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RESEARCH ARTICLE

# Confirming the presence of the invasive moth *Ypsolopha chazariella* (Lepidoptera: Ypsolophidae) in Siberia: insights into the species biology and molecular genetics

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## Abstract

*Ypsolopha chazariella* (Mann, 1866) (Lepidoptera: Ypsolophidae) is a European moth species known to feed on Tatar maple (*Acer tataricum L.*), a tree species naturally present in Europe. In 2009–2023, characteristic damage provisionally attributed to *Y. chazariella* was documented in botanical gardens in Novosibirsk, Krasnoyarsk (Russia, Siberia), suggesting the occurrence of a new pest. In 2024, significant damage was observed in an arboretum in Krasnoyarsk (Eastern Siberia) on the introduced *A. tataricum* and East Asian *Acer ginnala* Maxim. Two adult specimens of *Y. chazariella* were reared from larvae collected on both maple hosts and identified using genital morphology. Seven DNA barcodes (mitochondrial COI gene fragments) obtained for the specimens from Krasnoyarsk (6 specimens) and Novosibirsk (1) analyzed together with available DNA barcodes from Belarus and Finland showed low intraspecific divergence (0.7%). Among six haplotypes detected, two of them were formed solely by the Siberian specimens connected with the haplotypes recorded in Europe through two mutation steps. Genetic distance analyses revealed clear differentiation from closely related species (*Y. dorsimaculella*, *Y. arizonella*, and *Y. rubrella*) in the Barcode of Life Database (BOLD), with pairwise minimal distances between *Y. chazariella* and above-mentioned species ranging from 10.6% to 12.9%. A brief species essay was compiled, providing a note on the species biology, molecular genetics, present species range, and impact in ornamental plantings. Photographic documentation includes characteristic feeding damage and images of adult moths, along with detailed illustrations of male and female genitalia.

**Keywords**

Alien pest, moth, maple, *Acer tataricum*, damage, DNA barcoding, Asian Russia

## Introduction

The occurrence of phytophagous non-native species in novel regions is a growing trend observed across various insect groups (Roques et al. 2020), including the representatives of Lepidoptera (Suckling et al. 2017; Mally et al. 2022). Phytophagous insect invasions often arise from human-mediated plant introductions and can lead to significant ecological consequences (Bonnamour et al. 2023). Following host establishment, insects may arrive later or expand their dietary range to include closely related plant species (Kirichenko et al. 2023, 2024).

The family Ypsolophidae was known by 163 species from seven genera worldwide (van Nieukerken et al. 2011). Recent studies have added 23 species from the Far East (Jin et al. 2013; Ponomarenko and Zinchenko 2013) and one from Portugal (Corley and Ferreira 2021), bringing the total number of Ypsolophidae species to 187. In Russia, 57 species from five genera have been documented so far, including 49 species from the genus *Ypsolopha* (Ponomarenko and Sinev 2019). In the European part of Russia, 27 *Ypsolopha* species have been identified vs. 36 species in the Asian part of the country, including 14 species, namely: *Y. asperella* (Linnaeus, 1761), *Y. coriacella* (Herrich-Schäffer, 1855), *Y. dentella* (Fabricius, 1775), *Y. falcella* ([Denis & Schiffermüller], 1775), *Y. instabilella* (Mann, 1866), *Y. leuconotella* (Snellen, 1884), *Y. lucella* (Fabricius, 1775), *Y. nemorella* (Linnaeus, 1758), *Y. parenthesella* (Linnaeus, 1761), *Y. sarmaticella* (Rebel, 1917), *Y. satellitella* (Staudinger, 1871), *Y. scabrella* (Linnaeus, 1761), *Y. ustella* (Clerck, 1759), *Y. vittella* (Linnaeus, 1758), occurring in both parts (Ponomarenko and Sinev 2019).

The representatives of the genus *Ypsolopha* are trophically associated with deciduous woody plant species, specializing on plants belonging to a certain genus, less often to several genera within one family (Lepiforum 2025). Among *Ypsolopha* species present in Russia, only three species are known to feed on maples *Acer* spp. (Sapindaceae): *Y. chazariella* (Mann, 1866), *Y. sequella* (Clerck, 1759) and *Y. acerella* Ponomarenko, Sohn & Zinchenko, 2011. The first two moth species are distributed in Central and Eastern European countries and the European part of Russia (Ponomarenko and Sinev 2019; Lepiforum 2025) and *Y. acerella* is exclusively known from the Asian part of Russia, particularly Primorsky Krai, and Korea (Ponomarenko and Sinev 2019).

*Ypsolopha chazarella* is the only species known to feed on *Acer tataricum* L., the plant which is naturally occurs in some parts of Europe and introduced to other parts of Europe as ornamental (Buhr and Kummer 2011; Lepiforum 2025). *Ypsolopha sequella* develops on other maples in Europe, i.e., *A. pseudoplatanus*, *A. campestre*, and *A. platanoides* (Lepiforum 2025), whereas *Y. acerella* utilizes *A. ginnala* Maxim. in East Asia (Ponomarenko et al. 2011).

