dark.

Male and female genitalia (measurements see table 3) highly characteristic: the male by the low density of cornuti, arranged in three groups, and the female by the long spiny ductus leading to the accessory sac. There is some variability in the female genitalia shown here in figs. 85-86: this is explained partly by the smaller size of some specimens, but the more globular accessory sac is probably also a result of mating, after





Figs. 85-86. *Stigmella samiatella*, female genitalia, showing variability. – 85, Sweden, slide RJ2271, 'normal type'; 86, Greece, Kos, slide RJ1729, smaller genitalia, globular bursa.

which the sac is expanded and the spines are spread out. Also the male genitalia show some variation in shape of valva and length of aedeagus.

Biology

Hostplants. – *Castanea sativa***, *Quercus ithaburensis* subsp. *macrolepis* (Klimesch 1978), *Q. petraea***, *Q. pubescens***, *Q. pyrenaica**, *Q. robur***. *S. samiatella* is the only *Stigmella* species that is frequently reared from *Castanea*, the only other *Stigmella* known with certainty is *S. basiguttella*.

Leafmine. – A gallery with frass first in narrow midline, later in a broad band. Egg reported on leaf underside (Borkowski 1972) or on leaf upperside (Johansson & Nielsen 1990), probably a variable character; eggs usually against a vein; in the few mines studied by us, from which adults were reared, the egg indeed was on leaf underside. Larva yellow, no detailed description because of lack of material (Gustafsson & Van Nieukerken 1990). Mine similar to those of *S. ruficapitella, svenssoni* and sometimes *atricapitella* or *zangherii*.

Life-history. – Bivoltine, larvae in June-early August and September-November, adults April-September, October in southern Europe. In Britain believed to be (partly) univoltine (Emmet 1976b), but in the Netherlands and Sweden clearly bivoltine. The species is remarkably frequently taken at light, in the Netherlands most records are from light collected adults, and very few only of reared adults. The reason may be that *samiatella* prefers leaves higher up in the canopy, or occurs more frequent in periods when there are few other miners, and thus less collecting activity.

Distribution (fig. 177)

Throughout Europe and Southwest Asia, common almost everywhere. No positive records from: Albania, Belarus, Bosnia, Bulgaria, Ireland, Macedonia, Moldova or Portugal. New (or confirmed) records from Georgia and Russia (also recorded by Shmytova 2002). Highest altitude: 2400 m in Turkey.

Remarks

Cronau & Menken (1990) named one of the species of which they analysed several allozymes on the advice of EvN as *S. samiatella*. This was based on the assumption that in the Netherlands this species is commoner than *S. ruficapitella*, which makes similar

mines. However, although this is true when we look at the total amount of specimens taken (see material), it is now our experience that *S. samiatella* is relatively seldom reared from larvae. We now think that this material most likely belonged to *S. ruficapitella*, the more so because B. Gustafsson (in litt.) found that Dutch larvae, tentatively identified as *S. samiatella,* appeared indistinguishable from Swedish *ruficapitella*.

Material examined. – 237♂, 103♀, 6 adults. – AUSTRIA: 1♂. – BELGIUM: 6♂, 7♀. – CROATIA: 4♂, 1♀, Krk, 1976+1988, E. Jäckh, G. Baldizzone (USNM, GB, RMNH). – FRANCE: 15♂, 13♀. – GERMANY: 13♂, 17♀. – GREAT BRITAIN: 1♂. – GEORGIA: 2♂, Abchazia, Gumista reserve, 9.vii.1978, A. Zagulajev; 3♂, Lagodekhi, 7+21.vi.1986, 21.vii.1986, A. Lvovskij, S. Seksaeva (ZIN). – GREECE: 1♀, Kos, Asfendiou, 12.x.1988, R. Johansson (RJ); 1♂, Chios, Limnia, 15m, 15.ix.1996, R. Sutter (RS); 1♂, Evvoia, Dhírfis Oros, S. slopes, 34S GH4876, 700m, 12.ix.1980, *Quercus pubescens*, e.l.28-30.iii.1981, S.B.J. Menken & E. J. van Nieukerken (ZMAN); 1♂, Serrai, Shymon Delta, 16.viii.1985, A. Moberg (NHRS). – ITALY: 8♂, 16♀. – LATVIA: 2♂. – LITHUANIA: 2♂. – NETHERLANDS: 152♂, 32♀. – RUSSIA: 1♂, Belgorod Obl., Borisovska, reserve Les na Worskle, 19.vii.1986, Gusarov (ZIN); 1♂, Uljanovsk, Povolzhye, Shikovka, 200 km S Uljanovsk, 20.vii.1993, V. Zolotuhin (VZ); 2♀, Volgograd obl., Krasnoarm. r-n, Chapurnikovsk b., 25.vii+21.viii.1999, D. A. Komarov (RMNH, VZ); 1♂, Volgograd obl., Sredneakhtub r-n, okr. pos. Tumak, 22.vi.1997, D.A. Komarov (vz). – SLOVAKIA: 2♂, 1♀. – SPAIN: 3♂, 2♀, Salamanca, San Miguel de Valero N, 3 km S of Linares de Riofrio, 850m, 2.viii.1986, *Quercus pyrenaica* forest and heathland; at light, van Nieukerken & Richter (RMNH); 1♀, Segovia, Riazza, 3.viii.1986, C. Gielis (CG); 5♂, Segovia, San Ildelfonso, 26.vi+7.vii.1902, Chrétien (MNHN); 1♂, 2♀ Teruel, Noguera, 1500m, 11.vii. 1986, C. Gielis (CG, RMNH). – SWEDEN: 5♂, 4♀. – TURKEY: 1♀, Agri, Tahir Gecidi, 2400m, 18.ix. 1985, G. Derra (GD); 2♀, Ankara, 20 km NW Kizilcahamam, 1200m, 24.vii.1986, M. Fibiger (RJ); 1♂, Gümüshane, Pirnakapan, 1800m, 19.vii.1989, Fibiger & Esser (ZMUC); 1♂, Hakkâri, Tanin Daglari, 3 km E Mutluca, 0.5 km W Baharan Köy, 1250m, 23.iv.1987, H.P. Schreier (GD, RMNH); 1♀, Konya, 5 km SE Üçpinar, road Bozkor-Hadim, Taurus, 1100m, 13.vii. 1986, M. Fibiger (RJ); 1♂, Nigde, 40 km NW Nigde, Sivrihisar pass, 1700m, 4.viii.1989, Fibiger & Esser (ZMUC). – UKRAINE: 1♂, Borshchiv (former Borszczow), 'Dzwinograd', 9.vi.1937, Toll (ISZP); 2♂, Kiev, 6-11.vi.1934, A. Lebedev (ZIN).

Additional records (A. & Z. Laštůvka, *in litt.*). – GREECE: 1♂, Pieria, Leptokaria, 22.vi.1997; 2♂, Ioannina, Kepesovo, 13.vi.1996. – ITALY, SICILY: Francavilla; Etna, Monte Arso. – SLOVENIA: Nanos mts., Jan Liška (AL). – SPAIN: 1♂, Cáceres, Piornal, 1200m, 20.vi.2003; 1♂, Cáceres, San Juan, 400m, 21.vi.2003; 1♂, Cuenca, Boniches; 1200m, 17.vi.2002; 3♂, Gerona, Anglés, 500m, 24.vi.1991.

18. ***Stigmella roborella*** (Johansson)
(figs. 32, 36, 120-123, 144, 162, 178)

Nepticula roborella Johansson, 1971: 258. Holotype ♀: SWEDEN: Skåne, Snogeholm, 28.ix.1968, *Quercus robur*, e.l. 21.iv.1969, R. Johansson, genitalia slide RJ830 (RJ) [examined].

Nepticula roborella; Borkowski 1972: 791.

Stigmella roborella; Emmet 1976a: 241, Johansson & Nielsen 1990: 236, Puplesis 1994: 158, A. & Z. Laštůvka 1997: 113.

[*Nepticula ruficapitella*; Petersen 1930: 46, fig. 6 (male genitalia). Misidentification.]

[*Stigmella ruficapitella*; Vári 1950: 183, figs. 2, 3, 5 (male, female genitalia, mine), Klimesch 1951b: 56, fig. 47 (male genitalia). Misidentifications.]

Diagnosis

Male *S. roborella* can be recognised by the combination of a pale head, uniform forewings, and hindwings with a not very distinct cover of pale brown androconial scales. *S. eberhardi* has usually much darker (bronze brown) androconials, and *S. svenssoni* and *szoecsiella* have grey hindwings without androconials. Moreover, *S. svenssoni* has special scaling on the forewing underside. The rare pale-headed form of *S. samiatella* is particularly confusing, since it resembles *S. roborella* closely. Females resemble all the other pale-headed species, but *S. roborella* is the only one with a more or less pointed abdominal tip (ovipositor); it has more antennal segments (28-31) than *S. ruficapitella, dorsiguttella* or *szoecsiella* (23-27) and fewer than *S. suberivora* or *ilicifoliella* (33-40). In southern localities, especially Sicily (where *S. eberhardi* has not yet been found), the androconial scales may be as dark as in *eberhardi*, making it impossible to separate the species on externals.

Male genitalia (measurements see table 3) are characterized by a pointed inner lobe of the valva, resulting in a valva with two pointed tips, and the slightly curved vesica with three groups of cornuti, although less distinct than in the similar *S. eberhardi*. The vinculum is very variable in the length of the ventral plate (see figs. 120, 122).

Female genitalia characterised by the single coil and the spines in posterior part.

Biology

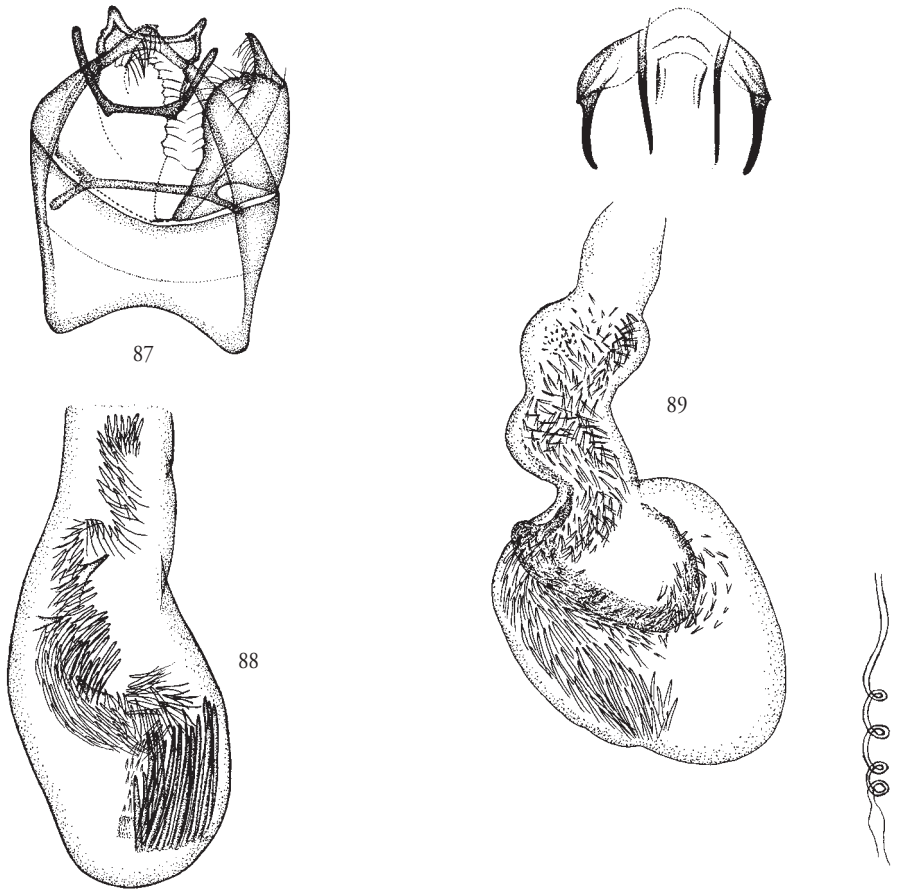
Hostplants. – *Quercus cerris* (Szőcs 1977), *Q. petraea***, *Q. pubescens***, *Q. robur***, *Q. rubra** [incidentally].

