

OVERVIEW OF LEAF MINER FAUNA IN SERBIA

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Abstract

Due to their specific lifestyle, frequency of occurrence, and the damage that they cause on plants, leaf miners have been investigated by many scientists in Serbia. Unfortunately, the overview of research on their fauna in Serbia has not been done yet. Therefore, based on the data from the literature sources and the results of our research, the first overview of leaf miner fauna research in Serbia was made. It was found that 363 species of leaf miners were ascertained in Serbia so far. They are classified as follows: 270 species from 26 families of the order Lepidoptera, 61 species from 5 families of the order Diptera, 21 species from 3 families of the order Coleoptera, and 11 species from 1 family of the order Hymenoptera. The majority of species of the order Lepidoptera belongs to the families Gracillariidae (71), Nepticulidae (61) and Coleophoridae (37), of the order Diptera to the family Agromyzidae (53), and from the order Coleoptera to the families Curculionidae (12) and Chrysomelidae (7). All species of the order Hymenoptera (11) belong to the family Tenthredinidae. Monophagous and Oligophagous species are dominant among the identified species of leaf miners in Serbia. The majority of the species (57%) develop on woody plants. Most of them (30) on the species of the genus *Quercus*, *Prunus* (20), *Malus* (19), and *Populus* (19). The list of 363 species of leaf miners that were identified in Serbia is not definitive. How European leaf mining insect fauna includes about 2500 species, it is certain that new species will be found in the future.

Keywords: *phyllophagous insect, Serbian species list.*

Introduction

Leaf miners are small insects from orders Coleoptera, Diptera, Hymenoptera and Lepidoptera, whose larvae, while feeding on the inside of the leaf, create cavities – mines – of different shape, size, and position on the leaf. These cavities are usually transparent so that when put against a light source, the excrements that the larvae left behind can be seen. They are frequently characteristic of the species that made them so they can be used for their determination. There are about 5500 species of leaf miners in the world (Hering 1957), and approximately 2500 in Europe (Ellis 2007). They are mostly monophagous species from the orders Lepidoptera and Diptera. The species from the order Diptera mostly inhabit herbaceous plants, while those from the order Lepidoptera more often inhabit woody plants. Leaf miners have been studied by many authors in Serbia. Unfortunately, none of them prepared a comprehensive list of Serbian species, so far. Considering that such a list would significantly improve the research on leaf-miners insect guild in Serbia, we compiled and presented in this paper the available data either gathered from the literature or from our researches.

Materials and methods

The work on compiling the list of leaf miners that have been identified in Serbia so far included:

1. Overview of the literature dealing with leaf miners in Serbia,
2. Cataloging of the material that we collected while researching the leaf miner fauna of Serbia.

All the data obtained were entered into a database, from which a list of all the species detected in Serbia was derived.

Results and discussion

Based on the data obtained by reviewing the 98 literature sources, and the data obtained from the inventory that we made while researching the fauna of leaf miners in Serbia, a list of 363 species of leaf miners that have so far been found in Serbia was compiled. They are classified as follows: 270 species from 26 families of the order Lepidoptera, 61 species from 5 families of the order Diptera, 21 species from 3 families of the order Coleoptera, and 11 species from 1 family of the order Hymenoptera. The majority of species of the order Lepidoptera belongs to the families Gracillariidae (71), Nepticulidae (61) and Coleophoridae (37), of the order Diptera to the family Agromyzidae (53), and from the order Coleoptera to the families Curculionidae (12) and Chrysomelidae (7). All species of the order Hymenoptera (11) belong to the family Tenthredinidae. Three hundred and sixty-three species of leaf miners that are listed in this paper were identified on the plants belonging to 205 genera. Monophagous (48%) and Oligophagous (42%) species are dominant among the identified insects. The majority of them (57%) develop on woody plants, most of them on the species of the genus *Quercus* (30), *Prunus* (20), *Malus* (19), and *Populus* (19). Some of them can cause significant damage to agriculture and forestry, and that is why they have been researched by many authors in Serbia. The list of the 363 species of leaf miners presented in this paper is the first faunistic list of leaf miners in Serbia. It surely contains some oversights. However, despite them, it is very useful to us. First of all, because of thanks to the list, we now know which species of leaf miners have been identified in Serbia so far, and how much each species group has been researched. This list will also be useful for researchers from abroad because now they will also know which species of leaf miners are present on the territory of Serbia. Considering that European leaf mining insect fauna includes about 2500 species and that Serbian flora is vibrant with vascular plants, it is certain that new species of leaf miners will be found in the future. Leaf miners identified in Serbia, based on the data from the literature sources and the data from our research, are listed in table 1. For convenience, they are all arranged alphabetically within the family to which they belong. Their names are compatible with the names that can be found on the Fauna Europaea website (Van Nieukerken & Karsholt 2016).

