



Current state of research into leaf-miner moths (Gracillariidae Stainton, 1854) and their feeding habits in relation to tree plantations in Kyiv

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Abstract. The most common plant-feeding insects in the dendrofauna of populated areas, which are prone to mass reproduction, are leaf-miner moths (Gracillariidae Stainton, 1854). The current state, distribution, and reproduction of leaf-miner moths are poorly understood. The purpose of the study was to identify and evaluate species of phytophagous leaf-miner moths in the woody plants of Kyiv. The study of the biodiversity of leaf-miner moths was conducted during 2023-2025 in the city of Kyiv: botanical gardens, parks, squares, streets with woody plants. The presence of leaf-miner moths was assessed visually by the presence of blotches on tree leaves. For this purpose, 100 leaves were collected from the control tree and taken to the laboratory to determine and identify the moth species. The species affiliation of leaf-miner moths was estimated using entomofauna determinants. The occurrence index (P_i) and the dominance index (D_i) were used to characterise the leaf-miner moth species complex. The study identified and described 20 species of leaf-miner moths of the family Gracillariidae (Lepidoptera), which are trophically associated with more than 49 species of host tree plants. These were mostly oligophages. Analysis of the settlement of various species of leaf-miner moth on woody plants in Kyiv showed the following: the highest level of available blotches on the leaves of the plants under study was noted in botanical gardens – 95% of 20 species of leaf-miner moths and parks – 75%. The presence of blotches on the leaves of the studied street trees was observed in 40% of the total number of leaf-miner moth species assessed. According to the indices of occurrence and dominance, it was determined that in the studied locations of woody plants in Kyiv, the dominant ones were *Cameraria ohridella* (95.12%), *Phyllonorycter populifoliella* (83.24%) and *Gracillaria syringella* (53.23%). The results of the study were of scientific value for investigating the biocoenotic relationships between phytophages and

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food plants in urban phytocoenoses and of practical importance for the selection of tree species resistant to blotching phytophages used in urban landscaping

Keywords: phytophage; invasive species; monitoring; occurrence index; host plants; abundance

INTRODUCTION

Landscaping of urban settlements, especially megacities, plays an important role in cleaning the air, soil, and creating favourable conditions for recreation of the population. F.-F. Li *et al.* (2024) identified the presence, mass reproduction, and feeding of phytophagous insects as factors contributing to the decline in the physiological, ornamental, and aesthetic qualities of woody plants. A. Ricciardi *et al.* (2021) called the problem of uncontrolled expansion of adventitious pests too urgent, which belongs to one of the most acute environmental problems at the global level, since urban green spaces are the most susceptible to the penetration and further spread of invasive species. In particular, this is facilitated by the import and use of new plant species, the emergence of new ecological niches, a favourable microclimate for the development of phytophages, etc. The same authors, A. Ricciardi *et al.* (2021), noted in their paper that invasive species pose a significant threat to tree stands in cities and forests. H.E. Roy *et al.* (2023) noted that biological invasions are recognised as a growing problem worldwide, with significant environmental, economic, and socio-cultural impacts. O.V. Selutina *et al.* (2020) noted that in the tree stands of large cities, the dominant and harmful arthropod species are those that have recently begun to reproduce en masse, namely the leaf-miner moths (Gracillariidae Stainton, 1854). The number of species of leaf-miner moths and their population is increasing with each growing season, posing a threat of damage and a reduction in the ornamental value of tree plantations, and environmental pollution from their excrement, which causes allergic reactions in humans. C. Diagne *et al.* (2021) concluded that biological invasions of alien species pose a global threat to biodiversity and human well-being. However, as stated by F.-F. Li *et al.* (2024), governance measures remain largely fragmented across different scales, sectors, and boundaries. Therefore, controlling biological intrusions and their impact requires more than isolated interventions: a globally coordinated system based on scientific information, political will, and public involvement.

The research by I.A. Zaitseva & I.A. Lazarev (2024) noted that in Ukraine, more than two dozen blotching phytophagous insects of the family Gracillariidae have been recorded on the trees of urban areas. Furthermore, L. Vagaliuk *et al.* (2024) noted that the appearance and reproduction of these insect species increased in 2004-2024. For the most part, these are invasive species: *Phyllonorycter platani* (Staudinger, 1870), *Phyllonorycter issikii* (Kumata, 1963), *Cameraria ohridella* (Deschka & Dimic, 1986). M. Zhussip *et al.* (2023) noted that alien species, having entered a new territory in favourable conditions for their development and reproduction, with a sufficient amount of food resource and, importantly, the absence of natural entomophages, multiply extremely rapidly in large numbers, expanding their range and thereby causing significant damage to local and national budgets. C. Diagne *et al.* (2021) in their paper showed that total recorded invasion costs have reached at least USD 1.288 trillion over the past few decades (1970-2017), with an average annual cost of USD 26.8 billion. Moreover, they estimated that the average annual cost could reach USD 162.7 billion. The researchers pointed out that these costs are underestimated, there is no slowdown in the pace, but on the contrary – there is a constant threefold increase over a decade. Furthermore, D.F. Sax *et al.* (2022) noted that among invasive insects, the spread of adventive phytophagous insect species – that is, insects that feed on the photosynthetic apparatus of plants – is becoming increasingly significant; resulting in leaf damage, which significantly affects the physiological condition of plants, leads to their weakening, and repeated damage – to their death.

