

## Checkered beetles moths (Lepidoptera: Gracillariidae) — hazardous phytophags of arboreal and shrubby plants of botanical gardens and plantings of Kiev

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**The purpose.** To carry out probes on revealing and specification of species composition of checkered moths (*Lepidoptera: Gracillariidae*) in conditions of botanical gardens and plantings of Kiev. **Methods.** Standard methods of faunistic research in entomology, population ecology, and protection of plants. **Results.** It is determined that 24 kinds of checkered moths are eating 54 kinds of plants which are widely used for gardening in Kiev. For the first time the following kinds are revealed: *Phyllonorycter issikii*, *Phyllonorycter platani*, and *Phyllonorycter emberizaepennella*. At calculation of Palii-Kovnatski indexes they specified that in city plantings the dominant phytophags are *Cameraria ohridella* (94,11%), *Phyllonorycter populifoliella* (86,37%) and *Gracillaria syringella* (59,14%). They consider that in formation of the secondary areal of invasion kinds of checkered moths the great value has an areal of spread of the host-plant. Environmental analysis is carried out of checkered moths of family *Gracillariidae* which is spread in cities of the Europe and which are absent in fauna of cities of Ukraine. That has important theoretical and practical value for ecology, entomology and protection of plants against hazardous checkered moths. **Conclusions.** All the probed kinds of checkered moths by their trophic specialization may be distributed into polyphages (6 kinds), oligophages (14 kinds) and monophages (3 kinds).

**Key words:** checkered moth, phytophage, arboreal woody plants, trophic circuit.

Among the complex of pests of woody plants in the botanical gardens and plantations cities Ukraine is common and harmful insects (60% of the total), including the recently acquired mass reproduction gracillariidae (*Gracillariidae*). In Ukraine greenery found more than 20 kinds of moles, strokatok [1]. In recent years (2004 - 2016)

the number of species of this group increased by herbivores. This is mainly adventitious species: *Phyllonorycter platani* Staudinger, 1870 [2,3], *Phyllonorycter issikii* Kumata, 1963 [4,5,6], *Cameraria ohridella* Deschka & Dimic, 1986 [7,8]. It is known that adventitious species got a new territory favorable for their development and reproduction conditions for the availability of sufficient food resources, lack of natural enemies very quickly expanding area. So, to prevent mass distribution of these species should be carried out regularly monitored, with the aim of early detection of insect cells.

Objective: to clarify the species composition of insect herbivores minuyuchyh woody plants m. Kyiv.

Materials and methods. The study was conducted (2010-2016 gg.) In botanical gardens and parks of the city. Kyiv. Monitoring and accounting for the appearance of damage (formation min) leaf fodder plants was performed [9,8]. To determine the density of settlement herbivores plants were at least 100 leaves. Henetaley specimens of moths produced in this way. Separated abdomen adult soaked in 10% KOH for 24 hours or heated for 30 minutes, purified preparuvalnoyu needle eosin stained B (males) or hlorazolom black (female), put a drop of glycerol and examined under a microscope with an increase of 200's or 400's. Identification moles, strokatok carried out by methods [10,11,12,13]. Also used a computerized version of «Global Taxonomic Database of Gracillariidae (Lepidoptera)».

To characterize species-complex moles used strokatok occurrence index (Pi) and the index of dominance. Index occurrence [14] - the ratio of the number of samples (nl), which was found gracillariidae (regardless of the number of individuals in the sample) to the total number of samples (N):  $P_i = (n_l / N) \cdot 100\%$ . Index dominance Paly-Kovnatski - a measure of how much dominated by this type over the other identified species than the frequency of occurrence, and the number of animals in the outbreak:  $D_i = p_i N_i / N_s$ , where  $P_i$  - occurrence type,  $N_i$  - number of individuals and - the first type,  $N_s$  - total number of individuals. Plants zhyvyteli-identified types of moles, strokatok are under the directory [15,16,17].

Results and discussion. Studies have phytosanitary state tree plantations Botanical Garden to them. Acad. OV Fomin Botanical Garden to them. Grisha NAS of Ukraine and park and street plantations. Kyiv (2000 - 2016 years.) Showed that 54 kinds of forage plants were found 24 species of moles, strokatok (Table. 1).