Since the end of 20th century, *Y. chazariella* became known by expanding its range in Europe (Lepiforum 2025). In 1996, it was found in Finland (Finnish Biodiversity… 2025) and some years later in Germany and France (May 2014; Vandromme et al. 2020). In all these countries, *A. tataricum* is an introduced plant species (Lepiforum 2025).

Outside Europe, the damage reminding *Y. chazarella* was documented in 2009–2023 in Novosibirsk and Krasnoyarsk (Russia, Siberia) (Kirichenko and Baranchikov 2023). By the damage type (spun leaves), host plant (*A. tataricum*) and the species phenology (occurrence in early spring), the presence of *Y. chazariella* was suggested in these regions (Kirichenko and Baranchikov 2023). Here we confirm the species presence in Siberia, provide short notes on its biology, molecular genetics, plant damage rate, and discuss its possible impact in ornamental plantings and further spread eastwards.

## Materials and methods

### Sampling and rearing

The study was carried out in Krasnoyarsk (Eastern Siberia) on the period of 29 May – 10 June 2024. In May, by five plants of *Acer tataricum* (trees of around 9 m in height), *A. ginnala* (bushes of 1.2 m in height), *A. negundo* (4 m in height), and 3 trees of *A. platanoides* (12 m in height) were investigated in the arboretum of V.N. Sukachev Institute of Forest SB RAS for the presence of damaged leaves, i.e. spun leaves on the apical part of branches. The trees were investigated in the low part of their crowns (up to 1.5 m from the ground) whereas bushes of *A. ginnala* composing green hedge were examined in whole.

By 20 spun leaves containing late-stage larvae were collected from 5 trees of *A. tataricum* and 5 bushes of *A. ginnala*. They were transferred to the insectarium of the institute and placed in two 5-liler containers above the litter collected under the respective host plants (Fig. 1).

The containers were tightly covered with fine mesh to prevent escape of emerging insect adults. The containers were kept in shadow at temperature +24°C and 60% humidity. Once-to-twice a week, the litter was slightly moisturized using water sprayer. Emerged moth adults were collected, pinned and placed to dry collection. Genitalia preparation was performed according to Robinson (1976), with genitalia mounting in Euparal.

Additionally in May on different trees and bushes of maples species by 5 to 10 larvae were dissected from spun leaves and preserved in 95% ethanol in 5-ml hermetic vials for following genetic study.

**Figure 1.** Maintaining *Ypsolopha chazariella* in laboratory conditions, V.N. Sukachev Institute of Forest SB RAS, June 2024. **A** – keeping spun leaves with mature larvae in the plastic box with litter collected under host plants (the mesh which was used to cover the box is not shown in the photo); **B** – mature larvae crawling from spun leaves to hide in the litter for pupation. Photo by N.I. Kirichenko.

## DNA barcoding

Six specimens of *Y. chazariella* collected in Krasnoyarsk in 2024 were subjected to DNA barcoding. Among them, there were five larvae collected from *A. tataricum* (3 larvae) and *A. ginnalla* (2), and one indoor grown adult (male) from *A. tataricum*. Additionally, one ethanol-preserved larva sampled from *A. tataricum* in Central Siberian botanical garden (Novosibirsk, Western Siberia) (6.06.2009 coll.) and stored in the collection of the Laboratory of Forest Zoology of V.N. Sukachev Institute of Forest SB RAS was used for DNA barcoding. Two last segments from larvae and one hind leg from a male adult were utilized.

The mitochondrial cytochrome oxidase I gene, mtDNA COI (658 bp) was sequenced with the primer set C_LepFolF/C_LepFolR using the standard protocol (de Waard et al. 2008). The analysis was performed at the Canadian Center for DNA barcoding (CCDB) at the University of Guelph (Canada) in a frame of DNA barcoding campaign of alien species of Lepidoptera. The specimen data, edited sequences and electropherograms were deposited in the Barcode of Life Data Systems (BOLD) (Ratnasingham and Hebert 2007) and GenBank. The data are available in BOLD by the link dx.doi.org/10.5883/DS-YPSSA (the dataset title: *Ypsolopha chazariella* (Lepidoptera, Ypsolophidae) in Siberia).

Additionally, eight COI sequences, publicly accessible in BOLD, were involved to the study for comparative analysis. Among them, there were five sequences of *Y. chazariella* – two from Belarus and three from Finland, and three sequences of other three *Ypsolopha* species (*Y. dorsimaculella*, *Y. arizonella*, *Y. rubrella*) used for defining interspecific genetic diversity in the genus. The specimen data are listed in the Table 1.