As a result of the analysis of sources on the selected problem, it was found that the current state, distribution, and reproduction of leaf-miner moths are insufficiently investigated, which was the goal of this study. Thus, the investigation of the biology and ecology of invasive species of phytophagous insects in the conditions of Ukraine is an urgent task. Control of the appearance and

reproduction of alien entomofauna species and prevention of the establishment of insect colonies in urban ecosystems of woody plants is possible through constant environmental monitoring and thorough data analysis. The purpose of the study was to identify and investigate species of leaf-miner moth, which are phytophages of woody plants in the city of Kyiv.

MATERIALS AND METHODS

The study of the biodiversity of leaf-miner moths (Gracillariidae Stainton, 1854) was conducted during the growing seasons of 2023-2025 at 10-day intervals across 17 study sites in Kyiv: the M.M. Hryshko National Botanical Garden of the NAS of Ukraine, the National University of Life and Environmental Sciences (NULES) of Ukraine Botanical Garden, and park and street plantings, including Holiivskyi Park, Kurenivskyi Park, Dubky Park (Syretskyi Hai), Peremoha Park, Natalka Park, Heydar Aliyev Square, and Holiivskyi Avenue, Druzhby Narodiv Boulevard, Beresteiskyi Avenue, Taras Shevchenko Boulevard, Lesia Ukrainka Boulevard, and the following streets: Khreshchatyk, Saksahanskoho Street, Bohatyrskaya Street, Olena Teliha Street, and Vyshhorodska Street. A total of 147 model trees representing different species were surveyed (3 model trees per species: 49×3), including: small-leaved linden (*Tilia cordata* Mill.), horse chestnut (*Aesculus hippocastanum* L.), oriental plane (*Platanus orientalis* L.), white poplar (silver) (*Populus alba* L.) and european aspen (*Populus tremula* L.), black locust (*Robinia pseudoacacia* L.), silver birch (*Betula pendula* Roth.), black alder (*Alnus glutinosa* (L.) Gaerth.), scots pine (*Pinus silvestris* L.), silver maple (*Lactinium saccharinum* (Wieri), wych elm (*Ulmus glabra* Huds.), large-leaved linden (*Tilia platyphyllos* Scop.) etc. The objects of the study were leaves of woody plants (100 from each model tree) with the presence of blotches, which were marked primarily visually. Leaves from the test trees were selected at random, placed in paper bags, labelled with the location, tree species and date, and transferred to the laboratory for the identification and analysis of the species classification of the leaf-miner moths. The material was collected according to standard methods of inspection, detection, fixation, and determination of blotching dendrophagous insects according to methods by V.L. Meshkova &

S.V. Nazarenko (2012) and S.V. Stankevych & S.V. Gornovska (2022). The identification of blotches from leaf-miner moth on the leaves of food plants was carried out using the method developed by the Spanish entomologist C. Lopez-Vaamonde *et al.* (2021) and determinants of entomological biodiversity (Ellis, n.d.). The names of leaf-miner moths were compared according to the electronic catalogue "Fauna Europa" (De Jong, 2024). To determine the population and number of phytophages of woody plants, 100 leaves were selected randomly from the control tree in June-August with an interval of 7-10 days (Silchuk *et al.*, 2016; Lesovoy *et al.*, 2020). The task of the research was not to determine the stage of development of leaf-miner moths, but only the presence of phytophagous blotches and the emergence of a new habitats. The sex of leaf-miner moth species was determined using the method by O.I. Silchuk *et al.* (2016). The occurrence Index (P_i) and the dominance index (D_i) were used to characterise the leaf-miner moths complex. The occurrence index was determined by the ratio of the number of samples (n_i), in which leaf-miner moth were detected (regardless of the number of individuals in the sample) to the total number of samples (N):

$$P_i = (n_i / N) \cdot 100\%. \quad (1)$$

The dominance index was determined by how much this species dominated over other identified species both by the frequency of occurrence and the number of individuals in the focus:

$$D_i = P_i N_i / N_s, \quad (2)$$

where P_i – occurrence of the species, N_i – number of individuals of another species, N_s – total number of individuals.

Identification of leaf-miner moths was carried out according to entomofauna determinants (Lisovoy *et al.*, 1999; De Prins & De Prins, n.d.). The names of insects were given according to the electronic catalogue "Fauna Europaea" (De Jong, 2016). The food plants of the studied species of entomological biodiversity were listed in accordance with the methods described in the National Catalogue of Biotopes of Ukraine and the Classification of Shrub Biotopes of Ukraine (Didukh, 2017; Kuzemko *et al.*, 2018).

RESULTS AND DISCUSSION

Between 2023 and 2025, the phytosanitary condition of tree stands in various locations across Kyiv was investigated for the presence of leaf-miner moth larvae in the foliage (districts: Holosiivskyi, Shevchynkyi, Darnytskyi, Pecherskyi, Obolonskyi, Podilskyi, Dnipro, Solomianskyi,

Sviatoshynskyi). During the study period, the taxonomic composition of leaf-miner moths of the family Gracillariidae (Lepidoptera) was identified and recorded in the wooded areas of the city of Kyiv, which are trophically connected with 49 types of food plants. The identified species are listed in Table 1.