### 1. Species composition strokatok-moles (Gracillariidae) and their forage plants

Mill-lagurus	Feed 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> Deshke & Dimic, 1986	<i>Aesculus hippocastanum</i> L.
<i>Gracillaria syringella</i> (Fabricius), 1794	<i>Syringa vulgaris</i> L., <i>Symphoricarpus 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 robiniella</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. x berolinensis</i> (K. Koch) Dipp., <i>P. x canescens</i> (Ait.) Smith, <i>P. italica</i> (Du Roi) Moench, <i>P. nigra</i> L., <i>P. simonii</i> Carr.
<i>Phyllonorycter acerifoliella</i> (Zeller), 1839	<i>Acer saccharinum</i> L.
<i>Phyllonorycter agilella</i> (Zeller), 1846	<i>Ulmus glabra</i> Huds.
<i>Phyllonorycter apparella</i> (Herrich-Schaffer), 1855	<i>Populus tremula</i> L.
<i>Phyllonorycter blancardella</i> Fabricius, 1781	<i>Malus</i> Mill.
<i>Phyllonorycter cerasicolella</i> Herrich-Schaffer, 1855	<i>Cerasus vulgaris</i> Mill.
<i>Phyllonorycter coryli</i> Nicelli, 1851	<i>Coryllus avellana</i> L.
<i>Phyllonorycter emberizaepennella</i> Bouche, 1834	<i>Lonicera tatarica</i> L., <i>Lonicera xylosteum</i> L., <i>Symphoricarpus albus</i> L.
<i>Phyllonorycter faginella</i> (Zeller), 1846	<i>Fagus sylvatica</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. x acerifolia</i> (Ait.) Wild.
<i>Phyllonorycter populifoliella</i> (Treitschke), 1833	<i>Populus italica</i> (Du Roi) Moench, <i>P. nigra</i> L.
<i>Phyllonorycter strigulatella</i> (Zeller), 1846	<i>Alnus glutinosa</i> (L.) Gaertn., <i>Alnus incana</i> (L.) Moench
<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</i> Medik., <i>Crataegus</i> L., <i>Malus</i> Mill., <i>Padus</i> Mill., <i>Prunus</i> L.
<i>Phyllonorycter tenerella</i> (de Joannis), 1915	<i>Carpinus betulus</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 italica</i> (Du Roi) Moench, <i>P. nigra</i> L., <i>P. alba</i> L.

The study found about 24 species of insect herbivores on their trophic specialization showed schopolifahamy are 6 types:

*Gracillaria syringella*, *Phyllocnistis labyrinthella*, *Phyllonorycter emberizaepennella*, *Phyllonorycter salicicolella*, *Phyllonorycter sorbi*, *Phyllocnistis labyrinthella*, olihofahamy (14 species)

– *Caloptilia semifascia*, *Caloptilia rufipennella*, *Parectopa robiniella*, *Phyllonorycter acerifoliella*, *Phyllonorycter apparella*, *Phyllonorycter blancardella*, *Phyllonorycter cerasicolella*, *Phyllonorycter coryli*, *Phyllonorycter guercifoliella*, *Phyllonorycter issikii*, *Phyllonorycter populifoliella*, *Phyllonorycter strigulatella*, *Phyllonorycter tenerella*, *Phyllonorycter ulmifoliella* і монофами є 3 види: *Cameraria ohridella*, *Phyllonorycter faginella* та *Phyllonorycter platani*.

For the first time in the area of research we found three types of moles, strokatok:

*Phyllonorycter issikii*, *Phyllonorycter platani* and

*Phyllonorycter emberizaepennella* (!!!). This suggests that Entomofauna Ukraine is constantly updated with new types of settlers that may have unintended consequences, such as chestnut minuyucha moth, western corn rootworm (*diabrotyka*), potato moth and others.

Analysis moth spread in different types of green cities showed that most species recorded in the botanical gardens (23 taxa) and parks - 16 species. In plants that grow in the alleys and along roads with heavy traffic only found six types of moles, strokatok (tab. 2).

