

Distribution and Bionomy of *Stigmella aceris* (Frey, 1857) and *Stigmella speciosa* (Frey, 1858) in Hungary (Lepidoptera, Nepticulidae)

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Abstract. Knowledge of the *Stigmella* species (Nepticulidae) in Hungary is incomplete. Over the past 50 to 60 years, almost no research has been undertaken. In this paper, the author examines the bionomics and geographic distribution in Hungary of *Stigmella aceris* (Frey, 1857) and *Stigmella speciosa* (Frey, 1858), based on their active research and a comprehensive literature review.

Keywords. *Stigmella aceris*, *Stigmella speciosa*, Nepticulidae, morphology, food plant, life cycle, habitat, Hungary

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Introduction

Current research indicates that 68 *Stigmella* species have been identified in Hungary. Most of these species are widespread throughout the country, while others are limited to specific regions. Examples of very local and rare species include *Stigmella ulmiphaga* (Preisseker, 1942), *S. obliquella* (Heinemann, 1862), *S. lonicerarum* (Frey, 1857), *S. tormentilella* (Herrich-Schäffer, [1855]).

The first summary of the Hungarian *Stigmella* species was prepared by Gozmány (1965), who placed them in the "*Nepticula* Z." (= Heyden, 1843) genus. Gozmány stated that 113 species in Hungary were reliably known. However, his book was not useful for Hungarian researchers for species identification purposes, as it contained very few illustrations. Gozmány obtained these illustrations from the works of Spuler and Hering but did not provide the exact bibliographical references. Furthermore, he did not describe and illustrate the genitalia of the species.

Josef Szócs did the most significant work on Hungarian species. His summary work was published in 1977 in the *Fauna Hungariae* fauna booklet series on 424 pages (Szócs 1977). This book is a basic work in Hungary for anyone interested in leaf-mining moth species. The author stated that *Stigmella* [*Nepticula*] *aceris* is "ubiquitous" and very common in Hungary. It has three generations per year. Its main food plants are *Acer platanoides*, *A. campestre* and *A. tataricum*. The larvae pupate in the soil.

Fifty to sixty years ago, Josef Szócs knew *Stigmella speciosa* from three sites in Hungary. According to him, it is a two-generation species. Its larvae are found on *Acer pseudoplatanus* but also *A. platanoides* and *A. campestre*. The latter statement is not his observation but was taken from other unnamed authors. Modern research suggests that the latter two food plants are not used by *S. speciosa*; because of this potential identification problem, the species *Stigmella aceris* and *S. speciosa* should be critically analysed together.

Josef Szócs (1977: p. 16) has a separate chapter on the "*Nepticula Szoecki* Klim." which he considered a Hungarian endemic. Klimesch (1956) described the species as "szócsi". However, they cautiously note that the validity of the species is doubtful and that it is probably only a variant of *Stigmella aceris*. Subsequent taxonomic studies have confirmed that *Nepticula szócsi* Klimesch, 1956 is synonymous with *Stigmella aceris* (Frey, 1857).

Results

Stigmella Schrank, 1802

The genus comprises small species, mostly with short antennae and collared (patagia) with leaf-like scales. Typically, the forewings lack a row of scales that sharply separates the wing margin from the fringe. The caterpillars of these species mine the leaves of trees and herbs belonging to various families. The genus is species-rich, with approximately 110–115 species in Europe, 90 in Central Europe, and 68 known in Hungary

Keys to wings of adults

– Forewing with single fascia, Collar white. Head dark fuscous in both sexes. Male without androconial scales

..... 1. *S. aceris*

– Forewing with single fascia, fascia tapering towards costa collar brown or black. Head black in males, ochreous to ferruginous in females. Male with long androconial scales on the hindwing. Hindwing fuscous with androconial scales extruding to at most two-thirds. Scape posteriorly edged with black

..... 2. *S. speciosa*



Text-figs 1–2. Diagnostic characters (indicated) of (1) *Stigmella aceris* and (2) *S. speciosa*. Completed after original watercolour © A. Laštůvka.