Table 1. Species composition of leaf-miner moth (Gracillariidae) that are trophically associated with their host tree species

Species composition, quantity	
Phytophages	Woody host plants
<i>Caloptilia semifascia</i> (Haworth, 1828)	<i>Acer negundo</i> L., <i>Acer platanoides</i> L., <i>Acer campestre</i> (L.)
<i>Caloptilia rufipennella</i> (Hübner, 1796)	<i>Acer platanoides</i> L., <i>Acer saccharinum</i> L.
<i>Cameraria ohridella</i> (Deshka & Dimic, 1986)	<i>Aesculus hippocastanum</i> L.
<i>Gracillaria syringella</i> (Fabricius, 1794)	<i>Syringa vulgaris</i> L., <i>Symphoricarpos albus</i> (L.) Blake, <i>Euonymus</i> sp., <i>Fraxinus excelsior</i> L., <i>Ligustrum</i> sp., <i>Forsythia</i> sp., <i>Jasminum fruticans</i> L.
<i>Parectopa robinella</i> (Clemens, 1863)	<i>Robinia pseudoacacia</i> L., <i>R. pseudoacacia</i> L. 'Pyramidalis', <i>R. pseudoacacia</i> L. 'Unifolia', <i>R. viscosa</i> Vent.
<i>Phyllocnistis labyrinthella</i> (Bjerkander, 1790)	<i>Populus alba</i> L., <i>P. × berolinensis</i> (K. Koch) Dipp., <i>P. × canescens</i> (Ait.) Smith, <i>P. italica</i> (Du Roi) Moench, <i>P. nigra</i> L., <i>P. simonii</i> Carr.
<i>Phyllonorycter acerfoliella</i> (Zeller, 1839)	<i>Acer saccharinum</i> L.
<i>Phyllonorycter agilella</i> (Zeller, 1846)	<i>Ulmus glabra</i> Huds.
<i>Phyllonorycter blancardella</i> (Fabricius, 1781)	<i>Malus</i> Mill.
<i>Phyllonorycter cerasicolella</i> (Herrich-Schaffer, 1855)	<i>Cerasus vulgaris</i> Mill. (<i>Prunus cerasus</i> L.)
<i>Phyllonorycter coryli</i> (Nicelli, 1851)	<i>Coryllus avellana</i> L.
<i>Phyllonorycter emberizaepenella</i> (Bouche, 1834)	<i>Lonicera tatarica</i> L., <i>Lonicera xylosteum</i> L., <i>Symphoricarpos albus</i> L.
<i>Phyllonorycter guercifoliella</i> (Zeller, 1839)	<i>Quercus robur</i> L.
<i>Phyllonorycter issikii</i> (Kumata, 1963)	<i>Tilia cordata</i> Mill., <i>T. platyphyllos</i> Scop.
<i>Phyllonorycter platani</i> (Staudinger, 1870)	<i>Platanus orientalis</i> L., <i>P. acerifolia</i> (Ait.) Wild.
<i>Phyllonorycter populifoliella</i> (Treitschke, 1833)	<i>Populus italica</i> (Du Roi) Moench, <i>P. nigra</i> L.
<i>Phyllonorycter salicicolella</i> (Sircom, 1848)	<i>Populus nigra</i> L., <i>Salix alba</i> L.
<i>Phyllonorycter sorbi</i> (Frey, 1855)	<i>Sorbus aucuparia</i> L., <i>Cotoneaster Medik.</i> , <i>Crataegus</i> L., <i>Malus</i> Mill., <i>Padus</i> Mill., <i>Prunus</i> L.
<i>Phyllonorycter ulmifoliella</i> (Hübner, 1817)	<i>Betula pendula</i> Roth., <i>Betula pubescens</i> Ehrh.
<i>Phyllocnistis labyrinthella</i> (Bjerkander, 1790)	<i>Populus alba</i> L., <i>P. tremula</i> L.
20	49

Source: developed by the authors

As a result of the research, it was determined that the identified phytophagous species were divided into groups according to their trophic specialisation: polyphages – 2 species, oligophages – 12 species, monophages – 6 species. Analysis of the distribution of leaf-miner moths in various types of tree stands in Kyiv showed that most of the species were recorded in the M.M. Hryshko Botanical Garden of the NAS of Ukraine and the Botanical Garden of the NULES of Ukraine (19 species), and in parks of varying sizes (Holosiivskyi, Kurenivskyi, and Peremoha) – 15 species. An analysis of the distribution of

various species of striped moths on woody plants in Kyiv was carried out, and the following was observed: the proportion of leaves infested on the trees in botanical gardens accounted for 95% of the total number of species (20) of leaf-miner moths identified, and in parks – 75%. In the street tree stands under study, which were used for landscaping, the presence of the blotches by leaf-mining moths accounted for only 40% of the total number of blotching insects. The difference in the number of identified leaf-mining moth species in botanical gardens and parks, according to the authors, may lie in the species range of woody

plant species. The aforementioned botanical gardens include hundreds of species and subspecies of woody plants, whereas this diversity is considerably lower in the parks mentioned. For example, the dominant tree species in Holosiivskyi Park is European hornbeam (*Caprilus betulus* L.), in Kurenivskyi Park it is small-leaved linden (*Tilia cordata* Mill.), and in Peremoha Park the

dominant species are black alder (*Alnus glutinosa* (L.) Gaerth.), poplar (*Populus* L.), and scots pine (*Pinus silvestris* L.). 8 species of leaf-mining moths were found on woody plants growing along roads with heavy traffic (Table 2). Noise and gas pollution from car exhaust gases play the role of a repellent barrier, as evidenced by the low number of phytophagous insects (8 species).

