

ON THE FAUNA OF APHIDS (HEMIPTERA: APHIDOIDEA: APHIDIDAE) OF THE UZHANSKYI NATIONAL NATURE PARK AND ITS VICINITY (TRANSCARPATHTIA, UKRAINE)

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*With the development of agriculture, aphids, like some other insects, have widely spread beyond their original geographical regions. The aim of this study was to obtain data that could improve the understanding of aphid-plant interactions in different habitats. As a result of research conducted in the Uzhanskyi National Nature Park and its environs in 2022, 18 species of aphids were identified on 16 taxa of plants. Among them, 12 species of aphids were recorded for the first time in the park: *Aphis fabae*, *Aphis craccivora*, *Anuraphis subterranea*, *Brachycaudus cardui*, *Delphiniobium junackianum*, *Macrosiphum funestum*, *Macrosiphum rosae*, *Megoura viciae*, *Sitobion avenae*, *Uroleucon achilleae*, *Uroleucon cichorii*, *Cinara piceae*. A species specific to beech forests, *Lachnus pallipes*, was also found. The annotated list also contains data on host plants, distribution, and some biological characteristics.*

Key words: aphids, host plant, biology, distribution, Ukraine.

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Фауна попелиць (Hemiptera: Aphidoidea: Aphididae) Ужанського національного природного парку та його околиць (Закарпаття, Україна)

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*З розвитком сільського господарства попелиці, як і деякі інші комахи, дуже поширилися за межами своїх початкових географічних регіонів. Метою роботи було отримання даних, які можуть поліпшити розуміння взаємодії попелиць і рослин у різних середовищах існування. У результаті дослідження в Ужанському національному природному парку та його околицях у 2022 році виявлено 18 видів попелиць на 16 таксонах рослин. Серед них 12 видів попелиць уперше вказані для території парку: *Aphis fabae*, *Aphis craccivora*, *Anuraphis subterranea*, *Brachycaudus cardui*, *Delphiniobium junackianum*, *Macrosiphum funestum*, *Macrosiphum rosae*, *Megoura viciae*, *Sitobion avenae*, *Uroleucon achilleae*, *Uroleucon cichorii*, *Cinara piceae*. Виявлено специфічний вид для букових лісів – *Lachnus pallipes*. Анований список також містить дані про рослини-господарі, поширення та деякі біологічні характеристики.*

Ключові слова: попелиці, рослина-господар, біологія, поширення, Україна.

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Introduction

At nowadays approximately 5600 species of Aphididae have been described worldwide (Favret 2024). About one-third of these species are found in Europe. Additionally, among all Hemiptera, aphids are one of the most numerous groups of introduced insects in Europe (Coeur D'acier et al. 2010). Most of these species' feed on commercially used plants, making them recognized pests. As with most insects, much more is known about the economic impact of aphids than their environmental impact (Wegierek, Czylok 2000).

All aphids are phytophagous, and around 90% of species are not pests. Their distribution is limited by the presence of host plants. Many aphids are specific to their host plants and localized on certain parts of

the plant, making them vulnerable due to the vulnerability of their host plants.

Besides damaging plants, aphids can be important to root mycorrhizae and affect soil communities through honeydew (Wilkinson et al. 2019).

Some aphids have close relationships with ants, providing them with honeydew. This is most studied in forest ants, which are a key species in forest ecosystems. Many aphids are preyed upon by other insects and birds, which use aphids to feed their young. Aphids are often among the most accessible and nutritious food sources early in the year, feeding species such as warblers (*Phylloscopus* Boie 1826), sparrows (Passeridae), larks (Charadriidae), and others (Bibby, Green 1983; Hussain, Afzal 2005).

The floristic richness of Ukraine, due to its diversity of natural zones, leads to a diverse aphid fauna. Despite significant research conducted over the last 50 years (Mamontova 1959; Bozhko 1976), most of this research dates back to the mid-20th century and focused on economically important groups. As a result, certain regions of Ukraine have been studied fragmentarily, suggesting a high likelihood of discovering new species for Ukraine and science.

Given the specificity of the territory and the ecological significance of the group, it is appropriate to establish the current fauna of aphids in Ukraine. A total of 757 aphid species are known in Ukraine. For the Ukrainian Carpathians, 424 species have been recorded (Chumak 2001). The aim of this work was to study the structure of the aphid fauna (Hemiptera: Aphididae) of the Uzhanskyi National Nature Park. Currently, 48 species are registered in the park.

Materials and methods

Research was conducted in 2022 from early May to late September in the Uzhanskyi National Nature Park.