## 2. Distribution-discovered species of moles strokatok by type spaces in Kyiv

Kind	Botanical gardens	Parks and gardens	The Street
<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 apparella</i>	+	–	–
<i>Phyllonorycter blancardella</i>	+	+	–
<i>Phyllonorycter cerasicolella</i>	+	+	+
<i>Phyllonorycter coryli</i>	+	–	–
<i>Phyllonorycter emberizaepennella</i>	+	–	–
<i>Phyllonorycter faginella</i>	+	–	–
<i>Phyllonorycter guercifoliella</i>	+	–	–
<i>Phyllonorycter issikii</i>	–	+	–
<i>Phyllonorycter platani</i>	+	–	–
<i>Phyllonorycter populifoliella</i>	+	+	+
<i>Phyllonorycter strigulatella</i>	+	–	–
<i>Phyllonorycter salicicolella</i>	+	+	–
<i>Phyllonorycter sorbi</i>	+	–	–
<i>Phyllonorycter tenerella</i>	+	+	+
<i>Phyllonorycter ulmifoliella</i>	+	+	–
<i>Phyllocnistis labyrinthella</i>	+	+	+

Note: "+" - found; "-" - no view

Calculation of the index occurrence moles feed on plants in the city. Kiev showed that most plants are damaged *C. ohridella* (8,54%) and *P. populifoliella* (5,16%) (Fig. 1, 1a).

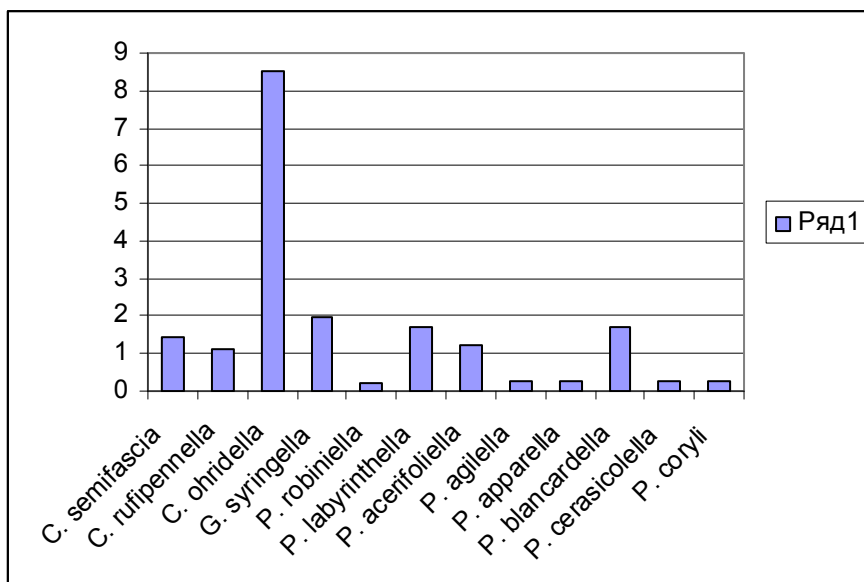


Fig. 1. Index-occurrence moles strokatok greenery in the city. Kyiv (2010-2016).

According to calculations conducted indices Paly-Kovnatski found that the city stands dominants are three types of moles, strokatok (*C. ohridella* (94,11%), *P. populifoliella* (86,37%) and *Gracillaria syringella* (59,14%).

