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Structure and origin of fauna

The Monograph

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Struktura i geneza fauny

Monografia

ROCZNIK MUZEUM GÓRNOŚLĄSKIEGO W BYTOMIU
PRZYRODA NR 18

Barbara Osiadacz, Wacław Wojciechowski

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ANNALS OF THE UPPER SILESIAN MUSEUM IN BYTOM
NATURAL HISTORY NO. 18

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Manuscript submission / Adres redakcji:
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World List abbreviation: *Roczn. Muz. górnośl.* (Przyr.)
Issued 25 August 2008

PL ISSN 0068-466X

Printed in Poland

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Abstract.

The paper presents distributional data on the aphids (Hemiptera: Aphidinea) occurring in the area of the Ojców National Park (Ojcowski Park Narodowy, OPN), Wyżyna Krakowsko-Wieluńska (Kraków-Wieluń Upland, SE Poland); UTM DA15 and DA16. The inventory of aphid species, their host plants, as well as ecological and chorological characteristics are given. The taxonomic structure, the chorological structure as well as ecological structure and trophic relationships of the aphids of OPN are given and discussed. The material for this study has been collected during years 2003–2006. The voucher specimens are deposited in the entomological collections of the Department of Zoology, University of Silesia in Katowice.

The number of 250 aphids species, including the published data from a previous research, not confirmed in this study, is given. Three species – *Aphis lilago*, *Macrosiphum albifrons* and *Cavariella salicicola* have been recorded for the first time in Poland. The 24 aphid species have been recorded for the first time in the region of Kraków-Wieluń Upland. Both inventory and faunological research confirmed high diversity and mosaic character of the Ojców National Park habitats. Numerous habitats are very limited in size, also some aphids host plants are present in limited numbers which is a factor strongly influencing the composition and commonality of aphid species. Various habitats, e.g. rock ledges covered with plant community *Festucetum pallentis*, even if very small-sized presented the highest numbers of aphid species, also xerothermic swards *Origano-Brachypodietum* and termophilous shrubs *Pruno-ligustretum* and the community of the border between associations *Geranion sanguinei* and *Potentilio albae-Quercion petraeae* presented high number of aphid species. The beech forests *Dentario glandulosae-Fagetum* and *Fagus sylvatica-Cruciata glabra* and alder forests of the *Alno-Ulmion* association presented the lowest number of aphid species. The very high number of aphid species was also recorded in the anthropogenic ruderal and segetal plant assemblages. The reason for this is the character of Ojców National Park habitats, strongly affected by human presence and activity, and the location of the Park, surrounded by the intensive agriculture landscape, and close vicinity of Kraków agglomeration and neighbouring industrialized areas.

The analysis of ecological composition of aphid species present in the area of the OPN displays the prevailing ratio of monophagous and strictly oligophagous (oligophags of 1st degree) species. This may prove that the area still preserves a rather natural character. On the other hand, the increasing number of polyphagous species records may be related to heavy influence from surrounding habitats and strong anthropopression. Similar results were obtained after analyses of other ecological factors and chrological elements.

The origin of the fauna of Ojców National Park was investigated. It is relatively young, originated after the glacier retreat, during the Holocene. Primeval fauna of the OPN reached the area using four migratory routes. These are: Moravian – from the west, Pannonian-Transcarpathian – from the south, Podolian-Volynian – from the east, and Scepusian – from the east. These routets were influenced by physiographic conditions of the area, i.e. shape and depths of the valleys. Recently, the composition of aphid fauna of the OPN has been strongly influenced by human activity.

Key words: Hemiptera, Aphidinea, aphids, Ojcowski Park Narodowy, faunistics, ecological relationships, host-plant relationships, chorology, origin of fauna

INTRODUCTION

Aphids (Aphidinea) represent the phytophag group of the order Hemiptera, suborder Sternorrhyncha, which apart from aphids also includes scale insects (Coccodea), jumping plant lice (Psyllodea) and whiteflies (Aleyrododea). Aphids are characterized by particularly tight relationship with their host plants; nearly 90% of aphid species are monophags or narrowly specialized oligophags. Most aphid species are associated with angiosperms, where they feed on all parts of plants, including subterranean parts and bark. Contrary to other memebers of the order Hemiptera, aphids have conquered mostly the temperate zones of the northern hempisphere, although they are also present in the tropical, subtropical, and temperate zones of the southern hemisphere. Viewed from the angle of human farming system, aphids are considered as dangerous pests attacking crop plants, since they transmit viral diseases and cause deformation of shootings and leaves, as well as the development of galls. However, in general environmental terms, aphids are a significant link in all ecosystems, since they play an important role serving as food for many species of insects (including rare and protected ones): beetles (Coleoptera), various species of Hymenoptera, flies (Diptera) that belong to the Syrphidae family, various species of Hemiptera that belong to the Anthocoridae family, and also spiders and birds. Furthermore, the importance of the aphid species that excrete honeydew cannot be overlooked, since they are important not only for ants and melitophagous insects, but also for man.

So far, 706 aphid species have been identified within Poland's territory, which constitutes almost 50% of the European aphidofauna (Węgierek & Wojciechowski, 2004; Osiadacz & Wieczorek, 2006). This number ascertains that the aphidofauna of Poland is very well, although not evenly, researched. The fact that there exist no faunistic and faunological studies which would characterize the fauna of particular regions of Poland is a serious flaw as far as the knowledge of the country's biodiversity is concerned. The regions that have been most thoroughly investigated include: Masurian Lakeland (Pojezierze Mazurskie) and Greater Poland-Kuyavia Lowland (Nizina Wielkopolsko-Kujawska), where over 450 aphid species have been identified. The southern part of Poland has been less thoroughly investigated, apart from the northern part of the Kraków-Częstochowa Upland (Wyżyna Krakowsko-Częstochowska), where 398 taxons of aphids have been discovered (Hałaj & Węgierek 1998). As for its southern part, together with the Ojców National Park (OPN), it had never been extensively examined despite a long history of faunistic investigations.

The investigation of aphidofauna in the OPN shall provide an insight into biodiversity of an area under special environmental protection, i.e. a national park. It is particularly important in connection with the special character of the OPN, due to constant presence and activity of man within its area (Partyka, 1990).

On the basis of information concerning the flora of the OPN, its richness, diversity, peculiarity and mosaic distribution and origin, as well as the acquaintace with the bionomy of aphids, the existence of a large variety of aphid species may

be assumed. Providing better insight into the relationship of aphids and their host plants and other organisms that are related to them is of vital importance both to environmental protection and to the protection of biological diversity.

In the light of these facts it seemed justified to launch a research program in order to:

– provide an inventory of the Aphidinea fauna of the OPN;
– specify the ecological structure of the aphidofauna of the OPN;
– specify the chorological structure of the aphidofauna of the OPN;
– trace the origin of aphid fauna of the OPN.

THE HISTORY OF BIOLOGICAL INVESTIGATION IN THE AREA OF THE OJCÓW NATIONAL PARK

Ojców National Park belongs to a group of well investigated parks as far as biological studies in Poland are concerned. The first explorations of the area aimed to investigate its flora; they were initialized by Wilibald Besser, a pioneer of the botanical studies in the Ojcowska Valley (Dolina Ojcowska), the area which he described as *Vallis pulcherima et plantis raris ditissima* (the most beautiful valley famous for rare plants) (Besser, 1809). Among the important botanical studies of the area in question which later became the national park, there ought to be mentioned, among others: Berdau, 1859; Jelenkin, 1901; Medwecka-Kornaś & Kornaś 1964; Medwecka-Kornaś, 1977; Michalik, 1977, 1978, 1979, 1983; Medwecka-Kornaś & Loster, 1995.

The historical fact which contributed to initializing faunistic research in this area consisted in cutting off the Congress Kingdom of Poland from the Carpathians and Podole, which encouraged Warsaw naturalists to focus on the surroundings of Ojców (Pawłowski, 1990). In 1853 there commenced the journey of three Warsaw naturalists: Antoni Waga, Władysław Taczanowski and Kazimierz Stronczyński, the results of which were later published by the Warsaw Library (Waga, 1855, 1857) and had fundamental significance for the later investigations of the area in question. Until 1988, in the area of the OPN and its protection zone there had been catalogued 4055 species of animals, although it is estimated that the area in question is inhabited by about 30% of national fauna, i.e. about 11,000 species (Pawłowski, 1990). Ten years later in the area of the park and its surroundings there were catalogued 5550 species of animals, including 4600 species of insects (Partyka & Wiśniowski, 1998). The most extensively investigated groups of animals in the Ojców National Park include molluscs (Urbański, 1977) and mammals (Rzebik-Kowalewska, 1977). As for insects, the most thoroughly investigated groups include, among others: Collembola (Szeptycki, 1967), Orthoptera (Bazyluk, 1970; Liana, 1990, Warchałowska-Śliwa & Maryańska-Nadachowska, 1992), Coleoptera (Pawłowski *et al.,* 1994), Diptera (Klasa, 2002), and Hymenoptera (Dylewska & Wiśniowski 2003a).

In spite of the long history of faunistic studies in the area of the Ojców National Park, which were initialized in the 19th century, the order Hemiptera has never been

extensively investigated. Among all the groups of Hemiptera inhabiting the OPN, there has only been conducted detailed faunistic investigation of scale insects of the superfamily Coccoidea (Koteja & Żak-Ogaza, 1969) and planthoppers and leafhoppers of the suborders Fulgoromorpha et Cicadomorpha (Szwedo, 1992).

Until 2003, before the aphidofauna of the OPN was investigated for the purposes of this monography, there had been identified merely 16 species of aphids in the area of the park. Mordvilko (1897, 1901) states that there are two aphid species in Ojców, namely *Phyllaphis fagi* and *Cinara pectinatae* (as *Lachnus pichtae*).

In his study on plant galls, completed in 1918, Moesz (1919) states that in the area of Ojców there can be encountered *Dysaphis sorbi* (as *Aphis sorbi*) on *Sorbus aucuparia*. The study which chronologically follows that of Moesz was written in the second half of the 20th century and was devoted to the discovery of *Hyadaphis coriandri* (as *Hyadaphis tatarica*) (Jakuczyn, 1972) in the area of OPN in 1970. The latest data on the presence of aphids in the area of the OPN and its protection zone comes from the 1990s. There is only one study from this period, according to which there exist merely 12 aphid species in the OPN, mostly having trees as their host plants, and including the following species: *Thelaxes dryophila*, *Glyphina schrankiana*, *Drepanosiphum aceris*, *Phyllaphis fagi*, *Euceraphis punctipennis*, *Betulaphis quadrituberculata*, *Tuberculatus querceus*, *Tuberculatus annulatus***,** *Pterocallis albidus*, *Therioaphis trifolii trifolii*, *Subsaltusaphis intermedia*, *Sminthuraphis ulrichi* (Piechota, 1990). The latest study of a more general character mentioning aphids concerns galls on the oak leaves which can be caused, among others, by *Phylloxera coccinea* (Skrzypczyńska, 1995).

Despite undeniable environmental values of the OPN and the fact that its fauna has been investigated for over half a century, aphids still remain a vastly underresearched group of organisms.

CHARACTERISTICS OF THE INVESTIGATED AREA

The investigated area, which constitutes the Ojców National Park, is situated in the southern part of the Kraków-Częstochowa Upland, situated at Lat 50°12'N and Long 19°46'E, about 20 kilometers to the north-west of the city of Kraków (Kondracki, 2002; Richling, 2006).

Ojców National Park was established in 1956 as the sixth national park of Poland, in the 12-kilometers-long central part of Prądnik Valley (Dolina Prądnika), the 5-kilometers-long lower and central part of the Sąspowska Valley (Dolina Sąspowska), and the fragments of Jurassic limestone hilltop surrounding these valleys. Together with other forms of landscape scattered on nearly the whole area of Kraków Jura, which were environmentally protected as the complex of Jurassic Landscape Parks (Zespół Jurajskich Parków Krajobrazowych) in the years 1980–1981, the OPN constitutes a regional network of protected areas (Partyka, 2006; Musielewicz, 2005).

The OPN is the smallest national park in Poland: its present area amounts to 2145.62 ha, and its protection zone is 6777 ha. The land owned by the State Treasury

constitutes 64% of the overall area of the park (Wiśniowski, 2003a; Partyka, 2006).

According to the Universal Transverse Mercator (UTM) system, applied for faunistic studies and recognized by the center of Faunistic Documentation and the Museum and Institute of Zoology of the Polish Academy of Sciences, the area of the OPN is situated in squares DA 15 and DA 16.

In administrative terms, the OPN is situated in Kraków District, which constitutes part of the Małopolska voivodship.

In the surroundings of Ojców there are present two lithological varieties of Jurassic limestones:

– massive limestones, with a high level of resistance to weathering, characterized by lack of bedding, considerable cohesion, vertical and horizontal separateness along joint fissures, lack of flint nodules and the presence of fossil sponges. As a result of the long-lasting processes of decay and erosion they have been formed from among the surrounding Jurassic limestone rocks and their agglomerations known as monadnocks. The largest rock complexes in the area of the OPN are: Skały Wernyhory, Skały Wdowie, Skały Zamkowe, Skały Panieńskie, Góra Koronna and Góra Okopy (Aleksandrowicz & Aleksandrowicz, 2004; Partyka, 2006).

– bedded limestones, characterized by the presence of horizontal bedding planes which are usually 0,5 meters to 1,5 meters thick, but sometimes even 3,0 meters thick. Among the fossils encountered in this variety of limestone rocks there are mainly lampshells (Brachiopoda) and very rarely also ammonites (Drzał, 1972; Partyka, 2006).

These limestone rock bassets form a belt about 20 kilometers wide, and their layers slightly sink in the NE direction. Their thickness varies from about 100 meters in Prądnik Valley to over 200 meters on the hilltop at the eastern side of the valley (Aleksandrowicz & Aleksandrowicz, 1977).

Cretaceous sediments of Senonian marls appear only fragmentarily near the park border in the neighbourhood of Skała (Drzał, 1972).

The valley sides and the hilltop are covered with Quaternary rock fromations: loess, marls, clays and gravels, while in the stream beds there are alluvial formations as well (Wiśniowski, 2003a).

According to the geomorphological division of Poland, the OPN is situated in the region of the Ojców Plateau which belongs to the southern part of the Kraków Upland mezoregion, the Kraków Upland macroregion, Silesia-Kraków Upland subprovince, the Uplands of Silesia and Małopolska province (Klimaszewski, 1972).

In the area in question there are mostly present landforms characterictic of limestone areas, such as:

– large, canyon-like limestone valleys 60 meters deep at the most, having narrow and usually flat bottoms with two low terraces; into the terraces there cuts, 0.5 – 1.5 meters deep, the bed of the draining stream. The valleys are usually bordered by steep slopes or vertical rock walls, rich in slope rock formations such as minor gullies with hanging mouths, limestone slope heaps, and others. Valleys of this

kind include Prądnik Valley and Sąspówka Valley (Drzał, 1972; Gilewska, 1972; Małecki, 1977).

– small ravine-like limestone valleys, very numerous, characterized by considerable slope gradient as well as narrow, winding bottoms developed by intermittent water flows. The bottoms of such valleys contain rock steps, washouts, breaches and silt-covered areas whose location frequently changes. The intermittent water flows result also in the development of alluvial fans at the valley mouths.

– terraces, fans and other small limestone and rock formations such as gates, walls, spurs, needles, pinnacles etc. are present in large numbers both in the valleys themselves and in their proximity. On the hilltop there can be encountered sinkholes, but they are not not very numerous.

– caves, developed mainly in the massive variety of Jurassic limestone. They are usually horizontally situated at various levels above the valley bottoms (Drzał, 1972; Małecki, 1977; Partyka, 2006).

An important period in relief development of the investigated area was the period of land evolution which lasted, with short interruptions, from Lower Cretaceous period until Miocene Epoch.

Long-lasting denudation process led to the development of slightly undulating hilltop known as Paleogene planation surface. In the surroundings of the OPN, mainly in the NW direction, the hilltop is strewn with numerous rocks, called monadnocks, consisting of massive limestone resistant to weathering, which did not yield to erosion during denudation processes undergone by the hilltop (Aleksandrowicz & Aleksandrowicz, 2004).

Ice sheet covered the area of the OPN during the period of Sanian Glaciation. During the Oder Glaciation (Middle Poland Glaciation) and Vistulian Glaciation (Baltic Glaciation) the area of the OPN was beyond the extent of ice sheet, in the cool climate zone (Drzał, 1972; Gilewska, 1972; Mojski, 1999).

The landforms of the OPN are very diversified. The highest peak in the park is Chełmowa Góra (472 masl), and the lowest point is Prądnik Korzkiewski (286 mbsl). Bottoms of valleys are situated at the height of approximately 320 masl, while steep valley sides on average reach the hilltop at the height of 450 masl. Small, dry side valleys, gorges and ravines feed into the main valleys (Michalik, 1978; Wiśniowski, 2003a).

In the area of the OPN there are three major soil types:

– rendzina: a type of soil that came into being as a result of limestone weathering; it covers mountain slopes with a thin layer (up to 25 cm thick); on the hilltop it lies at the foot of rocks;

– brown soil: a type of soil that came into being on the limestone surface covered with thin layer of loess; present on the sides and bottoms of valleys;

– podsol: a type of soil that came into being on the hilltop covered with thick layer of loess; it covers nearly half of the overall area of the park (Greszta & Bitka, 1977).

The area of the OPN is a typical limestone area with few streams, situated at the

catchment basin of Prądnik stream and its sole permanent tributary, Sąspówka.

The average flow of Prądnik is 370 l/s, while the average flow of Sąspówka is 120 l/s. Annual maximum water levels for both Prądnik and Sąspówka fall on the period of early spring and summer, while the annual minimum water levels fall on the autumn and winter months.

Both these water courses are fed with numerous karst-fissure springs; the presence of about 20 such springs has been recorded in the area of the park. They constitute natural outflaws of subterranean waters from the water-bearing floor of Jura limestone, and their flow does not exceed 10 l/s. The waters are characterized by high purity and low temperature, which in summer amounts to 8.5°C–10°C (Soja & Partyka, 2004; Partyka, 2006).

The Jura hilltop is completely waterless, and the level of groundwater is situated at the depth of 30–40 m (Małecki, 1977).

The park area is devoid of natural water reservoirs (Wiśniowski, 2003a; Partyka, 2006).

The climate of the OPN displays some features of mountain climate since it is characterized by variable sun exposure, high diurnal temperature range and frequent inversions. Thermal conditions are tightly connected with relief. Thus, the average annual temperature on the hilltop amounts to 7.5°C (while in the nearby Kraków it is 0.5°C lower), on the nort-facing slopes it amounts to 6.6°C, and at the valley bottom to no more than 6.2°C (Partyka, 2006).

Since the climatic conditions in the OPN area to a large extent modified by the diversified relief, there are differentiated the following microclimatic regions:

– temperate region that encompasses hilltop flattenings, where the micrclimatic conditions are most similar to these typical of the whole Silesia-Kraków region (Woś, 1999),

– cool region of valley bottoms, characterized by the high diurnal temperature range, sometimes 5°C higher than on the hilltop, snow cover duration longer by 12–14 days, and also increased humidity, sometimes even by 30% (Drzał, 1972; Klein, 1977).

For this reason in the cross section of Prądnik Valley and Sąspówka Valley there are present large thermal-humidity contrasts, where the temperature range amounts to nearly 40°C (Partyka, 2006).

An average amount of annual rainfall is considerably diversified. The highest annual rainfall is recorded on the north slopes and on the hilltop, i.e. 824–830 mm. In the valleys the annual rainfall is lower: 774 mm in Prądnik Valley and 749 mm in Sąspówka Valley. In the course of the year the amount of summer rainfall exceeds that of winter rainfall (Partyka, 2006).

An average snow cover duration on the hilltop in Biały Kościół amounts to 50 days, while in the Sąspówka Valley it is 107 days (Partyka, 2006).

The OPN is situated in the naighbourhood of large industrial centres, i.e. Upper Silesia Industrial Region (Górnośląski Okręg Przemysłowy), Jaworznicko-Chrzanowski Industrial Region (Jaworznicko-Chrzanowski Okręg Przemysłowy)

and in the immediate neighbourhood of the Olkusz-Bukowno-Bolesław region. Over 200 industrial plants have direct influence on the natural environment of the OPN.

Apart from industry, major threats to the natural environment of the OPN are posed by:

– the functioning of road network in the immediate neighbourhood and within the boundaries of the park (route E40 in the Prądnik Valley),

– mass tourism (littering the park premises, excessive noise, scaring away animals, picking up specimens of rare plants, danger of fire and air pollution by exhaust fumes (Caputa *et al.*, 2004; Partyka, 2006).