The Uzhanskyi National Nature Park was established in 1999 (Decree ... 2019) based on protected territories. It is located in the northwestern part of Zakarpattia Region in the Uzh River basin. Its area is 39 159 hectares. The park's territory consists of lowland and mid-mountain landscapes of the Polonynian Beskids, while the northern part includes the Vodorozdilny Beskids and the Volovets-Mizhhirya Upland (Gerenchuk 1981). The park is part of the "Eastern Carpathians" International Biosphere Reserve, which is included in UNESCO. Most of the park's territory is covered by forests, some of which are primeval.

The foothill forests are mainly composed of broad-leaved tree species, primarily common oak (*Quercus robur* L.), small-leaved lime (*Tilia cordata* Mill.), and common hornbeam (*Carpinus betulus* L.). Coniferous mountain forests are common at altitudes above 600 meters. European beech (*Fagus sylvatica* L.) and silver fir (*Abies alba* Mill.) are characteristic species, along with Norway spruce (*Picea abies* L. H. Karst.) and sycamore maple (*Acer pseudoplatanus* L.). Higher up, spruce with a mix of rowan (*Sorbus aucuparia* L.) predominates. At the upper tree line (1400 meters), Swiss pine (*Pinus cembra* Thunb.) and European larch (*Larix decidua* Mill.), Polish larch (*Larix polonica* Racib), dominate. Krummholz of mountain pine (*Pinus mugo* Turra), green alder (*Alnus alnobetula* subsp. *fruticosa* Rupr.), and shrubs of common juniper and *Siberian juniper* (*Juniperus communis* subsp. *alpina* Suter) are found above the tree line. Above

the zone of subalpine krummholz lie alpine meadows with grass and shrub vegetation.

Within the park, research sites were selected that are distant from each other (Fig. 1), as well as several points near the park with rather old trees.

All material is collected by the author himself.

Sampling of aphid specimens was conducted from their hosts, including flowering herbaceous plants, shrubs, and trees.

Insects were collected by inspecting the plants, then brushing adult individuals into an Eppendorf tube with 96% ethanol or collecting part of the plant with a colony, placing it in a box, and labeling it for further work in the laboratory. For each new record, taxonomic status, general characteristics, host plants, collection sites, collection date, some biological features, and distribution were provided.

Plant identification was conducted using the POWO (Plants of the World Online 2024) database. Live aphids were identified to the genus level using a Delta Optical SZ-450B microscope. Aphid sample preparation was conducted using the method of Hille Ris Lambers (Hille Ris Lambers 1950). More detailed identification of aphids was performed by the author using a SIGETA BIOGENIC 40x-2000x LED Trino Infinity microscope according to Blackman & Eastop's Aphids on the World's Plants (Blackman, Eastop (1994; 2006), A.C. Albrecht (2017), O.E. Heire (1995).

The current taxonomic status and names of the identified aphid species were given according to Aphid Species File (Favret 2024).

Data regarding host plants, biological features, and general distribution were provided according to Blackman and Eastop (1994; 2006) and Holman (2009).

Results

In the studied area, 18 species of aphids belonging to 13 genera and 4 subfamilies within the family Aphididae (Hemiptera: Aphidomorpha) were identified. A total of 16 plant taxa were examined. Among the collected aphids, 12 species were recorded for the first time in the park: *Aphis fabae*, *Aphis craccivora*, *Anuraphis subterranean*, *Brachycaudus cardui*, *Delphiniobium junackianum*, *Macrosiphum funestum*, *Macrosiphum rosae*, *Megoura viciae*, *Sitobion avenae*, *Uroleucon achilleae*, *Uroleucon cichorii*, *Cinara piceae*.

A total of 19 species were noted.

Most of the identified insects have a narrow range of host plants they feed on, with their entire life cycle occurring on a single plant – monoecious and holocyclic. In some cases, certain species are widely distributed and found on secondary host plants in