Leafmine. – A long gallery, often with straight parts, with frass usually in a narrow line throughout, occasionally slightly widened in second part. Egg on either side of the leaf, although Borkowski (1972) only mentioned upperside; usually against a vein. Larva yellow, pale headed (see photograph in Huisman et al. 2001). Mine similar to that of *S. eberhardi, atricapitella* and *dorsiguttella*.

Life-history. – Bivoltine, larvae in June-July and September-November, adults from April-September, usually somewhat later than *S. ruficapitella*.

Distribution (fig.178)

Throughout Europe, also in Southwest Asia, com-



Figs. 87-89. *Stigmella eberhardi*, genitalia, Italy, paratypes. – 87, 88, male genitalia, slide EJ5623; 89, female genitalia, slide RJ948, inset: ductus spermathecae from slide EJ5073.

mon almost everywhere, but fewer records in the Mediterranean countries. Since its description in 1971, positively recorded from most European countries (Borkowski 1972, Budashkin 1988, Gielis & Hull 1975, Johansson 1971, Johansson & Nielsen 1990, Karsholt & Nielsen 1976, A. & Z. Laštůvka 1990, 1991, 1997, Z. & A. Laštůvka 1998, Lo Duca et al. 2002, Puplesis 1994, Sulcs & Sulcs 1989, Szőcs 1977), except Albania, Belarus, Bosnia, Bulgaria, Ireland, Moldova, Portugal, Romania or Yugoslavia. New records for Georgia, Macedonia and Turkey. One of the few species on Mediterranean islands: Sardinia and Sicily. Highest altitude: 1500 m in Spain.

Material examined. – 168♂, 126♀, 7 adults. – AUSTRIA: 1♀. – BELGIUM: 6♂, 16♀. – CROATIA: 1♂,5♀, Krk, 1988-1990, G. Baldizzone (GB, RMNH). – FRANCE: 18♂, 11♀. – GEORGIA: 2♂, Abchazia, Sukhumi, 27.vi.1989, R. Puplesis (ZIN, RMNH). – GERMANY: 14♂, 11♀. – GREAT BRITAIN: 4♂, 3♀. – GREECE: 1♂, Korfu: Benitses, 25-26.iv.1977, V. Varis; 1♂, Larissa, Olympos, 700-2100m, 21-26.v.1990, O. Karsholt, (ZMUC); 1♀, Makedonia, Leptokaria, 15 km W Olympos, 750m, 21-23.v.2001, J. Junnilainen (JJ); 1♂, Zakynthos, S Vasilikos, 20m, 13.ix.1997, R. Sutter (RS). – ITALY: 7♂, 15♀. – ITALY, SARDINIA: 1♀, Nuoro Belvi, *Quercus pubescens,* e.l. 19.iv.1976 F. Hartig; 1♀, ibid., 17.vii.1975, F. Hartig (MRSN); 1♀, Nuoro, Funtana Raminosa, 900m, 4.viii.1984, J. H. Kuchlein (JHK); 1♀, Nuoro, Gennargentu, 5.ix.1974, F. Hartig (MRSN); 1♀, Nuoro, Mamoiada, 650m, 25.vii.1983, J. H. Kuchlein (JHK). – ITALY, SICILY: 1♂, Palermo, Cefalù, 500m, 9.vii.2000, P. Triberti (PT). – LATVIA: 3♀. – NETHERLANDS: 79♂, 54♀, 7 adults. – RUSSIA: 1♂, Kaliningrad Obl., Slavsk, 10.ix.1989, R. Puplesis (ZIN); 1♂, Uljanovsk, Vjazovka, 160 km S Uljanovsk, 15-16.vii.1999, A. & V. Isajevy (VZ). – SPAIN: 2♂, Teruel, Noguera, 1500m, 11.vii.1986, C. Gielis (CG, RMNH). – SWEDEN: 1♂ holotype plus an unspecified number. – TURKEY: 1♀, Ankara, Kizilcahamam, 31.vii-1.viii.1963, E. Arenberger (SMNK). – UKRAINE: 1♂, Kiev, 2.vi.1934, Lebedev; 3♂, Crimea Jalta env., Mys

Martyan, 29.viii.1989, Kornilov; 24♂, Crimea, Kara-Dag, 20 km W. of Feodosia, 25.vi.1977, 13.v.1985, 29.iv.1986-9.ix.1986, 5-21.vii.1987, Yu. Budashkin, R. Puplesis, Falkovitsh (ZIN, RMNH.).

Additional records (A. & Z. Laštůvka in litt.). – GREECE: 1♂, Messinia, Pirgos, 13.vi.1998. – ITALY, SICILY: Etna, Monte Arso; Ficussa; Francavilla; Mandanici; Solarino; Sortino. – MACEDONIA: Trojáci. – SPAIN: 1♂, Cádiz, Alcalá del Valle, 600m, 11.vii.1993; 1♀, Cuenca, Boniches, 1200m, 17.vi.2002; 1♀, Toledo, Robledo del Buey, 800m, 18.vi. 2002.

19. ***Stigmella eberhardi*** (Johansson)
(figs. 33, 34, 87-89, 126, 127, 145, 163, 179)

Nepticula eberhardi Johansson, 1971: 258. Holotype ♀, ITALY: Liguria, Val Merula di Moleto, 13.viii.1968, E. Jäckh, genitalia slide EJ 5073 (USNM) [examined].
Nepticula eberhardi; Borkowski 1972: 794.
Stigmella eberhardi; Van Nieukerken 1986b: 14, A. & Z. Laštůvka 1990: 187, A. & Z. Laštůvka 1997: 114.

Diagnosis

Males usually easy to recognise by the pale head and dark bronzy brown androconials; faded specimens may somewhat resemble *S. roborella* or pale headed *S. samiatella* (particularly in Spain). Sicilian *S. roborella* has androconials very similar to those of *eberhardi*. *S. dorsiguttella* has paler brown or orange-yellow androconials and also a clear androconial patch on basal ⅔ of forewing underside. Female very similar to *S. roborella*, but ovipositor not pointed.

Male genitalia resemble *S. roborella*, but valva with rounded inner lobe and aedeagus with broader anterior part and more clearly contorted vesica. Female genitalia with accessory sac very distinctly contorted, unmistakeable.

Description

Male (fig. 33). – Forewing length 2.3-3.1 mm, wingspan 5.0-6.8 mm. Frontal tuft yellowish white, ochreous or occasionally mixed white and brown, scape and collar white, antenna with 33-40 segments. Thorax and forewings dark bronze brown with faint bronze reflections; underside bluish black. Hindwing covered with almost bluish black androconial scales; underside bluish black. Abdomen brown, anal tufts yellowish, inserted on well sclerotized plates.

Female (fig. 34). – Forewing length 2.1-2.6 mm; wingspan 4.9-5.6 mm. Antenna with 25-31 segments. As male, but hindwings and underside of wings grey; abdomen without pointed tip.

Male genitalia (figs. 87, 88, 124, 125). – Measurements: see table 3. Vinculum anteriorly slightly bilobed. Uncus with triangular, widely separated horns. Gnathos with long and thin, widely separate processes. Valva with pointed distal process of about ⅓ valval length, inner lobe gradually rounded; sublateral processes about ⅓ transtilla length. Aedeagus long, basally widened; vesica coiled, forming almost a complete coil, with several groups of cornuti, anteriorly a group of long ones, more posteriorly the cornuti becoming shorter; manica not very conspicuous, only covering distalmost part of aedeagus.

Female genitalia (figs. 89, 145, 163). – Accessory sac distinctly coiled, forming up to four coils, covered with many spines, except in anteriormost part. Ductus spermathecae with about 5 convolutions.

Biology

Hostplants. – *Quercus ilex***, *Q. petraea***, *Q. pubescens***, *Q. pyrenaica***, *Q. robur***, *Q. suber***. Rare on the evergreen oaks (*Q. ilex* and *suber*), and only on teneral leaves of these.

Leafmine. – A gallery with thin frass throughout. Egg usually on leaf upperside. Larva yellow. Mine almost indistinguishable from that of *S. atricapitella* or *roborella*.

Life-history. – Bivoltine, or possibly continuously brooded in south, larvae found in February (Andalusia: on *Q. suber*) and late May to December (on deciduous oaks), adults taken in April-September.

Distribution (fig. 179)

A southern species, widespread in Mediterranean region and reaching southern Central Europe. Positively recorded from Czech Republic and Slovakia (A. & Z. Laštůvka 1990), Austria (Kasy 1979), Hungary, southeastern France, Spain (Vives Moreno 1991), Portugal, Italy, Sardinia, Slovenia (new record), Croatia (new record), Macedonia (new record), Greece (Van Nieukerken 1996), Turkey (new record). The record from northern France (Gibeaux 1999) is not accepted, as it may have been *S. samiatella*. Surprisingly as yet not recorded from Sicily, where it seems to be replaced by a form of *S. roborella* with hindwings as in *eberhardi*. Not yet found in North Africa. Highest altitude: 1500 m in Turkey.

Material examined. – 35♂, 38♀. – AUSTRIA: 2♀, Niederösterreich, Glaslauterriegel, Gümpoldskirchen, 10.viii.1983, F. Kasy (NMW, RMNH); 2♀, ibidem, 300-340m, 1.x.1983, *Quercus pubescens*, e.l. 17-18.iv.1984, E. J. van Nieukerken & J.J. Boomsma; 2♀, Niederösterreich, Hainburg: Hundsheimer Berg, 200-400m, 23.x.1983, *Quercus pubescens*, e.l. 14-18.iv.1984, E. J. van Nieukerken (RMNH); 1♂, 1♀, ibidem, 14.viii.1979, F. Kasy (NMW). – CROATIA: 1♂, Krk, Misucaynica, 9.vii.1976, E. Jäckh (USNM); 1♀, Krk, Picik, 19.vii.2001, G. Baldizzone (GB). – FRANCE: 4♂, 2♀, Alpes Maritimes, [Cannes], *Quercus pubescens* e.l. [A. Constant] [partly labelled: 'sp.n. Q. pubescens']; 1♂, ibid., *Quercus ilex* e.l. (MNHN); 2♂, Var, Nans-les-Pins, *Quercus pubescens*, e.l. 15-20.iv.1983, R. Buvat; 1♀, Vaucluse, Viens, 19.iv.1976, R. Buvat (MHNM). – GREECE: 1♂, 2♀, Evro, 35 km N Alexandropolis, Kirki, 500m, 20-21.viii.1985, A. Moberg, M. Fibiger (NRMS, ZMUC); 1♂, 1♀, Evro, Kavisos, 100m,