The measurements conducted by the Voivodeship Sanitary-Epidemiological Station in Kraków have shown considerable exceeding of permissible level of SO_2 (the pH of rainfall amounted to about 4.1–4.3). Apart from that, also high concentration of heavy metals is one of the factors that justify conting the OPN among degraded national parks (Caputa *et al.*, 2004; Sawicka-Kapusta *et al.*, 2006).

Pollution of the air is connetced with, among other things, the damage to tree stands in forests (the region of Złota Góra and patches of Jura hilltop).

Excluding the springs feeding into upper sections of the Prądnik and Sąspówka rivers within the boundaries of the villages Sułoszowa and Sąspów, in which there has been identified a high concentration of nitrates (thus they are identified as third class waters), spring waters in the OPN are mostly of good quality (i.e. second class) (Siwek, 2006).

Both diversified relief and vast diversity of climatic conditions contribute to significant richness of flora and the development of numerous habitats that encompass a variety of plant communities. In the area of the Ojców National Park and its protection zone there have been identified about 950 species of vascular plants which appear within phytocenoses that belong to 30 taxonomic units, although since the establishment of the park many of them have undergone serious transformations (Medwecka-Kornaś & Kornaś, 1964; Michalik, 1977, 1978; Medwecka-Kornaś, 1977; Medwecka-Kornaś & Loster, 1995).

The flora of the OPN is characterized by a significant percentage of xerothermic species, including, among others, such species as: *Stipa joannis*, *Festuca pallens*, *Inula hirta*, *Veronica austriaca*, *Anthemis tinctoria*, *Salvia verticillata*, *Alium montanum*, *Anthericum ramosum*, *Melica transsilvanica* and mountain species, including: *Aconitum moldavicum*, *Centaurea mollis*, *Dentaria glandulosa*, *Lunaria rediviva*, *Sempervivum soboliferum*, *Valeriana tripteris* (Michalik, 1979, 1983). Many of these species are rare in the area of Poland, including: *Aconitum moldavicum*, *Allium montanum*, *Centaurea mollis*, *Festuca pallens*, *Gentianella ciliata*, *Laserpitium latifolium*, *Libanotis pyrenaica*, *Lunaria rediviva*, *Melica transilvanica*, *Saxifraga tridactylites*, *Trifolium rubens* (Zając & Zając, 2001), while *Betula* x *oycoviensis*, *Thymus praecox*, *Stipa joannis*, *Verbascum chaixii* subsp. *austriacum* represent plant species threatened with extinction (Kaźmierczakowa & Zarzycki, 2001).

In the area of the OPN there prevail forest communities, among which the most important ones include:

– *Querco roboris-Pinetum* (formerly *Pino-Quercetum*) – several variants of temperate mixed forest, which is becoming extremely rare in the OPN; its few patches have survived in some parts of the hilltop in dry and heavily acidified spots. The tree stand includes: *Pinus sylvestris*, *Abies alba* or *Picea abies* mixed with *Quercus robur*, *Q. petraea*, *Betula pendula*. In the scrub layer there dominate *Sambucus nigra* and *S. racemosa*, while in the herb layer there may be encountered, among other species, *Hieracium laevigatum*, *H. murorum*, *Vaccinium myrtillus*, and *Pteridium aquillinum*. The most transformed phytocenoses of this community are characterized by thinned stand, and their herb layer is dominated by *Sencio fuchsii* and *Impatiens parviflora*. Most forests transform into beech forests or broad-leaved forests;
– *Dentario glandulosae-Fagetum* – Carpathian beech forest is frequent in the area of the OPN. It can be found mainly on the northern slopes of gorges with cold and humid climate, where the dominating soil types are rendzina and brown soil. In the tree stand there prevails *Fagus sylvatica* with admixture of *Acer pseudoplatanus* and rarely also *Abies alba*. In the herb layer there can be encountered *Dentaria glandulosa*, *Galium odoratum*, *Maianthemum bifolium*, *Asarum europaeum*, *Hepatica nobilis*. In the park area this community has an extrazonal and relict character;
– The community *Fagus sylvatica-Cruciata glabra* (formerly *Carici-Fagetum*) –stenothermic beech forest characteristic of the Małopolska region, which has several communes in sunny locations within the area of the OPN. Many plant species characteristic of the Carpathian beech forest are absent from the herb layer. They are replaced, among others, by the following plants: *Laserpitium latifolium*, *Vincetoxicum hirudinaria*, *Acinos arvensis*, *Convallaria maialis*, *Neottia nidus-avis*;
– *Tilio cordatae-Carpinetum betuli* (formerly *Tilio-Carpinetum*) – sub-continental broad-leaved forest is a widely spread community, which occupies valley sides exhibiting wide range of gradients and is typical of the areas where fertile brown soil is common. In the tree stand there dominates *Carpinus betulus* accompanied by *Fagus sylvatica*, *Acer platanoides*, *Acer pseudoplatanus*, *Tilia cordata*, sometimes also *Quercus robur* and *Q. petraea*. In the scrub layer *Lonicera xylosteum* is frequent, and in the herb layer, characterized by rich diversity of plant species, there are present: *Stellaria holostea*, *Hepatica nobilis*, *Galium odoratum* and *Campanula trachelium*;
– As for the *Alno-Ulmion* association (formerly *Alno-Padion*) – i.e. riparian forest, its patches have survived only over small areas by streams at the bottoms of river valleys. They grow in damp fen soil and brown soil. Plant species present in this kind of community include: *Alnus glutinosa*, *Fraxinus excelsior*, several species of *Salix* ssp., *Acer pseudoplatanus*, and also *Urtica dioica*, *Chaerophyllum hirsutum*, *Aegopodium podagraria* which are encountered in the herb layer;
– *Phyllitido-Aceretum* – sycamore forest with hart's tongue fern, which grows

in shallow and stony soil, has only few communes that occupy limited areas shadowed by the rocks of northern slopes. *Acer pseudoplatanus* is the species dominating in the tree stand, and in the herb layer there are present such species as *Phyllitis scolopendrium* and *Lunaria rediviva* (Matuszkiewicz J. M., 2001; Medwecka-Kornaś & Kornaś, 1964; Medwecka-Kornaś, 1977, 2004; Medwecka-Kornaś & Loster, 1995).

Major non-forest communities of the Ojców National Park include:

– The community on the borderline of *Geranion sanguinei* and *Potentilio albae-Quercion petraeae* (formerly *Peucedano cervariae-Coryletum*) associations – warm xerothermic thickets which grow on sunny southern and south-western slopes; they also develop on rocks and in their immediate neighbourhood. The community includes the following stunted trees: *Quercus robur*, *Q. petraea*, *Pinus sylvestris*, and several bush species: *Rhamnus cathartica*, *Euonymus verrucosa*, *Corylus avellana*, *Rosa* ssp. In the herb layer there are present, among others, the following plants: *Laserpitium latifolium*, *Vincetoxicum hirudinaria*, *Polygonatum odoratum* and *Trifolium rubens*;
– *Pruno-ligustretum* (formerly *Ligustro-Prunetum*) – privet and blackthorne thickets, the community which does not encompass such a rich variety of species as the pervious one. *Pruno-ligustretum* is dominated by *Prunus spinosa* with such companions as *Crataegus monogyna*, *Euonymus europaeus* and *Rosa* ssp.;
– *Arrhenathereteum elatioris* (formerly *Arrhentheretum medioeuropaeum*) – type of meadow which is a rich community of species growing in fen soil and brown soil; it is common at valley bottoms and on slopes that are not very steep. Plant species characteristic of this community include, among others: *Arrhenatherum elatius*, *Dactylis glomerata*, *Festuca pratensis*, *Geranium pratense*, *Crepis biennis*, *Ranunculus acris*, and *Heracleum sphondylium* with a significant participation of companions that belong to the genus *Alchemilla*;
– *Cirsietum rivularis* – moist thistle meadow. Due to the fact that the area has dried out, this type of community is presently rare and characterized by little diversity of plant species. It can be encountered in only small areas of land. Apart from *Cirsium rivulare*, it includes the following plant species: *Cirsium oleraceum*, *Myosotis palustris*, *Scirpus sylvaticus*, *Lychnis flos-cuculi*, *Carex echinata*, and others;
– *Lolio-Cynosuretum* – fertile pasture localized on a dry meadow habitat. Due to the fact that grazing, common in the initial period of the park's existence, ceased with time, nowadays the community occupies rather small areas. The low grassland of the community constitutes mainly of such species as: *Lolium perenne*, *Cynosurus cristatus*, *Trifolium repens*, *Potentilla erecta*, *Leontodon hispidus*, *L. autumnalis*, *Achillea millefolium*;
– *Molinietalia ceruleae* (referred to as *Geranio-Petasitetum*) community – tall-herb community that grows on stream banks and at moist valley bottoms. The main species here are *Petasites hybridus* and *P. albus* with such companions as:

Cirsium oleraceum, *Chaerophyllum hirsutum*, *Geranium phaeum*, *Aegopodium podagraria*, *Urtica dioica*;

– *Origano-Brachypodietum* – flowery xerothermic grassland which grows solely on dry and sunny slopes. It constitutes one of the stages of succession between rocky grasslands and warm thickets. In this habitat there grow, among others, the following plant species: *Origanum vulgare*, *Libanotis pyrenaica*, *Veronica austriaca*, *Verbascum chaixii* subsp. *austriacum*, *Thymus* ssp., *Centaurea scabiosa*, *Fragaria vesca*, *Carlina* ssp., *Phleum pratense*;

– *Festucetum pallentis* – rocky grassland. It constitutes a pioneer community of a natural character and grows on steep, sunny slopes and rocky ledges. Among species characteristic of this habitat there are: *Festuca pallens*, *Allium montanum*, *Jovibarba sobolifera*, *Libanotis pyrenaica*, *Melica transsilvanica*, and *Sedum* ssp. Slightly shadowed, north-facing rocks are occupied by umbriphilous saxicolous association *Festucetum pallentis neckeretosum*, in which there can be encountered, among other species, *Valeriana tripteris*;

– *Phragmitetum australis* (previously *Scirpo-Phragmitetum*) – rush/reed community; currently only fragmentary remains of this community are present in the neighbourhood of ponds in Pieskowa Skała, where the following species can be encountered: *Phragmites australis*, *Typha latifolia*, *Lythrum salicaria*, and *Mentha aquatica*;

– *Glycerietum plicatae* – stream rushes, which grow in shallow water along streams and wet ditches and encompass the following species: *Glyceria plicata*, *Berula erecta*, *Veronica beccabunga*, *Myosotis palustris*;

– Ruderal communities that belong to the class *Artemisietea vulgaris* – they grow in the neighbourhood of human dwellings, on roadsides and garbage dumps. Over the recent years they have been spreading quickly due to the reorganization of road network and the resulting earthworks. Among ruderal plants that grow in the area of the OPN the following species are frequent: *Artemisia vulgaris*, *Arctium tomentosum*, *Tanacetum vulgare*, *Urtica dioica*, *Carduus crispus*, *Achillea millefolium*, *Plantago major*, *Capsella bursa-pastoris*, *Sinapis arvensis*, *Polygonum aviculare*, *Cirsium arvense*, *Matricaria maritima* subsp. *inodora*, *Sonchus* ssp. The list is supplemented by plants that grow also on nearby meadows, for example *Cirsium oleraceum* and *Crepis biennis*;

– Segetal habitats that belong to the class *Stellarietea mediae* and are connected with grain and root crop cultivars; the following species can be encountered in this community: *Vicia* ssp., *Centaurea cyanus*, *Cirsium arvense*, *Viola arvensis*, *Papaver rhoeas*, *Apera spica-venti* (Matuszkiewicz W., 2001; Matuszkiewicz J. M., 2001; Medwecka-Kornaś & Kornaś, 1964; Medwecka-Kornaś, 1977; Medwecka-Kornaś & Loster, 1995).

Since the establishment of the Ojców National Park (1956) and the compilation of its phytosociological map (1964) the park's plant cover has undergone many changes, including the impoverishment of plant habitats, reduction of natural habitats, and

percolation of alien species (for example *Reynoutria japonica*, *Impatiens parviflora*, *I. glandulifera*, *Oenothera glazioviana*) into natural and semi-natural plant habitats (Michalik, 1974a; Kornaś & Dubiel, 1990). The most rapid changes of plant cover took place because some kinds of human activity had been abandoned, for instance mowing and grazing of meadow ecosystems. Trees and shrubs, despite being weakened by air pollution, invade grasslands and meadows, while some xerothermic thickets develop into forests (Medwecka-Kornaś, 2006).

MATERIALS AND METHODS

Material was collected in the years 2003 – 2006 in the whole area of the OPN, during periods from the beginning of May until the middle of October.

The task of material collection was performed mainly by applying hand collecting method, which consists in careful combing through host plants; this method is considered to be the most efficient one for the purpose of aphid collection (Szelegiewicz, 1959). Additionally, specimens acquired by shaking branches of trees and scrubs were collected into a standard sweeping net. Higher parts of trees were swept with a five-metre long sweeping net.

The studies encompassed 530 species of vascular plants present in the area of the OPN, belonging to 92 families.

Material has been collected in 134 localities, representing various types of habitats. The distribution of localities is presented on Fig. 1.

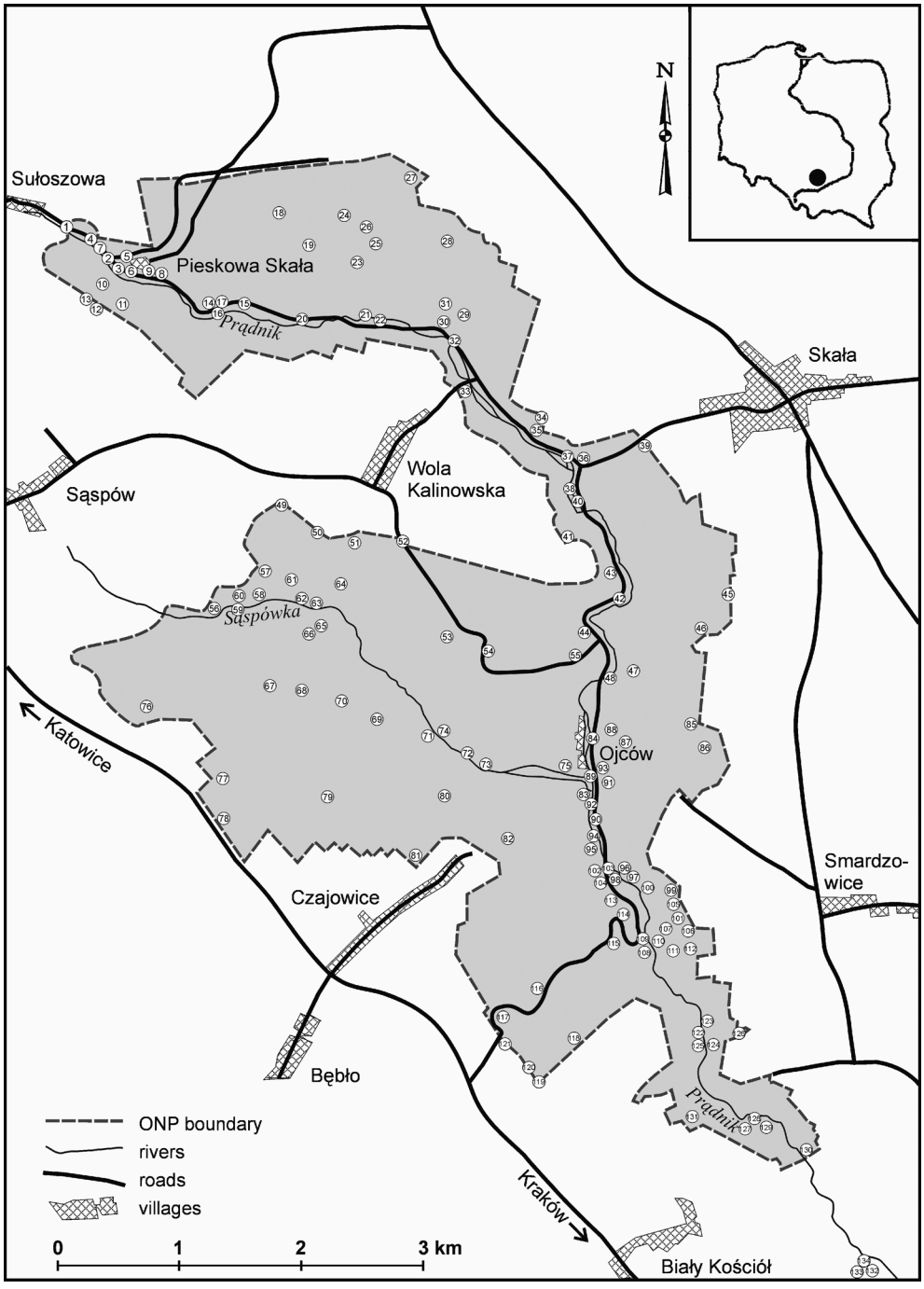
Type of plant community or habitat are identified for each locality, where the smaples were collected. Following abbreviations are used:

– bew – carpathian beech woods *Dentario glandulosae–Fagetum* and termphilous rock beech wood *Fagus sylvatica-Cruciata glabra*; localities: 64, 79, 80, 101;
– lbf – lime-hornbeam forests *Tilio cordatae-Carpinetum betuli*; localities: 8, 10, 31, 47, 55, 69, 75, 83, 87, 95, 99, 109, 112, 125;
– mix – mixed forests *Querco roboris-Pinetum*; localities: 5, 11, 18, 23, 28, 51, 53, 61, 65, 76, 77, 81, 82, 86, 106, 115, 116, 118, 132;
– ald – alder forests of the association *Alno-Ulmion*; localities: 4, 20, 43, 59, 71, 91, 103, 124;
– rsv – shelves and rock tops covered with xerothermophilous swards *Festucetum pallentis*, sometimes transitioning into xerothermic swards *Origano-Brachypodietum* or thermophilous shrubs from the border of associations *Geranion sanguinei* and *Potentilio albae-Quercion petraeae*, with single specimens of trees or bushes e.g.: *Rosa* ssp., *Rhamnus catharica*, *Pinus sylvestris*, *Quercus robur*, *Juniperus communis* frequently overgrowth by *Acer pseudopaltanus*, *Urtica dioica*, *Impatiens parviflora*; localities: 7, 9, 14, 17, 32, 40, 94, 96, 97, 100, 105, 107, 108;
– xer –xerothermal grasslands *Origano-Brachypodietum* with borders covered with termophilous shrubs *Pruno-ligustretum* and assemblage of the border

between associations *Geranion sanguinei* and *Potentilio albae-Quercion petraeae*, sometimes overgrowth by: *Calamagrostis epigejos*, *Urtica dioica*; localities: 6, 27, 33, 35, 36, 39, 41, 45, 56, 58, 63, 68, 89, 126, 127, 133;
– fmd – fresh meadows *Arrhenathereteum elatioris* and pastures *Lolio–Cynosuretum*; localities: 22, 25, 29, 50, 57, 62, 70, 73, 88, 110, 114, 119, 123, 128;
– hrb – herbal assemblages of the order *Molinietalia ceruleae* and wet thistle meadows *Cirsietum rivularis*; localities: 44, 48, 60, 74, 93, 98, 102, 104;
– rsh – reed rushes *Phragmitetum australis* and manna grass rushes *Glycerietum*