Table 2. Distribution of identified leaf-mining moth species by types of plantings in Kyiv (2023-2025)

Type of phytophage	Tree stands		
	Botanical gardens	Parks and squares	Streets
<i>Caloptilia semifascia</i>	+	+	-
<i>Caloptilia rufipennella</i>	+	+	-
<i>Cameraria ohridella</i>	+	+	+
<i>Gracillaria syringella</i>	+	+	-
<i>Parectopa robiniella</i>	+	+	+
<i>Phyllocnistis labyrinthella</i>	+	+	+
<i>Phyllonorycter acerifoliella</i>	+	+	-
<i>Phyllonorycter agilella</i>	+	+	-
<i>Phyllonorycter blancardella</i>	+	+	-
<i>Phyllonorycter cerasicolella</i>	+	+	+
<i>Phyllonorycter coryli</i>	+	-	-
<i>Phyllonorycter emberisaepenella</i>	+	-	-
<i>Phyllonorycter guercifoliella</i>	+	-	-
<i>Phyllonorycter issikii</i>	-	+	+
<i>Phyllonorycter platani</i>	+	-	+
<i>Phyllonorycter populifoliella</i>	+	+	+
<i>Phyllonorycter salicicolella</i>	+	+	-
<i>Phyllonorycter sorbi</i>	+	-	-
<i>Phyllonorycter ulmifoliella</i>	+	+	-
<i>Phyllocnistis labyrinthella</i>	+	+	+
Total:	19	15	8

Note: “+” – detected; “-” – species not present

Source: developed by the authors

An ecological analysis of the results (Table 2) on the presence of mottled moths in different stations was carried out and it was determined that botanical gardens, parks, squares, and tree stands along the streets are different in species abundance and number of tree species, which was reflected in trophic relationships with phytophagous insects. Botanical gardens and parks contain the full range of tree host plants for leaf-mining moths; the trees are more remote and protected from anthropogenic and abiotic factors that affect the insect fauna, and consequently 19 out of the 20 species of the leaf-mining moth insect complex have been recorded. Completely different features in tree stands along the streets are a

significant impoverishment of the species composition of plants (1, less often 2 species), which is a limiting factor in the development of diversity of all 20 species of leaf-mining moth. The following species have been recorded, mainly monophagous species of tree plants: *Cameraria ohridella* (Deshka & Dimic, 1986), *Parectopa robiniella* (Clemens, 1863) and, less frequently, oligophagous species – *Phyllonorycter issikii* (Kumata, 1963).

According to the calculation of the occurrence indices (equation 1) of leaf-mining moths on woody plants of certain research sites, it was noted that the plants were most frequently damaged by *Cameraria ohridella* – 7.51%, and *Phyllonorycter populifoliella* – 4.52%. Based on the calculations of

the dominance indices (equation 2), it was established that in the tree stands of Kyiv, three types of leaf-mining moth were dominant: *Cameraria ohridella*, *Phyllonorycter populifoliella*, *Gracillaria syringella* – 95.12%, 83.24%, 53.23%, accordingly. Two species of leaf-miner moths have been recorded in the tree plantations of Kyiv: *Phyllonorycter platani* (Holosiivskiy Avenue) and *Phyllonorycter emberizaepenella* (Heydar Aliyev Square), which, according to an analysis of the literature for the period 2016–2025, are classified as invasive species in the region under study. Both species are oligophages, which means that there are all prerequisites for their mass reproduction, which can have negative consequences for trophically related woody plants in the research region. The researchers noted that the establishment of a new range for invasive species of leaf-mining moth was determined by a combination of climatic factors, the absence of natural entomophages, and the distribution of woody plants that are trophically linked to the phytophages. For example, the expansion of the range of the Oriental plane (*Platanus orientalis* L.) and London plane *P. acerifolia* (Ait.) Wild. from the southern region to Kyiv contributed to the expansion of the range of *Phyllonorycter platani* (Staudinger, 1870) in this region, although the cause and route of penetration of the invasive phytophage is unknown.

After analysing the distribution of blotching phytophagous insects in other localities and countries, the ambiguity of settlement, and reproduction of invasive blotching insects and their interaction with woody host plants was noted. N. Kirichenko *et al.* (2019) noted that leaf miners are a taxonomically diverse group of endophagous insects. Some of them are harmful in forestry, horticulture, and agriculture, and some have become major invasive species. The researchers also described the biological characteristics of invasive leaf miners of woody plants and listed 12 invasive leaf-mining species found in the study area, belonging to four different orders of insects. For each of them, N. Kirichenko *et al.* briefly described their intrusions, including their pathways, impact and management methods, and ecology. Some species have a significant economic impact as garden pests, such as citrus miner (*Phyllocnistis citrella*), or as pests of ornamental plants, such as the horse-chestnut leaf miner (*Cameraria ohridella*).