Keys to mines and larvae of *Stigmella aceris* and *S. speciosa*

– The mine is filled with green faeces from the beginning to more than two-thirds of its length, only at the end does the line of faeces become narrow and leave light-coloured edges. The larva green, on *Acer campestre*, *A. tataricum* and *A. platanoides*

..... 1. *S. aceris*

The mine is a relatively short or longer gallery with linear or dispersed black frass. The larva yellow, on *Acer pseudoplatanus* 2. *S. speciosa*



Text-figs 3–4. (3) Leaf mines of *Stigmella aceris* on *Acer campestre* (Mecsek Mountains); (4) Leaf mines of *S. speciosa* on *Acer pseudoplatanus* (Héviz). Photographs (indicated) taken through a stereo microscope.

Stigmella aceris* (Frey, 1857)Nepticula aceris* Frey, 1857. Linn. Ent. 2: 386.*Nepticula penicillata* Heinemann & Wocke, 1877*Nepticula szöcsi* Klimesch, 1956

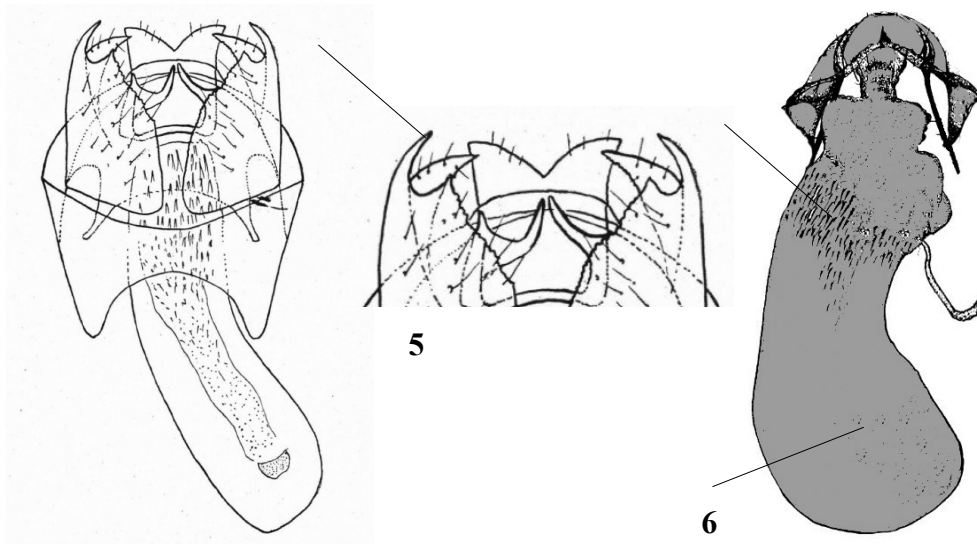
Diagnosis (Fig. 1). Wingspan 3,8–4,5 mm. Antennae brownish, barely half the length of the forewing, head with black scales on the vertex; the back of the head and eye patches are white. Forewings glossy bronze, darker behind the median fascia is golden white, indistinct, and sometimes absent.

Similar species. *S. speciosa* differs from *S. aceris* males by the presence of androconial scales on the hindwing and the greenish golden base of the forewing and in the females by the ferruginous head.

Biology. The adults fly in three generations: first from May to June and again in July to August, finally, in October. One of the few *Stigmella* that hibernates as an adult, usually behind hanging bark. Mines on *Acer campestre*, *A. platanoides*, *A. tataricum*. The mine is a slightly winding corridor filled with green faeces. As the mine progresses, the green frass is deposited in arcs and the very last part of the corridor the frass pattern becomes linear, whilst the colour changes from greenish to black. Larva green; cocoon white. Habitat: deciduous forests, parks, arboreta, along roads connecting small settlements, forest strips and patches of forest on agricultural land and wooded pastures.