Fig. 1: Distribution of collection sites in Ojców National Park

1 – Sułoszowa [village]; 2, 3, 4, 5, 6, 7, 8 – Pieskowa Skała [village]; 9 – Maczuga Herkulesa [rock foothill]; 10 – Wąwóz Sokolec [gorge]; 11, 12, 13 – Sokolec [village]; 14, 15, 16 – Skały Wernyhory 1 [foothill and lower slopes]; 17 – Skały Wernyhory 2 [upper shelves]; 18 – Mokrzys [village]; 19 – Dąbrówka nad Młynnikiem [village]; 20, 21, 22, 23 – Młynnik [village]; 24 – Herianówka [village]; 25, 26 – Słoneczna Góra [hill, top]; 27 – Dolina Zachwytu 1 [upper portion]; 28 – Dolina Zachwytu 2 [median portion]; 29, 30, 31 – Dolina Zachwytu 3 [mouth]; 32 – Skały Wdowie [rock shelves]; 33 – Kaliski [village]; 34, 35 – Grodzisko – Skała Długa [rock foothill and slopes]; 36 – Grodzisko – Skamieniały Wędrowiec [rock slope]; 37, 38 – Grodzisko – skrzyżowanie [crossroads on the bottom of the Prądnik river valley]; 39 – Kamieniołom [rock slopes]; 40 – Skały Ciche [rock slopes]; 41 – Kapkazy [village]; 42, 43 – Ojców-Zazamcze [village]; 44 – Ojców – Kaplica na Wodzie [village, wooden chappel]; 45 – Osicze [village]; 46 – ugór koło Cmentarza cholerycznego [top of the rock, Choleric Cemetary]; 47, 48 – Drewniana Droga [gorge]; 49, 50 – Słupianka [gorge]; 51 – Diabli Młyn [forest border at the village]; 52 – Wola Kalinowska [village]; 53, 54 – Złota Góra [slopes and top, along the road]; 55 – Ojców – Park Zamkowy [village, park in the bottom of the Prądnik river valley]; 56 – Skała Gęsia Szyja [sward at the rock foothill]; 57 – Zabugaje [village]; 58, 59, 60 – Obserwatorium Sejsmologiczne [near Sąspów village]; 61 – Wąwóz Koziarnia [gorge]; 62, 63 – Dolina Sąspowska – Warzechówka [village]; 64 – Wąwóz Słupianka [gorge]; 65, 66, 67, 68 – Poręba Sąspowska [village]; 69, 70 – Poręba [village]; 71, 72, 73, 74 – Dolina Sąspowska 1 [median portion]; 75 – Dolina Sąspowska 2 [mouth]; 76 – Lepianka Sąspowska [village, border of the forest]; 77, 78 – Lepianka Czajowska [village]; 79 – Wąwóz Jamki [gorge]; 80 – Wawóz Pradła [gorge]; 81 – Czajowice [village; border of the forest]; 82, 83 – Chełmowa Góra [top and slopes]; 84 – Ojców- Centrum [center of the village]; 85, 86 – Miotełka [village]; 87, 88 – Zamkowa Droga [gorge]; 89 – Skała Jonaszówka [rock shelves]; 90, 91, 92, 93 – Ojców – Pstrągarnia [village, trout fish ponds]; 94; 95 – Brama Krakowska 1 [rock and slopes]; 96 – Skała Krukowskiego [rock shelves]; 97, 98 – Grota Ciemna [rock shelves and slopes at the cave]; 99, 100, 101 – Góra Koronna [top and rock shelves]; 102 – Brama Krakowska 2 [gorge]; 103, 104 – Ojców - Źródło Miłości [spring]; 105 – Wapiennik [rock shelves]; 106, 107 – Okopy [top and rock shelves]; 108, 109,110, 111 – Ojców - Skała Koźniowa [rock foothills]; 112 – Wąwóz Smardzowidzki [gorge]; 113, 114, 115 – Serpentyny [slopes]; 116, 117 – Wąwóz Korytania (wierzchowina) [top of the rock surrounding the gorge]; 118, 119, 120, 121 – Murownia [village]; 122, 123, 124, 125 – Ojców - Caritas [village, southernmost part]; 126 – Skała Krzyżowa [rock slope and rock shelves]; 127, 128, 129, 130 – Prądnik Korzkiewski [village]; 131 – Skalska Droga [village]; 132, 133, 134 – Wesoła – Enklawa OPN [village, OPN enclave].


N
Sułoszowa
Pieskowa Skała
Prądnik
Skała
Wola
Kalinowska
Sąspów
Sąspówka
Ojców
Katowice
Smardzo-
wice
Czajowice
Bębło
Prądnik
Kraków
Biały Kościół
ONP boundary
rivers
roads
villages
0
1
2
3 km

plicatae; localities: 3, 72, 92;
– rud – ruderal communities of the class *Artemisietea vulgaris* present near houses, roads, gardens, etc.; localities: 1, 2, 12, 16, 19, 21, 24, 30, 34, 37, 42, 49, 52, 54, 66, 78, 84, 85, 90, 111, 113, 117, 120, 122, 130, 131, 134;
– seg –segetal communities of the class *Stellarietea mediae* formed in the cereal and root-plant cultivations; localities: 13, 15, 26, 38, 46, 67, 121, 129.

Ecological analyses are based on following criteria:

▪ Host alternation: Mn – monoecious; Ht – heteroecious

▪ Trophic relationships: M – monophagous, restricted to single species of host plant; O1 – 1st degree oligophagous, restricted to single genus of host plant; O2 – 2nd degree oligophagous, restricted to single family of host plants; P – poliphagous, not restricted to particular host-plants. For heteroecios aphids the combination of both elements is used.

▪ Humidity restrictions: xph1 – 1st degree xerophiles, i.e. restricted to extreme dry habitats; xph2 – 2nd degree xerophiles – restricted do dry and semidry habitats; mh – mesohigrophiles, i.e. living in fresh habitats; hg2 – 2nd degree higrophiles, i.e. living in humid habitats; hg1 – 1st degree higrophiles, i.e. restricted to wet habitats. Humidity dependence was identified on the basis of humidity requirements indices of host plants (Zarzycki *et al.*, 2002). For heteroecios aphids the combination of both elements is used.

▪ Habitats criteria: syl – sylvibiontics, living in forest areas, i.e. in carpathian beech woods *Dentario glandulosae–Fagetum* and termphilous rock beech wood *Fagus sylvatica-Cruciata glabra*, lime–hornbeam forests *Tilio–Carpinetum*, mixed forests *Querco roboris-Pinetum*; and alder forests of the association *Alno-Ulmion*; xer – xerothermobiontics, living on shelves and rock tops covered with xerothermophilous swards *Festucetum pallentis*, xerothermal grasslands *Origano-Brachypodietum*, termophilous shrubs *Pruno-ligustretum* and assemblage of the border between associations *Geranion sanguinei* and *Potentilio albae-Quercion petraeae*; her – herbosabiontics, living in tall herbs of the order *Molinietalia ceruleae* and wet thistle meadows *Cirsietum rivularis*, fresh meadows *Arrhenatheretum medioeuropaeum* and pastures *Lolio–Cynosuretum*; lmb – limnobiontics, living in reed rushes *Phragmitetum australis* and manna grass rushes *Glycerietum plicatae*; sth – synanthropobiontics, living in synanthropic vegetation, segetal of the class *Stelarietea mediae* and ruderal of the class *Artemisietea vulgaris*.

Several proposal for typification and description of range of the species of various groups , e.g. Lepidoptera (Kostrowicki, 1965), Coleoptera (Pawłowski, 1967; Mazur, 2001; Kryzhanovskii, 2002), Neuroptera (Krivokhatskii, 1998) or for general purposes (Yemel'yanov, 1987; Czechowski & Mikołajczyk, 1981). Such proposal is lacking for the aphids, only a few papers deals with the typology of aphid species ranges, however, the cholorology of the species is often mixed and/or misinterpret with genetical (*sensu* area of origin) of species (Szelegiewicz, 1962,

1974a, 1978b; Bochen, 1989). Taking this into consideration for the purpose of description of aphid chorology of the area of the Ojców National Park, the modified criteria used by Pawłowski *et al.* (1994), Dylewska & Wiśniowski (2003b) and Kostrowicki (1999) are used. Following chorological elements are identified:

Cosmopolitan (CSM) – enclosing species with ranges exceeding the border of the Holarctic region, including introduced species;

Holarctic (HOL) – enclosing species distributed in the whole area of the Holarctic Region;

Holarctic with disjunction (HOLD) – enclosing species distributed in the whole Holarctic Region, but not continuously;

Palearctic (PAL) – enclosing species distributed in the whole Palaearctic Region, between Atlantic and Pacific coasts;

Amphipalearctic (AMP) – enclosing species distributed in Europe and Far East;

Westernpalearctic (WP) – enclosing species widely distributed in western part of the Palaearctic Region;

Westpalearctic-steppe (WPS) – enclosing species distributed in the western part of the Palaearctic Region, within the range of steppe and forest-steppe biomes;

Euro-Siberian (EUS) – enclosing species distributed in Europe and Siberia;

European (EUR) – enclosing species distributed in the prevailing part of Europe.

The distributional data on particular species were collected, verified and analysed on the basis of the following reports: Andrásfalvy, 1971; Aslan & Uygun, 2005; Barbagallo *et al.*, 1995; Barbagallo & Stroyan, 1976; Blackman & Eastop, 1984, 1994; Bodenheimer & Swirski, 1957; Borges *et al.*, 2005; Börner, 1952; Börner & Heinze, 1957; Bozhko, 1950, 1963; Davletshina, 1964; Eastop, 1958, 1961, 1966; García Prieto *et al.*, 2004; Ghosh, 1986; Heie, 1980, 1982, 1986, 1992, 1994a, 1995; Holman, 1961, 1971; Holman & Pintera, 1977, 1981; Holman & Szelegiewicz, 1972; Hottes & Frison, 1931; Hua, 2000; Ivanovskaya, 1977a, b; Juronis & Rakauskas, 2004; Kadyrbekov, 2002, 2004, 2005; Kadyrbekov *et al.*, 2002; Lampel & Meier, 2003; Mamontova-Solukha, 1963; Mamontova, 1972; Meier, 1985; Millar, 1994; Narzikulov & Danyarova, 1990; Narzikulov & Umarov, 1969; Nieto Nafría & Mier Durante, 1998; Nieto Nafría *et al.*, 2003, 2005; Ortego *et al.*, 2004; Pashchenko, 1987, 1988; Pashchenko & Lobkova, 1990; Pintera, 1987; Raychaudhuri, 1980; Richards, 1968; Rupajs, 1972, 1989; Smith & Parron, 1978; Stekolshchikov, 2005; Stroyan, 1979; Shaposhnikov, 1964; Szelegiewicz, 1963, 1966, 1968a, b; Tashev, 1966; Wojciechowski, 2003.

For the species recorded in the area of the OPN, their distribution in Poland is also given (Table 1), according to the physiographic division of Poland given in the Catalogue of the Polish Fauna (Szelegiewicz, 1968b); these data have been updated and verified using the following papers: Achremowicz, 1972, 1986, 1990; Barczak, 1987; Bochen, 1977, 1989; Czylok, 1983; Czylok *et al.*, 1991, 1982, 1988; Czylok & Wojciechowski, 1987; Durak, 2003; Durak & Wojciechowski, 2005; Gębicki

Table 1. Distribution of aphids recorded in the area of the OPN in Poland

	Name of species	Balic-sea Coast	Pomeranian Lake District	Masurian Lake District	Wielkopolsko-Kujawska Lowland	Mazovian Lowland	Podlasie Lowland	Białowieża Primeval Forest	Lower Silesia	Trzebnica Hills	Upper Silesia	Kraków-Wieluń Upland	Małopolska Upland	Świętokrzyskie Mountains	Lublin Upland	Roztocze Upland	Sandomierz Lowland	Western Sudetes Mountains	Eastern Sudetes Mountains	Western Beskidy Mountains	Orawsko-Nowotarska Dale	Eastern Beskidy Mountains	Bieszczady Mountains	Pieniny Mountains	Tatry Mountains
		2	3	4	5	6	7	7a	8	8a	9	10	11	11a	12	13	14	15	16	17	17a	18	19	20	21
1	*Adelges laricis*	+	+	+		+					+	+			+			+		+	+		+		+
2	*Pineus pini*	+		+	+	+						+												+	+
3	*Sacchiphantes abietis*	+	+	+	+	+						+			+		+	+		+	+		+		+
4	*Sacchiphantes viridis*	+			+	+					+	+								+	+				
5	*Phylloxera coccinea*	+		+	+	+			+			+	+		+					+			+		
6	*Phylloxera glabra**				+	+																			
7	*Eriosoma ulmi**	+	+	+	+	+		+			+		+		+			+					+		
8	*Tetraneura ulmi*	+	+	+	+	+	+	+			+	+	+		+		+	+		+	+	+	+		
9	*Pemphigus borealis**		+																						
10	*Prociphilus bumeliae**				+	+		+							+					+	+	+	+		
11	*Prociphilus Stagona pini*			+	+						+	+	+		+										
12	*Prociphilus xylostei*	+		+	+	+		+	+		+	+									+		+		
13	*Thecabius affinis*	+		+	+	+	+	+				+	+		+			+		+	+	+	+		
14	*Forda marginata*		+	+	+	+	+				+	+	+				+	+					+		
15	*Glyphina betulae*	+	+	+	+	+	+				+	+	+		+		+	+		+	+		+		
16	*Glyphina jacutensis* ?	+	+		+	+	+					+	+				+			+		+	+		
17	*Thelaxes dryophila*	+	+	+	+	+	+		+		+	+	+		+		+	+		+		+	+		
18	*Anoecia corni*	+	+	+	+	+		+	+		+	+	+		+		+	+		+			+	+	

	Name of species	Balic-sea Coast	Pomeranian Lake District	Masurian Lake District	Wielkopolsko-Kujawska Lowland	Mazovian Lowland	Podlasie Lowland	Białowieża Primeval Forest	Lower Silesia	Trzebnica Hills	Upper Silesia	Kraków-Wieluń Upland	Małopolska Upland	Świętokrzyskie Mountains	Lublin Upland	Roztocze Upland	Sandomierz Lowland	Western Sudetes Mountains	Eastern Sudetes Mountains	Western Beskidy Mountains	Orawsko-Nowotarska Dale	Eastern Beskidy Mountains	Bieszczady Mountains	Pieniny Mountains	Tatry Mountains
		2	3	4	5	6	7	7a	8	8a	9	10	11	11a	12	13	14	15	16	17	17a	18	19	20	21
19	*Anoecia vagans*			+	+							+	+												
20	*Mindarus abietinus**	+		+	+			+							+		+			+		+	+		+
21	*Drepanosiphum acerinum*			+	+	+					+	+						+		+			+		
22	*Drepanosiphum aceris* ?	+		+	+	+					+	+	+		+			+		+	+				
23	*Drepanosiphum platanoidis*	+	+	+	+	+	+		+		+	+	+		+		+	+		+	+	+	+	+	+
24	*Calaphis betulicola*		+	+	+	+					+	+	+				+			+	+		+		
25	*Calaphis flava*	+	+	+	+	+			+		+	+	+		+		+	+		+	+		+		
26	*Callipterinella calliptera*	+	+	+	+	+	+				+	+	+		+		+	+		+	+		+		+
27	*Callipterinella tuberculata*	+	+	+	+	+	+		+		+	+	+		+		+	+		+			+		
28	*Chromaphis juglandicola*	+		+	+	+					+	+	+		+	+					+	+			
29	*Clethrobius comes*	+	+	+	+	+					+	+	+				+			+	+		+	+	
30	*Betulaphis quadrituberculata* ?	+	+	+	+	+		+			+	+	+	+	+		+	+		+	+		+		
31	*Eucallipterus tiliae*	+	+	+	+	+	+		+		+	+	+		+		+	+		+	+		+		+
32	*Euceraphis betulae*					+	+				+	+	+				+	+			+		+		
33	*Euceraphis punctipennis* ?	+	+	+	+	+					+	+	+		+		+	+		+	+		+	+	
34	*Monaphis antennata*		+	+	+	+		+			+	+	+				+	+		+	+	+	+		
35	*Myzocallis carpini*	+	+	+	+	+		+	+		+	+	+		+		+	+		+		+	+	+	+
36	*Myzocallis coryli*	+	+	+	+	+	+		+		+	+	+		+		+	+		+	+	+	+		+
37	*Panaphis juglandis*	+			+	+					+	+	+		+	+				+		+	+		

	Name of species	Balic-sea Coast	Pomeranian Lake District	Masurian Lake District	Wielkopolsko-Kujawska Lowland	Mazovian Lowland	Podlasie Lowland	Białowieża Primeval Forest	Lower Silesia	Trzebnica Hills	Upper Silesia	Kraków-Wieluń Upland	Małopolska Upland	Świętokrzyskie Mountains	Lublin Upland	Roztocze Upland	Sandomierz Lowland	Western Sudetes Mountains	Eastern Sudetes Mountains	Western Beskidy Mountains	Orawsko-Nowotarska Dale	Eastern Beskidy Mountains	Bieszczady Mountains	Pieniny Mountains	Tatry Mountains
		2	3	4	5	6	7	7a	8	8a	9	10	11	11a	12	13	14	15	16	17	17a	18	19	20	21
38	*Phyllaphis fagi*	+	+	+	+	+		+	+		+	+	+		+		+	+		+	+		+		
39	*Pterocallis albidus* ?			+	+	+					+	+	+				+	+		+	+	+	+		
40	*Pterocallis alni*	+		+	+	+	+		+		+	+	+		+		+			+			+		
41	*Symydobius oblongus*	+	+	+	+	+	+	+			+	+	+		+		+	+		+	+	+	+		+
42	*Therioaphis trifolii* ?	+		+	+	+		+	+			+	+	+	+	+	+			+			+	+	
43	*Tinocallis platani**	+		+	+	+	+		+		+				+	+				+					
44	*Tinocallis saltans*										+	+													
45	*Tuberculatus querceus*		+	+	+	+					+	+	+		+		+	+		+		+			
46	*Tuberculatus annulatus*	+	+	+	+	+	+		+		+	+	+	+	+	+	+	+		+	+	+	+		
47	*Sminthuraphis ulrichi* ?	+		+	+			+				+		+		+									+
48	*Subsaltusaphis intermedia* ?	+			+							+				+		+							
49	*Chaitophorus capreae*	+		+	+	+			+		+	+	+		+		+	+		+	+		+		
50	*Chaitophorus hypogaeus*										+	+													
51	*Chaitophorus mordvilkoi* *			+									+								+				
52	*Chaitophorus populeti*	+	+	+	+	+	+		+		+	+	+		+		+	+		+	+	+	+		
53	*Chaitophorus salicti*	+	+	+	+	+	+		+		+	+	+		+		+			+	+		+		
54	*Chaitophorus salijaponicus niger*	+			+	+	+		+		+	+	+		+		+	+		+	+		+		
55	*Chaitophorus tremulae*	+	+	+	+	+			+		+	+	+	+	+		+	+		+	+		+		
56	*Chaitophorus truncatus*			+	+	+	+				+	+	+		+		+			+	+	+	+		

	Name of species	Balic-sea Coast	Pomeranian Lake District	Masurian Lake District	Wielkopolsko-Kujawska Lowland	Mazovian Lowland	Podlasie Lowland	Białowieża Primeval Forest	Lower Silesia	Trzebnica Hills	Upper Silesia	Kraków-Wieluń Upland	Małopolska Upland	Świętokrzyskie Mountains	Lublin Upland	Roztocze Upland	Sandomierz Lowland	Western Sudetes Mountains	Eastern Sudetes Mountains	Western Beskidy Mountains	Orawsko-Nowotarska Dale	Eastern Beskidy Mountains	Bieszczady Mountains	Pieniny Mountains	Tatry Mountains
		2	3	4	5	6	7	7a	8	8a	9	10	11	11a	12	13	14	15	16	17	17a	18	19	20	21
57	*Chaitophorus vitellinae*			+	+	+					+	+	+		+		+			+	+	+			
58	*Periphyllus acericola*	+			+	+			+		+	+	+		+		+			+		+	+		+
59	*Periphyllus aceris*	+			+	+					+	+			+		+			+	+				
60	*Periphyllus coracinus*	+	+	+	+	+					+	+	+		+					+					
61	*Periphyllus lyropictus*	+	+		+	+	+		+		+	+	+		+					+	+		+		
62	*Periphyllus testudinaceus*	+	+	+	+	+					+	+	+		+		+					+	+		
63	*Laingia psammae*	+	+	+	+	+	+		+		+	+	+				+			+					
64	*Plocamaphis flocculosa brachysiphon*			+	+	+					+	+	+												
65	*Pterocomma jacksoni*	+	+	+	+	+	+					+	+		+			+		+	+	+	+		
66	*Pterocomma pilosum*	+		+	+	+					+	+	+		+						+				
67	*Pterocomma pilosum konoi*	+	+	+	+	+	+				+	+	+		+		+	+		+		+	+		
68	*Pterocomma rufipes*						+	+			+	+						+			+		+		
69	*Pterocomma salicis*	+		+	+	+					+	+	+		+			+		+	+	+	+		
70	*Aphis affinis* *			+													+			+		+	+		
71	*Aphis brohmeri* *	+		+																					
72	*Aphis brunellae*			+								+	+										+		
73	*Aphis chloris*	+	+	+	+	+	+				+	+	+				+	+		+			+		
74	*Aphis clinopodii*			+			+				+	+											+		
75	*Aphis confusa*	+		+		+	+				+	+	+		+			+		+					