22-23.viii.1985, A. Moberg (NRMS). – HUNGARY: 1♂, Budaörs, 23.vi.1971, *Quercus petraea*, J. Szőcs (MCNT). – ITALY: 1♀, Latina, Monti Aurunci, 4 km NW Castelforte, 400m, 22-23.vi.1969, R. Johansson (RJ); 2♂, 1♀, Potenza, Mte Vulture, Laghi di Monticchio, 750m, 22.xi, 18.xii.1966, *Quercus robur*, e.l. 25.iii+12.iv.1967, F. Hartig (MRSN); 1♂, Savona, Andora, Conna, 250m, 14.vii.1969, E. Jäckh (RJ); 1♀, ibidem, 300m, 8.ix.1973, G. Baldizzone (GB). – ITALY, SARDINIA: 1♂, Nuoro, Mt. Istiddi, 700m, 30.vi.1976, G. Derra (GD); 1♂, Nuoro, Belvi, Mt. Istiddi, 700m, 30.viii.1974, F. Hartig; 1♀, ibidem, 900m, 9.vi.1977, F. Hartig; 1♂, 2♀, Nuoro, Belvi, *Quercus pubescens*, e.l. 19-20.iv.1976, F. Hartig; 2♀, Nuoro, Belvi, surroundings, 700m, 17.vii.1975, F. Hartig (MRSN); 1♂, Nuoro, Funtana Raminosa, 900m, 4.viii.1984, J. H. Kuchlein (JHK); 1♂, Nuoro, Gennargentu, Arcu Tascussi, 1000m, 28.vii.1981, G. Baldizzone (GB); 1♂, Nuoro, Mamoiada, 31.vii.1983, J. H. Kuchlein (JHK). – PORTUGAL: 1♀, Beira Alta, Videmonte, 750m, 5.ix.2001, M. F. V. Corley (MC); 1♂, 2♀, [Beira Baixa, Sao Fiel], [e.l.] 8.v., *Quercus pyrenaica* [as *Q. toza*], [Mendes], coll. Joannis (MNHN). – SLOVAKIA: 2♀, Slov. Kras.: Háj, 9 km W Moldava n. B., 200m, 9.x.1992, leafmines, *Quercus pubescens*, e.l. 23-24.iii.1993, E. J. van Nieukerken (RMNH). – SPAIN: 1♂, 1♀, Barcelona, La Pobla de Claramunt, Anoia, 26.viii.2000, E. Requena (RMNH); 1♂, 1♀, Cadiz, San Roque, 26.vii.1986, C. Gielis (CG); 1♂, Cadiz, Sierra de Ojén, 200m, 28.viii.1982, A. Vives Moreno (AV); 2♂, 1♀, Cuenca, Cuenca, 900m, 16.vii.1986, C. Gielis (CG, RMNH); 1♂, Cuenca, Sa de Altomira, Vellisca, 1000m, 11.viii.1983, A. Vives Moreno (AV); 1♂, Málaga, 6 km E of Marbella: Los Monteros, 8.ii.1984, *Quercus suber*, e.l. 2.iii.1984, E. J. van Nieukerken (RMNH); 1♂, 2♀, Málaga, Camino de Istan, 400m, 28.vi+21.vii.1972, 4.vii.1973, E. Traugott-Olsen (RMNH, ZMUC); 1♂, Málaga, Camino de Istan, 200m, 18.vi.1983, E. Traugott-Olsen (ZMUC); 2♂, 3♀, Málaga, Camino de Ronda, Urb. Madronal, Loma de Colmenas, 14.viii.1988, 3.ix.1988, E. Traugott-Olsen (ZMUC, RMNH). – TURKEY: 1♂, Isparta, Aksehir 30 km SW, Sultan Daglari, 1500m, 31.viii.1997, K. Nupponen & J. Junnilainen; 1♂, Isparta, Aksehir, 35 km SW: Cetince, 1200m, 9-13.v.2000, J. Junnilainen; 1♀, Konya, Konya, 30 km W, 21.v.1997, K. Nupponen & J. Junnilainen (JJ); 2♀, Konya, Eregli, Bolkar Daglari, 1200m, 24.vi.1968, M. & W. Glaser (SMNK).

Additional records (A. & Z. Laštůvka, in litt.). – CROATIA: Istra, Rabac; Dalmacia, Oračac. – GREECE: 2♂, Preveza, Thesprotiko, 11.vi.1997; 3♂, 1♀, Messinia, Kardamili, 20.vi. 1996; 1♂, Akhaia, Kalavrita, 20.vi.1997. – ITALY: Campania, San Salvatore Telesino. – MACEDONIA: Negotino. – SLOVENIA: Nanos mts. – SPAIN: 1♀, Cáceres, Piornal, 1200m, 20.vi. 2003; 1♀, Huelva, Bonares, 100m, 26.vi.2003.

Discussion

Phylogenetic remarks

A phylogenetic analysis was not part of this study. Such an analysis should also include species other than the oak feeders and preferably also the Eastern Palearctic species. Moreover, a framework of the phylogeny of the genus *Stigmella* is still lacking; we expect that on the basis of ongoing DNA studies this can hopefully be prepared in the coming years.

There is no clear support yet for the monophyly of the *ruficapitella* group, but certain parts of it most likely form monophyletic entities. A few characters apparently showing phylogenetic signal are given below:

1. Female tergum 8 with two parallel furrows and ridges. This character may well be a synapomorphy for most of this group: it is only absent from *S. fasciata*, some Eastern Palaearctic species and the non-*Quercus* feeders.

2. Development of accessory sac in female. In the group of *suberivora* and related species (here species 1 to 5) and several East-Palearctic species, the accessory sac is well developed and folded, but not spiny. In these species the bursa itself is still well developed. This condition resembles many other *Stigmella* species and is therefore regarded as the plesiomorphic condition.

In the other species treated here and *S. tristis*, plus several Eastern Palearctic species, the accessory sac is well developed and usually contains a large number of spines and some other sclerotizations, whereas the bursa proper is either lost or very much reduced (Van Nieukerken 1986a).

The bursa of the non-Quercus feeders *S. hemargyrella* and *S. speciosa* is rather atypical, that of *S. lonicerarum* belongs to the *suberivora* type.

3. Spatulate androconial scales on male hindwing. This character occurs scattered in the group. All the species related to *S. suberivora* (2-5), *S. ruficapitella* and *S. atricapitella* show it very convincingly, *S. trojana* and *S. bicuspidata* have few such scales. Also various Eastern Palearctic species show this character, whereas it is rare elsewhere in *Stigmella* (i.e. in *S. lemniscella* (Zeller)). It may therefore well be an apomorphy for the group, which is lost again several times.

4. Abdominal tufts on segment 8 in male inserted on well sclerotized plates. This occurs in most species, except *S. fasciata*.

5. Widening of aedeagus and coiling of vesica. This distinct character is shared by species 9-13 as a possible synapomorphy. It somewhat resembles the more elaborate coiling of the vesica in the species of the *castanopsiella* subgroup (Van Nieukerken & Liu 2000), although these species differ widely in other characters.

Biogeographic considerations

The distribution pattern of the oak feeders in the Western Palearctic is becoming better known, although we still have very little knowledge of northern Africa, the Levantine coast, the Caucasus and the mountain oak forests of Iran. Also in the central part of the Balkan Peninsula, the Ukraine and Russia data are scarce, but new data there will probably mostly serve to fill in the gaps in known distributions.

Seven species are very widespread, with *S. svenssoni*

and *ruficapitella* showing a more northern distribution, *S. atricapitella* a more southwestern and *S. dorsiguttella* a more southeastern one. Of the remaining species, two are widespread in southern and southern central Europe: *S. zangherii* and *S. eberhardi*, only three are confined to the southwest (*S. suberivora, ilicifoliella* and *karsholti*) and the remaining six to the southeast of Europe and Asia Minor. It is not surprising that Turkey has the richest fauna with thirteen known species, which probably will increase after more focussed collecting: Turkey also has the highest number of oak species recorded. Also Greece and Italy have rich faunas with twelve and eleven species respectively. The western European fauna is much poorer, with only eight species recorded from Spain.

Also remarkable is the poor fauna of the larger Mediterranean islands, with the exception of Sicily, which still has five species, probably because it is close to mainland Italy. From the other islands Sardinia has been sampled best: only *S. suberivora, eberhardi* and *roborella* are recorded here, and on Crete only *S. cocciferae*. No species are yet known from Cyprus, despite the presence of forests of *Quercus alnifolia* Poech, which harbour at least two *Ectoedemia* species (Van Nieukerken 1985).

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Figs. 90-98. *Stigmella* spp., male genitalia, photographs, slides by EvN, unless otherwise mentioned. – 90, *S. fasciata*, slide 3462; 91, *S. suberivora*; 92, 93, *S. ilicifoliella*, slides 3340 and 3443; 94, 95, *S. cocciferae*, slide 2986; 96, *S. kasyi*, holotype, slide RJ1528; 97, 98, *S. basiguttella*, slide 2555. Scale lines 100 µm.

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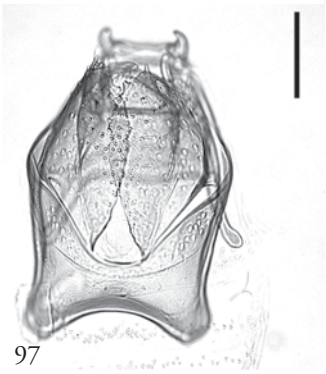

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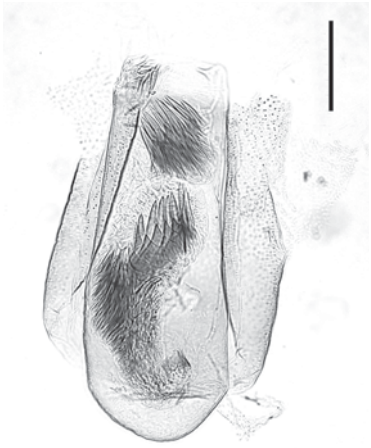

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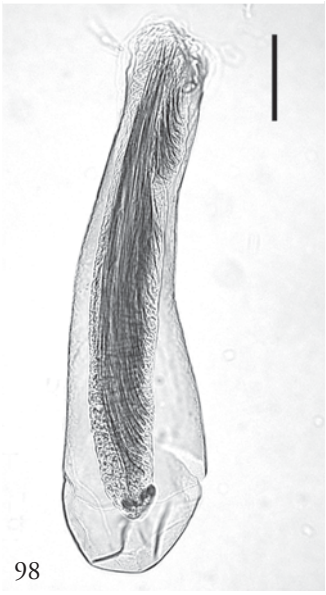