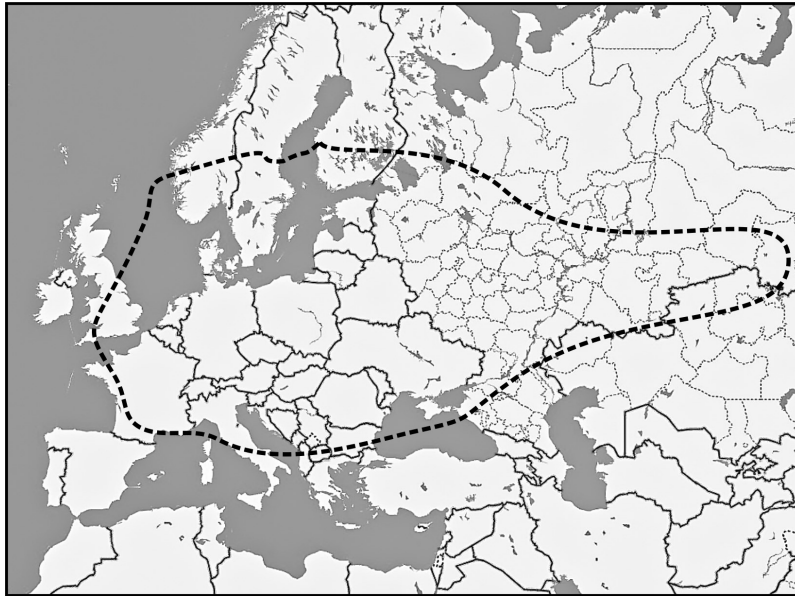
Genitalia (Text figs 5-6.). Male genitalia characterised by the combination of two distal processes on the valve and the presence of a juxta. Female genitalia can be easily distinguished from species outside the *aceris* group by the band of small spines near the accessory sac and broad and blunt apophyses anteriores.

Distribution. European and west Siberian faunal elements are mainly found in southern Scandinavia, central Europe, western Europe and southern England. It is highly localised in the Apennines and Balkan Peninsula. In Russia, it reaches the Yenisei River in the west Siberian



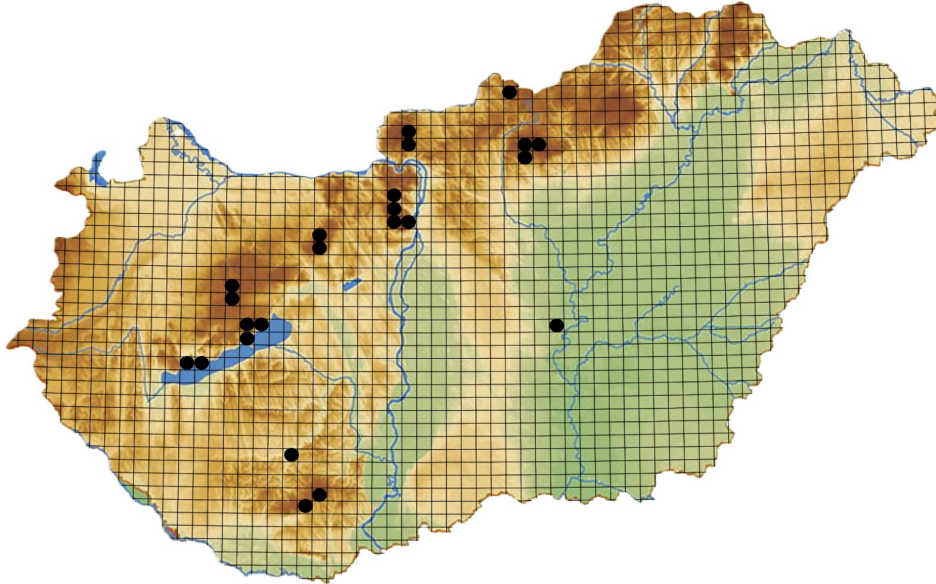
Text-figs 5–6. Male (5) and female (6) genitalia (indicated) of *Stigmella aceris*; (5) Budakeszi, Hársbokor-hegy, 22.06.1952. leg. J. Szöcs, gen. prep No.455a, J. Klimesch. The specimen was originally described by Klimesch as “*Nepticula szöcsi*”. (6) Mecsek Mountains, Pécs, 30.06.1981. leg. I. Fazekas, gen. prep. 81.6030. (preserved in micro-vials filled with glycerol). Detailed description in the text.

lowlands. In the south (Greece, Turkey) there are uncertain observation data. Several authors have observed the expansion of the species in Germany, Belgium, The Netherlands and England (Emmet 1977, Edmunds 2006, Nieuwerkerken et al. 2006). *Stigmella aceris* seems to be particularly widely distributed in Central Europe, except in the high Alps and eastern and south-eastern Europe (see Nieuwerkerken et al. 2006).