	Name of species	Balic-sea Coast	Pomeranian Lake District	Masurian Lake District	Wielkopolsko-Kujawska Lowland	Mazovian Lowland	Podlasie Lowland	Białowieża Primeval Forest	Lower Silesia	Trzebnica Hills	Upper Silesia	Kraków-Wieluń Upland	Małopolska Upland	Świętokrzyskie Mountains	Lublin Upland	Roztocze Upland	Sandomierz Lowland	Western Sudetes Mountains	Eastern Sudetes Mountains	Western Beskidy Mountains	Orawsko-Nowotarska Dale	Eastern Beskidy Mountains	Bieszczady Mountains	Pieniny Mountains	Tatry Mountains
		2	3	4	5	6	7	7a	8	8a	9	10	11	11a	12	13	14	15	16	17	17a	18	19	20	21
76	*Aphis coronillae* *			+			+						+							+					
77	*Aphis craccae*	+		+	+		+		+		+	+	+		+			+		+	+		+		+
78	*Aphis craccivora*	+		+	+	+	+				+	+	+		+		+	+		+			+		
79	*Aphis crepidis*			+								+								+			+		
80	*Aphis cytisorum sarothamni*	+	+	+	+	+			+		+	+	+		+		+			+					
81	*Aphis euphorbiae*		+	+	+	+					+	+	+							+		+	+		
82	*Aphis fabae*	+	+	+	+	+	+	+	+		+	+	+		+		+	+		+	+	+	+	+	
83	*Aphis fabae cirsiiacanthoidis*	+	+	+			+		+			+			+					+					
84	*Aphis fabae evonymi*	+	+			+	+				+	+					+			+			+		
85	*Aphis fabae solanella* *		+	+	+	+	+				+		+		+			+		+	+	+			
86	*Aphis farinosa*	+		+	+	+	+				+	+	+		+		+	+		+	+	+	+		+
87	*Aphis forbesi*			+	+							+								+					
88	*Aphis frangulae*	+	+	+	+	+	+		+		+	+	+		+		+	+		+	+		+		
89	*Aphis galiiscabri*	+		+	+		+				+	+	+							+			+		
90	*Aphis genistae*		+	+	+	+					+	+	+		+					+			+		
91	*Aphis hederae*				+	+						+	+				+			+					
92	*Aphis hieracii*	+		+	+		+				+	+	+					+		+			+		
93	*Aphis idaei*	+	+	+	+	+			+		+	+	+		+		+	+		+	+		+		
94	*Aphis ilicis*	+									+	+													

	Name of species	Balic-sea Coast	Pomeranian Lake District	Masurian Lake District	Wielkopolsko-Kujawska Lowland	Mazovian Lowland	Podlasie Lowland	Białowieża Primeval Forest	Lower Silesia	Trzebnica Hills	Upper Silesia	Kraków-Wieluń Upland	Małopolska Upland	Świętokrzyskie Mountains	Lublin Upland	Roztocze Upland	Sandomierz Lowland	Western Sudetes Mountains	Eastern Sudetes Mountains	Western Beskidy Mountains	Orawsko-Nowotarska Dale	Eastern Beskidy Mountains	Bieszczady Mountains	Pieniny Mountains	Tatry Mountains
		2	3	4	5	6	7	7a	8	8a	9	10	11	11a	12	13	14	15	16	17	17a	18	19	20	21
95	*Aphis intybi*	+	+	+	+	+			+		+	+	+		+					+		+			
96	*Aphis jacobaeae*		+	+	+		+					+	+					+		+					
97	*Aphis janischi*			+			+					+	+										+		
98	*Aphis lambersi*			+	+	+	+				+	+	+		+		+			+		+	+		
99	*Aphis lamiorum* *			+	+															+					
100	*Aphis leontodontis*	+		+	+		+					+	+												
101	*Aphis lilago* **																								
102	*Aphis mammulata*											+	+												
103	*Aphis molluginis*			+					+			+	+					+							
104	*Aphis nasturtii*	+		+	+	+	+				+	+	+		+		+			+	+	+	+		
105	*Aphis origani*			+							+	+	+										+		
106	*Aphis pilosellae*		+	+	+		+					+	+												
107	*Aphis plantaginis*		+	+	+	+	+				+	+	+		+					+		+	+		
108	*Aphis podagrariae*		+		+						+	+	+		+					+			+		
109	*Aphis pomi*	+	+	+	+	+	+	+	+		+	+	+		+		+	+		+	+	+	+	+	
110	*Aphis praeterita*		+	+	+		+				+	+								+	+				+
111	*Aphis proffti*			+							+	+	+												
112	*Aphis pseudocomosa*											+													
113	*Aphis ruborum*	+	+	+	+	+					+	+	+				+	+		+			+		

	Name of species	Balic-sea Coast	Pomeranian Lake District	Masurian Lake District	Wielkopolsko-Kujawska Lowland	Mazovian Lowland	Podlasie Lowland	Białowieża Primeval Forest	Lower Silesia	Trzebnica Hills	Upper Silesia	Kraków-Wieluń Upland	Małopolska Upland	Świętokrzyskie Mountains	Lublin Upland	Roztocze Upland	Sandomierz Lowland	Western Sudetes Mountains	Eastern Sudetes Mountains	Western Beskidy Mountains	Orawsko-Nowotarska Dale	Eastern Beskidy Mountains	Bieszczady Mountains	Pieniny Mountains	Tatry Mountains
		2	3	4	5	6	7	7a	8	8a	9	10	11	11a	12	13	14	15	16	17	17a	18	19	20	21
114	*Aphis rumicis*	+		+	+	+	+		+		+	+			+		+	+		+	+		+		
115	*Aphis sambuci*	+	+	+	+	+	+		+		+	+	+		+		+	+		+	+	+	+		
116	*Aphis sedi*	+		+	+	+	+				+	+	+		+			+		+					
117	*Aphis serpylli*			+	+						+	+	+							+		+	+		
118	*Aphis stachydis*											+													
119	*Aphis taraxacicola*	+	+	+	+	+	+				+	+	+		+			+		+			+		
120	*Aphis triglochinis*											+	+				+				+	+			
121	*Aphis urticata*	+	+	+	+	+	+		+		+	+	+		+		+	+			+	+	+		
122	*Aphis verbasci*	+		+	+	+					+	+	+							+					
123	*Aphis verbenae*				+																				
124	*Aphis verticillatae*			+								+	+												
125	*Aphis viburni*	+		+	+	+	+				+	+			+		+	+		+	+		+		
126	*Aphis epilobii*	+		+	+	+	+				+	+			+		+	+		+	+		+		
127	*Aphis grossulariae*		+	+	+	+			+		+	+	+		+		+				+	+	+		
128	*Aphis schneideri*	+	+	+	+	+	+					+	+		+			+		+					
129	*Aphis vandergooti*	+	+	+	+	+	+				+	+	+		+			+		+	+	+	+		
130	*Hyalopterus pruni*	+	+	+	+	+	+	+			+	+	+		+		+	+		+	+	+	+	+	
131	*Rhopalosiphum padi*	+	+	+	+	+	+		+		+	+	+		+		+	+		+	+		+		
132	*Acyrthosiphon malvae*	+		+	+						+	+	+		+		+			+		+			

	Name of species	Balic-sea Coast	Pomeranian Lake District	Masurian Lake District	Wielkopolsko-Kujawska Lowland	Mazovian Lowland	Podlasie Lowland	Białowieża Primeval Forest	Lower Silesia	Trzebnica Hills	Upper Silesia	Kraków-Wieluń Upland	Małopolska Upland	Świętokrzyskie Mountains	Lublin Upland	Roztocze Upland	Sandomierz Lowland	Western Sudetes Mountains	Eastern Sudetes Mountains	Western Beskidy Mountains	Orawsko-Nowotarska Dale	Eastern Beskidy Mountains	Bieszczady Mountains	Pieniny Mountains	Tatry Mountains
		2	3	4	5	6	7	7a	8	8a	9	10	11	11a	12	13	14	15	16	17	17a	18	19	20	21
133	*Acyrthosiphon pisum*	+		+	+	+	+	+	+		+	+	+		+		+	+		+	+		+	+	
134	*Acyrthosiphon chelidonii* *			+	+	+			+		+		+		+			+							
135	*Amphorophora idaei*		+	+	+	+	+		+		+	+			+		+	+		+	+		+		
136	*Amphorophora rubi*	+	+		+	+					+	+	+		+		+	+		+	+				
137	*Aulacorthum solani*		+	+	+	+	+	+	+		+	+	+		+		+	+		+		+			
138	*Brachycaudus helichrysi*	+		+	+	+			+		+	+	+		+		+	+		+	+	+	+		
139	*Brachycaudus cardui*	+		+	+	+	+		+		+	+	+		+		+	+		+	+	+	+		
140	*Brachycaudus lateralis* *			+	+	+							+							+					
141	*Brachycaudus lychnidis*	+	+	+	+	+	+		+		+	+	+		+		+	+		+		+	+		
142	*Brachycaudus prunicola*	+			+	+						+	+							+		+	+		
143	*Brevicoryne brassicae*	+	+	+	+	+		+	+		+	+	+		+		+	+		+	+	+	+		
144	*Capitophorus hippophaes*	+	+	+	+				+		+	+	+		+		+			+			+		
145	*Capitophorus pakansus* *																						+		
146	*Capitophorus similis*	+	+	+	+	+			+		+	+	+					+		+					
147	*Cavariella aegopodii*	+	+	+	+	+	+		+		+	+	+		+		+	+		+	+	+	+		
148	*Cavariella archangelicae*	+			+	+					+	+	+		+			+		+				+	+
149	*Cavariella konoi*	+		+	+	+	+				+	+	+		+			+		+	+		+		
150	*Cavariella pastinacae*	+	+		+	+	+		+		+	+	+		+			+		+	+		+		+
151	*Cavariella salicicola* **																								

	Name of species	Balic-sea Coast	Pomeranian Lake District	Masurian Lake District	Wielkopolsko-Kujawska Lowland	Mazovian Lowland	Podlasie Lowland	Białowieża Primeval Forest	Lower Silesia	Trzebnica Hills	Upper Silesia	Kraków-Wieluń Upland	Małopolska Upland	Świętokrzyskie Mountains	Lublin Upland	Roztocze Upland	Sandomierz Lowland	Western Sudetes Mountains	Eastern Sudetes Mountains	Western Beskidy Mountains	Orawsko-Nowotarska Dale	Eastern Beskidy Mountains	Bieszczady Mountains	Pieniny Mountains	Tatry Mountains
		2	3	4	5	6	7	7a	8	8a	9	10	11	11a	12	13	14	15	16	17	17a	18	19	20	21
152	*Cavariella theobaldi*	+	+	+	+	+	+		+		+	+	+		+		+	+		+		+	+		+
153	*Chaetosiphon tetrarhodum* *	+		+	+	+			+		+						+			+	+				
154	*Coloradoa artemisiae*	+		+	+						+	+	+		+					+					
155	*Corylobium avellanae*	+		+	+						+	+	+		+					+					
156	*Cryptomyzus alboapicalis*	+		+	+	+						+	+				+			+			+		
157	*Cryptomyzus galeopsidis*	+	+	+	+	+	+				+	+	+		+		+	+		+	+	+	+		
158	*Cryptomyzus ribis*	+	+	+	+	+	+				+	+	+		+		+	+		+	+	+	+		
159	*Delphiniobium junackianum* *			+	+	+												+		+	+		+		
160	*Dysaphis apiifolia petroselini*			+	+	+						+	+		+										
161	*Dysaphis bonomii*			+	+	+					+	+	+		+										
162	*Dysaphis lappae*		+	+	+				+		+	+	+		+					+					
163	*Dysaphis newskyi aizenbergi* *			+																					
164	*Dysaphis ranunculi*	+		+	+							+	+							+					
165	*Dysaphis plantaginea*	+		+	+	+					+	+			+		+			+		+			
166	*Dysaphis pyri*			+	+							+			+					+		+			
167	*Dysaphis sorbi*	+	+	+	+						+	+	+		+		+	+		+	+		+		+
168	*Hayhurstia atriplicis*	+	+	+	+	+			+		+	+	+					+		+					
169	*Hyadaphis foeniculi*	+		+	+	+	+		+		+	+	+					+					+		
170	*Hyadaphis coriandri* ?			+	+	+						+			+										

	Name of species	Balic-sea Coast	Pomeranian Lake District	Masurian Lake District	Wielkopolsko-Kujawska Lowland	Mazovian Lowland	Podlasie Lowland	Białowieża Primeval Forest	Lower Silesia	Trzebnica Hills	Upper Silesia	Kraków-Wieluń Upland	Małopolska Upland	Świętokrzyskie Mountains	Lublin Upland	Roztocze Upland	Sandomierz Lowland	Western Sudetes Mountains	Eastern Sudetes Mountains	Western Beskidy Mountains	Orawsko-Nowotarska Dale	Eastern Beskidy Mountains	Bieszczady Mountains	Pieniny Mountains	Tatry Mountains
		2	3	4	5	6	7	7a	8	8a	9	10	11	11a	12	13	14	15	16	17	17a	18	19	20	21
171	*Hyperomyzus lactucae*	+		+	+	+	+				+	+	+		+			+		+		+	+		
172	*Hyperomyzus pallidus*			+	+	+					+	+	+		+		+			+				+	
173	*Impatientinum asiaticum*				+							+			+		+	+			+		+		
174	*Impatientinum balsamines*		+	+	+	+					+	+	+				+	+		+			+		
175	*Liosomaphis berberidis*	+		+	+	+			+		+	+	+		+			+		+					
176	*Lipaphis erysimi*	+		+	+	+			+		+	+	+		+			+		+		+	+		
177	*Lipaphis rossi*											+													
178	*Macrosiphoniella absinthii*	+	+	+	+	+	+		+		+	+	+		+					+	+		+		
179	*Macrosiphoniella artemisiae*			+	+	+	+		+			+	+		+		+	+		+	+	+	+		
180	*Macrosiphoniella millefolii*	+	+	+	+	+	+		+		+	+	+		+		+	+		+	+	+	+		
181	*Macrosiphoniella tanacetaria*	+		+	+	+	+		+		+	+	+		+		+	+		+	+		+		
182	*Macrosiphoniella oblonga*		+	+	+	+		+	+		+	+	+		+			+		+		+	+		
183	*Macrosiphum albifrons***																								
184	*Macrosiphum cholodkovskyi*	+		+	+	+	+		+			+	+				+	+			+	+	+		
185	*Macrosiphum funestum*								+		+	+	+				+	+		+			+	+	
186	*Macrosiphum gei*		+	+	+	+			+			+	+		+		+	+		+	+	+	+	+	
187	*Macrosiphum rosae*	+	+	+	+	+	+	+	+		+	+	+		+		+			+	+	+	+		
188	*Macrosiphum sileneum* *																								
189	*Megoura litoralis**	+			+																				

	Name of species	Balic-sea Coast	Pomeranian Lake District	Masurian Lake District	Wielkopolsko-Kujawska Lowland	Mazovian Lowland	Podlasie Lowland	Białowieża Primeval Forest	Lower Silesia	Trzebnica Hills	Upper Silesia	Kraków-Wieluń Upland	Małopolska Upland	Świętokrzyskie Mountains	Lublin Upland	Roztocze Upland	Sandomierz Lowland	Western Sudetes Mountains	Eastern Sudetes Mountains	Western Beskidy Mountains	Orawsko-Nowotarska Dale	Eastern Beskidy Mountains	Bieszczady Mountains	Pieniny Mountains	Tatry Mountains
		2	3	4	5	6	7	7a	8	8a	9	10	11	11a	12	13	14	15	16	17	17a	18	19	20	21
190	*Megoura viciae*	+	+	+	+	+	+		+		+	+	+		+		+	+		+	+		+		
191	*Metopeurum fuscoviride*	+		+	+	+	+		+		+	+	+		+		+	+		+	+	+	+		
192	*Microlophium carnosum*	+		+	+		+				+	+	+				+	+		+			+		
193	*Myzaphis rosarum*	+		+	+	+			+			+	+		+			+							
194	*Myzus cerasi*	+	+	+	+	+	+	+	+		+	+	+		+		+	+		+		+	+		
195	*Myzus lythri*			+	+	+			+			+	+		+					+					
196	*Myzus langei*	+		+			+				+	+	+		+			+			+	+	+	+	
197	*Myzus ligustri*			+	+	+					+	+						+				+			
198	*Myzus myosotidis*		+		+	+						+						+							
199	*Myzus persicae*	+	+	+	+	+	+		+		+	+	+		+			+		+			+		
200	*Nasonovia compositellae**																								
201	*Nasonovia compositellae nigra*	+	+	+	+						+	+	+		+		+	+		+		+		+	
202	*Nasonovia pilosellae*	+	+	+	+		+					+	+		+		+	+							
203	*Nasonovia ribisnigri*	+		+	+	+			+		+	+	+		+		+	+		+	+	+	+		+
204	*Ovatus insitus **			+	+												+								
205	*Ovatus mentharius*	+										+	+							+	+		+		
206	*Phorodon humuli*	+	+	+	+	+	+		+		+	+	+		+			+		+	+	+	+		
207	*Rhopalomyzus lonicerae*	+	+	+	+	+					+	+	+		+			+		+			+		
208	*Semiaphis dauci*			+	+	+					+	+	+		+			+		+			+		

	Name of species	Balic-sea Coast	Pomeranian Lake District	Masurian Lake District	Wielkopolsko-Kujawska Lowland	Mazovian Lowland	Podlasie Lowland	Białowieża Primeval Forest	Lower Silesia	Trzebnica Hills	Upper Silesia	Kraków-Wieluń Upland	Małopolska Upland	Świętokrzyskie Mountains	Lublin Upland	Roztocze Upland	Sandomierz Lowland	Western Sudetes Mountains	Eastern Sudetes Mountains	Western Beskidy Mountains	Orawsko-Nowotarska Dale	Eastern Beskidy Mountains	Bieszczady Mountains	Pieniny Mountains	Tatry Mountains
		2	3	4	5	6	7	7a	8	8a	9	10	11	11a	12	13	14	15	16	17	17a	18	19	20	21
209	*Sitobion avenae*	+	+	+	+	+	+		+		+	+	+		+		+	+		+	+		+		
210	*Trichosiphonaphis corticis*		+	+	+	+						+													
211	*Uroleucon achilleae*	+		+	+	+					+	+	+				+			+		+			
212	*Uroleucon cichorii*			+	+	+	+		+		+	+	+		+		+	+		+	+	+	+		
213	*Uroleucon cichorii grossum*											+													
214	*Uroleucon cirsii*	+		+	+	+	+		+		+	+	+		+					+	+				
215	*Uroleucon hypochoeridis*	+		+	+				+		+	+	+		+					+		+			
216	*Uroleucon murale*	+		+	+						+	+	+		+		+	+		+	+	+			
217	*Uroleucon obscurum*	+		+	+						+	+	+		+		+	+		+	+		+		
218	*Uroleucon sonchi*	+	+	+	+	+	+				+	+	+		+		+	+		+			+		
219	*Uroleucon tanaceti*	+	+	+	+	+			+		+	+			+		+			+		+	+		
220	*Uroleucon tussilaginis*		+	+	+				+		+	+						+		+		+	+		
221	*Uroleucon erigeronense*			+	+	+					+	+	+		+										
222	*Uroleucon aeneum*			+	+	+			+		+	+	+		+								+		
223	*Uroleucon campanulae*	+		+	+	+						+	+				+	+					+		
224	*Uroleucon jaceae*	+	+	+	+	+					+	+	+		+		+	+		+	+	+	+		
225	*Uroleucon jaceae henrichi*			+	+							+	+		+			+		+					
226	*Uroleucon nigrocampanulae*			+	+				+		+	+	+					+		+	+				
227	*Uroleucon rapunculoidis*			+	+							+													