The researchers noted that the ecological impact of these species should be better studied, especially those that destroy native trees such as the beech leaf weevil (*Orchestes fagi*) in Canada. The presented study covered only leaf-mining moth of the family Gracillariidae and 20 species estimated within Kyiv, which allowed comparing the results obtained with a wider list of invasive leaf miners, given in the paper by N. Kirichenko *et al.* (2019). Comparison of data on the distribution routes of phytophages confirmed the conclusions of these researchers about the need for further studies of the mechanisms of their settlement, and the search for local natural parasitoids as an important biological method for controlling the number of invasive species.

K.K. Holoborodko *et al.* (2021) noted that the complex of invasive phytophagous insect species that can adapt to new living conditions is constantly growing. The ecological effect of their vital activity in the new environment is almost impossible to predict, and as a result, economically undesirable invasions are often observed. The horse-chestnut leaf miner (*Cameraria ohridella*) (Deschka & Dimič, 1986, Gracillariidae) is one of these problematic invasive species in the introduced range of the horse chestnut (*Aesculus hippocastanum* (Linnaeus, 1753), Sapindaceae). The researchers investigated the impact *C. ohridella* on the state of the photosynthetic apparatus of *A. hippocastanum* leaves and studied the effect of caterpillar feeding *C. ohridella* on the functional state and activity of the photosynthetic apparatus of horse chestnut trees. In this study, changes in photosynthetic activity in the leaves of horse-chestnut under the influence of feeding horse-chestnut leaf miner larvae were not analysed. K.K. Holoborodko *et al.* (2021) and literature data allowed comparing them with the results obtained and emphasising the relevance of research aimed at creating forms of *A. hippocastanum* that are more resistant to the enzymatic effects of *C. ohridella* larvae.

I.A. Zaitseva & A.S. Lazariyev (2022) in their research for the first time compared the population of walnut (*Juglans regia* L.) and two types of invasive phytophages – *Aceria erinea* (Nalepa, 1891) and *A. tristriata* (Nalepa, 1890) in the city of Dnipro (Ukraine) on 75 trees. The average population of these phytophages was 42.8%. No phytophages were observed in a separate study area (Tunnelna



Balka tract). Further, the researchers noted that the population of *A. tristriata* on the trees *J. regia* was 27.3%, which was higher than the population of *A. erinea* (15.5%) by 11.8%. The average number of galls per leaf of *J. regia* caused by the pest *A. erinea* was 1-6.2, whereas that caused by *A. tristriata* – 19.1-144.2. Further research on the ecology of invasive phytophages *J. regia* is planned. Although the present study did not analyse the population of invasive species on walnut, the results obtained by I.A. Zaitseva & A.S. Lazariev (2022) provide an opportunity to compare their observations with the results obtained in this study and confirm the feasibility of further studies of the ecology of invasive phytophages in wider areas of distribution of the same tree species.

O.V. Seliutina *et al.* (2020) conducted a study and analysed the dynamics of leaf damage, the content of easily soluble proteins, benzidine peroxidase activity, and the composition of acid enzyme isoforms in leaves of *Aesculus hippocastanum* L. under the influence of colonisation and nutrition of the horse-chestnut leaf miner (*Cameraria ohridella*) (Deschka et Dimić) (Lepidoptera, Gracillariidae) and noted that the horse chestnut responds specifically to larval nutrition of *C. ohridella* due to changes in the activity of individual peroxidase isoenzymes, the expression of which varies across the entire spectrum. In horse chestnut leaves with a high level of damage caused by the horse-chestnut leaf miner, the expression of enzyme isoforms in the pH range of 4.08-4.15 is significantly enhanced, which may be regarded as a reliable biochemical marker of the sensitivity of *A. hippocastanum* plants to feeding by the phytophagous insect *C. ohridella*. This study focused on identifying infestations of tree species in Kyiv by the leaf-miner moth in various locations and on identifying the moths themselves, thereby enabling the results to be compared with the biochemical indicators of the reaction of *Aesculus hippocastanum* described in the paper by O.V. Seliutina *et al.* (2020). This comparison indicated the feasibility of further studies of biochemical changes in the leaves of woody plants that occur in response to the nutrition and development of tunnelling phytophagous insects.

V. Tytar *et al.* (2022) associated spread and outbreaks of phytophagous pests with global warming. In addition to economic interest, the

species under study may be biological indicators of climate change. As an example, the researchers investigated the locust leaf-miner moth (*Parectopa robiniella* (Clemens, 1863) (Lepidoptera: Gracillariidae), which is actively spreading across the continent. Using a georeferenced record of *P. robiniella* across Europe and the Bayesian additive regression tree (BART) algorithm, the researchers modelled the distribution of the leaf-miner moth. The researchers concluded that, among the factors determining the ecological niche of *Parectopa robiniella* Clemens, 1863, temperature conditions are the key factor facilitating the spread and natural adaptation of this phytophagous insect. Results of the study by V. Tytar *et al.* (2022) regarding the determining role of temperature conditions in the spread and natural adaptation of phytophage are consistent with the observations. A comparison of these findings with the results of the study also indicates that the distribution range of the host plant, which is trophically linked to the pest, plays an important role in the establishment of secondary ranges for invasive species of leaf-miner moths, particularly in the case of monophagous or oligophagous species.