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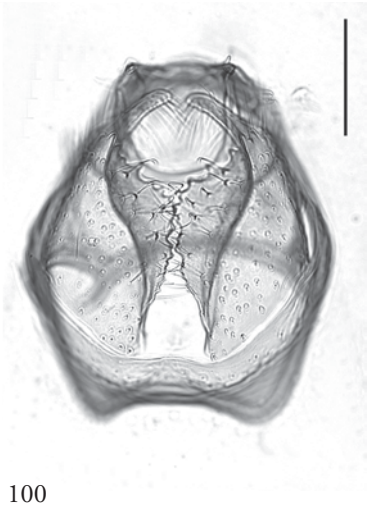
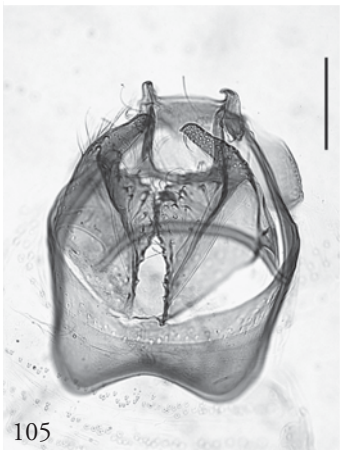
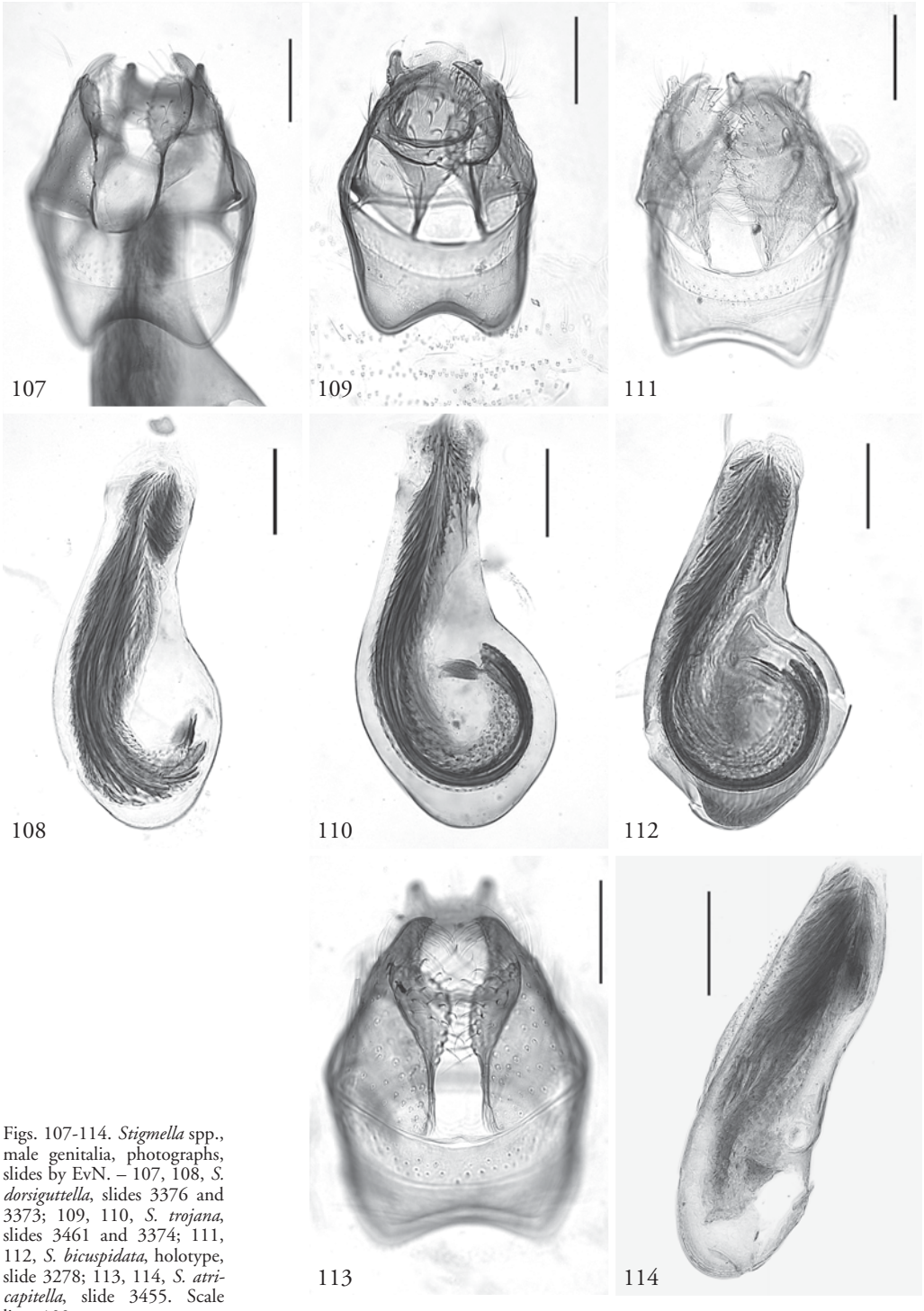
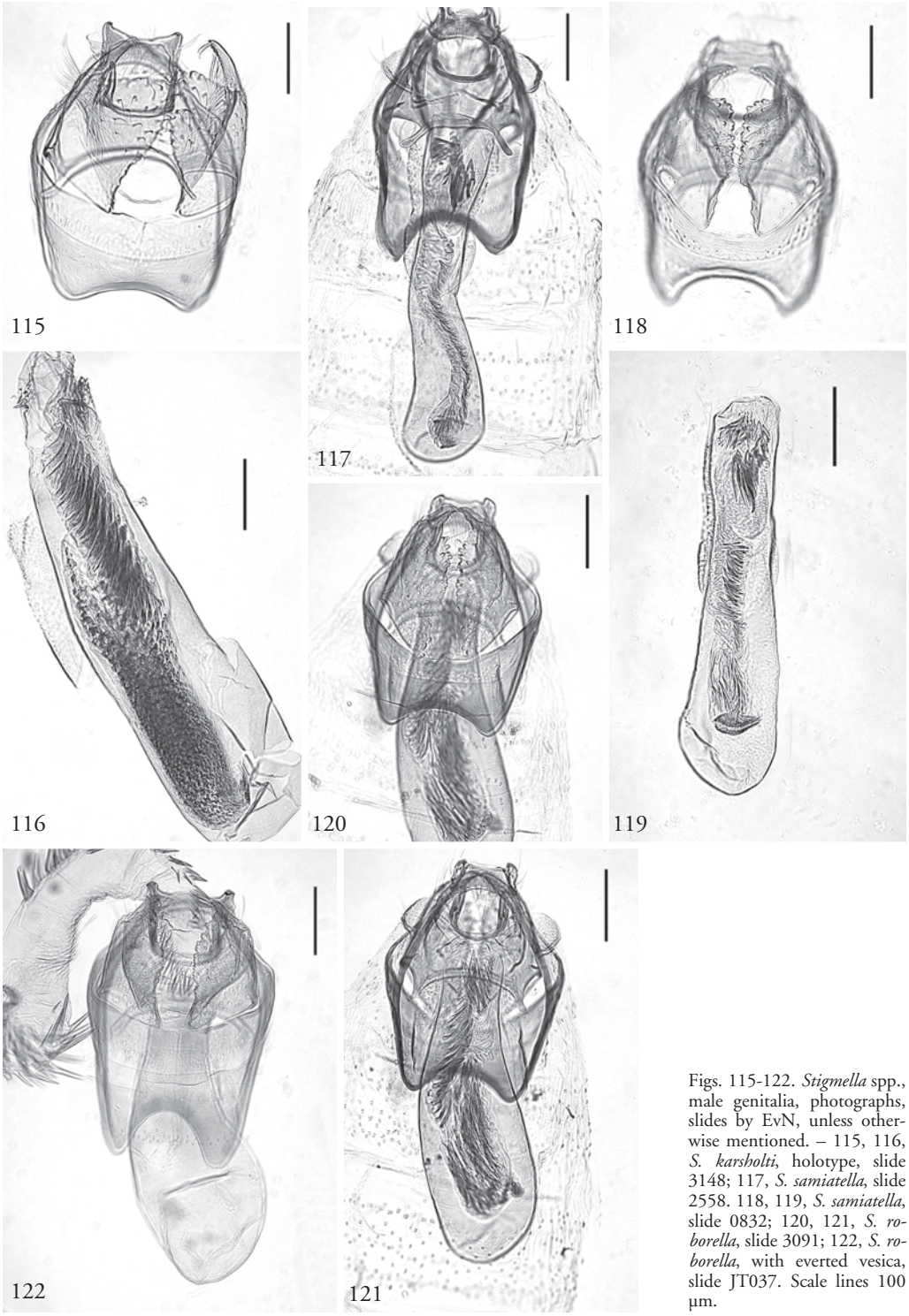




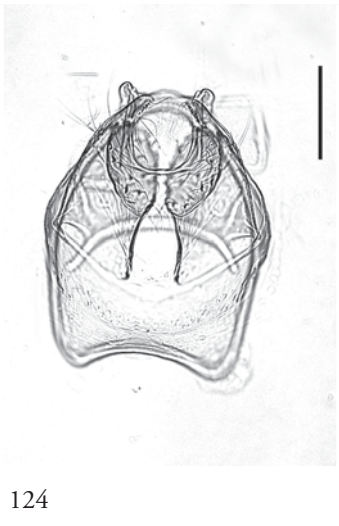
Figs. 99-106. *Stigmella* spp., male genitalia, photographs, slides by EvN. – 99, *S. macrolepidella*, slide 2908; 100, 101, *S. svenssoni*, slide 3464; 102, *S. szoecsiella*, slide 3345; 103, 104, *S. zangherii*, slide 3451; 105, 106, *S. ruficapitella*, slide 3458. Scale lines 100 µm.

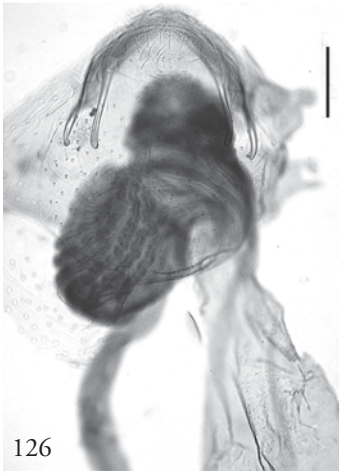


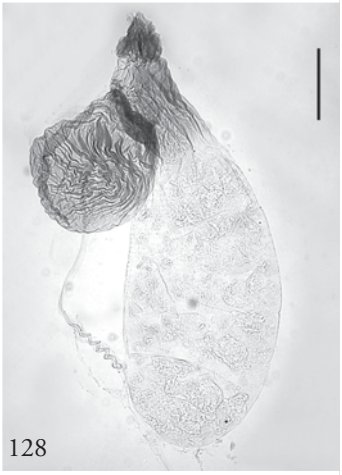
Figs. 107-114. *Stigmella* spp., male genitalia, photographs, slides by EvN. – 107, 108, *S. dorsiguttella*, slides 3376 and 3373; 109, 110, *S. trojana*, slides 3461 and 3374; 111, 112, *S. bicuspidata*, holotype, slide 3278; 113, 114, *S. atricapitella*, slide 3455. Scale lines 100 µm.

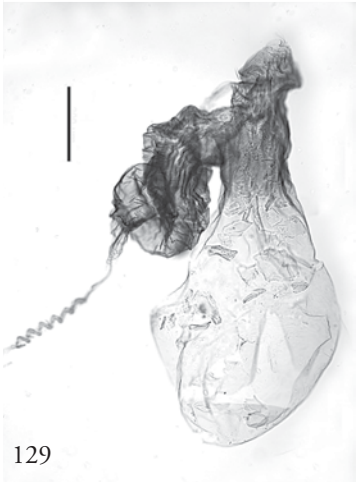


Figs. 115-122. *Stigmella* spp., male genitalia, photographs, slides by EvN, unless otherwise mentioned. – 115, 116, *S. karsholti*, holotype, slide 3148; 117, *S. samiatella*, slide 2558. 118, 119, *S. samiatella*, slide 0832; 120, 121, *S. roborella*, slide 3091; 122, *S. roborella*, with everted vesica, slide JT037. Scale lines 100 µm.