	Name of species	Balic-sea Coast	Pomeranian Lake District	Masurian Lake District	Wielkopolsko-Kujawska Lowland	Mazovian Lowland	Podlasie Lowland	Białowieża Primeval Forest	Lower Silesia	Trzebnica Hills	Upper Silesia	Kraków-Wieluń Upland	Małopolska Upland	Świętokrzyskie Mountains	Lublin Upland	Roztocze Upland	Sandomierz Lowland	Western Sudetes Mountains	Eastern Sudetes Mountains	Western Beskidy Mountains	Orawsko-Nowotarska Dale	Eastern Beskidy Mountains	Bieszczady Mountains	Pieniny Mountains	Tatry Mountains
		2	3	4	5	6	7	7a	8	8a	9	10	11	11a	12	13	14	15	16	17	17a	18	19	20	21
228	*Uroleucon simile*			+	+	+					+	+	+										+		+
229	*Uroleucon solidaginis*	+		+	+	+	+		+		+	+			+		+			+		+			
230	*Uroleucon taraxaci*	+		+	+				+		+	+	+		+		+	+		+			+		
231	*Lachnus longirostris*		+	+	+	+		+				+	+				+								
232	*Lachnus pallipes*	+	+		+							+	+										+		
233	*Lachnus roboris*	+	+	+	+	+	+				+	+	+		+		+	+		+					
234	*Stomaphis quercus*	+	+	+	+	+						+	+		+		+			+					
235	*Cinara brauni*	+			+							+													
236	*Cinara confinis* *				+																+	+	+		
237	*Cinara costata*	+		+		+		+			+	+	+		+		+	+		+	+	+	+		
238	*Cinara cuneomaculata*										+	+						+			+		+		
239	*Cinara hyperophila* *					+		+			+		+		+		+			+	+	+			
240	*Cinara laricis*				+						+	+		+	+			+			+				
241	*Cinara nuda*		+	+	+	+	+	+				+			+										
242	*Cinara pectinatae*				+							+					+			+	+	+	+	+	+
243	*Cinara piceicola*		+								+	+			+		+			+			+		
244	*Cinara pilicornis*	+	+	+	+	+	+		+		+	+	+				+	+		+	+	+	+		
245	*Cinara pinea*	+	+	+	+	+	+	+			+	+	+	+	+		+	+		+	+	+	+		+
246	*Cinara pini*	+	+	+	+	+	+	+				+	+		+		+			+	+	+			

	Name of species	Balic-sea Coast	Pomeranian Lake District	Masurian Lake District	Wielkopolsko-Kujawska Lowland	Mazovian Lowland	Podlasie Lowland	Białowieża Primeval Forest	Lower Silesia	Trzebnica Hills	Upper Silesia	Kraków-Wieluń Upland	Małopolska Upland	Świętokrzyskie Mountains	Lublin Upland	Roztocze Upland	Sandomierz Lowland	Western Sudetes Mountains	Eastern Sudetes Mountains	Western Beskidy Mountains	Orawsko-Nowotarska Dale	Eastern Beskidy Mountains	Bieszczady Mountains	Pieniny Mountains	Tatry Mountains
		2	3	4	5	6	7	7a	8	8a	9	10	11	11a	12	13	14	15	16	17	17a	18	19	20	21
247	*Cinara pinihabitans* *			+	+	+		+																	
248	*Cinara juniperi*	+	+	+	+	+					+	+	+		+					+	+	+	+	+	
249	*Schizolachnus pineti*	+	+	+	+	+	+	+			+	+	+		+		+	+		+	+	+	+	+	+
250	*Trama troglodytes*	+	+	+	+	+	+		+		+	+	+		+			+		+			+		+

* - species new to region Kraków-Wieluń Upland
** - species new to Poland
? - unconfirmed records

et al., 1977; Hałaj, 1991, 1993, 1995, 1996; Hałaj & Węgierek, 1999; Hałaj & Wojciechowski, 1996, 1997; Herczek *et al.*, 1977; Karwańska, 1975, 1987, 1991a, b; Karwańska & Wojciechowski, 1973; Klimaszewski & Płachta, 1977; Klimaszewski *et al.*, 1980a, b; Krzywiec, 1970, 1982; Lubiarz & Cichocka 2003; Olesiński & Szelegiewicz, 1974; Osiadacz & Wieczorek, 2003; Piechota, 1990; Płachta *et al.*, 1996; Stacherska, 1974; Szelegiewicz, 1972, 1974b, 1975, 1976b, 1978a 1981, 1985; Węgierek & Czylok, 2000; Węgierek & Wojciechowski, 1999; Wieczorek, 2007; Wieczorek & Osiadacz, 2005, 2007; Wilkaniec, 1999; Wilkaniec & Borowiak-Sobkowiak, 2001; Wojciechowski *et al.*, 1989; Wojciechowski & Woźnica, 1989; Złotkowski, 1987.

For some species, in addition to chorological characteristics, the genetical (origin) characteristics could be given, according to literature data, and their host plants data (Szelegiewicz, 1974a, 1978c; Achremowicz, 1975; Dostál, 1989; Jörg & Lampel, 1990; Podbielkowski, 1995; Burnie, 1997; Lampel & Meier, 2003).

In order to specify the frequency of recording the presence of particular aphid species in the investigated area, there have been established six frequency classes:

I – common species – recorded over 71 times during the period of investigation;
II – frequent species – recorded 41 – 70 times during the period of investigation;
III – relatively frequent species – recorded 16 – 40 times during the period of investigation;
IV – rare species – recorded 6 – 15 times during the period of investigation;
V – very rare species – recorded 2 – 5 times during the period of investigation;
VI – single record.

In order to calculate the frequency of recording particular species in samples from the area of the OPN there has been applied the general frequency rate (F_q) (Tischler, 1949; Durska, 2001):

$F_q = q/P$; where:

q – number of samples where a given species is present;

P – number of all samples.

The frequency of appearance of particular aphid species in connection with specific families of host plants has also been calculated (i.e. rate of aphid host plant selection):

$F_r = Q_{1, 2, 3,..., 58}/P$; where:

$Q_{1, 2, 3, ..., 58}$ is a number of samples containing any species recorded on particular families of host plants.

While analyzing the similarities of aphid species composition in particular types of habitat and the similarities in selecting particular families of host plants by aphids, the fact of presence/absence of a species in the compared samples is taken into account. In consequence, all species are treated in the same way, regardless of frequency or commonness of their presence.

The advantage of such an approach lies in the fact that it provides an opportunity

to compare data sets of different sizes (Faith *et al.*, 1987).

The analysis of the similarities of aphid species composition in particular types of habitat and the similarities in selecting particular families of host plants by aphids is the analysis of objects with binary attributes. Thus the similarity rate between particular pairs of analyzed habitats ought to depend on the number of attributes whose values are either matching, or not. In the coincidence analysis the instances of simultaneous appearance of particular attribute values are investigated. While comparing two elements, A and B, each of which is described by one binary attribute, there are possible four different combinations specified in the coincidence table for binary attributes (Jain & Dubes, 1988; Grabmeier & Rudolph, 2002):

		set B	
		1	0
set A	1	M_{11}	M_{10}
	0	M_{01}	M_{00}

where:
M_{11} represents the total number of attributes where *A* and *B* both have a value of 1.
M_{01} represents the total number of attributes where the attribute of *A* is 0 and the attribute of *B* is 1.
M_{10} represents the total number of attributes where the attribute of *A* is 1 and the attribute of *B* is 0.
M_{00} represents the total number of attributes where *A* and *B* both have a value of 0.

Thus, each attribute belongs to one of the categories, which means that:
$M_{11} + M_{01} + M_{10} + M_{00} = n$

With the help of these coefficients the similarity coefficient can be specified. There are several measures which differ in the way they regard the combinations referred to as M_{01} and M_{10} (Jain & Dubes, 1988; Tan *et al.*, 2005). In the case of sets analysed in this study the number of attributes M_{00} is not taken into account, since it indicates double negation (double absence in the compared set pairs).

Jaccard similarity coefficient (1900, 1908) is calculated according to the formula:

$$J_c = \frac{M_{11}}{M_{01} + M_{10} + M_{11}}$$

while Jaccard's distance (dissimilarity measure) is calculated according to the formula:

$$J_c' = 1 - J_c = 1 - \frac{M_1}{M_0 + M_0 + M_1} = \frac{M_1 + M_0 + M_0 - M_1}{M_0 + M_0 + M_1} = \frac{M_0 + M_0}{M_0 + M_0 + M_1}$$

The calculation of Jaccard's distance was done with the help of appropriate algorithms of the R-project program (Faith *et al.*, 1987; Crawley, 2005; R Development Team, 2006).

In the further part of the study there has been implemented the pair-group analysis (Sneath & Sokal, 1973; Jain & Dubes, 1988; Tan *et al.*, 2005). Grouping as a data exploration technique is widely applied in many fields of study. It is based on grouping algorithms, whose usefulness is strictly dependent on the form and character of input data. Cluster analysis utilizes the developed distance matrix showing the measure of similarity (or difference) of all possible OTU pairs (Operational Taxonomic Unit – in this case plant families and habitat types). The choice of an appropriate distance measure is subjective (Sneath & Sokal, 1973) and depends on the researcher. In order to specify the distance between elements of each cluster, it becomes necessary to apply the rules of clustering, or agglomerattion. The rules of clustering specify, when two clusters are similar enough to be merged. Distance measures between clusters have been identifed by calculating the number of all common neighbours of a given set pair. Ward's method has been chosen for calculating distance measures between clusters (Ward, 1963; Orlóci, 1978; StatSoft, 2005a, b).This method utilizes the analysis of variance approach, which aims to minimalize the sum of squared deviations of any two clusters. The method has the highest level of efficacy in identifying the true data structure (Grabiński & Sokołowski, 1981); it also allows for verifiying the hypothesis stating that the whole data set is homogeneous. Ward's method has been developed for euclidean distance (Orlóci, 1967, (Cao *et al.*, 1997a, b). Ward's formula for calculating distance between clusters developed during the stages preceding the identification of every following element *k* is presented below:

$$d[k,(i \cup j)] = (p_k + p_i)d(k,i) + (p_k + p_j)d(k,j) - p_k d(i,j)$$

where:

$$p_k = \frac{n_k}{(n_k + n_i + n_j)}$$; (distance measures connected with group *k*);

$$p_i = \frac{n_i}{(n_k + n_i + n_j)}$$; (distance measures connected with group *i*) and

$$p_j = \frac{n_j}{(n_k + n_i + n_j)}$$; (distance measures connected with group *j*).

In order to compare the host plants with respect to aphid species preferences, the polyphagous species were excluded from the analysis while the species which are not host specific have been given the potential value 1 for different host plants. Graphic interpretation of the grouping analysis results for chosen host plants and habitats has been shown in dendrograms.

The systematic list of *Aphidinea* presented in this study has been adopted from Heie (1980), while the names of particular aphid species have been adopted from Remaudiere & Remaudiere (1997).

Botanical nomenclature has been adopted from Mirek *et al.* (2002), while geobotanical nomenclature has been adopted after Matuszkiewicz W. (2001).

Collected material is part of the entomological collection that belongs to the Department of Zoology, Faculty of Biology and Environmental Protection of the University of Silesia in Katowice, Poland.

RESULTS

Systematics list of aphid species:

Superfamily: Phylloxeroidea
Family: Adelgidae
Genus: ***Adelges*** Vallot, 1836

1. ***Adelges laricis*** Vallot, 1836

Host plants: *Larix decidua*
Localities: Poręba Sąspowska [village], Ojców-Centrum [center of the village], Prądnik Korzkiewski [village]
Number of records: 5
Ecological elements: heteroecious; 1st degree oligophagous/1st degree oligophagous; mesohigrophiles/2nd degree xerophiles; xerothermobiontic, synanthropobiontic
Chorological elements: European
Note: species originating from the montane areas of southern Europe
References: Osiadacz, 2006

Genus: ***Pineus*** Shimer, 1869

2. ***Pineus pini*** (Ratzeburg, 1844)

Host plants: *Pinus sylvestris*
Localities: Ojców – Skała Koźniowa [rock foothills], Skała Krzyżowa [rock slope and rock shelves]
Number of records: 2
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic, synanthropobiontic
Chorological elements: Cosmopolitan
References: Osiadacz, 2006

Genus: ***Sacchiphantes*** Curtis, 1844

3. ***Sacchiphantes abietis*** (Linnaeus, 1758)

Host plants: *Picea abies*
Localities: Dąbrówka nad Młynnikiem [village], Grodzisko – Skała Długa [rock foothill and slopes], Złota Góra [slopes and top, along the road]
Number of records: 3
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, synanthropobiontic
Chorological elements: Euro-Siberian
References: Osiadacz, 2006

4. ***Sacchiphantes viridis*** (Ratzeburg, 1843)

Host plants: *Picea abies*
Localities: Ojców-Centum [center of the village]
Number of records: 1
Ecological elements: heteroecious; 1st degree oligophagous/1st degree oligophagous; mesohigrophiles/mesohigrophiles; synanthropobiontic
Chorological elements: Westernpalearctic

Family: Phylloxeridae
Genus: ***Phylloxera*** Boyer de Fonscolombe, 1834

5. ***Phylloxera coccinea*** (von Heyden, 1837)

Host plants: *Quercus robur*
Localities: Wąwóz Sokolec [gorge]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic
Chorological elements: European
References: Skrzypczyńska, 1995

6. ***Phylloxera glabra*** (von Heyden, 1837)

Host plants: *Quercus robur*
Localities: Sułoszowa [village]
Number of records: 1
Ecological elements: monoecious; monophagous; mesohigrophiles; synanthropobiontic
Chorological elements: European
Note: species new to region Kraków-Wieluń Upland

Superfamily: Aphidoidea
Family: Pemphigidae
Subfamily: Eriosomatinae
Genus: ***Eriosoma*** Leach, 1818

7. ***Eriosoma ulmi*** (Linnaeus, 1758)

Host plants: *Ulmus glabra*

Localities: Ojców-Zazamcze [village]
Number of records: 2
Ecological elements: heteroecious; 1st degree oligophagous/1st degree oligophagous; mesohigrophiles/mesohigrophiles; synanthropobiontic
Chorological elements: Palearctic
Note: species new to region Kraków-Wieluń Upland

Genus: ***Tetraneura*** Hartig, 1841

8. ***Tetraneura (Tetraneura) ulmi*** (Linnaeus, 1758)

Host plants: *Arrhenatherum elatius*, *Festuca gigantea*, *Phleum pratense*, *Ulmus glabra*
Localities: Grodzisko – Skała Długa [rock foothill and slopes], Kamieniołom [rock slopes], Poręba Sąspowska [village], Ojców-Centrum [center of the village], Ojców – Caritas [village, southernmost part]
Number of records: 5
Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous; mesohigrophiles/mesohigrophiles; xerothermobiontic, herbosabiontic, synanthropobiontic
Chorological elements: Holarctic with disjunction

Subfamily: Pemphiginae
Genus: ***Pemphigus*** Hartig, 1839

9. ***Pemphigus borealis*** Tullgren, 1909

Host plants: *Bidens cernua*
Localities: Pieskowa Skała [village]
Number of records: 1
Ecological elements: heteroecious; 1st degree oligophagous/1st degree oligophagous; mesohigrophiles/2nd degree higrophiles; synanthropobiontic
Chorological elements: Westernpalearctic
Note: Nearctic species; species new to region Kraków-Wieluń Upland
References: Osiadacz and Wojciechowski, 2005

Genus: ***Prociphilus*** Koch, 1857

10. ***Prociphilus (Prociphilus) bumeliae*** (Schrank, 1801)

Host plants: *Abies alba*
Localities: Chełmowa Góra [top and slopes]
Number of records: 1
Ecological elements: heteroecious; 2nd degree oligophagous/monophagous; 2nd degree higrophiles/mesohigrophiles; sylvibiontic
Chorological elements: Westpalearctic-steppe
Note: species new to region Kraków-Wieluń Upland

11. ***Prociphilus (Stagona) pini*** (Burmeister, 1835)

Host plants: *Crataegus monogyna*
Localities: Sokolec [village]
Number of records: 1

Ecological elements: heteroecious; 1st degree oligophagous/1st degree oligophagous; mesohigrophiles/2nd degree xerophiles; sylvibiontic
Chorological elements: European

12. ***Prociphilus (Stagona) xylostei*** (DE GEER, 1773)

Host plants: *Geranium phaeum*, *Lonicera xylosteum*
Localities: Dolina Sąspowska 2 [mouth], Ojców-Centurm [center of the village], Ojców – Źródło Miłości [spring]
Number of records: 3
Ecological elements: heteroecious; 1st degree oligophagous/monophagous; mesohigrophiles/ mesohigrophiles; sylvibiontic, herbosabiontic, synanthropobiontic
Chorological elements: Holarctic with disjunction

Genus: ***Thecabius*** KOCH, 1857

13. ***Thecabius (Thecabius) affinis*** (KALTENBACH, 1843)

Host plants: *Ranunculus repens*, *Populus nigra*
Localities: Młynnik [village], Ojców-Centrum [center of the village]
Number of records: 2
Ecological elements: heteroecious; 1st degree oligophagous/1st degree oligophagous; mesohigrophiles/mesohigrophiles-2nd degree higrophiles; synanthropobiontic
Chorological elements: Holarctic

Subfamily: Fordinae
Genus: ***Forda*** VON HEYDEN, 1837

14. ***Forda marginata*** KOCH, 1857

Host plants: *Arrhenatherum elatius*
Localities: Grodzisko – Skamieniały Wędrowiec [rock slope]
Number of records: 1
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree xerophiles-mesohigrophiles; xerothermobiontic
Chorological elements: Holarctic with disjunction
Note: Caspian species

Family: Thelaxidae
Genus: ***Glyphina*** KOCH, 1856

15. ***Glyphina betulae*** (LINNAEUS, 1758)

Host plants: *Betula pendula*
Localities: Kamieniołom [rock slopes], Poręba Sąspowska [village]
Number of records: 2
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles, xerothermobiontic
Chorological elements: Holarctic with disjunction

16. ***Glyphina jacutensis*** Mordvilko, 1931

Number of records: 0

Ecological elements: monoecious; 2nd degree oligophagous; mesohigrophiles-1st degree higrophiles

Chorological elements: Holarctic with disjunction

Note: species recorded in Ojców on Alnus glutinosa

References: Piechota, 1990

Genus: ***Thelaxes*** Westwood, 1840

17. ***Thelaxes dryophila*** (Schrank, 1801)

Host plants: *Quercus petraea*, *Q. robur*, *Q. rubra*

Localities: Pieskowa Skała [village], Mokrzys [village], Diabli Młyn [forest border at the village], Obserwatorium Sejsmologiczne [near Saspów village], Wąwóz Koziarnia [gorge], Poręba Sąspowska [village], Lepianka Sąspowska [village, border of the forest], Lepianka Czajowska [village], Czajowice [village, border of the forest], Serpentyny [slopes], Ojców – Caritas [village, southernmost part], Wesoła – Enklawa OPN [village, OPN enclave]

Number of records: 16

Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, xerothermobiontic, synanthropobiontic

Chorological elements: Holarctic with disjunction

References: Piechota, 1990

Family: Anoeciidae

Genus: ***Anoecia*** Koch, 1856

18. ***Anoecia (Anoecia) corni*** (Fabricius, 1775)

Host plants: *Tilia cordata*, *Rosa canina*, *Cornus alba*, *C. sanguinea*, *Quercus robur*

Localities: Pieskowa Skała [village], Sokolec [village], Obserwatorium Sejsmologiczne [near Saspów village], Poręba Sąspowska [village], Ojców-Centrum [center of the village], Skała Krukowskiego [rock shelves], Wapiennik [rock shelves], Skała Krzyżowa [rock slope and rock shelves], Prądnik Korzkiewski [village], Wesoła – Enklawa OPN [village, OPN enclave]

Number of records: 20

Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous; 2nd degree xerophiles/2nd degree xerophiles; sylvibiontic, xerothermobiontic, synanthropobiotic

Chorological elements: Cosmopolitan

References: Osiadacz, 2006

19. ***Anoecia (Anoecia) vagans*** (Koch, 1856)

Host plants: *Arrhenatherum elatius*

Localities: Ojców – Caritas [village, southernmost part]

Number of records: 1

Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous; 2nd degree xerophiles/2nd degree xerophiles; herbosabiontic

Chorological elements: European

Family: Mindaridae
Genus: ***Mindarus*** Koch, 1857

20. ***Mindarus abietinus*** Koch, 1857

Host plants: *Abies alba*
Localities: Chełmowa Góra [top and slopes]
Number of records: 2
Ecological elements: monoecious; monophagous; mesohigrophiles; sylvibiontic
Chorological elements: Holarctic with disjunction
Note: species new to region Kraków-Wieluń Upland

Family: Drepanosiphidae
Subfamily: Drepanosiphinae
Tribe: Drepanosiphini
Genus: ***Drepanosiphum*** Koch, 1855

21. ***Drepanosiphum acerinum*** (Walker, 1848)

Host plants: *Acer pseudoplatanus*
Localities: Dolina Sąspowska 1 [median portion], Wawóz Pradła [gorge]
Number of records: 2
Ecological elements: monoecious; monophagous; 2nd degree higrophiles; sylvibiontic
Chorological elements: European
Note: Caspian species