I.M. Shvydenko *et al.* (2021) noted that *Parectopa robiniella* (Clemens, 1863) is a native species of North America that spread to Italy, Slovenia, Croatia, Austria, Slovakia, Romania, Hungary, and Ukraine in the 1980s. *Phyllonorycter robiniella* (Clemens, 1859) is also of North American origin. The leaf-miner moth was found in Switzerland in 1983, France, Germany, Italy in 1988, Austria in 1990, Slovakia in 1992, Slovenia in 1994, Hungary in 1996, the Netherlands in 1999, and Bulgaria in 2003. At present, both Robinia-associated phytophagous species are distributed in 19 European countries. In Ukraine, these species appeared relatively recently and are insufficiently studied. The researchers investigated some bioecological features of *P. robiniella* and *Ph. robiniella* in the conditions of the Kharkiv region: the density of tunnels/leaves, the swarming dynamics, and the state of populations. Bioecological features of these invasive species of blotching phytophages were not analysed in this study, since attention was focused on describing the appearance and development in Kyiv of such types as *Cameraria ohridella* (Deschka & Dimić, 1986), *Phyllonorycter platani* (Staudinger, 1870), *Phyllonorycter issikii* (Kumata, 1963)



etc., results for which were obtained in previous studies. Comparison of these data with results by I.M. Shvydenko *et al.* (2021) provided an opportunity to contrast the features of the spread and development of invasive blotching phytophages in different regions of Ukraine.

M. Paterska *et al.* (2025) analysed the phytosanitary status of horse chestnut trees, susceptible and resistant varieties, against *Cameraria ohridella* (Deschka & Dimić) in Europe and noted that this invasive phytophage colonises trees of the genus *Aesculus* every year throughout Europe, causing dark brown damage (tunnels) that gradually cover the surface of the leaves. As a result of the studies, the profiles of volatile organic compounds (VOCs) released by chestnut leaves with different susceptibility to phytophage were compared, and the results of changing the profiles in which the larvae fed were evaluated. The study included susceptible tree species *Aesculus turbinata* and resistant trees *Aesculus glabra* and *A. parviflora* during the three growing seasons, leaf damage and VOC profile were analysed biweekly, from May to September. Leaf damage progressively grew in *A. turbinata* throughout all seasons. VOC profiles differed both qualitatively and quantitatively between trees of favourable and resistant species. Results by M. Paterska *et al.* (2025) on differences in the profiles of volatile organic compounds in susceptible and resistant species of *Aesculus* formed an important basis for comparison with the results of this study, in which such biochemical parameters were not analysed, since this was not part of the tasks set. Comparison of these data with the results obtained highlights the feasibility of further biochemical studies of changes in the leaves of woody plants that occur in response to the nutrition and development of tunnelling phytophagous insects.

Thus, the reasons for the appearance, behaviour, and settlement of new territories by invasive biodiversity species in Europe and Ukraine are not sufficiently studied. Problems of invasive leaf-miner moth species in tree stands in Kyiv are significant and ignoring this issue will be costly in the not-too-distant future. To avoid negative unpredictable consequences, monitoring studies on the state of appearance and development of invasive species in the research region are necessary.

CONCLUSIONS

As a result of research (2023-2025), 20 species of leaf-miner moths were identified on tree stands in Kyiv, which systematically belong to the family Gracillariidae. It was established that the number of studied species of leaf-miner moths, which are trophically related to 49 species of host trees growing in botanical gardens, parks, and along highways in Kyiv, is: in botanical gardens – 95% of the 20 species of leaf-miner moths, parks – 75%, outdoor tree stands – 40% of the total number of estimated species of leaf-miner moth. The analysis of leaf-miner moths by trophic specialisation with woody plants was carried out and it was determined that 6 of them are polyphages, 14 are oligophages, and 3 are monophages. The group of oligophages was found to be the most numerous in terms of trophic specialisation, suggesting that the group of phytophages is potentially best adapted to the new conditions. The invasive phytophagous insects identified as dominant in the tree stands of Kyiv, based on the dominance index, were: *C. ohridella*, *P. populifoliella*, and *G. syringella*, with dominance indices of 95.12%, 83.24%, and 53.23%, respectively. Two species of leaf-miner moths have been recorded in the tree stands of Kyiv: *Phyllonorycter platani* and *Phyllonorycter emberizaepenella*, both of which are classified as invasive species in the study region. To date, it is not known for certain how these alien insect species in the tree plantations of the studied locations in Kyiv first appeared, adapted, and proliferated. There is an assumption that the presence of woody host plants in research sites based on trophic relationships contributes to the reproduction of alien entomofauna species in new biocoenoses (Kyiv, Ukraine).

Thus, given the above, it can be stated that the rate of infestations, the absence of natural entomophages, the ecological plasticity that invader species of the Gracillariidae family are endowed with, and research on the state of their populations, are important for science, namely, the ecology of entomological species. Prospects for further research are associated with an in-depth study of trophic relationships of leaf-miner moths, in particular invasive species, which will allow substantiating and developing effective strategies for regulating their numbers and improving the system of protection of tree stands of settlements from



common invasive entomological phytophages of ornamental and landscape crops in the city of Kyiv. None.