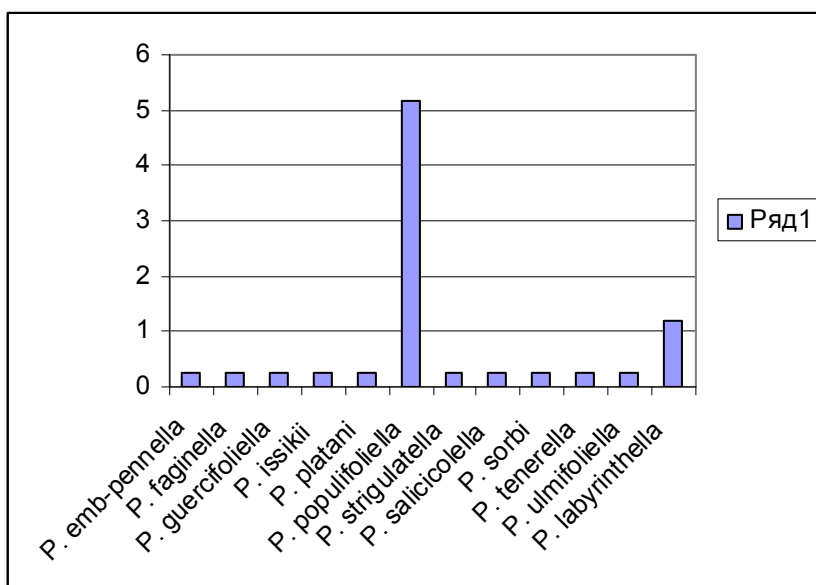


Fig. 1a. Continued Fig. 1: Index-occurrence moles strokatok greenery in the city. Kyiv (2010-2016).

We believe that the formation of secondary area moles, invasive species are important strokatok complex of climatic factors and range plant zhyvetelya. Thus, for example, expanding the range of *Platanus orientalis* L. and *P. x acerifolia* (Ait.) Wild. contributed to the expansion of the range *Phyllonorycter platani* (Staudinger).

Comparing the results of studies on the spread of this group of insect herbivores in botanical gardens and urban green plantations in other cities of the former Soviet Union can note that they were fragmented. Thus, in [18,19] are only two types of moles, strokatok

(*Gracillaria syringella* та *Phyllonorycter populifoliella*), which are common in Minsk. AA Rupays [20] fauna of Baltic Cities cites 14 types of moles, strokatok. In St. Petersburg on plants that grow in the city identified 11 types of moles, strokatok [21,22]. A study of these insects dendrophilous forests and parks of Armenia shows that among the identified herbivores happens only 9 types of moles, strokatok [23,24].

It should be noted that since these studies fauna in many cities of the former Soviet Union, there have been dramatic changes size and quantitative mass reproduction of alien species, strokatok moles. So rapid spread of mass reproduction and acquired in recent years gracillariidae -

*Cameraria ohridella*, *Parectopa robiniella*, *Phyllonorycter issikii*. From our analysis, the spread of alien moles strokatok in a park in Europe follows a logical conclusion that this is not the whole list of herbivores that group. More extensive and detailed examination not only of green space. Kyiv and other cities in Ukraine can expand our knowledge of the fauna-strokatok moles, the most dangerous insect herbivores ornamental species. Thus, in many cities of Europe common, but not in Ukraine is *Caloptilia azaleella* (Brants, 1913), the Netherlands, the Rhododendron - *Parectopa robiniella* (Clemens, 1863), Italy, on Robinia - *Phyllocnistis citrella* (Stainton, 1856), Spain, Citrus - *Phyllocnistis vitegenella* (Clemens, 1859), Italy, on Vitis - *Phyllonorycter leucographella* (Zeller, 1850), Italy, on *Pyracantha* - *Phyllonorycter robiniella* (Clemens, 1859), Switzerland [25,26,13].

### Conclusions

Established that 54 species of plants that are widely used for landscaping city. Kyiv inhabited by 24 species of moles, strokatok. New to study in Ukraine revealed three types: *Phyllonorycter issikii*, *Phyllonorycter platani* and *Phyllonorycter emberizaepennella*. Calculation of the index occurrence moles feed on plants in the city. Kiev showed that most plants are damaged *C. ohridella* (8,54%) and *P. populifoliella* (5,16%).

A calculation of the index Paly-Kovnatski follows that stands in the city dominants are three types of moles, strokatok (*C. ohridella* (94,11%), *P. populifoliella* (86,37%) and *Gracillaria syringella* (59,14%). established that the rapid spread of mass reproduction and acquired in recent years gracillariidae - *Cameraria ohridella*, *Parectopa robiniella* and *Phyllonorycter issikii*. The authors believe that the formation of secondary

Range invasive species strokatok moles-important area of distribution has zhyvytelya plant. Thus, for example, expanding the range of plane *Platanus orientalis* L. and *P. x acerifolia* (Ait.) Wild. and contributed to the expansion of the range *Phyllonorycter platani* (Staudinger). Analysis moles family Gracillariidae, common in the cities of Europe and are kind of lacking in the fauna of cities in Ukraine, which has important theoretical and practical value in protecting plants against particularly dangerous moles, strokatok to study the ecology of insects and protect the ornamental tree and shrub species.

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