22. ***Drepanosiphum aceris*** Koch, 1855

Number of records: 0
Ecological elements: monoecious; monophagous; mesohigrophiles
Chorological elements: Westernpalearctic
Note: species recorded in Ojców on Acer campestre
References: Piechota, 1990

23. ***Drepanosiphum platanoidis*** (Schrank, 1801)

Host plants: *Acer platanoides*, *A. pseudoplatanus*
Localities: Wąwóz Sokolec [gorge], Drewniana Droga [gorge], Złota Góra [slopes and top, along the road], Ojców – Park Zamkowy [village, park in the bottom of the Prądnik river valley], Dolina Sąspowska 2 [mouth], Zamkowa Droga [gorge], Góra Koronna [top and rock shelves], Skała Krzyżowa [rock slope and rock shelves]
Number of records: 11
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; syvibiontic, xerothermobiontic, synanthropobiontic
Chorological elements: Cosmopolitan
Note: Caspian species

Subfamily: Phyllaphidinae
Tribe: Phyllaphidini
Genus: ***Calaphis*** Walsh, (1862) 1863

24. ***Calaphis betulicola*** (Kaltenbach, 1843)

Host plants: *Betula pendula*
Localities: Kaliski [village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles, xerothermobiontic
Chorological elements: Holarctic with disjunction
Note: Boreo-Eurasian species

25. ***Calaphis flava*** Mordvilko, 1928

Host plants: *Betula pendula*
Localities: Zabugaje [village], Poręba Sąspowska [village]
Number of records: 2
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles
Chorological elements: Cosmopolitan
Note: Boreo-Eurasian species

Genus: ***Callipterinella*** van der Goot, 1913

26. ***Callipterinella calliptera*** (Hartig, 1841)

Host plants: *Betula pendula*
Localities: Zabugaje [village], Miotełka [village], Skała Krzyżowa [rock slope and rock shelves], Prądnik Korzkiewski [village]
Number of records: 5
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; herbosabiontic, xerothermobiontic, sylvibiontic, synanthropobiontic
Chorological elements: Holarctic with disjunction

27. ***Callipterinella tuberculata*** (von Heyden, 1837)

Host plants: *Betula pendula*
Localities: Kamieniołom [rock slopes], Zabugaje [village], Prądnik Korzkiewski [village], Wesoła – Enklawa OPN [village, OPN enclave]
Number of records: 4
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; herbosabiontic, xerothermobiontic, sylvibiontic, synanthropobiontic
Chorological elements: Westernpalearctic

Genus: ***Chromaphis*** Walker, 1870

28. ***Chromaphis juglandicola*** (Kaltenbach, 1843)

Host plants: *Juglans regia*
Localities: Grodzisko – Skała Długa [rock foothill and slopes], Wola Kalinowska [village]
Number of records: 2

Ecological elements: monoecious; monophagous; mesohigrophiles; synanthropobiontic
Chorological elements: Holarctic with disjunction
Note: Sub-Pontic species
References: Osiadacz, 2006

Genus: ***Clethrobius*** Mordvilko, 1928

29. ***Clethrobius comes*** (Walker, 1848)

Host plants: Betula pendula
Localities: Sokolec [village]
Number of records: 1
Ecological elements: monoecious; 2nd degree oligophagous; mesohigrophiles; synanthropobiontic
Chorological elements: Westernpalearctic
Note: Carpathian species

Genus: ***Betulaphis*** Glendenning, 1926

30. ***Betulaphis quadrituberculata*** (Kaltenbach, 1843)

Number of records: 0
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles-2nd degree higrophiles
Chorological elements: Holarctic with disjunction
Note: species recorded in Ojców on Betula pubescens
References: Piechota, 1990

Genus: ***Eucallipterus*** Schouteden, 1906

31. ***Eucallipterus tiliae*** (Linnaeus, 1758)

Host plants: *Tilia cordata*
Localities: Drewniana Droga [gorge], Złota Góra [slopes and top, along the road], Ojców – Park Zamkowy [village, park in the bottom of the Prądnik river valley], Ojców-Centrum [center of the village], Zamkowa Droga [gorge]
Number of records: 6
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, synanthropobiontic
Chorological elements: Cosmopolitan

Genus: ***Euceraphis*** Walker, 1870

32. ***Euceraphis betulae*** (Koch, 1855)

Host plants: *Betula pendula*
Localities: Słoneczna Góra [hill top], Poręba Sąspowska [village], Miotełka [village], Serpentyny [slopes], Skała Krzyżowa [rock slope and rock shelves]
Number of records: 15
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; herbosabiontic, xerothermobiontic, sylvibiontic, synanthropobiontic
Chorological elements: Cosmopolitan

33. ***Euceraphis punctipennis*** (Zetterstedt, 1828)

Number of records: 0
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles
Chorological elements: Holarctic
Note: species recorded in Ojców on Betula pendula
References: Piechota, 1990

Genus: ***Monaphis*** Walker, 1870

34. ***Monaphis antennata*** (Kaltenbach, 1843)

Host plants: ***Betula pendula***
Localities: Poręba Sąspowska [village], Serpentyny [slopes]
Number of records: 2
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; xerothermobiontic, synanthropobiontic
Chorological elements: Euro-Siberian

Genus: ***Myzocallis*** Passerini, 1860

35. ***Myzocallis (Myzocallis) carpini*** (Koch, 1855)

Host plants: *Carpinus betulus*
Localities: Drewniana Droga [gorge], Dolina Sąspowska 2 [mouth], Ojców – Skała Koźniowa [rock foothills], Wąwóz Korytania (wierzchowina) [top of the rock surrounding the gorge]
Number of records: 4
Ecological elements: monoecious; monophagous; mesohigrophiles; sylvibiontic
Chorological elements: Cosmopolitan

36. ***Myzocallis (Myzocallis) coryli*** (Goeze, 1778)

Host plants: ***Corylus avellana***
Localities: Pieskowa Skała [village], Ojców-Centrum [center of the village]
Number of records: 3
Ecological elements: monoecious; monophagous; 2nd degree xerophiles-mesohigrophiles; xerothermobiontic, synanthropobiontic
Chorological elements: Cosmopolitan

Genus: ***Panaphis*** Kirkaldy, 1904

37. ***Panaphis juglandis*** (Goeze, 1778)

Host plants: *Juglans regia*
Localities: Grodzisko – Skała Długa [rock foothill and slopes], Ojców – Skała Koźniowa [rock foothills]
Number of records: 2
Ecological elements: monoecious; monophagous; mesohigrophiles; synanthropobiontic
Chorological elements: Holarctic with disjunction
Note: Sub-Pontic species
References: Osiadacz, 2006

Genus: ***Phyllaphis*** Koch, 1856

38. ***Phyllaphis fagi*** Linnaeus, 1767

Host plants: *Fagus sylvatica*
Localities: Złota Góra [slopes and top, along the road], Dolina Sąspowska 2 [mouth], Wąwóz Jamki [gorge]
Number of records: 3
Ecological elements: monoecious; monophagous; mesohigrophiles; sylvibiontic
Chorological elements: Cosmopolitan
Note: Sub-Atlantic species
References: Mordvilko, 1897, Piechota, 1990

Genus: ***Pterocallis*** Passerini, 1860

39. ***Pterocallis albidus*** Börner, 1940

Number of records: 0
Ecological elements: monoecious; monophagous; 2nd degree higrophiles
Chorological elements: European
Note: species recorded in Ojców on Alnus incana
References: Piechota, 1990

40. ***Pterocallis alni*** (de Geer, 1773)

Host plants: *Alnus glutinosa*
Localities: Pieskowa Skała [village]
Number of records: 1
Ecological elements: monoecious; monophagous; 1st degree higrophiles; sylvibiontic
Chorological elements: Holarctic with disjunction

Genus: ***Symydobius*** Mordvilko, 1894

41. ***Symydobius oblongus*** (von Heyden, 1837)

Host plants: ***Betula pendula***
Localities: Sokolec [village], Mokrzys [village], Dolina Zachwytu 1 [upper portion], Poręba Sąspowska [village], Prądnik Korzkiewski [village], Wesoła – Enklawa OPN [village, OPN enclave]
Number of records: 8
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, xerothermobiontic, synanthropobiontic
Chorological elements: Westernpalearctic

Genus: ***Therioaphis*** Walker, 1870

42. ***Therioaphis trifolii*** (Monell, 1882)

Number of records: 0
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree xerophiles-2nd degree higrophiles
Chorological elements: Cosmopolitan

Note: species recorded in Ojców on Lotus coriculatus
References: Piechota, 1990

Genus: ***Tinocallis*** Matsumura, 1919

43. ***Tinocallis (Tinocallis) platani*** (Kaltenbach, 1843)

Host plants: *Ulmus glabra*
Localities: Pieskowa Skała [village], Mokrzys [village], Złota Góra [slopes and top, along the road]
Number of records: 4
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, xerothermobiontic
Chorological elements: Holarctic with disjunction
Note: species new to region Kraków-Wieluń Upland

44. ***Tinocallis (Tinocallis) saltans*** (Nevsky, 1929)

Host plants: *Ulmus glabra*
Localities: Góra Koronna [top and rock shelves]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic
Chorological elements: Euro-Siberian

Genus: ***Tuberculatus*** Mordvilko, 1894

45. ***Tuberculatus (Tuberculatus) querceus*** (Kaltenbach, 1843)

Host plants: *Quercus robur*
Localities: Mokrzys [village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic
Chorological elements: Westpalearctic-steppe
References: Piechota, 1990

46. ***Tuberculatus (Tuberculoides) annulatus*** (Hartig, 1841)

Host plants: *Quercus robur*
Localities: Sułoszowa [village], Mokrzys [village], Dolina Zachwytu 2 [median portion], Wąwóz Koziarnia [gorge], Lepianka Sąspowska [village, border of the forest]
Number of records: 5
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, synanthropobiontic
Chorological elements: Cosmopolitan
References: Piechota, 1990

Tribe: Saltusaphidini
Genus: ***Sminthuraphis*** Quednau, 1953

47. ***Sminthuraphis ulrichi*** Quednau, 1953

Number of records: 0

Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles
Chorological elements: European
Note: species recorded in Ojców on Carex ligerica
References: Piechota, 1990

Genus: ***Subsaltusaphis*** Quednau, 1953

48. ***Subsaltusaphis intermedia*** (Hille Ris Lambers, 1939)

Number of records: 0
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles-2nd degree higrophiles
Chorological elements: European
Note: species recorded in Ojców on Carex sp.
References: Piechota, 1990

Subfamily: Chaitophorinae
Tribe: Chaitophorini
Genus: ***Chaitophorus*** Koch, 1854

49. ***Chaitophorus capreae*** (Mosley, 1841)

Host plants: *Salix caprea*
Localities: Wola Kalinowska [village]
Number of records: 2
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; synanthropobiontic
Chorological elements: Westpalearctic-steppe
Note: Sub-Boreal species

50. ***Chaitophorus hypogaeus*** Hille Ris Lambers, 1947

Host plants: *Salix fragilis*, *S. x sepulcralis* «Chrysocoma»
Localities: Młynnik [village], Ojców – Źródło Miłości [spring], Skalska Droga [village]
Number of records: 3
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles-2nd degree higrophiles; sylvibiontic, synanthropobiontic
Chorological elements: European
Note: Sub-Boreal species

51. ***Chaitophorus mordvilkoi*** Mamontova ex Szelegiewicz, 1961

Host plants: *Salix purpurea*
Localities: Wola Kalinowska [village], Ojców-Centrum [center of the village]
Number of records: 2
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree higrophiles; synanthropobiontic
Chorological elements: Westpalearctic-steppe
Note: Pontic species; species new to region Kraków-Wieluń Upland

52. ***Chaitophorus populeti*** (Panzer, 1804)

Host plants: *Populus nigra*, *P. tremula*

Localities: Pieskowa Skała [village], Młynnik [village], Dolina Zachwytu 3 [mouth], Diabli Młyn [forest border at the village], Poręba Sąspowska [village], Serpentyny [slopes], Murownia [village]

Number of records: 9

Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, xerothermobiontic, synanthropobiontic

Chorological elements: Westernpalearctic

Note: Sub-Boreal species

53. ***Chaitophorus salicti*** (Schrank, 1801)

Host plants: Salix caprea

Localities: Wola Kalinowska [village]

Number of records: 1

Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; synanthropobiontic

Chorological elements: Westpalearctic-steppe

Note: Ponto-Siberian species

54. ***Chaitophorus salijaponicus niger*** Mordvilko, 1929

Host plants: *Salix fragilis*, *S. x sepulcralis* «Chrysocoma»

Localities: Młynnik [village], Ojców – Źródło Miłości [spring], Skalska Droga [village]

Number of records: 3

Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles-2nd degree higrophiles; sylvibiontic, synanthropobiontic

Chorological elements: Westernpalearctic

Note: Far East species

55. ***Chaitophorus tremulae*** Koch, 1854

Host plants: *Populus tremula*

Localities: Sokolec [village], Mokrzys [village], Poręba Sąspowska [village], Miotełka [village]

Number of records: 6

Ecological elements: monoecious; monophagous; mesohigrophiles; sylvibiontic, xerothermobiontic, synanthropobiontic

Chorological elements: Westernpalearctic

Note: Sub-Boreal species

56. ***Chaitophorus truncatus*** (Hausmann, 1802)

Host plants: Salix alba, S. fragilis, S. purpurea, S. triandra

Localities: Pieskowa Skała [village], Sokolec [village], Ojców-Zazamcze [village], Wola Kalinowska [village], Obserwatorium Sejsmologiczne [near Saspów village]

Number of records: 7

Ecological elements: monoecious; 1st degree oligophagous; 2nd degree higrophiles;

sylvibiontic, xerothermobiontic, synanthropobiontic
Chorological elements: Westernpalearctic
Note: Sub-Boreal species

57. ***Chaitophorus vitellinae*** (Schrank, 1801)

Host plants: *Salix fragilis*, *S. x sepulcralis* «Chrysocoma»
Localities: Młynnik [village], Obserwatorium Sejsmologiczne [near Saspów village]
Number of records: 2
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles-2nd degree higrophiles; xerothermobiontic, synanthropobiontic
Chorological elements: Westpalearctic-steppe
Note: Ponto-Siberian species

Genus: ***Periphyllus*** van der Hoeven, 1863

58. ***Periphyllus acericola*** (Walker, 1848)

Host plants: *Acer pseudoplatanus*
Localities: Sokolec [village], Grodzisko – skrzyżowanie [crossroad on the bottom of the Prądnik river valley], Ojców-Zazamcze [village], Ojców – Park Zamkowy [village, park in the bottom of the Prądnik river valley], Brama Krakowska 1 [rock and slopes], Serpentyny [slopes], Ojców – Caritas [village, southernmost part]
Number of records: 9
Ecological elements: monoecious; monophagous; mesohigrophiles, sylvibiontic, synanthropobiontic
Chorological elements: European

59. ***Periphyllus aceris*** (Linnaeus, 1761)

Host plants: *Acer platanoides*, *A. pseudoplatanus*
Localities: Wąwóz Sokolec [gorge], Ojców-Zazamcze [village], Wola Kalinowska [village]
Number of records: 3
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, synanthropobiontic
Chorological elements: Holarctic with disjunction

60. ***Periphyllus coracinus*** (Koch, 1854)

Host plants: *Acer platanoides*, *A. pseudoplatanus*
Localities: Sokolec [village], Ojców – Park Zamkowy [village, park in the bottom of the Prądnik river valley], Poręba Sąspowska [village], Ojców – Caritas [village, southernmost part]
Number of records: 4
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, xerothermobiontic, synanthropobiontic
Chorological elements: European

61. ***Periphyllus lyropictus*** (Kessler, 1886)

Host plants: *Acer platanoides*

Localities: Wąwóz Sokolec [gorge]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic
Chorological elements: Holarctic with disjunction
Note: Ponto-Siberian species

62. ***Periphyllus testudinaceus*** (Fernie, 1852)

Host plants: *Acer platanoides*, *A. pseudoplatanus*
Localities: Pieskowa Skała [village], Wąwóz Sokolec [gorge], Sokolec [village], Grodzisko – Skała Długa [rock foothill and slopes], Wąwóz Słupianka [gorge], Dolina Sąspowska 1 [median portion], Dolina Sąspowska 2 [mouth], Wąwóz Jamki [gorge], Ojców-Centrum [center of the village]
Number of records: 10
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, synanthropobiontic
Chorological elements: Cosmopolitan

Tribe: Siphini
Genus: Laingia Theobald, 1922

63. ***Laingia psammae*** Theobald, 1922

Host plants: *Calamagrostis epigejos*
Localities: Poręba Sąspowska [village]
Number of records: 3
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: Euro-Siberian
Note: Caspian species

Family: Aphididae
Subfamily: Pterocommatinae
Genus: ***Plocamaphis*** Oestlund, 1922

64. ***Plocamaphis flocculosa brachysiphon*** Ossiannilsson, 1959

Host plants: *Salix alba*
Localities: Pieskowa Skała [village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree higrophiles; sylvibiontic
Chorological elements: European
Note: Sub-Boreal species

Genus: ***Pterocomma*** Buckton, 1879

65. ***Pterocomma jacksoni*** Theobald, 1921

Host plants: *Salix caprea*

Localities: Sokolec [village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; synanthropobiontic
Chorological elements: European

66. ***Pterocomma pilosum pilosum*** Buckton, 1879

Host plants: *Salix alba*, *S. fragilis*
Localities: Dolina Sąspowska 1 [median portion], Ojców – Źródło Miłości [spring]
Number of records: 4
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree higrophiles; sylvibiontic
Chorological elements: Holarctic with disjunction
Note: Sub-Boreal species

67. ***Pterocomma pilosum konoi*** Hori ex Takahashi, 1939

Host plants: *Salix alba*, *S. caprea*, *S. purpurea*
Localities: Grodzisko – Skała Długa [rock foothill and slopes], Wola Kalinowska [village]
Number of records: 3
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree higrophiles; synanthropobiontic
Chorological elements: Palearctic

68. ***Pterocomma rufipes*** (Hartig, 1841)

Host plants: *Salix alba*, *S. fragilis*, *S. triandra*
Localities: Pieskowa Skała [village], Młynnik [village], Ojców-Zazamcze [village], Słupianka [gorge], Dolina Sąspowska 1 [median portion], Serpentyny [slopes]
Number of records: 9
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree higrophiles; sylvibiontic, synanthropobiontic
Chorological elements: Euro-Siberian

69. ***Pterocomma salicis*** (Linnaeus, 1758)

Host plants: *Salix caprea*
Localities: Wola Kalinowska [village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; synanthropobiontic
Chorological elements: Holarctic with disjunction

Subfamily: Aphidinae
Tribe: Aphidini
Genus: ***Aphis*** Linnaeus, 1758

70. ***Aphis (Aphis) affinis*** del Guercio, 1911

Host plants: *Mentha arvensis*

Localities: Poręba Sąspowska [village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; xerothermobiontic
Chorological elements: Westpalearctic-steppe
Note: species new to region Kraków-Wieluń Upland

71. ***Aphis (Aphis) brohmeri*** Börner, 1952

Host plants: *Anthriscus sylvestris*, *Heralceum sphodylium*
Localities: Kaliski [village], Grodzisko – skrzyżowanie [crossroad on the bottom of the Prądnik river valley], Miotełka [village]
Number of records: 3
Ecological elements: monoecious; monophagous; mesohigrophiles; xerothermobiontic
Chorological elements: Westpalearctic-steppe
Note: species new to region Kraków-Wieluń Upland

72. ***Aphis (Aphis) brunellae*** Schouteden, 1903

Host plants: *Prunella vulgaris*
Localities: Poręba Sąspowska [village], Lepianka Czajowska [village]
Number of records: 2
Ecological elements: monoecious; monophagous; mesohigrophiles; xerothermobiontic, synanthropobiontic
Chorological elements: European

73. ***Aphis (Aphis) chloris*** Koch, 1854

Host plants: *Hypericium perforatum*
Localities: Pieskowa Skała [village], Słoneczna Góra [hill top], Kapkazy [village], Dolina Sąspowska – Warzechówka [village], Poręba Sąspowska [village], Murownia [village], Wesoła – Enklawa OPN [village, OPN enclave]
Number of records: 9
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic, herbosabiontic
Chorological elements: Westpalearctic-steppe

74. ***Aphis (Aphis) clinopodii*** Passerini, 1861

Host plants: *Clinopodium vulgare*
Localities: Poręba Sąspowska [village]
Number of records: 1
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: European