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CONFLICT OF INTEREST

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REFERENCES

- [1] De Jong, Y. (2016). *Fauna Europaea*. Berlin: Fauna Europaea Consortium. doi: [10.15468/ymk1bx](https://doi.org/10.15468/ymk1bx).
- [2] De Prins, J., & De Prins, W. (n.d.). *Global taxonomic database of Gracillariidae (Lepidoptera)*. CERN: World Wide Web electronic publication.
- [3] Diagne, C., Leroy, B., Vaissie're, A.-C., Gozlan, R.E., Roiz, D., Jaric, I., Salles, J.-M., Bradshaw, C.J.A., & Courchamp, F. (2021). High and rising economic costs of biological invasions worldwide. *Nature*, 592, 571-576. doi: [10.1038/s41586-021-03405-6](https://doi.org/10.1038/s41586-021-03405-6).
- [4] Didukh, Ya.P. (2017). A classification scheme of shrub biotopes of Ukraine. *Ukrainian Botanical Journal*, 74(4), 347-354. doi: [10.15407/ukrbotj74.04.347](https://doi.org/10.15407/ukrbotj74.04.347).
- [5] Ellis, W.N. (n.d.). *Leafminers and plant galls of Europe*. Retrieved from <http://www.bladmineerders.nl>.
- [6] Holoborodko, K.K., Seliutina, O.V., Ivanko, I.A., Alexeyeva, A.A., Shulman, M.V., & Pakhomov, O.Y. (2021). Effect of *Cameraria ohridella* feeding on *Aesculus hippocastanum* photosynthesis. *Regulatory Mechanisms in Biosystems*, 12(2), 346-352. doi: [10.15421/022147](https://doi.org/10.15421/022147).
- [7] Kirichenko, N., Augustin, S., & Kenis, M. (2019). Invasive leafminers on woody plants: A global review of pathways, impact, and management. *Journal of Pest Science*, 92, 93-106. doi: [10.1007/s10340-018-1009-6](https://doi.org/10.1007/s10340-018-1009-6).
- [8] Kuzemko, A.A., Didukh, Ya.P., Onyshchenko, V.A., & Sheffer, Ya. (Eds.). (2018). *National catalogue of biotopes of Ukraine*. Kyiv: Individual Entrepreneur Klymenko Yu.Ya.
- [9] Lesovoy, N., Fedorenko, V., Viger, S., Chumak P., Kliuchevych M., Strygun, O., Stoliar, Retman, M., & Vagaliuk, L. (2020). Biological, trophological, ecological and control features of horse-chestnut leaf miner (*Samegagia ohridella* Deschka & Dimic). *Ukrainian Journal of Ecology*, 10(3), 24-27. doi: [10.15421/2020_128](https://doi.org/10.15421/2020_128).
- [10] Li, F.-F., Hao, Q., Cui, X., Lin, R.-Z., Luo, B.-S., & Ma, J.-S. (2024). Global invasive alien plant management lists: Assessing current practices and adapting to new demands. *Plant Diversity*, 47, 666-680. doi: [10.1016/j.pld.2024.11.002](https://doi.org/10.1016/j.pld.2024.11.002).
- [11] Lisovoy, M.P., Bubylyk, L.I., Vasechko, G.I., & Vasylyev, V.P. (1999). *Handbook on plant protection*. Kyiv: Urojai.
- [12] Lopez-Vaamonde, C., Kirichenko, N., & Ohshima, I. (2021). Collecting, rearing, and preserving leaf-mining insects. In *Measuring arthropod biodiversity* (pp. 439-466). Cham: Springer. doi: [10.1007/978-3-030-53226-0_17](https://doi.org/10.1007/978-3-030-53226-0_17).
- [13] Meshkova, V.L., & Nazarenko, S.V. (2012). *Phyllonorycter platani (Staudinger, 1870) (Lepidoptera: Gracillariidae) in the Kherson region*. *Proceedings of the Kharkiv Entomological Society*, 20(2), 63-64.
- [14] Paterska, M., Bandurska, H., Dziadas, M., Zawieja, B., & Chadzinikolaou, T. (2025). Analysis of the profile of volatile compounds during the growing season in leaves of *Aesculus* trees differing in susceptibility to horse chestnut leaf miner (*Cameraria ohridella* Deschka & Dimić). *Molecules*, 30(3), article number 518. doi: [10.3390/molecules30030518](https://doi.org/10.3390/molecules30030518).
- [15] Ricciardi, A., et al. (2021). Four priority areas to advance invasion science in the face of rapid environmental change. *Environmental Reviews*, 29(2), 119-141. doi: [10.1139/er-2020-0088](https://doi.org/10.1139/er-2020-0088).
- [16] Roy, H.E., et al. (2023). *IPBES Invasive alien species assessment: Chapter 1. Introducing biological invasions and the IPBES thematic assessment of invasive alien species and their control*. Bonn: IPBES secretariat.
- [17] Sax, D.F., Schlaepfer, M.A., & Olden, J.D. (2022). Valuing the contributions of non-native species to people and nature. *Trends in Ecology & Evolution*, 37(12), 1058-1066. doi: [10.1016/j.tree.2022.08.005](https://doi.org/10.1016/j.tree.2022.08.005).
- [18] Seliutina, O.V., Shupranova, L.V., Holoborodko, K.K., Shulman, M.V., & Bobylev, Y.P. (2020). Effect of *Cameraria ohridella* on accumulation of proteins, peroxidase activity and composition in *Aesculus hippocastanum* leaves. *Regulatory Mechanisms in Biosystems*, 11(2), 299-304. doi: [10.15421/022045](https://doi.org/10.15421/022045).