Text-fig 7. Putative range of *Stigmella aceris* based on literature data in the West Palearctic region

Occurrence in Hungary (Text-Fig. 8). There are few reliable old distribution records (e.g. Gozmány 1965: Budapest; Szöcs 1977). Szöcs (1977) interpreted the distribution of *aceris* in Hungary in a much broader sense when he wrote: "In Hungary, it occurs everywhere, it is common everywhere". My recent studies have not confirmed this claim and it is now considered to be erroneous. Moving from the southern landscapes to the north, I identified the following areas; Mecsek Mountains and the surrounding hills, the Somogy-Tolna Hills, the Transdanubian mountain range (the Bakony, Vértes, Pilis and Buda Mountains), in the north in the Mátra Mountains. Studies show that the species prefers hilly and mountainous habitats in Hungary. So far, it has not been observed in flat rural areas. This observation in Hungary is at odds with the data available from south-east England, where Colin Plant has demonstrated a continuous distribution across the contiguous lowland counties (= megye) of Hertfordshire and Middlesex (= the London area), where the altitude ranges from sea level to a maximum of 260 metres at a single locality only (<https://hertsmiddxmoths.uk/micros.php?bf=1020>). The strongly continental climate of the Hungarian Great Plain is probably not favourable for the species. It should be noted here that many new occurrences have been recorded in Hungary in the last 50-60 years. However, I would be more cautious than the western European authors (Emmet 1977, Edmunds 2006, Nieuwerkerken 2006) who indicate a gradual expansion of the species. I am advised (Colin Plant, personal communication) that one year before the distribution map for Hertfordshire and London (above) was produced, there were almost no dots on the distribution map. A specific campaign over a single autumn period, in 2017, to target *Acer*-feeding nepticulids, accounts for almost all of the distribution records. The general view is that this indicates past under-recording, not past absence; the results stand as a testament to the value of "citizen science" projects. The apparent expansion in Hungary may simply be the result of more intensive observations. This hypothesis can only be confirmed by more thorough chorological and ecological studies.



Text-fig 8. Occurrence of *Stigmella aceris* in Hungary. The old, uncertain literature is not on the map. Studies show that the species prefers hilly and mountainous habitats in Hungary.

Remarks. According to Laštůvka & Laštůvka (1997), only 2 *Stigmella* species occur in maple leaves, which can be easily the mine of *Stigmella speciosa* is filled with a narrow line of faeces from the beginning, to more than two-thirds of its length, only at the end does the line of faeces become narrow and leave light-coloured edges. Here on *Acer campestre* and *Acer platanoides*, also on *Acer tataricum*. The mine of *Stigmella speciosa* is filled with a narrow line of faeces from the beginning, leaving light-coloured edges, only on *Acer pseudoplatanus*.

According to Nieuwerkerken et al (2006) based on the (many) literature data, there seem to be two generations all over Europe: the first with caterpillars from June (or May in southern Europe) until well into July, and a second with caterpillars in August and early September. Only rarely are caterpillars found later in the year, and when they are found they are often parasites.

***Stigmella speciosa* (Frey, 1858)**

Nepticula speciosa Frey, 1858. | The Entomologist's Weekly Intelligencer 4: 27.

Stigmella pseudoplatanella Skala, 1933

Nepticula pseudoplatanella Weber, 1937

References (only Hungarian): Gozmány 1965; Szöcs 1977, 1984)

Diagnosis (Fig. 2.). Wingspan 4.5–5.5 mm; head with black scales in male and ochre to rusty in female; x collar brownish-black to black; forewings dark greenish, bronze-gold in front of the septum, black in front of and behind the septum; transverse fascia silvery to silvery-gold; male with long androconial scales on the hindwing; mine on sycamore *Acer pseudoplatanus*, larvae pale yellow (Fig. 4); cocoon light to dark brown. Bivoltine.

Habitat: forests, parks, arboreta, forest strips in agricultural landscapes; western, central and partly southern Europe; in central Europe and Hungary very local.