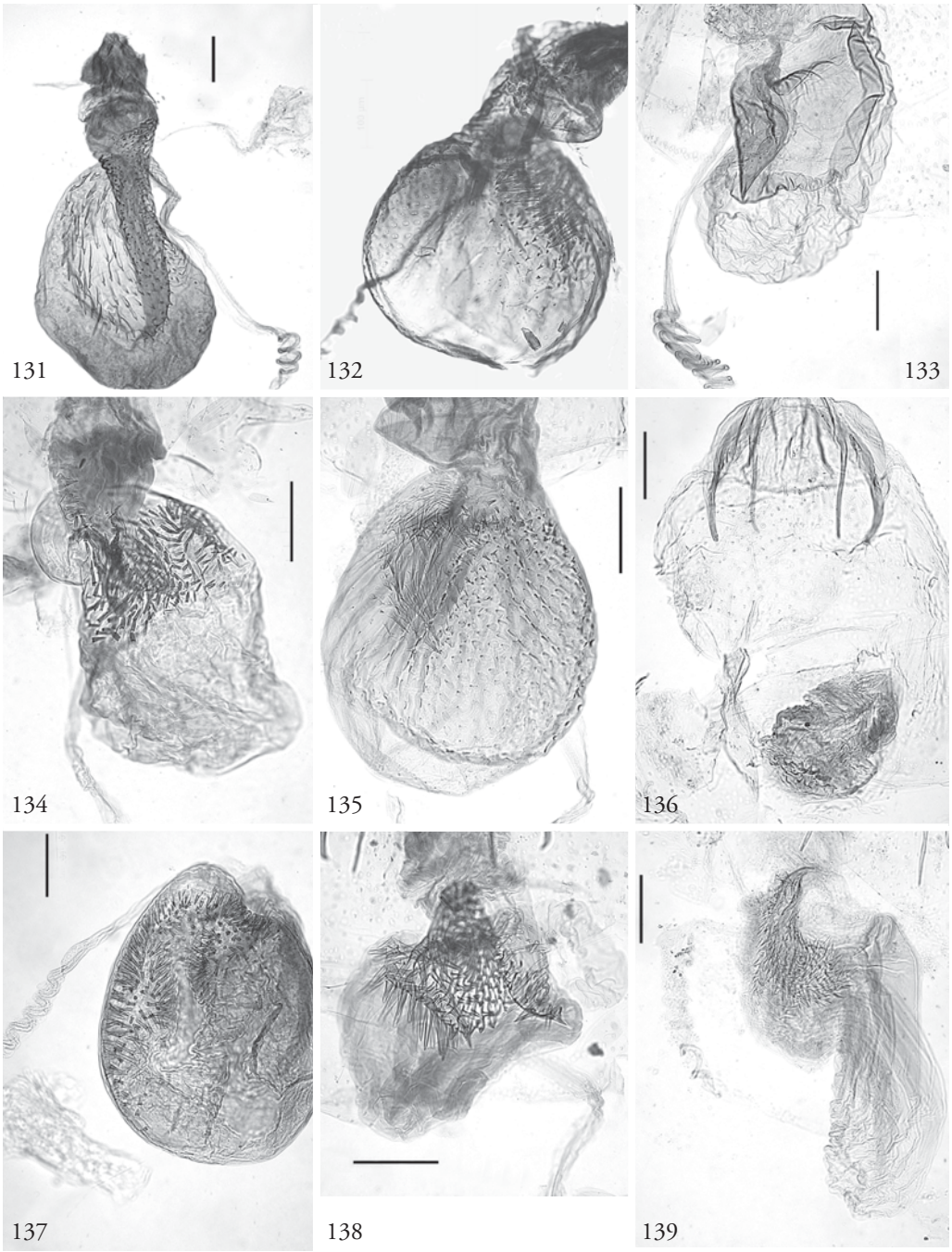




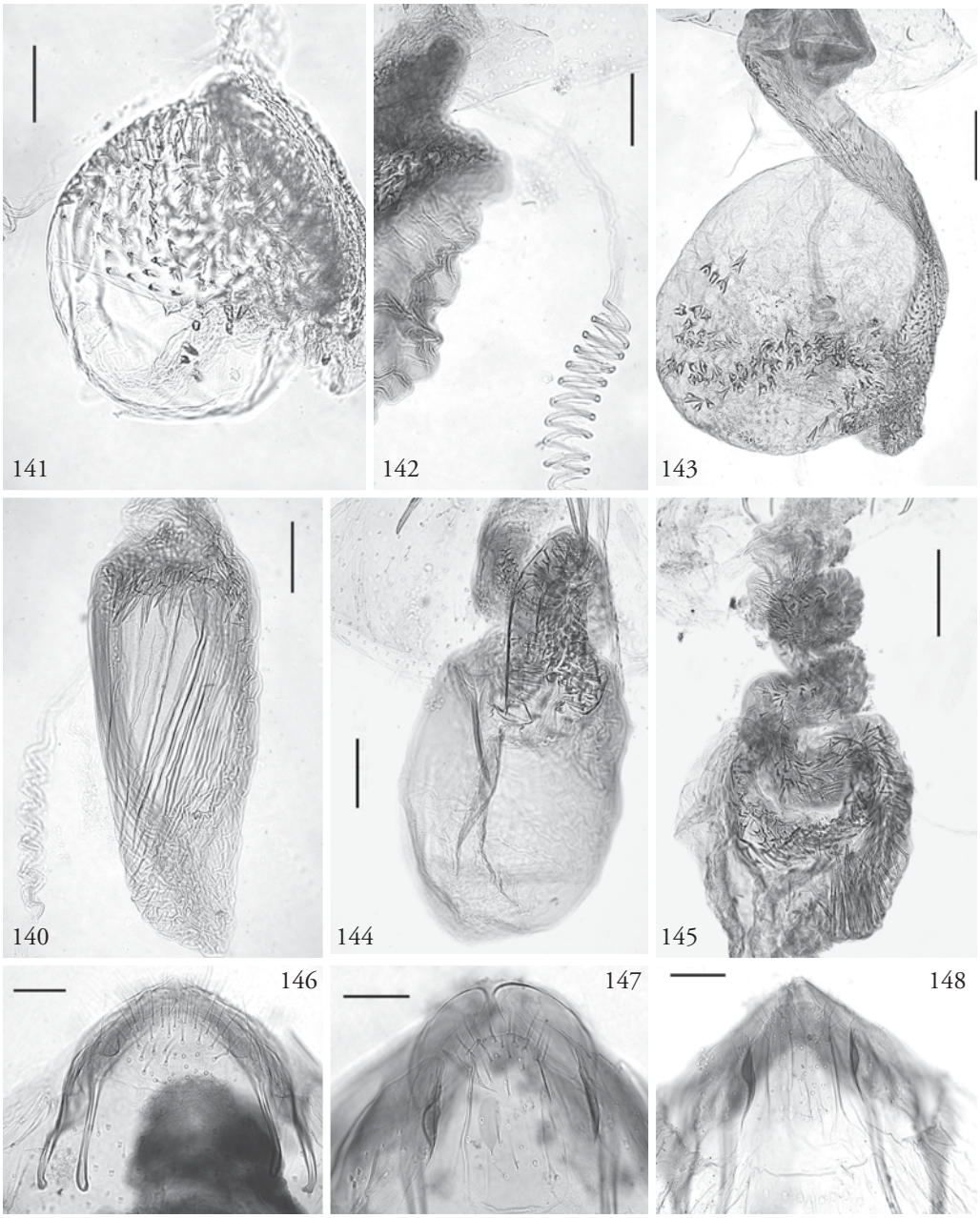




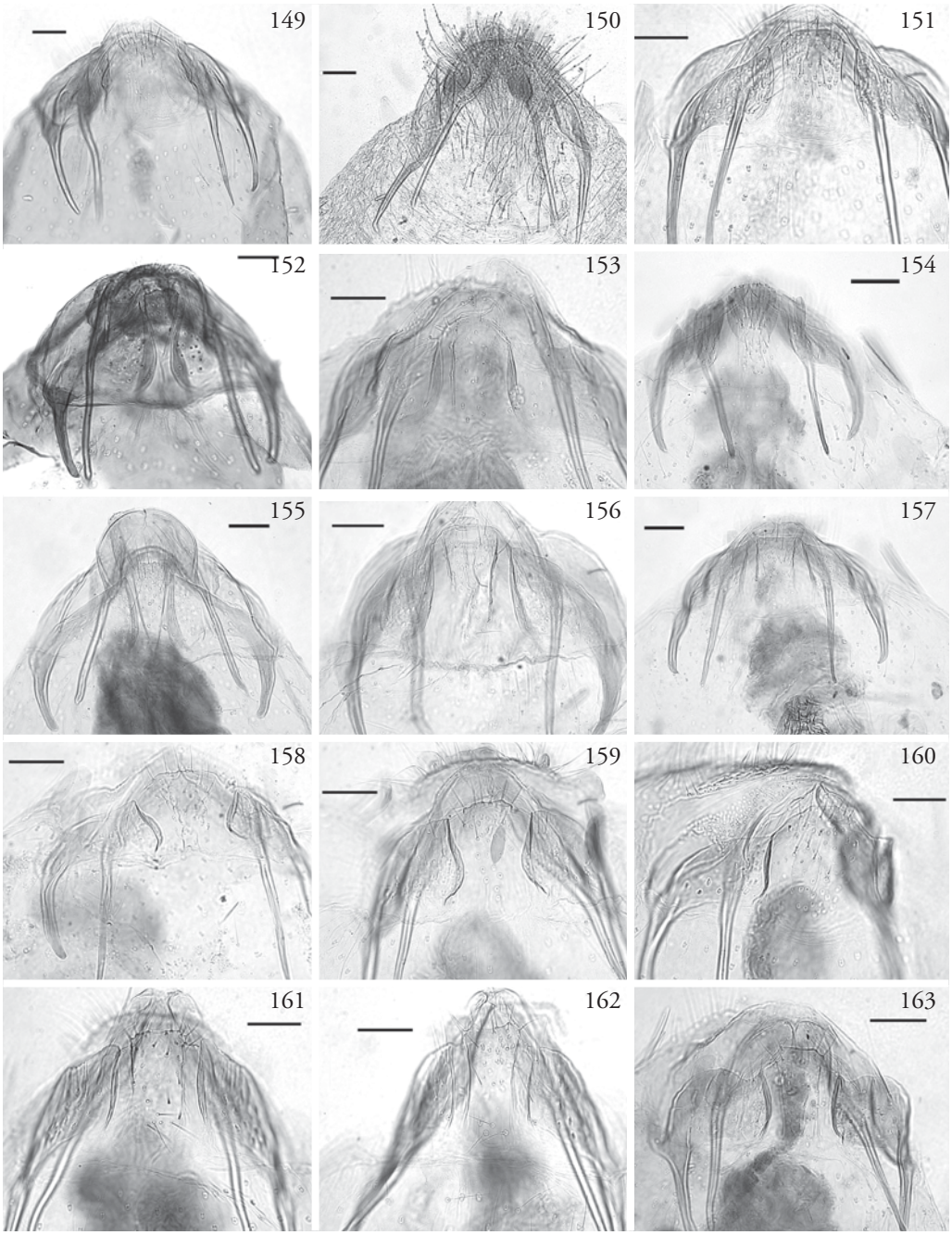
Figs. 126-130. *Stigmella* spp., male (123-125) and female genitalia, bursa, photographs, slides by EvN, unless otherwise mentioned. – 123, *S. roborella*, everted vesica, slide JT037; 124, 125, *S. eberhardi,* slide 1965; 126, *S. fasciata*, holotype; 127, *S. suberivora*, slide 1904; 128, *S. ilicifoliella*, slide 3364; 129, *S. cocciferae,* slide 2845 ; 130, *S. kasyi* slide MV5408. Scale lines 200 µm (127, 128, 129), 50 µm (123), 100 µm (others).