Table 1. List of species identified in Serbia

Order: Coleoptera
Buprestidae: <i>Trachys minutus</i> (L.), <i>T. troglodytiformis</i> Obenb.
Chrysomelidae: <i>Dibolia depressiuscula</i> Letz., <i>D. foersteri</i> Bach, <i>D. occultans</i> (Koch), <i>Longitarsus luridus</i> (Scop.), <i>Psylliodes chrysocephala</i> (L.), <i>Zeugophora flavicollis</i> (Marsh.), <i>Z. scutellaris</i> Suffr.
Curculionidae: <i>Ceutorhynchus napi</i> Gyll., <i>C. pallidactylus</i> (Marsh.), <i>C. rapae</i> Gyll., <i>Isochnus foliorum</i> (Mull.), <i>I. sequensi</i> (Stierl.), <i>Oprohinus suturalis</i> (F.), <i>Orchestes fagi</i> (L.), <i>O. quercus</i> (L.), <i>O. subfasciatus</i> Gyll., <i>O. testaceus</i> (Mull.), <i>Rhamphus oxyacanthae</i> (Marsh.), <i>Tachyerges decoratus</i> (Germ.)
Order: Diptera
Agromyzidae: <i>Agromyza ambigua</i> Fall., <i>A. anthracina</i> Meig., <i>A. apfelbecki</i> Strobl, <i>A. conjuncta</i> Spen., <i>A. flavipennis</i> Hend., <i>A. frontella</i> (Rond.), <i>A. intermittens</i> (Beck.), <i>A. nana</i> Meig., <i>A. nigrella</i> (Rond.), <i>A.</i>

nigrescens Hend., *A. polygoni* Her., *A. pulla* Meig., *A. reptans* Fall., *A. sulfuriceps* Strobl, *A. Amauromyza chenopodivora* Spen., *A. flavifrons* (Meig.), *A. labiatarum* (Hend.), *A. lamii* (Kalt.), *A. morionella* (Zett.), *Aulagromyza fulvicornis* (Hend.), *A. populi* (Kalt.), *A. populicola* (Walk.), *A. tridentata* (Loew), *Calycomyza artemisiae* (Kalt.), *Chromatomyia fuscata* (Zett.), *Ch. horticola* (Gour.), *Ch. nigra* (Meig.), *Galiomyza violiphaga* (Hend.), *Liriomyza amoena* (Meig.), *L. artemisicola* Meij., *L. brassicae* (Riley), *L. bryoniae* (Kalt.), *L. congesta* (Beck.), *L. demeijerei* (Her.), *L. huidobrensis* (Blanch.), *L. pascuum* (Meig.), *L. sonchi* Hend., *L. strigata* (Meig.), *L. taraxaci* Her., *L. trifolii* (Burg. & Comst.), *Ophiomyia cunctata* (Hend.), *Phytomyza agromyzina* Meig., *Ph. glechomae* Kalt., *Ph. gymnostoma* Loew, *Ph. hellebori* Kalt., *Ph. kaltenbachii* Hend., *Ph. marginella* Falle, *Ph. petoei* Her., *Ph. plantaginis* Rob.-Des., *Ph. ranunculi* (Schra.), *Ph. rectae* Hend., *Ph. vitalbae* Kalt., *Pseudonapomyza balkanensis* Spen.

Anthomyiidae: *Delia echinata* (Seguy), *Pegomya betae* (Curtis), *P. hyoscyami* (Panz.), *P. solennis* (Meig.)

Cecidomyiidae: *Monarthropalpus flavus* (Schra.)