Male genitalia. Vinculum very wide, anterior emargination shallow; lateral corners rounded. Uncus distinctly bilobed, each lobe with a deep medial notch. Gnathos with large rounded anterior processes and relatively short - almost parallel - horns. Valva small; distal process long and almost straight; inner lobe very short, posteriorly rounded. Transtilla with short, slender transverse bar and short, triangular sublateral processes. The aedeagus is distinctly longer than the genital capsule with a large square chitin plate at the tip; the vesica is almost completely

covered with large triangular cornuti, the largest near the tip of the aedeagus.

Female genitalia. Bursa large, almost globular, posteriorly well sclerotized, with many longitudinal folds. Ductus spermathecae are very long and thin, without spines. Apophyses are widely separated; posterior longer than anterior. Abdominal tip blunt.

Biology. The adults fly in two generations: from the end of May to the end of June, and from July to the end of August. Its larvae live only in the leaves of *Acer pseudoplatanus*. In Hungary, *speciosa* leaf miner is often confused with *Stigmella aceris* leaf miner. The mine is filled with green faeces from the beginning to more than two-thirds of its length, only at the end does the line of faeces become narrow and not leave light-coloured edges. In contrast, the mine of the *S. speciosa* is a long, tortuous gallery, filled with coiled green frass (brown in older mines), and the faeces are just a thin strip with a light border. The larva is yellow. Szöcs (1977) wrote that the leaf mines of the two species cannot be distinguished.

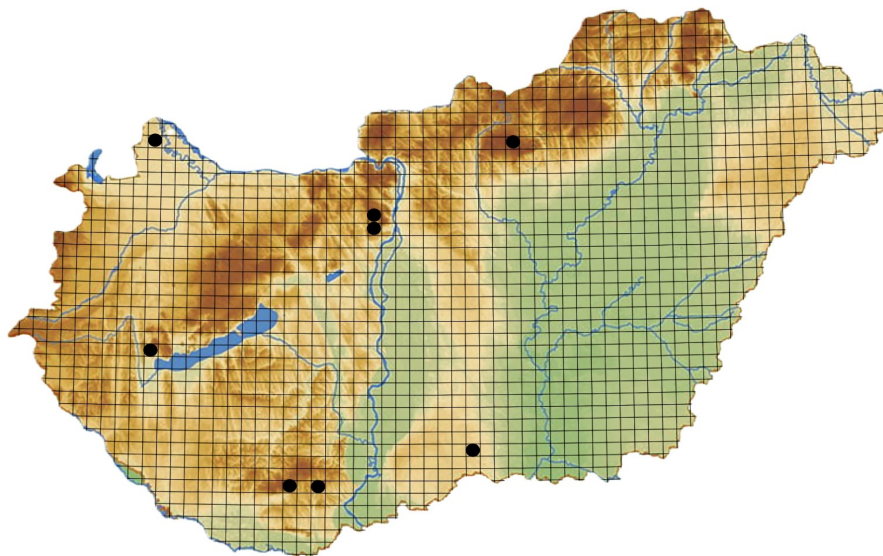
Distribution. Very local From Denmark to the Iberian Peninsula (for example Portugal), Italy, and Greece and from Britain to the Ukraine.

Occurrence in Hungary (Text-fig. 9.). In the middle of the 20th century, only a few sites were known in the country (Gozmány 1965; Szöcs 1977): Budapest, Mosonmagyaróvár, Mát-ra Mountains, Kunfehértó, Szederkény. These isolated sites are widely separated.

New observations. Héviz, 19.07.2024, arboretum (leaf mines).; Pécs, 21.08.2024, a downtown street with bushes, and trees (leaf mines).

Summary. These results of the study of *Stigmella aceris* and *S. speciosa* in Hungary present only a preliminary overview. Most of the data in the literature for the *Stigmella speciosa* are very uncertain. It has also been shown that authors mostly have difficulty, or even no way, to distinguish the *Stigmella aceris* from the *Stigmella speciosa*. For this reason, I have included only confirmed sites on the distribution maps for Hungary. The proposed maps should be further expanded.

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Text-fig. 9. Hungarian distribution map of *Stigmella speciosa*. Based on verified data. The spread is assumed to be larger.

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Note: I have reviewed the following literature while writing this paper. And I have used them only up to the critical level.

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