75. ***Aphis (Aphis) confusa*** Walker, 1849

Host plants: *Knautia arvensis*, *Scabiosa ochroleuca*
Localities: Skały Wernyhory 1 [foothill and lower slopes], Lepianka Czajowska [village], Skalska Droga [village]

Number of records: 3
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree xerophiles; xerothermobiontic, synanthropobiontic
Chorological elements: Euro-Siberian

76. ***Aphis (Aphis) coronillae*** Ferrari, 1872

Host plants: *Trifolium aureum*
Localities: Kapkazy [village]
Number of records: 1
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: European
Note: species new to region Kraków-Wieluń Upland

77. ***Aphis (Aphis) craccae*** Linnaeus, 1758

Host plants: *Vicia sylvatica*
Localities: Serpentyny [slopes]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; synanthropobiontic
Chorological elements: Euro-Siberian

78. ***Aphis (Aphis) craccivora*** Koch, 1854

Host plants: *Caragana arborescens*, *Lathyrus pratensis*, *Trifolium rubens*
Localities: Ojców – Kaplica na Wodzie [village, wooden chappel], Ojców-Centrum [center of the village], Góra Koronna [top and rock shelves]
Number of records: 3
Ecological elements: monoecious; 2nd degree oligophagous; mesohigrophiles; xerothermobiontic, herbosabiontic, synanthropobiontic
Chorological elements: Cosmopolitan
References: Osiadacz, 2006

79. ***Aphis (Aphis) crepidis*** (Börner, 1940)

Host plants: *Crepis biennis*
Localities: Ojców-Centrum [center of the village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; synanthropobiontic
Chorological elements: European

80. ***Aphis (Aphis) cytisorum sarothamni*** Franssen, 1928

Host plants: *Sarothamnus scoparius*
Localities: Kaliski [village]
Number of records: 1
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: Holarctic with disjunction

Note: Mediterranean species

81. ***Aphis (Aphis) euphorbiae*** Kaltenbach, 1843

Host plants: *Euphorbia cyparissias*, *E. esula*, *E. peplus*
Localities: Pieskowa Skała [village], Skały Wernyhory 1 [foothill and lower slopes], Poręba Sąspowska [village], Skała Jonaszówka [rock shelves]
Number of records: 5
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic, synanthropobiontic
Chorological elements: Westpalearctic-steppe
Note: Mediterranean species

82. ***Aphis (Aphis) fabae fabae*** Scopoli, 1763

Host plants: *Papaver rhoeas*, *P. somniferum*, *Fumaria officinalis*, *Urtica dioica*, *Amaranthus retroflexus*, *Atriplex patula*, *Beta vulgaris*, *Chenopodium album*, *C. strictum*, *Polygonum aviculare*, *Reynoutria japonica*, *Rumex obtusifolius*, *Brassica napus*, *Capsella bursa-pastoris*, *Lysimachia vulgaris*, *Philadelphus coronarius*, *P. pubescens*, *Vicia faba*, *Impatiens glandulifera*, *I. noli-tangere*, *I. parviflora*, *Chamaenerion angustifolium*, *Aegopodium podagraria*, *Berula erecta*, *Heralceum sphodylium*, *Laserpitium latifolium*, *Libanotis pyrenaica*, *Torillis japonica*, *Euonymus europaeus*, *Asperula tinctoria*, *Galium aparine*, *G. mollugo*, *Valeriana officinalis*, *V. tripteris*, *Convolvulus arvensis*, *Cuscuta europaea*, *Verbascum chaixii subsp. austriacum*, *Phyteuma spicatum*, *Arctium lappa*, *A. tomentosum*, *Calendula officinalis*, *Carduus crispus*, *Chamomilla suaveolens*, *Cirsium arvense*, *C. oleraceum*, *C. vulgare*, *Helianthus annuus*, *Matricaria maritima subsp. inodora*
Localities: Pieskowa Skała [village], Maczuga Herkulesa [rock foothill], Sokolec [village], Skały Wernyhory 1 [foothill and lower slopes], Skały Wernyhory 2 [upper shelves], Młynnik [village], Słoneczna Góra [hill top], Dolina Zachwytu 1 [upper portion], Dolina Zachwytu 3 [mouth], Grodzisko – Skała Długa [rock foothill and slopes], Grodzisko – Skamieniały Wędrowiec [rock slope], Grodzisko – skrzyżowanie [crossroad on the bottom of the Prądnik river valley], Skały Ciche [rock slopes], Osicze [village], Słupianka [gorge], Złota Góra [slopes and top, along the road], Ojców – Park Zamkowy [village, park in the bottom of the Prądnik river valley], Obserwatorium Sejsmologiczne [near Saspów village], Dolina Sąspowska – Warzechówka [village], Poręba Sąspowska [village], Dolina Sąspowska 1 [median portion], Dolina Sąspowska 2 [mouth], Chełmowa Góra [top and slopes], Ojców-Centrum [center of the village], Miotełka [village], Skała Jonaszówka [rock shelves], Ojców – Pstrągarnia [village, trout fish ponds], Brama Krakowska 1 [rock and slopes], Skała Krukowskiego [rock shelves], Grota Ciemna [rock shelves and slopes at the cave], Góra Koronna [top and rock shelves], Wapiennik [rock shelves], Okopy [top and rock shelves], Serpentyny [slopes], Wąwóz Korytania (wierzchowina) [top of the rock surrounding the gorge], Murownia [village], Ojców – Caritas [village, southernmost part], Skała Krzyżowa [rock slope and rock shelves], Prądnik Korzkiewski [village], Skalska Droga [village]
Number of records: 146
Ecological elements: heteroecious; poliphagous/poliphagous; mesohigrophiles/1st degree higrophiles-mesohigrophiles; herbosabiontic, xerothermobiontic, limnobiontic, sylvibiontic,

synanthropobiontic
Chorological elements: Cosmopolitan
References: Osiadacz, 2006, Osiadacz & Wojciechowski, 2005

83. ***Aphis (Aphis) fabae cirsiiacanthoidis*** Scopoli, 1763

Host plants: *Cirsium rivulare*
Localities: Dolina Sąspowska 1 [median portion]
Number of records: 1
Ecological elements: heteroecious; poliphagous/poliphagous; 2nd degree higrophiles; herbosabiontic
Chorological elements: Holarctic with disjunction

84. ***Aphis (Aphis) fabae evonymi*** Fabricius, 1775

Host plants: *Euonymus europaeus*
Localities: Pieskowa Skała [village], Maczuga Herkulesa [rock foothill], Ojców – Pstrągarnia [village, trout fish ponds]
Number of records: 7
Ecological elements: heteroecious; poliphagous/poliphagous; mesohigrophiles/2nd degree xerophiles-mesohigrophiles; xerothermobiontic, synanthropobiontic
Chorological elements: European

85. ***Aphis (Aphis) fabae solanella*** Theobald, 1914

Host plants: *Rumex crispus*, *Cirsium arvense*, *C. oleraceum*, *C. rivulare*, *Onopordum acanthium*
Localities: Pieskowa Skała [village], Ojców-Zazamcze [village], Poręba [village], Dolina Sąspowska 1 [median portion], Ojców – Skała Koźniowa [rock foothills], Murownia [village]
Number of records: 8
Ecological elements: heteroecious; poliphagous/poliphagous; mesohigrophiles/2nd degree xerophiles-mesohigrophiles; xerothermobiontic, herbosabiontic, synanthropobiontic
Chorological elements: Cosmopolitan
Note: species new to region Kraków-Wieluń Upland
References: Osiadacz and Wojciechowski, 2005

86. ***Aphis (Aphis) farinosa*** J. F. Gmelin, 1790

Host plants: *Salix alba*, *S. caprea*, *S. fragilis*
Localities: Pieskowa Skała [village], Młynnik [village], Poręba Sąspowska [village], Dolina Sąspowska 1 [median portion], Ojców – Pstrągarnia [village, trout fish ponds], Ojców – Źródło Miłości [spring], Ojców – Caritas [village, southernmost part]
Number of records: 13
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree higrophiles; sylvibiontic, xerothermobiontic, synanthropobiontic
Chorological elements: Holarctic

87. ***Aphis (Aphis) forbesi*** Weed, 1889

Host plants: *Fragaria vesca*

Localities: Obserwatorium Sejsmologiczne [near Saspów village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; xerothermobiontic
Chorological elements: Cosmopolitan
Note: Sub-Boreal species

88. ***Aphis (Aphis) frangulae*** Kaltenbach, 1845

Host plants: *Capsella bursa-pastoris*, *Malva sylvestris*, *Chamaenerion angustifolium*, *Frangula alnus*, *Digitalis grandiflora*, *Melampyrum nemorosum*, *M. pratense*, *Scrophularia nodosa*, *Acinos arvensis*, *Sonchus arvensis*
Localities: Pieskowa Skała [village], Skały Wernyhory 1 [foothill and lower slopes], Poręba Sąspowska [village], Ojców-Centrum [center of the village], Brama Krakowska 1 [rock and slopes], Grota Ciemna [rock shelves and slopes at the cave], Serpentyny [slopes], Skała Krzyżowa [rock slope and rock shelves], Skalska Droga [village]
Number of records: 12
Ecological elements: heteroecious; monophagous/poliphagous; mesohigrophiles/2nd degree xerophiles-mesohigrophiles; sylvibiontic, xerothermobiontic, synanthropobiontic
Chorological elements: Cosmopolitan

89. ***Aphis (Aphis) galiiscabri*** Schrank, 1801

Host plants: *Asperula tinctoria*, *Galium schultesii*
Localities: Dolina Zachwytu 2 [median portion], Kamieniołom [rock slopes]
Number of records: 2
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree xerophiles; sylvibiontic, xerothermobiontic
Chorological elements: European

90. ***Aphis (Aphis) genistae*** Scopoli, 1763

Host plants: *Genista tinctoria*
Localities: Poręba Sąspowska [village]
Number of records: 1
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: European
Note: Mediterranean species

91. ***Aphis (Aphis) hederae*** Kaltenbach, 1843

Host plants: *Hedera helix*
Localities: Ojców – Skała Koźniowa [rock foothills]
Number of records: 1
Ecological elements: monoecious; monophagous; mesohigrophiles; synanthropobiontic
Chorological elements: Cosmopolitan
Note: Mediterranean species
References: Osiadacz, 2006

92. ***Aphis (Aphis) hieracii*** Schrank, 1801

Host plants: *Hieracium lachenalii*, *H. laevigatum*, *H. murorum*
Localities: Kamieniołom [rock slopes], Kapkazy [village], Poręba Sąspowska [village]
Number of records: 8
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: Holarctic with disjunction

93. ***Aphis (Aphis) idaei*** van der Goot, 1912

Host plants: *Rubus idaeus*
Localities: Ojców – Park Zamkowy [village, park in the bottom of the Prądnik river valley]
Number of records: 1
Ecological elements: monoecious; monophagous; mesohigrophiles; sylvibiontic
Chorological elements: Cosmopolitan

94. ***Aphis (Aphis) ilicis*** Kaltenbach, 1843

Host plants: *Cephalantera damsonium*, *Epipactis helleborine*
Localities: Dolina Zachwytu 3 [mouth], Ojców – Park Zamkowy [village, park in the bottom of the Prądnik river valley], Poręba [village], Ojców-Centrum [center of the village], Góra Koronna [top and rock shelves], Ojców – Caritas [village, southernmost part]
Number of records: 6
Ecological elements: monoecious; 2nd degree oligophagous; mesohigrophiles; sylvibiontic, synanthropobiontic
Chorological elements: Holarctic with disjunction

95. ***Aphis (Aphis) intybi*** Koch, 1855

Host plants: *Cichorium intybus*
Localities: Lepianka Czajowska [village]
Number of records: 1
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; synanthropobiontic
Chorological elements: Westpalearctic-steppe

96. ***Aphis (Aphis) jacobaeae*** Schrank, 1801

Host plants: *Senecio jacobaea*
Localities: Kaliski [village], Kapkazy [village], Skała Gęsia Szyja [sward at the rock foothill], Zabugaje [village], Obserwatorium Sejsmologiczne [near Saspów village], Poręba Sąspowska [village], Murownia [village]
Number of records: 9
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic, herbosabiontic
Chorological elements: European
References: Osiadacz and Wojciechowski, 2005

97. ***Aphis (Aphis) janischi*** (Börner, 1940)

Host plants: *Cirsium oleraceum*

Localities: Ojców – Kaplica na Wodzie [village, wooden chappel], Ojców – Skała Koźniowa [rock foothills]
Number of records: 2
Ecological elements: monoecious; monophagous; 2nd degree higrophiles; herbosabiontic
Chorological elements: European

98. ***Aphis (Aphis) lambersi*** (Börner, 1940)

Host plants: *Daucus carota*
Localities: Poręba Sąspowska [village]
Number of records: 2
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: European

99. ***Aphis (Aphis) lamiorum*** (Börner, 1950)

Host plants: *Lamium purpureum*
Localities: Skały Wernyhory 1 [foothill and lower slopes]
Number of records: 1
Ecological elements: monoecious; monophagous; mesohigrophiles; synanthropobiontic
Chorological elements: Westpalearctic-steppe
Note: species new to region Kraków-Wieluń Upland

100. ***Aphis (Aphis) leontodontis*** (Börner, 1950)

Host plants: *Leontodon autumnalis*
Localities: Pieskowa Skała [village]
Number of records: 1
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: European
References: Osiadacz and Wojciechowski, 2005

101. ***Aphis (Aphis) lilago*** F. P. Müller, 1968

Host plants: *Anthericum ramosum*
Localities: Grodzisko – Skamieniały Wędrowiec [rock slope], Skały Ciche [rock slopes], Skała Krukowskiego [rock shelves], Grota Ciemna [rock shelves and slopes at the cave], Góra Koronna [top and rock shelves], Wapiennik [rock shelves], Skała Krzyżowa [rock slope and rock shelves]
Number of records: 11
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: European
Note: European species; species new to Poland

102. ***Aphis (Aphis) mammulata*** Ghimingham & Hille Ris Lambers, 1949

Host plants: *Rhamnus catharticus*
Localities: Skała Krukowskiego [rock shelves], Grota Ciemna [rock shelves and slopes at the cave], Wapiennik [rock shelves]
Number of records: 26
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic

Chorological elements: European

103. ***Aphis (Aphis) molluginis*** (Börner, 1950)

Host plants: *Galium aparine*, *G. mollugo*
Localities: Pieskowa Skała [village], Ojców – Źródło Miłości [spring]
Number of records: 4
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, xerothermobiontic
Chorological elements: European

104. ***Aphis (Aphis) nasturtii*** Kaltenbach, 1843

Host plants: *Myosoton aquaticum*, *Polygonum persicaria*, *Armoracia rusticana*, *Veronica beccabunga*
Localities: Pieskowa Skała [village], Młynnik [village], Grodzisko – Skała Długa [rock foothill and slopes], Dolina Sąspowska 1 [median portion], Ojców – Pstrągarnia [village, trout fish ponds]
Number of records: 5
Ecological elements: heteroecious; poliphagous/poliphagous; 2nd degree xerophiles/1st degree xerophiles-1st degree higrophiles; synanthropobiontic, limnobiontic
Chorological elements: Holarctic with disjunction

105. ***Aphis (Aphis) origani*** Passerini, 1860

Host plants: *Origanum vulgare*
Localities: Zamkowa Droga [gorge], Skała Jonaszówka [rock shelves], Prądnik Korzkiewski [village]
Number of records: 5
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic, herbosabiontic
Chorological elements: Westernpalearctic
Note: Mediterranean species

106. ***Aphis (Aphis) pilosellae*** (Börner, 1952)

Host plants: *Hieracium laevigatum*, *H. murorum*, *H. pilosella*
Localities: Kapkazy [village], Poręba Sąspowska [village], Brama Krakowska 1 [rock and slopes], Góra Koronna [top and rock shelves]
Number of records: 5
Ecological elements: monoecious; 1st degree oligophagous; 1st degree xerophiles-2nd degree xerophiles; sylvibiontic, xerothermobiontic
Chorological elements: Westpalearctic-steppe
References: Osiadacz and Wojciechowski, 2005

107. ***Aphis (Aphis) plantaginis*** Goeze, 1778

Host plants: *Plantago major*
Localities: Młynnik [village], Obserwatorium Sejsmologiczne [near Saspów village], Ojców-Centrum [center of the village], Skała Jonaszówka [rock shelves]
Number of records: 4

Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; xerothermobiontic, herbosabiontic, synanthropobiontic
Chorological elements: Holarctic with disjunction

108. ***Aphis (Aphis) podagrariae*** Schrank, 1801

Host plants: *Aegopodium podagraria*
Localities: Młynnik [village], Ojców-Zazamcze [village], Brama Krakowska 1 [rock and slopes], Murownia [village], Prądnik Korzkiewski [village]
Number of records: 6
Ecological elements: monoecious; monophagous; mesohigrophiles-2nd degree higrophiles; sylvibiontic, xerothermobiontic, synanthropobiontic
Chorological elements: Euro-Siberian

109. ***Aphis (Aphis) pomi*** de Geer, 1773

Host plants: *Cotoneaster horizontalis*, *Crataegus monogyna*, *Malus domestica*, *Prunus domestica*, *P. spinosa*
Localities: Grodzisko – Skamieniały Wędrowiec [rock slope], Grodzisko – skrzyżowanie [crossroad on the bottom of the Prądnik river valley], Kamieniołom [rock slopes], Skały Ciche [rock slopes], Kapkazy [village], Poręba Sąspowska [village], Ojców-Centrum [center of the village], Ojców – Pstrągarnia [village, trout fish ponds], Ojców – Caritas [village, southernmost part]
Number of records: 14
Ecological elements: monoecious; 2nd degree oligophagous; mesohigrophiles; xerothermobiontic, synanthropobiontic
Chorological elements: Cosmopolitan
References: Osiadacz, 2006

110. ***Aphis (Aphis) praeterita*** Walker, 1849

Host plants: *Epilobium montanum*, *E. roseum*
Localities: Słoneczna Góra [hill top], Dolina Zachwytu 1 [upper portion], Dolina Zachwytu 3 [mouth]
Number of records: 4
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles-2nd degree higrophiles; sylvibiontic, xerothermobiontic, herbosabiontic
Chorological elements: European

111. ***Aphis (Aphis) proffti*** (Börner, 1942)

Host plants: *Agrimonia eupatoria*
Localities: Poręba Sąspowska [village]
Number of records: 2
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: European

112. ***Aphis (Aphis) pseudocomosa*** Stroyan, 1972 b

Host plants: *Lathyrus pratensis*
Localities: Ojców-Centrum [center of the village]

Number of records: 1
Ecological elements: monoecious; monophagous; mesohigrophiles; synanthropobiontic
Chorological elements: European

113. ***Aphis (Aphis) ruborum*** (Börner, 1932)

Host plants: *Rubus bifrons*
Localities: Ojców – Skała Koźniowa [rock foothills]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic
Chorological elements: Westernpalearctic

114. ***Aphis (Aphis) rumicis*** Linnaeus, 1758

Host plants: *Rumex conglomeratus*, *R. crispus*, *R. obtusifolius*
Localities: Pieskowa Skała [village], Młynnik [village], Grodzisko – Skała Długa [rock foothill and slopes], Osicze [village], Dolina Sąspowska – Warzechówka [village], Poręba Sąspowska [village], Ojców – Pstrągarnia [village, trout fish ponds], Ojców – Źródło Miłości [spring]
Number of records: 9
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles-2nd degree higrophiles; herbosabiontic, xerothermobiontic, sylvibiontic, synanthropobiontic
Chorological elements: Cosmopolitan

115. ***Aphis (Aphis) sambuci*** Linnaeus, 1758

Host plants: *Dianthus carthusianorum*, *Capsella bursa-pastoris*, *Oenothera fruticosa*, *Sambucus nigra*
Localities: Skały Wernyhory 1 [foothill and lower slopes], Młynnik [village], Ojców-Centrum [center of the village], Serpentyny [slopes], Ojców – Caritas [village, southernmost part], Prądnik Korzkiewski [village]
Number of records: 9
Ecological elements: heteroecious; 1st degree oligophagous/poliphagous; mesohigrophiles-2nd degree higrophiles/2nd degree xerophiles-mesohigrophiles; sylvibiontic, xerothermobiontic, synanthropobiontic
Chorological elements: Cosmopolitan
References: Osiadacz, 2006