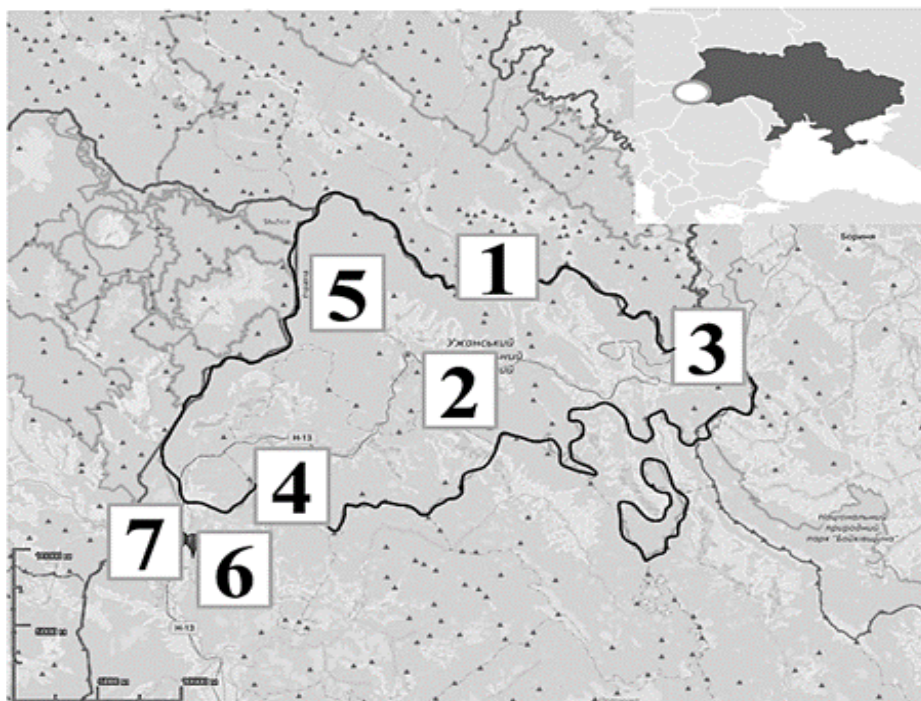


Fig. 1. Geographical location of the Uzhanskyi National Nature Park and the site of material collection

- 1: Lubnia 49°02'41.6"N 22°42'46.4"E, Vezha Mountain, beech forest;
- 2: Stavne 48°59'16.1"N 22°41'18.6"E, Cheremkha Mountain with predominantly beech forest, forest edges, and meadows;
- 3: Uzhok pass 49°00'18.9"N 22°53'01.9"E, Uzhok Pass – source of the Uzh River, predominantly beech forest;
- 4: Mochar 48.917683, 22.532298, on the slopes of Yavirnyk Mountain, beech-sycamore forest edge;
- 5: Stuzhytsia 49°02'15.2"N 22°35'43.7"E, in the mountainous landscape of Stuzhytsia, mixed forest, forest edge;
- 6: outskirts of Velykyi Bereznyi 48°52'45.4"N 22°28'08.1"E, beech forest with anthropogenic impact;
- 7: outskirts of Velykyi Bereznyi 48°52'51.1"N 22°27'30.1"E, valley of the Uzh River

specific areas, reproducing parthenogenetically year-round – anholocyclic, whereas under other conditions, they are holocyclic.

The annotated list below systematically details the aphids, the host plant from which the material was collected, and some biological characteristics of the species.

Order Hemiptera Linnaeus, 1758.

Suborder Sternorrhyncha Amyot & Serville, 1843.

Family Aphididae Latreille, 1802.

Subfamily Aphidinae Latreille, 1802.

Genus *Aphis* Linnaeus, 1758.

Aphis fabae Scopoli, 1763.

Material: Lubnia, 23.06.2022, manual collection from stem bases, root collars of *Arctium minus* (Hill) Bernh.

Biology. Heteroecious, holocyclic. anglocyclic.

Host plants: primary hosts are *Euonymus europaeus* L., *Philadelphus coronarius* L., *Viburnum opulus* L., migrate to a wide range of secondary hosts, including the young of some trees and many crops.

Distribution: cosmopolitan.

Aphis genistae Scopoli, 1763.

Material: Mochar, 20.06.2022, manual collection from leaves and stem of *Genista tinctoria* L.

Biology. Monoecious, holocyclic.

Host plants: *Genista* spp.

Distribution: Europe, West Asia, North America.

Aphis craccivora Koch, 1854.

Material. Uzhok pass 13.06.2022, manual collection on from leaves and stem of *Galium verum* L.

Biology. Monoecious, anholocyclic, holocyclic.

Host plants: *Spiraea* and *Citrus*. On a very wide range of secondary hosts in over 20 families, on Caprifoliaceae, Compositae, Rosaceae (including hosts of the very similar *A. pomi*, q.v.), Rubiaceae and Rutaceae, and *Achillea collina* (Wirtg.).

Distribution: cosmopolitan.

Genus *Anuraphis* Del Guercio, 1907.

Anuraphis subterranea Walker, 1852.