For all sequences, the Barcode Index Numbers (BINs) were retrieved from BOLD (Ratnasingham and Hebert 2013). The sequences were aligned in BioEdit 7.2.5 (Jeanmougin et al. 1998). A maximum likelihood tree was constructed using the maximum likelihood method, the Kimura two-parameter model, and a bootstrap method (1000 iterations) in MEGA X (Kumar et al. 2018). The intraspecific distances were calculated only for *Y. chazariella*. For this species, the closest neighbor was identified on the phylogenetic tree and the minimal interspecific distance estimated. In addition, maximal interspecific distance between the representative of *Ypsolopha* was assessed for identifying interspecies genetic variability.

**Table 1.** The specimens of *Ypsolopha* spp. used in the DNA barcoding analysis

| № | Process ID | Country | State/region | Year | Collectors | GenBank No. |
|---|---|---|---|---|---|---|
| | | | *Ypsolopha chazariella* | | | |
| 1 | EABRU062-24 | Russia | Krasnoyarsk | 30.05.2024 | Kirichenko N.I. | PX429895 |
| 2 | EABRU063-24 | Russia | Krasnoyarsk | 30.05.2024 | Kirichenko N.I. | PX429903 |
| 3 | EABRU064-24 | Russia | Krasnoyarsk | 30.05.2024 | Kirichenko N.I. | PX429904 |
| 4 | EABRU065-24 | Russia | Krasnoyarsk | 30.05.2024 | Kirichenko N.I. | PX429898 |
| 5 | EABRU066-24 | Russia | Krasnoyarsk | 30.05.2024 | Kirichenko N.I. | PX429902 |
| 6 | EABRU075-24 | Russia | Krasnoyarsk | 21.07.2024 | Kirichenko N.I. | PX429901 |
| 7 | EABRU061-24 | Russia | Novosibirsk | 02.06.2020 | Kirichenko N.I. | PX429899 |
| 8 | GMBMN020-17 | Belarus | Minsk | 30.06.2016 | Lipinksaya T. | PX429900 |
| 9 | GMBMP609-18 | Belarus | Minsk | 28.07.2016 | Lipinksaya T. | PX429905 |
| 10 | LEFIE221-10 | Finland | no data | no data | Mutanen M. | HM873957 |
| 11 | LEFIG604-10 | Finland | no data | 29.07.2009 | Mutanen T. | HM876270 |
| 12 | LEFIG605-10 | Finland | no data | 29.07.2009 | Mutanen T. | HM876271 |
| | | | *Y. dorsimaculella* | | | |
| 13 | MNAQ335-15 | Canada | B. Columbia | 04.04.2012 | Holden D.G. | PX429894 |
| | | | *Y. arizonella* | | | |
| 14 | MNAQ379-15 | USA | Utah | 08.07.2007 | Dombroskie J.J. | PX429893 |
| | | | *Y. rubrella* | | | |
| 15 | MNAQ380-15 | USA | Utah | 07.07.2007 | Dombroskie J.J. | PX429896 |
| | | | Outgroup: *Phyllonorycter geniculella* | | | |
| 16 | PAROF079-18 | France | Normandie | 14.07.2018 | Kirichenko N.I. | PX429897 |

The DNA barcode of a micromoth *Phyllonorycter geniculella* (Ragonot, 1874) (*Acer pseudoplatanus*, France, 15.07.2010, Kirichenko N.I. coll.) was used for tree rooting. For *Y. chazariella*, the number of haplotypes were estimated and the median-joining haplotype network was bult in the program PopART (version 1.7 for Windows) (Leigh and Bryant 2015).

### Photographing, mapping

The adults of *Y. chazariella* were photographed with a digital camera incorporated to a smartphone Xiaomi 11 Lite (China, Beijing, Xiaomi Corporation) through an Olympus SZX10 microscope (Japan, Tokyo, Olympus Corporation). Male and female genitalia were photographed with a Bio trinocular panchromatic 2002 microscope–EUM-2000 (China, Chongqing, Chongqing Optec Instrument Co., Ltd.). All specimens are stored in the collection at V.N. Sukachev Institute of Forest (SIF) SB RAS (Krasnoyarsk). For illustrating the distribution of *Y. chazariella* in Russia, the map with the territorial division was borrowed from Sinev (2019) and revised in Adobe Photoshop 2023. The species records in Russia are given according to early data (Bogacheva and Zamshina 2017; Ponomarenko and Sinev 2019; Kirichenko and Baranchikov 2023) and the present paper.

## Results

**Material examined.** Russia, Krasnoyarsk Krai, Krasnoyarsk, arboretum of SIF SB RAS, 10 larvae, *Acer tatatirum*, 30.05.2024 col., 3 larvae DNA barcoded (process IDs: EABRU64-24, EABRU65-24, EABRU66-24), 1 male & 1 female reared, 21–22.07.2024 em., of which 1 male was sequenced (EABRU075-24); ibidem, 30.05.2024, 10 larvae, *A. negundo*, 2 larvae DNA barcoded (EABRU62-24, EABRU63-24), Kirichenko N.I. & Babichev N.S. coll., Kirichenko N.I. & Gomboc S. det.