Ephydriidae: *Hydrellia griseola* (Fall.)

Tephritidae: *Euleia heraclei* (L.), *Trypeta immaculata* (Macqu.)

Order: Hymenoptera

Tenthredinidae: *Fenella nigrita* Westw., *Fenusa ulmi* Sund., *Heterarthrus aceris* (Kalt.), *H. microcephalus* (Klug), *H. ochropoda* (Klug), *H. wuestneii* (Konow), *Hinatara recta* (Thoms.), *Metallus pumilus* Klug, *Parna tenella* (Klug), *Profenusa pygmaea* (Klug), *Scolioneura betuleti* (Klug)

Order: Lepidoptera

Acrolepiidae: *Acrolepiopsis assectella* (Zell.)

Bedelliidae: *Bedellia somnulentella* (Zell.)

Bucculatricidae: *Bucculatrix albedinella* (Zell.), *B. albella* Stain., *B. artemisiella* Herr.-Schaeff., *B. bechsteinella* (Bech. & Scharf.), *B. frangutella* (Goeze), *B. ulmella* Zell., *B. ulmifoliae* Her.

Choreutidae: *Millieria dolosalis* (Heyd.), *Prochoreutis myllerana* (F.), *Tebenna micalis* (Man)

Coleophoridae: *Coleophora albicostella* (Dup.), *C. albidella* (Den. & Schiff.), *C. anatipennella* (Hubn.), *C. betulella* Hein., *C. brevipalpella* Wck., *C. congeriella* Stgr., *C. conspicuella* Zell., *C. coronillae* Zell., *C. directella* Zell., *C. fretella* Zell., *C. gryphipennella* Hubn., *C. hemerobiella* Scop., *C. ibipennella* Zell., *C. kroneella* Fuchs, *C. kuehnella* Goeze, *C. laricella* (Hubn.), *C. limosipennella* (Dup.), *C. lithargyrinella* Zell., *C. lixella* Zell., *C. lutipennella* (Zell.), *C. milvipennis* Zell., *C. ochrea* (Haw.), *C. onopordiella* Zell., *C. ornatipennella* (Hubn.), *C. paripennella* Zell., *C. prunifoliae* Doets, *C. ramosella* Zell., *C. saponariella* Heeg., *C. serratella* (L.), *C. sternipennella* (Zett.), *C. succursella* Herr.-Schaeff., *C. vacciniella* Herr.-Schaeff., *C. vibicella* (Hubn.), *C. vibicigerella* Zell., *C. vicinella* Zell., *C. violacea* (Ström), *C. zelleriella* Hein.

Cosmopterigidae: *Cosmopterix zieglerella* (Hubn.)

Crambidae: *Cataclysta lemnata* (L.), *Cynaeda dentalis* (Den. & Schiff.), *Donacaula forficella* (Thunb.), *Elophila nymphaeata* (L.), *Nymphula nitidulata* (Hfn.), *Titanio normalis* (Hubn.)

Depressariidae: *Agonopterix arenella* (Den. & Schiff.), *A. carduella* (Hubn.), *A. nanatella* (Stt.), *A. propinquella* (Treit.), *A. purpurea* (Haw.)

Elachistidae: *Elachista anserinella* Zell., *E. argentella* (Cl.), *E. bedellella* (Sirc.), *E. bifasciella* Treit., *E. cingillella* (Herr.-Schaeff.), *E. dispilella* Zell., *E. freyerella* (Hubn.), *E. rudectella* Stt., *E. rufocinerea* (Haw.), *E. subalbidella* Schlag., *Stephensia brunnichella* (L.)

Epermeniidae: *Epermenia aequidentellus* (Hofm.), *E. insecurella* (Stt.), *Ochromolopis ictella* (Hubn.)

Eriocraniidae: *Dyseriocrania subpurpurella* (Haw.)

Gelechiidae: *Aproaerema anthyllidella* (Hubn.), *Caryocolum blandella* (Doug.), *Chrysoesthia drurella* (F.), *Ch. sexguttella* (Thunb.), *Neofriseria peliella* (Treit.), *Recurvaria leucatella* (Cl.), *R. nanella* (Den. & Schiff.), *Scrobipalpa artemisiella* (Treit.), *S. atriplicella* (F.R.), *S. ocellatella* (Boyd), *Syncopacma suecicella* (Wolff)

Glyphipterigidae: *Glyphipterix equitella* (Scop.), *Orthotelia sparganella* (Thunb.)