Material: the vicinity of Velykyi Bereznyi, 11.07.2022, manual collection at stem bases and on subterranean parts of *Heracleum* L.

Biology. Heteroecious, holocyclic.

Host plants: *Pyrus communis* L., migrate to the basal parts of some umbels, especially *Heracleum* and *Pastinaca*.

Distribution: Europe, North Africa (Tunisia, Iran, western Siberia and Kazakhstan. Cited to have been found in USA.

- Genus *Brachycaudus* van der Goot, 1913.
Brachycaudus cardui Linnaeus, 1758.
 Material: Stavne: 23.06.2022, manual collection from underside of the leaves, at the base of the stem of *Cirsium waldsteinii* Rouy.
 Biology. Heteroecious, holocyclic.
 Host plants: Compositae (e.g. *Arctium*, *Carduus*, *Cirsium*, *Cynara*, *Chrysanthemum*, *Tanacetum*, *Matricaria*) and Boraginaceae (e.g. *Borago*, *Cynoglossum*, *Echium*, *Symphytum*), and also frequently on other plants, e.g. *Capsella*.
 Distribution: Europe, Asia, north Africa, and North America.
- Genus *Delphiniobium* Mordvilko, 1914.
Delphiniobium junackianum Karsch, 1887.
 Material: Uzhok pass, 20.07.2022, manual collection from stem of *Aconitum moldavicum* Hacq.
 Biology. Monoecious, holocyclic.
 Host plants: *Aconitum* and *Delphinium* sp., on upper parts of stems and between flowers.
 Distribution: north-west and central Europe, west Siberia and Kazakhstan.
- Genus *Macrosiphoniella* Del Guercio, 1911.
Macrosiphoniella millefolii De Geer, 1773.
 Material: Uzhok pass, 20.07.2022, manual collection from stem of *Achillea millefolium* L.
 Biology. Monoecious, holocyclic.
 Host plants: *Achillea* sp., on plants of related genera (*Leucanthemum*, *Tanacetum*, *Tripleurospermum*).
 Distribution: Europe, Asia and North America.
- Genus *Macrosiphum* Passerini, 1860.
Macrosiphum funestum Macchiati, 1885.
 Material: Stavne, 23.06.2022, manual collection from leaves and stem of *Rubus fruticosus* L.
 Biology. Monoecious holocyclic.
 Host plants: *Rubus* spp., esp. *R. fruticosus* Lat.
 Distribution: Europe, to the East to Moldova, Turkey, and Iran, and recorded from Canada.
- Macrosiphum rosae* Linnaeus, 1758.
 Material: Stavne, 23.06.2022, manual collection from underside of the leaves, at the base of the stem of *Dipsacus fullonum* L.
 Biology. Monoecious, anholocyclic.
 Host plants: Rosaceae, Dipsacaceae and Valerianaceae also some Onagraceae, and Aquifoliaceae Ilex.
 Distribution: world-wide, except for east and south-east Asia.
- Genus *Megoura* Buckton, 1876.
Megoura viciae Buckton, 1876.
 Material: Stuzhytsia, 29.06.2022, manual collection from leaves and stems of *Lathyrus sylvestris* L.
 Biology. Monoecious holocyclic.
 Host plants: Fabaceae, especially *Lathyrus* and *Vicia* sp.
- Distribution: Europe, Middle East, north and Central Asia, and Ethiopia.
- Genus *Sitobion* Mordvilko, 1914.
Sitobion avenae Fabricius, 1775.
 Material: Mochar, 20.06.2022, manual collection from leaf and stem of *Poa pratensis* L.
 Biology. Monoecious, anholocyclic.
 Host plants: Poaceae, as well as many other monocots, on some dicotyledons.
 Distribution: cosmopolitan.
- Genus *Uroleucon* Mordvilko, 1914.
Uroleucon achilleae Koch, 1855.
 Material: Stavne, 23.06.2022, manual collection from stem of *Achillea millefolium* L.
 Biology. Monoecious, holocyclic.
 Host plants: *Achillea* sp.
 Distribution: Europe and Iran, Kazakhstan and Kyrgyzstan and introduced to USA (California, Oregon). There is also a trap records from Pakistan.
- Uroleucon cichorii* Koch, 1855.
 Material: Mochar, 20.06.2022, manual collection from leaf and stem of *Cichorium intybus* L.
 Biology. Monoecious, holocyclic.
 Host plants: *Cichorium* and related genera of Cichorieae (*Crepis*, *Hieracium*, *Lactuca*, *Lapsana*, *Leontodon*, etc).
 Distribution: Europe and Asia.
- Subfamily Chaetophorinae Mordvilko, 1909.
 Genus Chaitophorus Koch, 1854.
Chaitophorus populeti Panzer, 1801.
 Material: Mochar, 02.06.2022, manual collection from stem of *Populus tremula* L.
 Biology. Monoecious, holocyclic.
 Host plants: young shoots and terminal leaf petioles of various *Populus* spp.
 Distribution: Palearctic region.
- Genus *Sipha* Passerini, 1860.
Sipha elegans Del Guercio, 1905.
 Material: Uzhok pass, 20.06.2022, manual collection from leaves and stems of *Elytrigia repens* L.
 Biology. Monoecious holocyclic.
 Host plants: it has been recorded on many genera of grasses (Poaceae) including *Agropyron*, *Agrostis*, *Ammophila*, *Arrhenatherum*, *Bromus*, *Elymus*, *Festuca*, *Hordeum*, *Phleum*, and *Triticum*.
 Distribution: Palearctic and northern USA.
- Subfamily Lachninae Herrich-Schaeffer, 1854.
 Genus *Cinara* Curtis, 1835.
Cinara piceae Panzer, 1801.
 Material: Uzhok pass, 13.06.2022, manual collection from the shoot of *Picea abies* (L.) H. Karst.
 Biology. Monoecious holocyclic.
 Host plants: *Picea* sp.