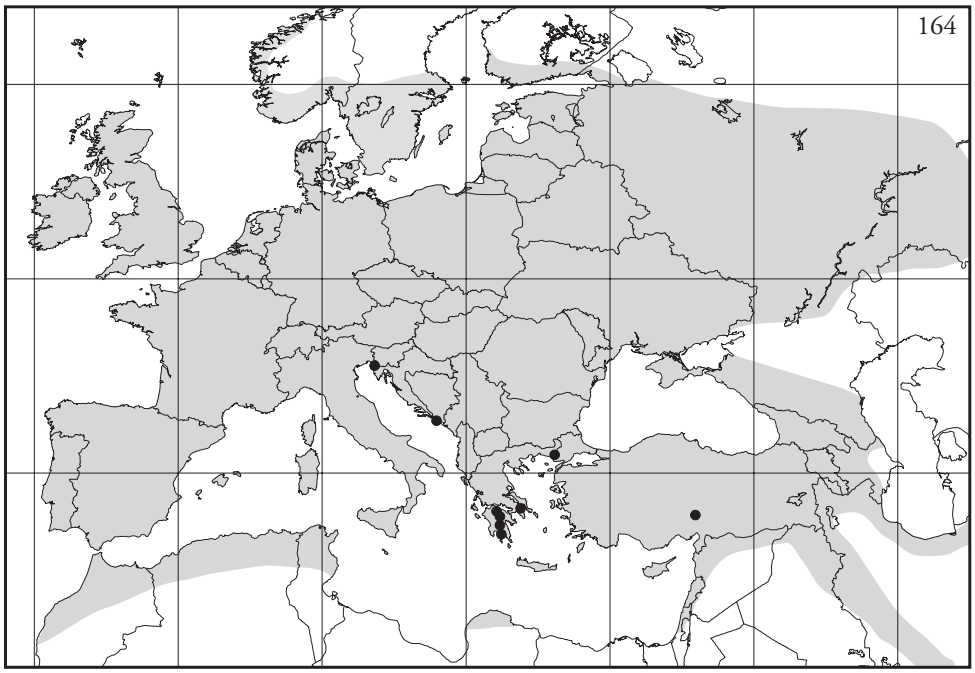
Figs. 131-139. *Stigmella* spp., female genitalia, bursa, photographs, slides by EvN, unless otherwise mentioned. – 131, *S. basiguttella*, slide 2562; 132, *S. macrolepidella*, slide 2904; 133, *S. svenssoni*, slide 3459; 134, *S. szoecsiella*, slide 3345; 135, *S. zangherii*, slide 3348; 136, 137, *S. dorsiguttella*, slide 3475, accessory sac broken posteriorly; 138, *S. trojana*, slide 3375; 139, *S. ruficapitella*, slide 3467; Scale lines 100 µm.

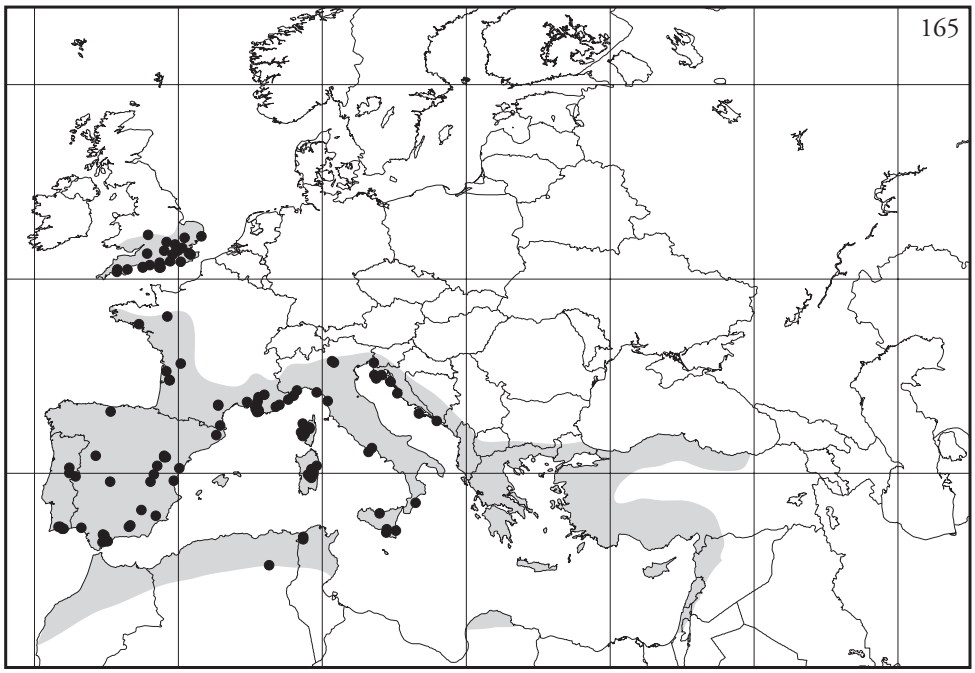


Figs. 140-148. *Stigmella* spp., female genitalia, bursa (140-145), abdominal tip with tergite viii (146-148), photographs, slides by EvN, unless otherwise mentioned. – 140, *S. atricapitella*, slide 3466; 141, 142, *S. karsholti*, slides 3164 and 3160; 143, *S. samiatella*, slide 3327; 144, *S. roborella*, slide 2726; 145, *S. eberhardi,* slide 3366. – 146, *S. fasciata*, holotype; 147, *S. suberivora*, slide 3456; 148, *S. ilicifoliella*, slide 2517. Scale lines 100 µm (140-145), 50 µm (146-148).

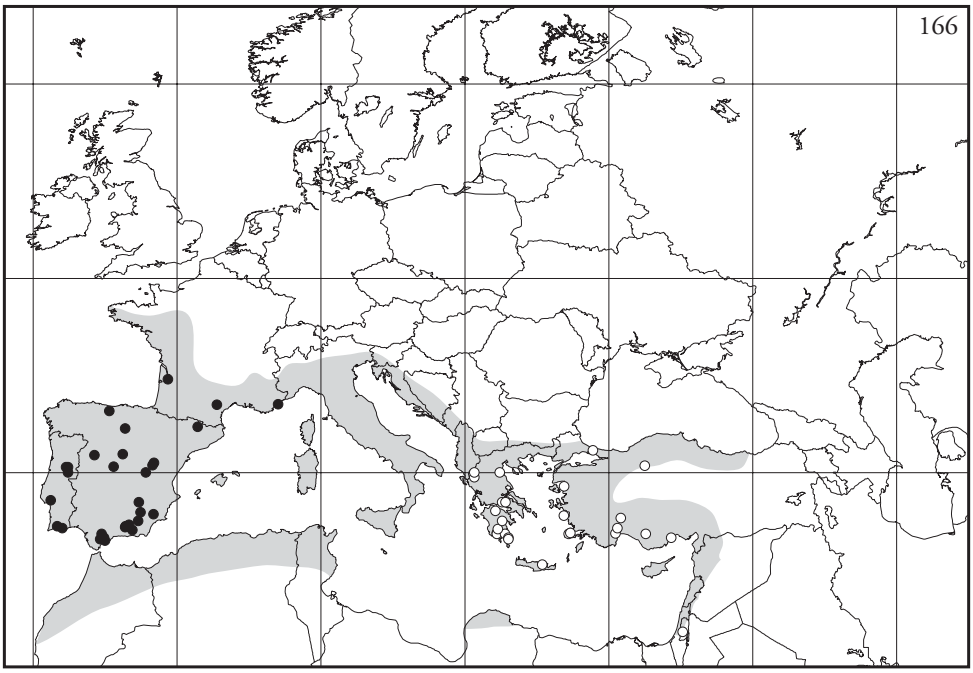


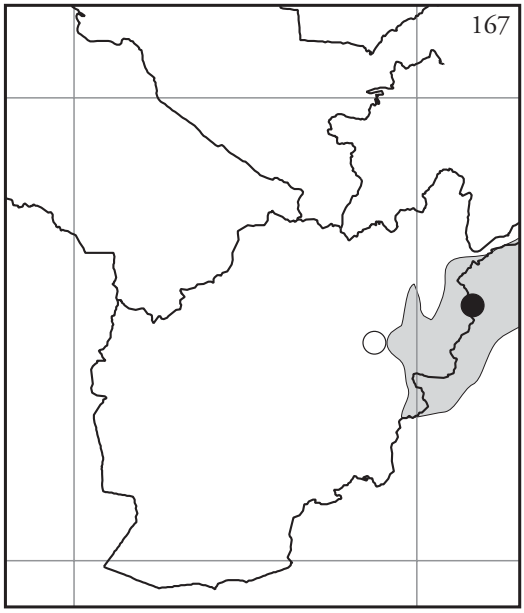
Figs. 149-163. *Stigmella* spp., female genitalia, abdominal tip with tergite 8, photographs, slides by EvN. – 149, *S. cocciferae,* slide 2845; 150, *S. kasyi* slide MV5408; 151, *S. basiguttella*, slide 2562; 152, *S. macrolepidella,* slide 2904; 153, *S. svenssoni*, slide 3459; 154, *S. szoecsiella*, slide 3345; 155, *S. zangherii*, slide 3348; 156, *S. dorsiguttella,* slide 3475; 157, *S. trojana*, slide 3375; 158, *S. ruficapitella*, slide 3467; 159, *S. atricapitella*, slide 3460; 160, *S. karsholti*, slide 3160; 161, *S. samiatella*, slide 2725; 162, *S. roborella*, slide 2726; 163, *S. eberhardi,* , slide 3366. Scale lines 50 µm.



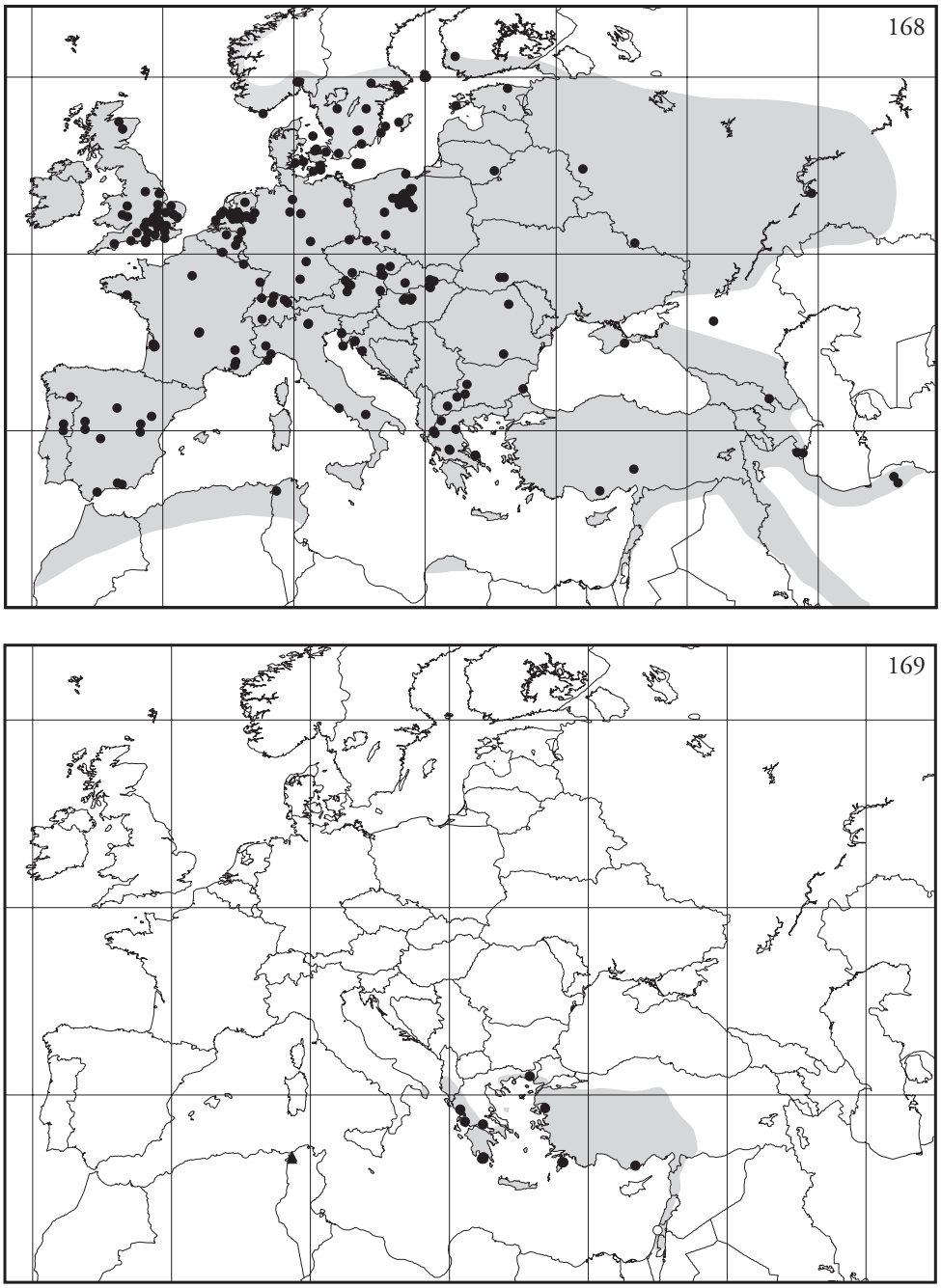


Figs. 164-179 (pages 363-370). Distribution maps of *Stigmella* spp. – 164, *S. fasciata;* shaded area represents approximate natural distribution area of *Quercus*; 165, *S. suberivora*, shaded area represents combined distribution of evergreen oaks (*Quercus coccifera, ilex, rotundifolia* and *suber*), in Britain area of planted *Q. ilex*.