**Additional material examined.** Russia, Novosibirsk Oblast, Novosibirsk, Central Siberian Botanical Garden SB RAS, *A. tatatirum* (host plant), 2 larvae, 01.06.2009 col., 1 larva DNA barcoded (process ID: EABRU61-24), N.I. Kirichenko coll.

**Adult morphology** (Fig. 2). The morphology of adult specimens from Siberia corresponded to the characteristics of *Y. chazariella* (Bengtsson and Johansson 2011). Wingspan is 16-18 mm. The forewings are uniformly dull, with a dark brown background and somewhat darker scale patches. The most noticeable feature is a blackish spot located just before the pale patch near the apex: this spot may extend beyond a faint whitish discal mark toward the costa, forming an indistinct oblique fascia. In darker specimens, this characteristic is not well pronounced. The forewing is widest at the far end, and the outer edge is slightly curved inward. Male genitalia (Fig. 2C): valvae are broadly spatulate with a straight costal margin, the aedeagus is nearly twice the length of the valvae, cornute are long and pointed. Female genitalia (Fig. 2D): ductus bursae long, 1.4 length of corpus bursae, tubular, membranous;

corpus bursae obovate; signum narrowed at the middle, long (about 60% length of corpus bursae) and somewhat broad, granulated, with two transverse ridges. *Ypsolopha chazariella* reminds the East Asian *Y. acerella* in adult external morphology but differs in genitalia structures (Ponomarenko et al. 2011).

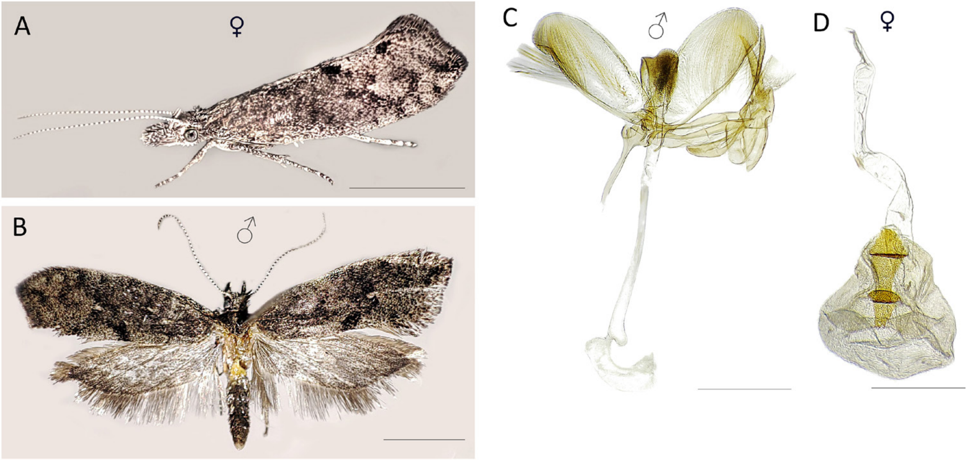

**Figure 2.** Female and male of *Ypsolopha chazariella* (**A**–**B**) and their genitalia (**C**–**D**). In female genitalia, only ductus bursae and bursa copulatrix are shown. Adults reared from larvae fed on *Acer tataricum*, Krasnoyarsk, July 2024. Photo by N.I. Kirichenko & S. Gomboc.

**Molecular genetics** (Figs 3, 4; Table 1). Seven sequences were obtained for *Y. chazariella* from Siberia; they yielded the targeted length of 658 b.p. These sequences formed one cluster with three specimens from Finland and two from Belarus, and they all corresponded to a single BIN assigned to the species in BOLD (Fig. 3).

The sequences from Siberia – one from Novosibirsk and four from Krasnoyarsk – had no difference in the studied fragment of the COI gene. Two other sequences from Siberia (EABRU065-24 and EABRU075-24), obtained from larvae which were feeding on *A. tataricum*, showed 0.4% divergence from the subgroup of the mentioned-above Siberian specimens. The maximal intraspecies genetic divergence of 0.7% was recorded between the specimens from Europe (Finland: LEFIG604-10, LEFIG605-10 and Belarus: GMBMN020-18, GMBMP609-18) and the subgroup of five sequences of *Y. chazariella* from Russia.

The genetic interspecific distances between *Y. chazariella* and other three analyzed species, which sequences are publicly accessible in BOLD, i.e., *Y. dorsimaculella*, *Y. arizonella*, *Y. rubrella*, were pronounced, with the minimal values 10.6 % between *Y. chazariella* and *Y. dorsimaculella*, 12.4% between *Y. chazariella* and *Y. arizonella*, and 12.9% between *Y. chazariella* and *Y. rubrella* (Table 2). In these four analyzed species of *Ypsolopha*, the lowest minimal genetic distance was recorded between *Y. arizonella* and *Y. rubrella*.