Distribution: Europe, and what is nominally the same species also occurs in Kazakhstan, east and west Siberia, China and Japan, recorded in Argentina.

Genus *Lachnus* Burmeister, 1835.

Lachnus pallipes Hartig, 1841.

Material: the vicinity of Velykyi Bereznyi, 15.07.2022, manual collection from the old trunk of *Fagus sylvatica* L. on cambium rupture.

Biology. Monoecious, holocyclic.

Host plants: old branches and stems of *Fagus sylvatica* L., causing feeding damage due to cambium rupture, and on branches and twigs of mainly evergreen *Quercus* species, on *Castanea sativa*. In summer, it can feed on *Fagus* roots.

Distribution: Europe, and east to the Caucasus.

Subfamily Phyllaphidinae Herrich-Schaeffer, 1857.

Genus *Phyllaphis* Koch, 1856.

Phyllaphis fagi Linnaeus, 1761.

Material: the vicinity of Velykyi Bereznyi, 15.07.2022, Mochar, 02.06.2022, manual collection from undersides of mostly young leaves of *Fagus sylvatica* L.

Biology. Monoecious, holocyclic.

Host plants: *Fagus sp.*

Distribution: Europe, east to Turkey and Caucasus, from China and Korea, and introduced to Australia, New Zealand and North America.

Conclusions

Despite the specific characteristics of the studied area, a detailed study of aphids in the Uzhanskyi National Nature Park has not been conducted, and the conclusions are preliminary results.

Based on the research conducted in the Uzhanskyi National Nature Park and its vicinity, 12 species were recorded for the first time in the park: *Aphis fabae*, *Aphis craccivora*, *Anuraphis subterranean*, *Brachycaudus cardui*, *Delphiniobium junackianum*, *Macrosiphum*

funestum, *Macrosiphum rosae*, *Megoura viciae*, *Sitobion avenae*, *Uroleucon achilleae*, *Uroleucon cichorii*, *Cinara piceae*.

In total, 18 species of aphids, belonging to 13 genera and 4 subfamilies within the family Aphididae (Hemiptera: Aphidomorpha) were identified. The most diverse subfamily was Aphidinae, which included 13 species. Aphids were found on 16 taxa of host plants. A total of 19 species were noted.

Most of the identified aphids spend their entire lives on a single host plant with alternating sexual generations (*Phyllaphis fagi* L., *Delphiniobium junackianum* Karsch., and others), which may indicate the naturalness of these forests and minimal transformation due to logging.

A specific and relatively rare species for beech forests *Lachnus pallipes* Hartig, 1841, which had not been recorded in western Ukraine for over 50 years, was discovered. This aphid feeds on beech or oak, often on the trunk at the site of cambium rupture, and has symbiotic relationships with ants. Since ants colonize the tree under certain conditions, this species, like some of the identified species, can be considered stenotypic and mesophilic concerning the host plant.

The list of aphids in the park is still incomplete, and further research will undoubtedly expand it with new species, providing a more comprehensive understanding of the diversity and ecological characteristics necessary for monitoring and developing management strategies for protected areas.

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