Gracillariidae: *Aspilapteryx limosella* (Dup.), *A. tringipennella* (Zell.), *Callisto coffeella* (Zett.), *C. denticulella* (Thunb.), *Caloptilia alchimiella* (Scop.), *C. cuculipennella* (Hubn.), *C. fidella* (Rtti.), *C. roscipennella* (Hubn.), *C. semifascia* (Haw.), *C. stigmatella* (F.), *Calybites phasianipennella* (Hubn.), *C. quadrisignella* (Zell.), *Cameraria ohridella* Desch. & Dim., *Euspilapteryx auroguttella* Steph., *Gracillaria syringella* (F.), *Micrurapteryx kollariella* (Zell.), *Parectopa ononidis* (Zell.), *P. robiniella* Clem., *Parornix anglicella* (Stt.), *P. anguliferella* (Zell.), *P. betulae* (Stt.), *P. carpinella* (Frey), *P. devoniella* (Stt.), *P. fagivora* (Frey), *P. finitimella* (Zell.), *P. torquillella* (Zell.), *Phyllocnistis saligna* (Zell.), *Ph. unipunctella* (Steph.), *Ph. xenia* Her., *Phyllonorycter acerifoliella* (Zell.), *Ph. agilella* (Zell.), *Ph. blancardella* (F.), *Ph. cerasicolella* (Herr.-Schaeff.), *Ph. comparella* (Dup.), *Ph. corylifoliella* (Hubn.), *Ph. cydoniella* (Den. & Schiff.), *Ph. delitella* (Dup.), *Ph. distentella* (Zell.), *Ph. esperella* (Goeze), *Ph. froelichiella* (Zell.), *Ph. geniculella* (Rag.), *Ph. harrisella* (L.), *Ph. hostis* Trib., *Ph. ilicifoliella* (Dup.), *Ph. insignitella* (Zell.), *Ph. issikii* (Kum.), *Ph. klemannella* (F.), *Ph. lautella* (Zell.), *Ph. leucographella* (Zell.), *Ph. maestingella* (Mull.), *Ph. medicaginella* (Geras.), *Ph. mespilella* (Hubn.), *Ph. messaniella* (Zell.), *Ph. nicellii* (Stt.), *Ph. oxyacanthae* (Frey), *Ph. pastorella* (Zell.), *Ph. platani* (Stgr.), *Ph. populifoliella* (Treit.), *Ph. quercifoliella* (Zell.), *Ph. rajella* (L.), *Ph.*

robiniella (Clem.), *Ph. roboris* (Zell.), *Ph. sagitella* (Bjerk.), *Ph. salicicolella* (Sirc.), *Ph. schreiberella* (F.), *Ph. sorbi* (Frey), *Ph. spinicolella* (Zell.), *Ph. strigulatella* (Lien. & Zell.), *Ph. tenerella* (Joann.), *Ph. tristrigella* (Haw.), *Ph. ulmifoliella* (Hubn.)

Heliozelidae: *Antispila metallella* (Den. & Schiff.), *A. treitschkiella* (F.R.), *Heliozela sericiella* (Haw.)

Lyonetiidae: *Leucoptera malifoliella* (Costa), *L. sinuella* (Rtti.), *Lyonetia clerkella* (L.), *L. prunifoliella* (Hubn.)

Momphidae: *Mompha locupletella* (Den. & Schiff.)