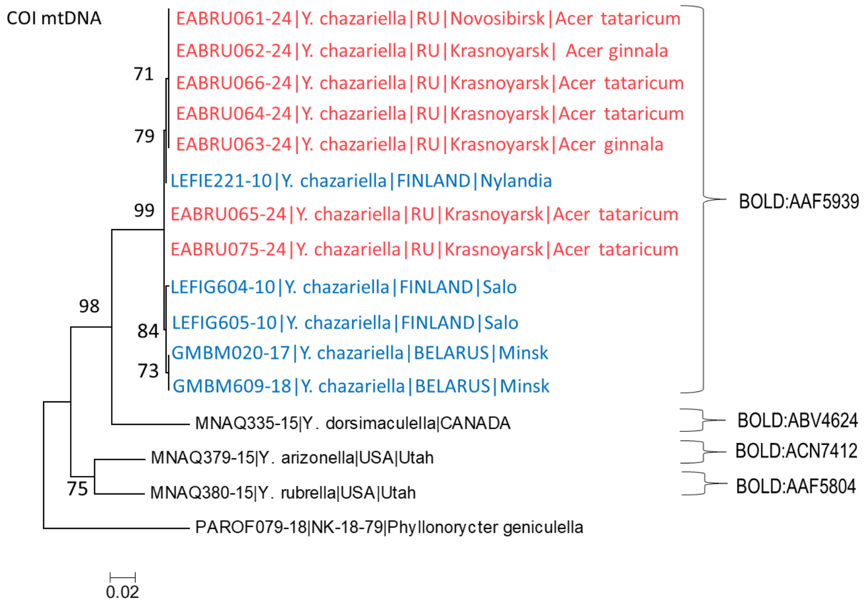

**Figure 3.** Maximum likelihood COI tree highlighting the cluster of *Ypsolopha chazariella* formed by the specimens from Russia, Siberia (Krasnoyarsk and Novosibirsk) and European countries (Finland, Minsk) and its relatedness to other *Ypsolopha representatives*. The clusters indicated by brackets correspond to four species BINs (indicted next to each cluster). In the tree, the specimens are indicated by the BOLD process ID (begins with EABRU etc.), species name, country, locality, host plant (documented only for the specimens from Russia). Bootstrap values > 70 are shown next to the corresponding clusters.

**Table 2.** Intra- and interspecific distances in COI gene among *Ypsolpha* spp. in the Holarctic

| **Species*** | **Species** | | | |
|---|---|---|---|---|
| | ***Y. chazariella*** | ***Y. dorsimaculella*** | ***Y. arizonella*** | ***Y. rubrella*** |
| *Y. chazariella* (12) | [0.7] | - | - | - |
| *Y. dorsimaculella* (1) | 10.6 | [-] | - | - |
| *Y. arizonella* (1) | 12.4 | 13.3 | [-] | - |
| *Y. rubrella* (1) | 12.9 | 12.6 | 7.8 | [-] |

Notes: * For each species pair, minimal pairwise distances are shown; in square brackets, maximal intraspecific distances are provided. The number of specimens of each species involved to the analysis is indicated in round brackets in the first column.

Overall, six haplotypes were detected in 12 analyzed specimens of *Y. chazariella* (Fig. 4). Among them, two haplotypes were formed solely by the Siberian specimens connected with the haplotypes recorded in Europe through two mutation steps. Thus, no common haplotypes between Siberia and European countries (Belarus, Finland) were detected.

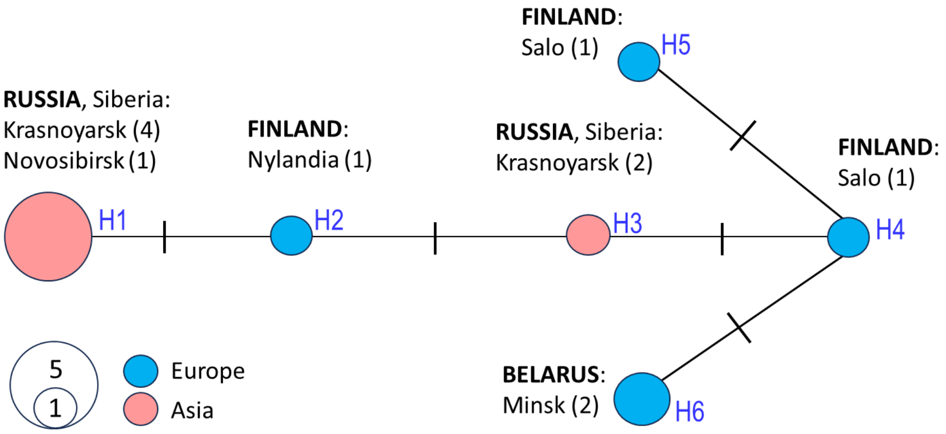

**Figure 4.** Median haplotype network of *Ypsolopha chazariella*. Colored circles represent haplotypes (H1–H6) from the two continents (Europe and Asia), with the circle size proportional to the number of studied specimens (see legend). Short transverse lines are suggestive haplotypes (undetected in the study).