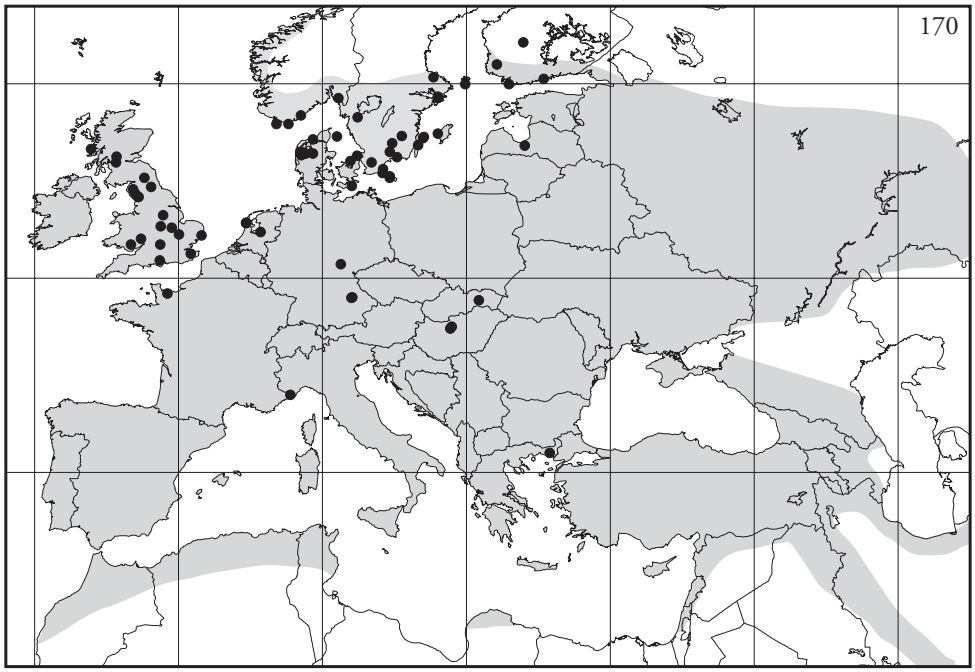


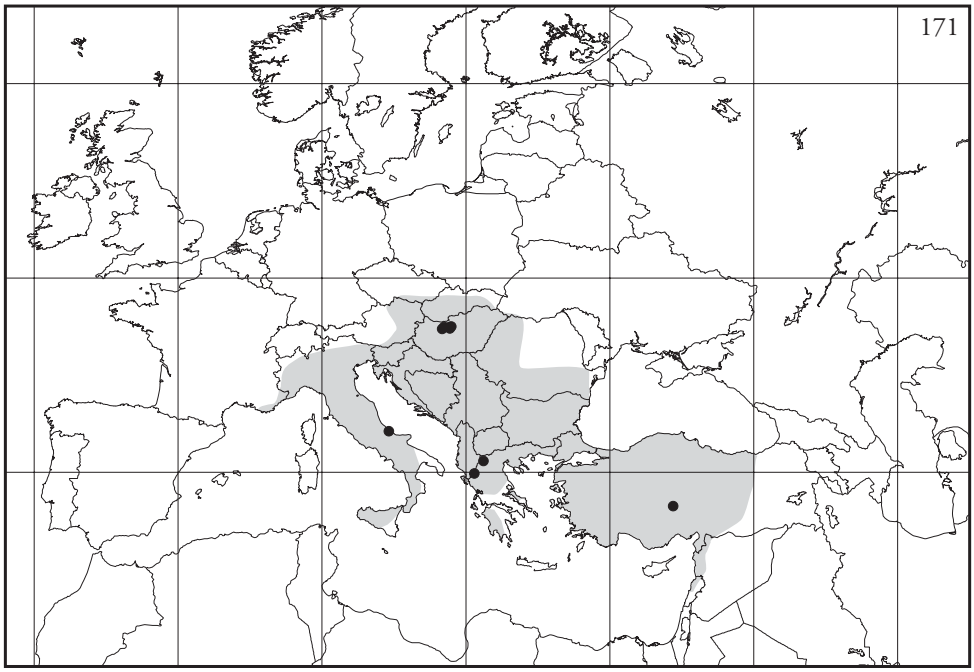


166, *S. ilicifoliella* (black dots) and *S. cocciferae* (open dots); shaded area represents combined natural distribution of evergreen oaks (*Quercus coccifera, ilex, rotundifolia* and *suber*); 167, *S. kasyi*, the open dot represents the female; shaded area represents approximate combined distribution area of *Quercus* species: *Q. baloot, Q. dilatata* and *Q. semecarpifolia*.

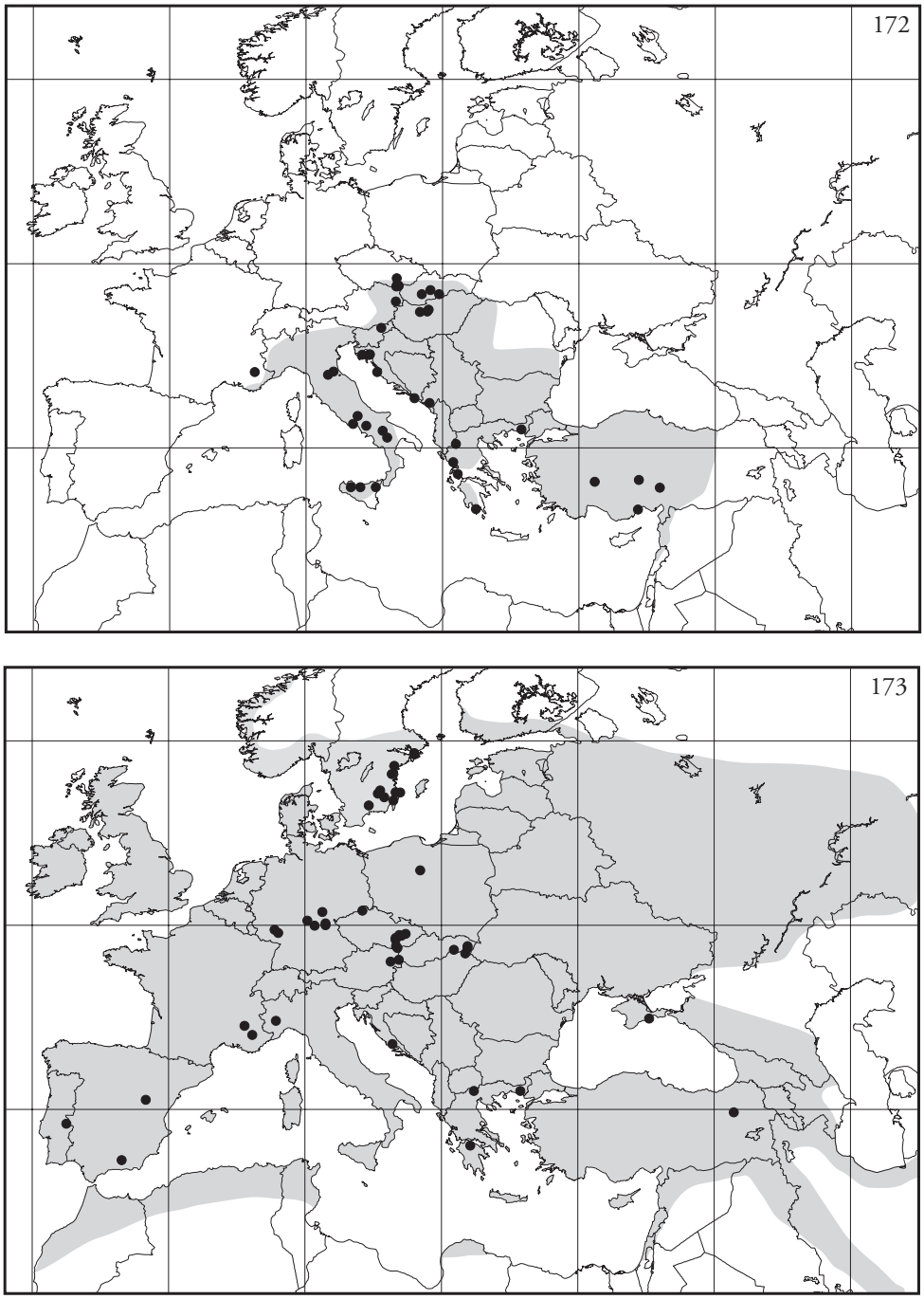


168, *S. basiguttella*, shaded area represents approximate natural distribution area of *Quercus*; dot outside distribution area of *Quercus* north of Caucasus refers to mine records from Kalmykia on planted oaks; 169, *S. macrolepidella* (dots) and *S. karsholti* (triangles, Tunisia); the open dot in Israel refers to the record of leafmines on *Quercus ithaburensis* ssp. *ithaburensis* which belong possibly to *S. macrolepidella*; shaded area represents approximate distribution area of *Quercus ithaburensis*, host of *S. macrolepidella*.