Nepticulidae: *Bohemannia pulverosella* (Stt.), *Ectoedemia agrimoniae* (Frey), *E. caradjai* (Gros.), *E. gilvipennella* (Klim.), *E. hannoverella* (Glitz), *E. heringi* (Toll), *E. klimeschi* (Skala), *E. liechtensteini* (Zimm.), *E. quinquella* (Bed.), *E. rufifrontella* (Cara.), *E. septembrella* (Stt.), *E. spinosella* (Joann.), *E. subbimaculella* (Haw.), *E. turbidella* (Zell.), *Stigmella aceris* (Frey), *S. aeneofasciella* (Herr.-Schaeff.), *S. anomalella* (Goeze), *S. assimilella* (Zell.), *S. atricapitella* (Haw.), *S. aurella* (F.), *S. basiguttella* (Hein.), *S. carpinella* (Hein.), *S. catharticella* (Stt.), *S. centifoliella* (Zell.), *S. confusella* (Wood & Wals.), *S. desperatella* (Frey), *S. freyella* (Heyd.), *S. glutinosae* (Stt.), *S. hemargyrella* (Koll.), *S. hybnerella* (Hubn.), *S. incognitella* (Herr.-Schaeff.), *S. lemniscella* (Zell.), *S. malella* (Stt.), *S. mespilicola* (Frey), *S. microtheriella* (Stt.), *S. nylandriella* (Teng.), *S. obliquella* (Hein.), *S. oxyacanthella* (Stt.), *S. paradoxa* (Frey), *S. perpygmaeella* (Doub.), *S. plagicolella* (Stt.), *S. pretiosa* (Hein.), *S. prunetorum* (Stt.), *S. pyri* (Glitz), *S. regiella* (Herr.-Schaeff.), *S. rhannella* (Herr.-Schaeff.), *S. roborella* (Johan.), *S. ruficapitella* (Haw.), *S. salicis* (Stt.), *S. samiatella* (Zell.), *S. speciosa* (Frey), *S. splendidissimella* (Herr.-Schaeff.), *S. tiliae* (Frey), *S. tityrella* (Stt.), *S. torminalis* (Wood), *S. trimaculella* (Haw.), *S. ulmiphaga* (Preiss.), *S. ulmivora* (Fol.), *S. viscerella* (Stt.), *S. zangherii* (Klim.), *S. zelleriella* (Snell.)

Plutellidae: *Plutella xylostella* (L.)

Pterophoridae: *Platyptilia gonodactyla* (Den. & Schiff.), *Stenoptilia graphodactyla* (Treit.)

Roeslerstammiidae: *Roeslerstammia erxlebella* (F.)

Tischeriidae: *Coptotriche angusticollella* (Dup.), *C. gaunacella* (Dup.), *C. heinemanni* (Wck.), *C. marginata* (Haw.), *Tischeria decidua* (Wck.), *T. dodonaea* (Stt.), *T. ekebladella* (Bjerk.)

Tortricidae: *Ancylys badiana* (Den. & Schiff.), *Archips oporana* (L.), *Cnephasia incertana* (Treit.), *Dichelia histrionana* (Frol.), *Epinotia nanana* (Treit.), *E. tedella* (Cl.), *Pseudohermenias abietana* (F.), *Spilonota ocellana* (Den. & Schiff.), *Zeiraphera ratzeburgiana* (Sax.)

Yponomeutidae: *Argyresthia abdominalis* (Zell.), *A. fundella* (F.R.), *A. laevigatella* Herr.-Schaeff., *Kessleria alpicella* (Stt.), *Ocnerosstoma piniariella* Zell., *Prays fraxinella* (Bjerk.), *Scythropia crataegella* (L.), *Swammerdamia caesiella* (Hubn.), *Yponomeuta cagnagella* (Hubn.), *Y. evonymella* (L.), *Y. malinellus* Zell., *Y. rorrella* (Hubn.), *Y. sedella* Treit.

Zygaenidae: *Adscita geryon* (Hubn.), *A. statices* (L.), *J. budensis* (Ad. & Au. Speyer), *Jordanita chloros* (Hubn.), *J. globulariae* (Hubn.), *J. graeca* (Jordan), *J. notata* (Zell.), *J. subsolana* (Stgr.)

Conclusions

Based on the data from the literature sources, and the data from our research, we have found that 363 species of leaf miners, from orders Coleoptera (21), Diptera (61), Hymenoptera (11) and Lepidoptera (270) have been found in Serbia. They were identified on plants from 205 genera, the majority of them on the plants of the genera: *Quercus* (30), *Prunus* (20), *Malus* (19), and *Populus* (19). The number of leaf miners that were identified in Serbia is not definitive. Considering that European leaf mining insect fauna includes about 2500 species, it is certain that new species will be found in Serbia in the future.

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