**Biology** (Figs 5, 6). In Krasnoyarsk, the insect seems to develop only one generation, with adult moths flying in late April – early May and feeding larvae in early May – early June, and mature larvae descending to litter for pupation in late May – mid June.

Young larvae develop inside juvenile, unopened leaves, which they spun with silk at the apical parts of shoots. Each spun leaf cluster usually harbors a single larva. At this stage, the damage is not externally visible, as the leaves are still small and tightly bound together by silk and the larva feeds mainly on the inner leaves, while the outer ones remain undamaged for some time. As the larvae grow, they may incorporate additional leaves from nearby buds into the original cluster by spuning them together, thereby enlarging the shelter and securing both protection and sufficient food for development. Importantly, the leaves continue to grow while bound by silk.

Inside spun leaves the larva can be found together with grains of frass (Figs 5D. 6E). Once leaves mature and gain structural strength, they eventually break free of the silk connections through turgor pressure (Figs 5C, 6B–D), usually by early-to-mid June. Consequently, when the leaves open no larvae remain on the host trees or shrubs and the damage becomes visible characterized by round or elongated holes (up to ~20 mm wide) and extensive feeding between the secondary veins while leaving primary and secondary veins intact (Fig. 6C). By this time, the larvae typically complete their development and descend to the litter.

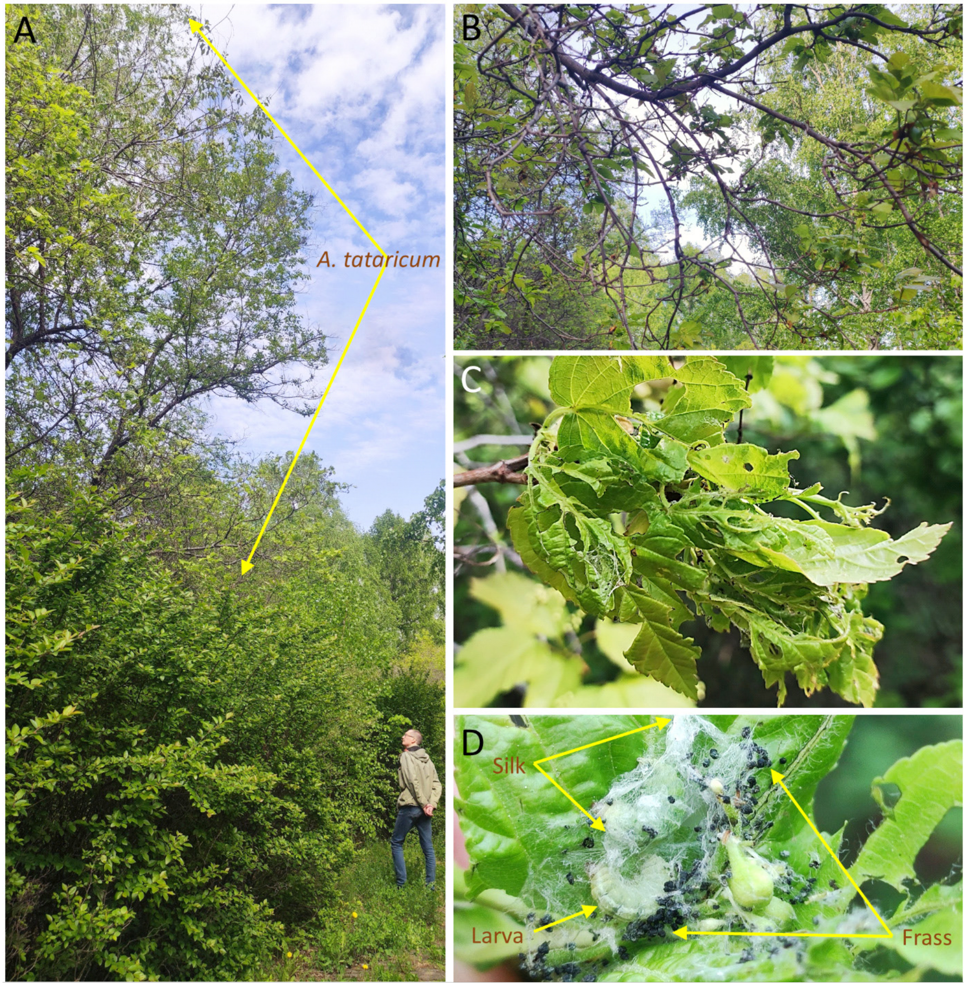

**Figure 5.** The tree of *Acer tataricum* damaged by *Ypsolopha chazariella*, the arboretum of the V.N. Sukachev Institute of Forest Arboretum, early June 2024. **A** – Impacted tree (indicated by arrows); **B** – Low branch partial drying due to extensive insect damage in previous years; **C** – Spun leaves, opened for photography; **D** – Hidden larvae and frass distributed on silk threads (shown by yellow arrows) within spun leaves. Photo **A** was taken with the permission from the photographed person, N. Babichev. Photo by N.I. Kirichenko.