- [19] Shvydenko, I.M., Stankevych, S.V., Goroshko, V.V., Bulat, A.G., Cherkis, T.M., Zabrodina, I.V., Lezhenina, I.P., & Baidyk, H.V. (2021). Adventitious leaf miner *Parectopa robiniella* Clemens, 1863 and *Phyllonorycter robiniella* Clemens, 1859 on a black locust tree in the Kharkiv region. *Ukrainian Journal of Ecology*, 11(7), 22-32. doi: [10.15421/2021_172](https://doi.org/10.15421/2021_172).
- [20] Silchuk, O.I., Chumak, P.Ya., Viger, S.M., Kovalchuk, V.P., & Lisovyi, M.M. (2016). Small-leaved linden (*Tilia cordata* Mill.) and its invasive phytophagous moth *Phyllonorycter issikii* Kumata, *Agroecological Journal*, 2, 134-138. doi: [10.33730/2077-4893.2.2016.249128](https://doi.org/10.33730/2077-4893.2.2016.249128).
- [21] Stankevych, S.V., & Gornovska, S.V. (2022). *Methods of detecting, collecting, and preserving insects*. Zhytomyr: Publishing house "Ruta".
- [22] Tytar, V., Nekrasova, O., Marushchak, O., Pupins, M., Skute, A., Čeirāns, A., & Kozynenko, I. (2022). The spread of the invasive locust digitate leafminer *Parectopa robiniella* Clemens, 1863 (Lepidoptera: Gracillariidae) in Europe, with special reference to Ukraine. *Diversity*, 14(8), article number 605. doi: [10.3390/d14080605](https://doi.org/10.3390/d14080605).
- [23] Vagaliuk, L., Lisovyy, M., & Palamarchuk, S. (2024). *Biodiversity and its conservation*. Kyiv: National University of Life and Environmental Sciences of Ukraine.
- [24] Zaitseva, I., & Lazariyev, A. (2024). Phytosanitary state of walnut (*Juglans regia* L.) in the green plantings of the Dnipro city. *Scientific Reports of the National University of Life and Environmental Sciences of Ukraine*, 20(3). doi: [10.31548/dopovidi.3\(109\).2024.017](https://doi.org/10.31548/dopovidi.3(109).2024.017).
- [25] Zaitseva, I.A., & Lazariyev, A.S. (2022). Harmfulness of invasive species gall mites (Acariformes: Eriophyidae) – phyllophages *Juglans regia* L., in urbocenoses of Dnipro city. *Scientific Reports of the National University of Life and Environmental Sciences of Ukraine*, 18(2). doi: [10.31548/dopovidi2022.02.011](https://doi.org/10.31548/dopovidi2022.02.011).
- [26] Zhussip, M., Akhmetov, K., & Burkitbaeva, U. (2023). Elm (*Ulmus*) leaf miners in North-East Kazakhstan. *Biosystems Diversity*, 31(3), 376-381. doi: [10.15421/012344](https://doi.org/10.15421/012344).



Сучасний стан досліджень молей-строкаток (Gracillariidae Stainton, 1854) та їх трофічна спеціалізація з деревними насадженнями м. Києва

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Анотація. Найбільше розповсюдженими комахами-фітофагами дендрофауни населених пунктів, які набувають масового розмноження, є молі-строкатки (Gracillariidae Stainton, 1854). Сучасний стан, розповсюдження та розмноження молей-строкаток недостатньо вивчені. Метою досліджень було виявлення та оцінювання видів молей-строкаток, які є фітофагами деревних рослин в м. Києві. Дослідження біорізноманіття молей-строкаток було проведено впродовж 2023-2025 років у м. Києві: ботанічні сади, парки, сквери, вулиці, де є деревні рослини. Наявність молей-строкаток оцінювали за наявністю мін на листках дерев візуально. Для цього відбирали по 100 листків з контрольного дерева і переносили в лабораторію для визначення та ідентифікації видів молей. Видову приналежність молей-строкаток оцінювали за допомогою визначників ентомофауни. Для характеристики видового комплексу молей-строкаток використовували індекс трапляння (P_i) та індекс домінування (D_i). В результаті досліджень виявлено і визначено 20 видів молей-строкаток родини Gracillariidae (Lepidoptera), які трофічно пов'язані з більш як 49 видами деревних рослин-господарів. В основному це олігофаги. Аналіз заселення різними видами молей-строкаток деревних рослин у м. Києві показав наступне: найвищий рівень наявних мін на листках досліджених рослин відмічали в ботанічних садах (95 % з 20 видів молей-строкаток) і парках (75 %). Наявність мін на листках досліджуваних дерев вуличних насаджень відмічена на рівні 40 % від загальної кількості оцінених видів молей-строкаток. Згідно індексів трапляння та домінування визначено, що на досліджуваних локаціях деревних рослин Києва домінуючими є *Cameraria ohridella* (95,12 %), *Phyllonorycter populifoliella* (83,24 %) та *Gracillaria syringella* (53,23 %). Результати дослідження мають наукову цінність для вивчення біоценотичних зв'язків між фітофагами та кормовими рослинами в урбофітоценозах і практичне значення для вибору стійких до мінуючих фітофагів деревних порід, що використовуються в міському озелененні

Ключові слова: фітофаг; інвазійний вид; моніторинг; індекс трапляння; рослини-господарі; чисельність