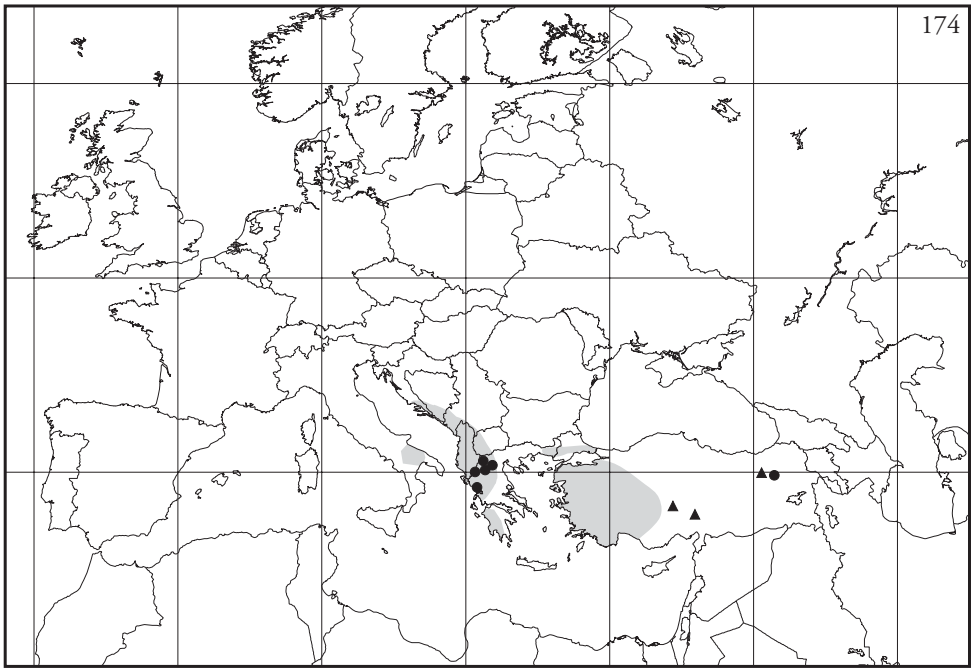


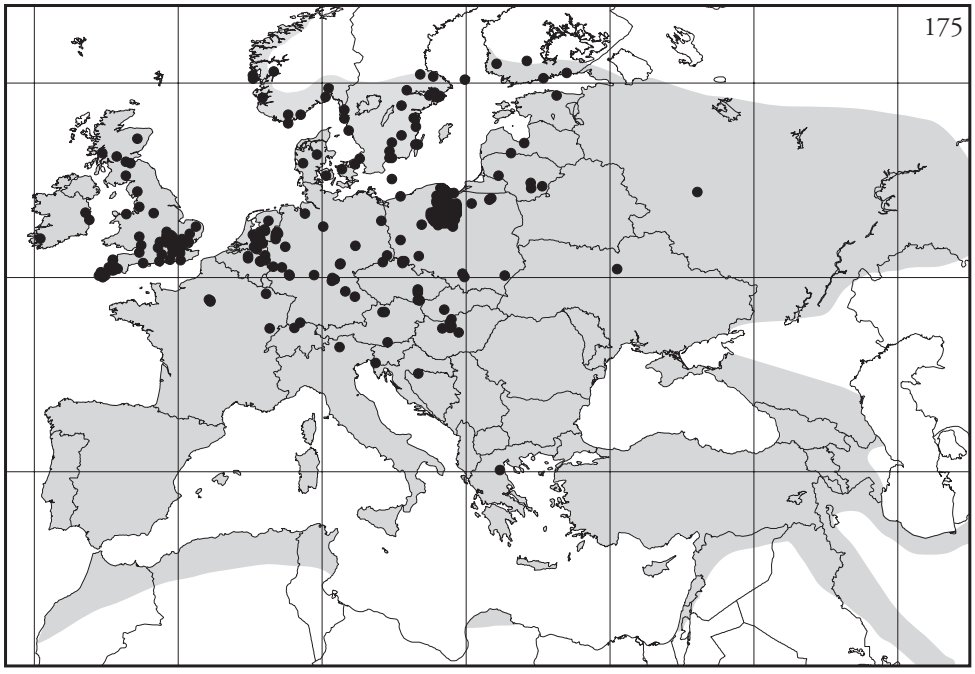


170, *S. svenssoni*; shaded area represents approximate natural distribution area of *Quercus*; 171, *S. szoecsiella*; shaded area represents approximate distribution area of *Quercus cerris*, the most common host.

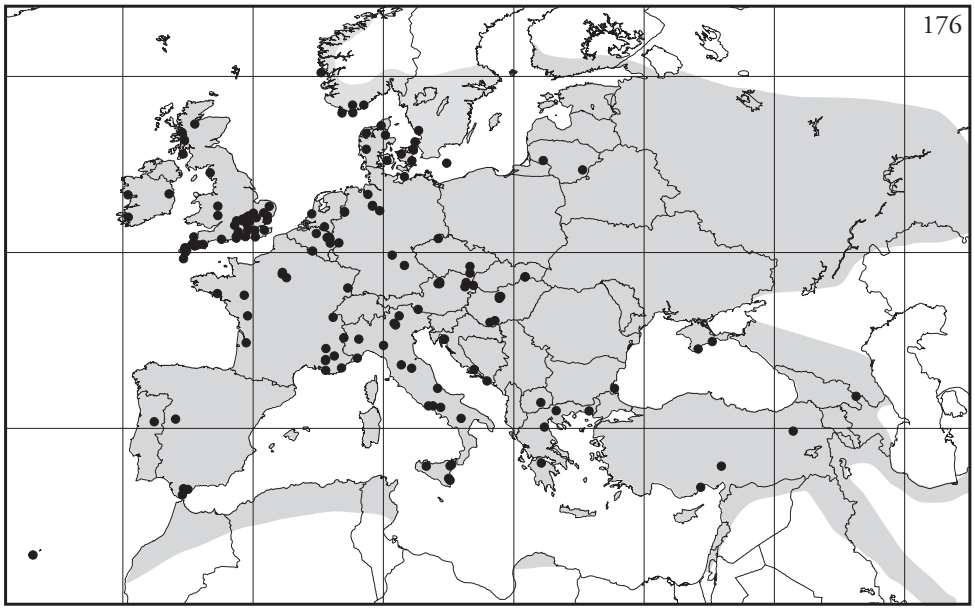


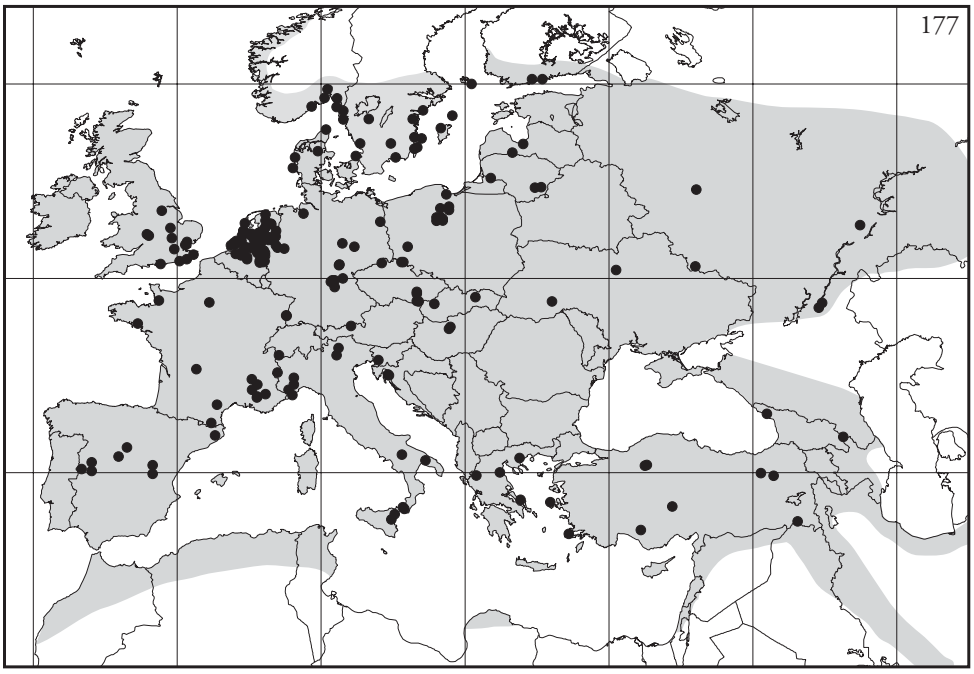
172, *S. zangherii*; shaded area represents approximate distribution area of *Quercus cerris*, the most common host; 173, *S. dorsiguttella*; shaded area represents approximate natural distribution area of *Quercus*.



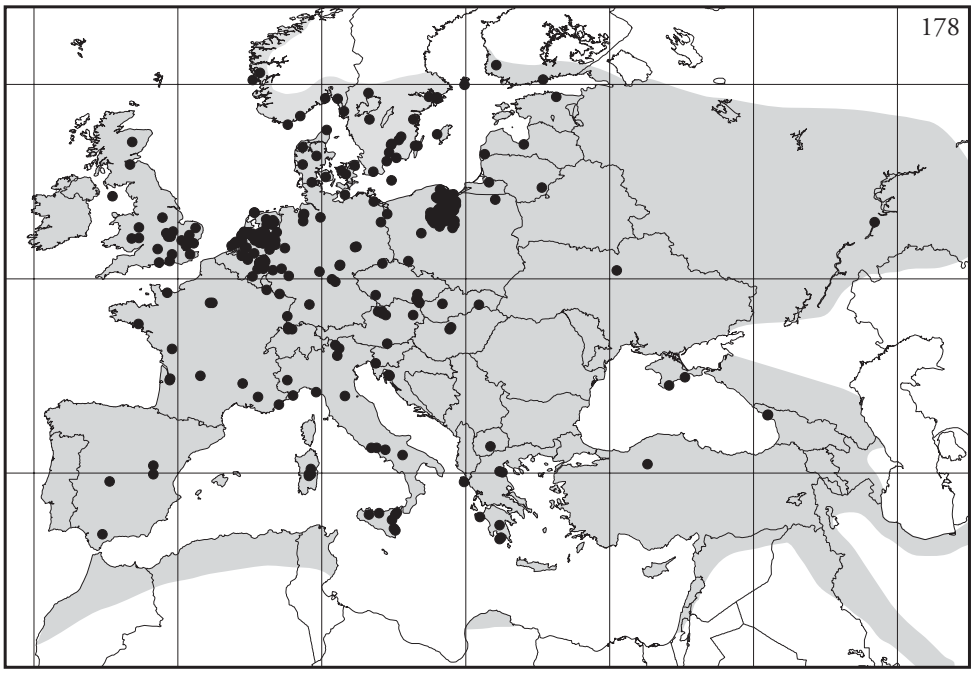


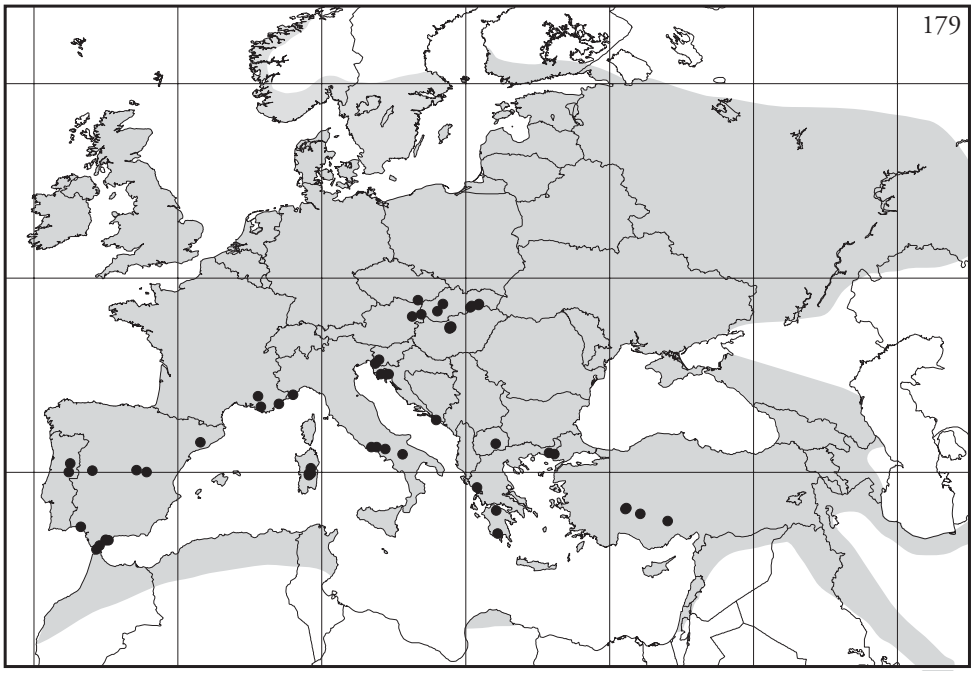
174, *S. trojana* (dots) and *S. bicuspidata* (triangles); shaded area represents approximate distribution area of *Quercus trojana*, host of *S. trojana*; 175, *S. ruficapitella*; shaded area represents approximate natural distribution area of *Quercus*;





176, *S. atricapitella*; 177, *S. samiatella*; shaded areas represents approximate natural distribution area of *Quercus*;





178, *S. roborella*; 179, *S. eberhardi*; shaded areas represents approximate natural distribution area of *Quercus.*