**Figure 6.** The hedge composed of *Acer ginnala* bushes affected by *Ypsolopha chazariella*, the arboretum of the V.N. Sukachev Institute of Forest Arboretum, early June 2024. **A** – Damaged bushes; **B** – Leaves spun by larvae; **C**, **D** – Naturally opened spun leaves revealing window-like feeding damage; **E** – Larva discovered within the spun leaves; **F** – Larva descending to the ground using a silk thread after disturbance (during opening of spun leaves for examination). Photo by N.I. Kirichenko.

When feeding within spun leaves, larvae respond to disturbance (e.g., mechanical opening of the leaf cluster) by quickly descending to the litter on a silk thread (Fig. 6F). Once on the ground, they hide themselves among leaf litter. We did not investigate whether or not and how disturbed larvae are able to return to the trees or shrubs of their host plants to continue feeding.

In laboratory conditions, when spun leaves containing mature larvae were placed on litter collected under their host plants (*A. tataricum* and *A. ginnala*), we observed that larvae remained in the leaf shelters for few (1–2) days before leaving the shelters and entering the litter for pupation by mid-June. Under controlled indoor conditions, pupa stage lasted around 4 weeks, and adults emerged between 15–22 July. Only two adults (Fig. 2) were obtained from 20 larvae, despite all being kept under the same conditions in the insectarium. No parasitoid species were recorded to emerge, making it impossible to determine whether or not this non-native moth is attacked by parasitoids in Siberia.

**Host plants.** In its native range, Central and Eastern Europe, the moth is known exclusively on *Acer tataricum*, the maple species native to some parts of Europe and used as ornamental in landscape plantings. In Finland, where the species is believed to be alien, it was also recorded on *A. tataricum* introduced to the country and planted in some cities (Lepiforum 2025). In the European part of Russia (native range), the host plant is *A. tataricum*, in the Ural region (Ekaterinburg) (invaded range), the hosts are *A. tataricum* and *A. ginnala* (Bogacheva and Zamshina 2017). In Siberia (invaded range), the moth develops on the European *A. tataricum*, East Asian *A. ginnala*, and seems to try the European *A. platanoides* (only characteristic damage so far was recorded, no insects collected) (Kirichenko and Baranchikov 2023; present paper). No damage signs on the European *A. pseudoplatanus* and the North American *A. negundo* were detected (Kirichenko and Baranchikov 2023; present paper).

Important to mention that all species of the genus *Acer* L. (Sapindales: Sapindaceae) are non-native to Siberia (Koropachinsky and Vstovskaya 2012). In urban plantings, the most common maples are the North American *Acer negundo* L., which gets weedy (Ovcharova et al. 2024), and the East Asian *Acer ginnala* Maxim. (Bakulin et al. 2008; Koropachinsky and Vstovskaya 2012). Some authors treat *A. ginnala* as a subspecies of Tatarian maple (*Acer tataricum* subsp. *ginnala* (Maxim.) Wesm.) (World Flora… 2023), a view we do not contradict. Others distinguished the species by their foliage: *A. ginnala* has glossy, deeply lobed leaves, while *A. tataricum* has matte leaves that are unlobed or only shallowly lobed (Rushforth 1999). Furthermore, they are separated by a geographic gap of about 3,000 km (*A. tataricum* in Kyrgyzstan vs. *A. ginnala* in Eastern China, Korea, southern Russian Far East).

**Damage appearance** (Figs 5, 6). In Siberia, the larvae damage apical leaves of *A. tataricum* and *A. ginnala* by spuning them in spring – early summer, thereby disfiguring the apical foliage. By mid-June, the injury becomes more evident as the leaves continue to grow and the spun clusters begin to open, revealing conspicuous feeding traces. In 2024, in the arboretum in Krasnoyarsk, significant damage, with more than 50% of the leaves affected, was recorded on *A. tataricum* trees and on a green hedge of *A. ginnala*.

**Distribution** (Fig. 7). *Ypsolopha chazariella* is known from western and eastern Europe: Bosnia and Herzegovina, Romania, Bulgaria (Rebel 1904), Albania (Friese 1966), Sweden (Bengtsson and Johansson 2011), Ukraine (Baraniak et al. 2014), Germany (May 2014), Serbia (Jakšić 2016), Poland (Buszko and Nowacki 2017), Finland [first recorded in 1996], Latvia, Lithuania (Aarvik et al. 2017; Finnish Biodiversity… 2025), Hungary (Buschmann and Pastorális 2018), Czech Republic, Slovakia (Laštůvka et al. 2018), France (Vandromme et al. 2020); Transcaucasia (Agassiz and Friese 1996). In Russia, the species is known from several regions in the European part, predominantly in the south (Ponomarenko and Sinev 2019); detected in the Ural region (in urban plantings in Ekaterinburg) (Bogacheva and Zamshina 2017) and in Western and Central Siberia (in urban plantings in Novosibirsk and Krasnoyarsk) (Fig. 7).

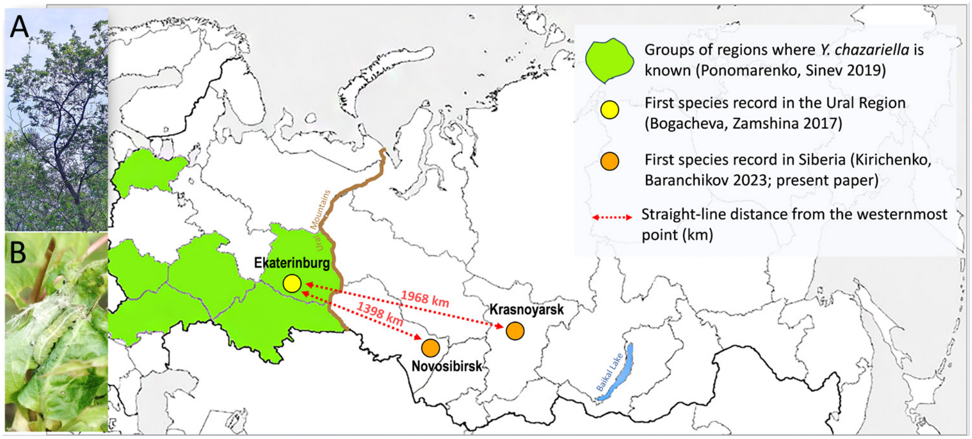

**Figure 7.** Distribution of *Ypsolopha chazariella* in Russia with documented eastward records in Siberia. The territorial division of regions in Russia is given as per Sinev (2019). Inset: **A** – thinning of *Acer tataricum* tree crown caused by larval feeding; **B** – late-instar larva feeding within spun leaves. Photos by N.I. Kirichenko.

## Discussion

*Ypsolopha chazariella* is a moth of European origin that has established its populations further east, in Siberia. This finding broadens the species' known distribution by nearly 2,000 km beyond the Ural region (Bogacheva and Zamshina 2017), where it is also regarded as non-native.

The molecular analyses of the COI gene showed that all specimens of *Y. chazariella* from Siberia cluster with those from Europe, forming a single BIN, but two haplotypes detected are unique to Siberia. Low intraspecific divergence support relatively recent introduction of the moth to Siberia. However, to clarify the phylogeographic patterns underlying the moth's invasion into Siberia, additional specimens would need to be sampled and analyzed from across its current range in Russia.

The presence of *Y. chazariella* in Siberia is most likely the result of human-mediated introduction linked to ornamental maple plantings. Indeed, in few European countries (Finland, Germany, and France), the occurrence of this moth species is thought to be linked to the introduction of its host plant, *A. tataricum*, which is widely used as an ornamental in parks and gardens (May 2014; Lepiforum 2025). To Siberia, *Y. chazariella* could have distributed with its host, *A. tataricum*, which was used for planting in botanical gardens and urban area.

Initial records of leaf damage (2009–2023) (Kirichenko and Baranchikov 2023) and subsequent adult rearing for species identification in Krasnoyarsk in 2024 (present paper) indicate that the species can complete its life cycle on maples introduced to this region. While native populations feed exclusively on *Acer tataricum*, the moth's typical host (Lepiforum 2025), the Siberian populations also utilize *A. ginnala*. This indicates moderate host flexibility, which may facilitate the moth's further eastward establishment, where *A. ginnala* is a native plant species.

The establishment of *Y. chazariella* in Siberia highlights the risk posed by this alien herbivore associated with ornamental plantings. In Krasnoyarsk, larval feeding caused conspicuous damage, with over 50% of apical leaves affected in 2024 arboretum observations. This pattern indicates potential aesthetic and ecological impacts in ornamental plantings. Thus, early detection is challenging because larvae feed within protective leaf clusters, delaying visible damage.

Monitoring should focus on apical parts of branches of susceptible maples (*A. tataricum*, *A. ginnala*) in botanical gardens, arboreta, and urban plantings, particularly in spring (May) when larvae are actively feeding. Management options could include removal of infested apical leaves before larvae descend to litter, combined with leaf litter treatment to reduce pupal survival.

## Conclusion

*Ypsolopha chazariella* has successfully established in the Siberian cities, Krasnoyarsk and Novosibirsk, on introduced maples (*A. tataricum*, *A ginnala*), highlighting both its trophic flexibility and effective survival strategies. Given the extent of leaf damage observed in the arboretum in Krasnoyarsk, continued monitoring and further study focusing on survival rates, natural enemy interactions, and the species' potential for further range expansion would be needed.

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