116. ***Aphis (Aphis) sedi*** Kaltenbach, 1843

Host plants: *Jovibarba sobolifera*, *Sedum maximum*, *S. spurium*
Localities: Pieskowa Skała [village], Skały Wernyhory 1 [foothill and lower slopes], Skały Wernyhory 2 [upper shelves], Skały Wdowie [rock shelves], Skała Jonaszówka [rock shelves], Brama Krakowska 1 [rock and slopes]
Number of records: 13
Ecological elements: monoecious; 2nd degree oligophagous; 1st degree xerophiles; xerothermobiontic, synanthropobiontic
Chorological elements: Cosmopolitan
Note: Boreo-Eurasian species

References: Osiadacz, 2006

117. ***Aphis (Aphis) serpylli*** Koch, 1854

Host plants: *Thymus pulegioides*
Localities: Skała Jonaszówka [rock shelves]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: Westpalearctic-steppe
Note: Mediterranean species

118. ***Aphis (Aphis) stachydis*** Mordvilko, 1929

Host plants: *Stachys recta*
Localities: Grota Ciemna [rock shelves and slopes at the cave], Góra Koronna [top and rock shelves]
Number of records: 2
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: Westpalearctic-steppe
Note: Sub-Pontic species

119. ***Aphis (Aphis) taraxacicola*** (Börner, 1940)

Host plants: *Taraxacum officinale*
Localities: Młynnik [village], Brama Krakowska 2 [gorge]
Number of records: 2
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; herbosabiontic, synanthropobiontic
Chorological elements: Westpalearctic-steppe

120. ***Aphis (Aphis) triglochinis*** Theobald, 1926

Host plants: *Rorippa palustris*, *Lappula squarrosa*, *Myosotis arvensis*
Localities: Pieskowa Skała [village], Maczuga Herkulesa [rock foothill], Ojców-Centrum [center of the village]
Number of records: 3
Ecological elements: monoecious; poliphagous; 2nd degree xerophiles-mesohigrophiles ; xerothermobiontic, synanthropobiontic
Chorological elements: European
Note: West European species

121. ***Aphis (Aphis) urticata*** J. F. Gmelin, 1790

Host plants: *Urtica dioica*
Localities: Pieskowa Skała [village], Brama Krakowska 1 [rock and slopes], Grota Ciemna [rock shelves and slopes at the cave]
Number of records: 4
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, xerothermobiontic, herbosabiontic
Chorological elements: Holarctic with disjunction

122. ***Aphis (Aphis) verbasci*** Schrank, 1801

Host plants: *Verbascum thapsus*
Localities: Dolina Sąspowska – Warzechówka [village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: Westpalearctic-steppe

123. ***Aphis (Aphis) verbenae*** Nevsky, 1929

Host plants: *Verbena officinalis*
Localities: Ojców-Centrum [center of the village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; synanthropobiontic
Chorological elements: Westpalearctic-steppe
Note: Irano-Anatolian species

124. ***Aphis (Aphis) verticillatae*** (Börner, 1940)

Host plants: *Salvia verticillata*
Localities: Maczuga Herkulesa [rock foothill], Grodzisko – Skamieniały Wędrowiec [rock slope]
Number of records: 2
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: European

125. ***Aphis (Aphis) viburni*** Scopoli, 1763

Host plants: *Viburnum opulus*
Localities: Pieskowa Skała [village], Poręba Sąspowska [village], Czajowice [village, border of the forest]
Number of records: 11
Ecological elements: monoecious; monophagous; mesohigrophiles; sylvibiontic, xerothermobiontic
Chorological elements: Holarctic with disjunction
Note: West Palaearctic-steppe species

126. ***Aphis (Bursaphis) epilobii*** Kattenbach, 1843

Host plants: *Epilobium hirsutum*, *E. montanum*, *E. roseum*
Localities: Pieskowa Skała [village], Ojców – Park Zamkowy [village, park in the bottom of the Prądnik river valley], Poręba [village], Dolina Sąspowska 1 [median portion], Dolina Sąspowska 2 [mouth], Lepianka Czajowska [village]
Number of records: 6
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles-2nd degree higrophiles; sylvibiontic, herbosabiontic, synanthropobiontic
Chorological elements: Holarctic with disjunction

127. ***Aphis (Bursaphis) grossulariae*** Kaltenbach, 1843

Host plants: *Ribes nigrum*, *R. uva-crispa*, *Epilobium hirsutum*, *E. montanum*

Localities: Pieskowa Skała [village], Kamieniołom [rock slopes], Dolina Sąspowska 1 [median portion], Ojców-Centrum [center of the village]

Number of records: 4

Ecological elements: heteroecious; 1st degree oligophagous/1st degree oligophagous; mesohigrophiles-2nd degree higrophiles/mesohigrophiles-2nd degree higrophiles; xerothermobiontic, herbosabiontic, synanthropobiontic

Chorological elements: Holarctic with disjunction

References: Osiadacz, 2006

128. ***Aphis (Bursaphis) schneideri*** (Börner, 1940)

Host plants: *Ribes nigrum*

Localities: Murownia [village]

Number of records: 1

Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; synanthropobiontic

Chorological elements: Westpalearctic-steppe

References: Osiadacz, 2006

129. ***Aphis (Toxopterina) vandergooti*** (Börner, 1939)

Host plants: *Veronica chamaedrys*, *Plantago major*, *Achillea millefolium*

Localities: Kaliski [village], Drewniana Droga [gorge], Ojców-Centrum [center of the village], Ojców – Pstrągarnia [village, trout fish ponds], Wąwóz Korytania (wierzchowina) [top of the rock surrounding the gorge]

Number of records: 6

Ecological elements: monoecious; poliphagous; 2nd degree xerophiles-mesohigrophiles; xerothermobiontic, herbosabiontic, synanthropobiontic

Chorological elements: European

References: Osiadacz and Wojciechowski, 2005

Genus: ***Hyalopterus*** Koch, 1854

130. ***Hyalopterus pruni*** (Geoffroy, 1762)

Host plants: *Prunus spinosa*, *Phalaris arundinacea*, *Phragmites australis*, *Typha latifolia*

Localities: Pieskowa Skała [village], Dolina Sąspowska 1 [median portion], Czajowice [village, border of the forest], Ojców-Centrum [center of the village], Skalska Droga [village]

Number of records: 8

Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous; mesohigrophiles/1st degree higrophiles; sylvibiontic, synanthropobiontic, limnobiontic

Chorological elements: Cosmopolitan

Note: Sub-Pontic species

Genus: ***Rhopalosiphum*** Koch, 1854

131. ***Rhopalosiphum padi*** (Linnaeus, 1758)

Host plants: *Prunus padus*, *Apera spica-venti*, *Arrhenatherum elatius*, *Dactylis glomerata*, *Elymus repens*, *Phalaris arundinacea*

Localities: Pieskowa Skała [village], Młynnik [village], Wola Kalinowska [village], Poręba [village], Dolina Sąspowska 1 [median portion], Ojców-Centrum [center of the village]

Number of records: 6

Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous; mesohigrophiles/2nd degree xerophiles-1st degree higrophiles; herbosabiontic, synanthropobiontic, limnobiontic

Chorological elements: Holarctic with disjunction

Tribe: Macrosiphini

Genus: ***Acyrthosiphon*** Mordvilko, 1914

132. ***Acyrthosiphon (Acyrthosiphon) malvae*** (Mosley, 1841)

Host plants: *Geranium phaeum*, *G. robertianum*

Localities: Pieskowa Skała [village], Skały Wernyhory 2 [upper shelves], Dolina Sąspowska 1 [median portion], Ojców-Centrum [center of the village], Brama Krakowska 2 [gorge]

Number of records: 6

Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; xerothermobiontic, herbosabiontic, synanthropobiontic

Chorological elements: Cosmopolitan

133. ***Acyrthosiphon (Acyrthosiphon) pisum*** (Harris, 1776)

Host plants: *Capsella bursa-pastoris*, *Coronilla varia*, *Medicago lupulina*, *Pisum sativum*, *Trifolium campestre*, *T. dubium*, *T. pratense*, *T. repens*, *Vicia cracca*

Localities: Sułoszowa [village], Pieskowa Skała [village], Młynnik [village], Słoneczna Góra [hill top], Dolina Sąspowska – Warzechówka [village], Dolina Sąspowska 1 [median portion], Ojców-Centrum [center of the village], Wąwóz Korytania (wierzchowina) [top of the rock surrounding the gorge], Ojców – Caritas [village, southernmost part]

Number of records: 10

Ecological elements: monoecious; poliphagous; mesohigrophiles; xerothermobiontic, herbosabiontic, synanthropobiontic

Chorological elements: Cosmopolitan

134. ***Acyrthosiphon (Liporrhinus) chelidonii*** (Kaltenbach, 1843)

Host plants: *Chelidonium majus*

Localities: Ojców – Skała Koźniowa [rock foothills]

Number of records: 1

Ecological elements: monoecious; monophagous; mesohigrophiles; sylvibiontic

Chorological elements: Amphipalearctic

Note: species new to region Kraków-Wieluń Upland

Genus: ***Amphorophora*** Buckton, 1876

135. ***Amphorophora (Amphorophora) idaei*** (Börner, 1939)

Host plants: ***Rubus idaeus***
Localities: Złota Góra [slopes and top, along the road]
Number of records: 1
Ecological elements: monoecious; monophagous; mesohigrophiles; synanthropobiontic
Chorological elements: European
References: Osiadacz, 2006

136. ***Amphorophora (Amphorophora) rubi*** (Kaltenbach, 1843)

Host plants: *Rubus caesius*, *R. idaeus*
Localities: Pieskowa Skała [village], Dolina Zachwytu 2 [median portion], Obserwatorium Sejsmologiczne [near Saspów village]
Number of records: 4
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, xerothermobiontic
Chorological elements: Holarctic

Genus: ***Aulacorthum*** Mordvilko, 1914

137. ***Aulacorthum (Aulacorthum) solani*** (Kaltenbach, 1843)

Host plants: *Stellaria media*, *Capsella bursa-pastoris*, *Geranium phaeum*, *Aegopodium podagraria*, *Myosotis arvensis*, *M. palustris*, *Veronica beccabunga*, *Mentha longifolia*
Localities: Pieskowa Skała [village], Ojców – Kaplica na Wodzie [village, wooden chappel], Dolina Sąspowska 1 [median portion], Ojców-Centrum [center of the village], Ojców – Pstrągarnia [village, trout fish ponds], Brama Krakowska 2 [gorge], Ojców – Źródło Miłości [spring], Ojców – Caritas [village, southernmost part]
Number of records: 9
Ecological elements: monoecious; poliphagous; mesohigrophiles-1st degree higrophiles; herbosabiontic, xerothermobiontic, limnobiontic, sylvibiontic, synanthropobiontic
Chorological elements: Cosmopolitan
References: Osiadacz, 2006

Genus: ***Brachycaudus*** van der Goot, 1913

138. ***Brachycaudus (Brachycaudus) helichrysi*** (Kaltenbach, 1843)

Host plants: *Achillea millefolium*, *Chamomilla suaveolens*, *Erigeron acris*, *Matricaria maritima subsp. inodora*
Localities: Grodzisko – skrzyżowanie [crossroad on the bottom of the Prądnik river valley], ugór koło cmentarza cholerycznego [top of the rock, Choleric Cemetary], Ojców-Centrum [center of the village], Prądnik Korzkiewski [village]
Number of records: 5
Ecological elements: heteroecious; 1st degree oligophagous/poliphagous; mesohigrophiles/ 2nd degree xerophiles-mesohigrophiles; synanthropobiontic
Chorological elements: Cosmopolitan

Note: Irano-Turanian species
References: Osiadacz and Wojciechowski, 2005

139. ***Brachycaudus (Acaudus) cardui*** (Linnaeus, 1758)

Host plants: *Prunus domestica*, *P. spinosa*, *Lappula squarrosa*, *Myosotis arvensis*, *M. palustris*, *Symphytum officinale*, *Achillea millefolium*, *Anthemis tinctoria*, *Cirsium arvense*, *C. oleraceum*, *Leucanthemum vulgare*, *Matricaria maritima subsp. inodora*, *Senecio jacobaea*, *Tanacetum parthenium*
Localities: Pieskowa Skała [village], Skały Wernyhory 1 [foothill and lower slopes], Młynnik [village], Grodzisko – Skała Długa [rock foothill and slopes], Grodzisko – Skamieniały Wędrowiec [rock slope], Kamieniołom [rock slopes], Skały Ciche [rock slopes], Ojców-Zazamcze [village], Wola Kalinowska [village], Dolina Sąspowska – Warzechówka [village], Poręba Sąspowska [village], Lepianka Czajowska [village], Ojców-Centrum [center of the village], Ojców – Caritas [village, southernmost part], Prądnik Korzkiewski [village], Skalska Droga [village]
Number of records: 22
Ecological elements: heteroecious; 1st degree oligophagous/poliphagous; mesohigrophiles/ 2nd degree xerophiles-2nd degree higrophiles; xerothermobiontic, herbosabiontic, synanthropobiontic
Chorological elements: Holarctic
Note: Irano-Turanian species
References: Osiadacz, 2006, Osiadacz and Wojciechowski, 2005

140. ***Brachycaudus (Acaudus) lateralis*** (Walker, 1848)

Host plants: *Galinsoga ciliata*
Localities: Ojców – Caritas [village, southernmost part]
Number of records: 1
Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous; mesohigrophiles/mesohigrophiles; synanthropobiontic
Chorological elements: European
Note: species new to region Kraków-Wieluń Upland

141. ***Brachycaudus (Acaudus) lychnidis*** (Linnaeus, 1758)

Host plants: Melandrium album, Veronica persica
Localities: Skały Wernyhory 1 [foothill and lower slopes], Grodzisko – Skała Długa [rock foothill and slopes]
Number of records: 3
Ecological elements: monoecious; poliphagous; mesohigrophiles; synanthropobiontic
Chorological elements: Euro-Siberian

142. ***Brachycaudus (Appelia) prunicola*** (Kaltenbach, 1943)

Host plants: *Prunus spinosa*
Localities: Skały Ciche [rock slopes]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles-

mesohigrophiles; xerothermobiontic
Chorological elements: Cosmopolitan
Note: Irano-Turanian species
Genus: Brevicoryne van der Goot, 1915

143. ***Brevicoryne brassicae*** (Linnaeus, 1758)

Host plants: *Sinapsis arvensis*
Localities: Sułoszowa [village]
Number of records: 1
Ecological elements: monoecious; 2nd degree oligophagous; mesohigrophiles; synanthropobiontic
Chorological elements: Cosmopolitan

Genus: ***Capitophorus*** van der Goot, 1913

144. ***Capitophorus hippophaes*** (Walker, 1852)

Host plants: *Polygonum persicaria*
Localities: Pieskowa Skała [village], Grodzisko – Skała Długa [rock foothill and slopes]
Number of records: 2
Ecological elements: heteroecious; 2nd degree oligophagous/1st degree oligophagous; mesohigrophiles/mesohigrophiles; synanthropobiontic
Chorological elements: Cosmopolitan

145. ***Capitophorus pakansus*** Hottes & Frison, 1931

Host plants: *Inula conyza*
Localities: Ojców – Park Zamkowy [village, park in the bottom of the Prądnik river valley]
Number of records: 1
Ecological elements: heteroecious; 1st degree oligophagous/1st degree oligophagous; mesohigrophiles/2nd degree xerophiles; sylvibiontic
Chorological elements: Holarctic with disjunction
Note: species new to region Kraków-Wieluń Upland

146. ***Capitophorus similis*** van der Goot, 1915

Host plants: *Petasites albus*
Localities: Dolina Sąspowska 1 [median portion]
Number of records: 1
Ecological elements: heteroecious; 2nd degree oligophagous/2nd degree oligophagous; mesohigrophiles/2nd degree higrophiles; sylvibiontic
Chorological elements: Westpalearctic-steppe

Genus: ***Cavariella*** del Guercio, 1911

147. ***Cavariella (Cavariella) aegopodii*** (Scopoli, 1763)

Host plants: *Salix purpurea*, *Aegopodium podagraria*, *Anthriscus sylvestris*, *Daucus carota*
Localities: Sokolec [village], Młynnik [village], Poręba Sąspowska [village], Ojców-Centrum [center of the village], Ojców – Źródło Miłości [spring]
Number of records: 5

Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous; 2nd degree higrophiles/mesohigrophiles; sylvibiontic, xerothermobiontic, synanthropobiontic
Chorological elements: Cosmopolitan

148. ***Cavariella (Cavariella) archangelicae*** (Scopoli, 1763)

Host plants: *Chaerophyllum hirsutum*
Localities: Brama Krakowska 2 [gorge]
Number of records: 1
Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous; 2nd degree higrophiles/mesohigrophiles; herbosabiontic
Chorological elements: Cosmopolitan

149. ***Cavariella (Cavariella) konoi*** Takahashi, 1939

Host plants: *Salix alba*
Localities: Serpentyny [slopes]
Number of records: 1
Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous; 2nd degree higrophiles/mesohigrophiles; synanthropobiontic
Chorological elements: Holarctic with disjunction

150. ***Cavariella (Cavariella) pastinacae*** (Linnaeus, 1758)

Host plants: *Heralceum sphodylium*
Localities: Skały Ciche [rock slopes]
Number of records: 1
Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous; 2nd degree higrophiles/mesohigrophiles-2nd degree higrophiles; xerothermobiontic
Chorological elements: Holarctic

151. ***Cavariella (Cavariella) salicicola*** (Matsumura, 1917)

Host plants: *Salix triandra*
Localities: Pieskowa Skała [village]
Number of records: 1
Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous; 2nd degree higrophiles/mesohigrophiles-2nd degree higrophiles; sylvibiontic
Chorological elements: Amphipalearctic
Note: species new to Poland

152. ***Cavariella (Cavariella) theobaldi*** (Gillette & Bragg, 1918)

Host plants: *Salix alba*, *S. caprea*, *S. fragilis*, *Heralceum sphodylium*, *Pastinaca sativa*
Localities: Pieskowa Skała [village], Skały Wernyhory 1 [foothill and lower slopes], Obserwatorium Sejsmologiczne [near Saspów village], Dolina Sąspowska 1 [median portion], Lepianka Czajowska [village], Skalska Droga [village]
Number of records: 8
Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous; 2nd degree higrophiles/mesohigrophiles; herbosabiontic, xerothermobiontic, sylvibiontic, synanthropobiontic

Chorological elements: Holarctic with disjunction

Genus: ***Chaetosiphon*** Mordvilko, 1914

153. ***Chaetosiphon (Pentatrichopus) tetrarhodum*** (Walker, 1849)

Host plants: *Rosa canina*, *R. tomentosa*
Localities: Skała Krukowskiego [rock shelves], Wapiennik [rock shelves]
Number of records: 10
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; xerothermobiontic
Chorological elements: Cosmopolitan
Note: species new to region Kraków-Wieluń Upland

Genus: *Coloradoa* Wilson, 1910

154. ***Coloradoa artemisiae*** (del Guercio, 1913)

Host plants: ***Artemisia vulgaris***
Localities: Lepianka Czajowska [village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles-mesohigrophiles; synanthropobiontic
Chorological elements: Westpalearctic-steppe

Genus: ***Corylobium*** Mordvilko, 1914

155. ***Corylobium avellanae*** (Schrank, 1801)

Host plants: *Corylus avellana*
Localities: Pieskowa Skała [village], Skały Ciche [rock slopes], Ojców-Zazamcze [village], Poręba Sąspowska [village], Dolina Sąspowska 2 [mouth], Brama Krakowska 1 [rock and slopes]
Number of records: 19
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; sylvibiontic, xerothermobiontic, synanthropobiontic
Chorological elements: Holarctic with disjunction
Note: Mediterranean species

Genus: ***Cryptomyzus*** Oestlund, 1922

156. ***Cryptomyzus (Cryptomyzus) alboapicalis*** (Theobald, 1916)

Host plants: *Ballota nigra*, *Lamium album*
Localities: Ojców – Źródło Miłości [spring], Ojców – Skała Koźniowa [rock foothills]
Number of records: 2
Ecological elements: monoecious; 2nd degree oligophagous; mesohigrophiles; herbosabiontic, synanthropobiontic
Chorological elements: European
Note: East Mediterranean species

157. ***Cryptomyzus (Cryptomyzus) galeopsidis*** (Kaltenbach, 1843)

Host plants: *Galeobdolon luteum*, *Galeopsis pubescens*, *Lamium maculatum*, *Campanula trachelium*

Localities: Pieskowa Skała [village], Ojców-Centrum [center of the village], Grota Ciemna [rock shelves and slopes at the cave], Wąwóz Smardzowidzki [gorge]

Number of records: 5

Ecological elements: heteroecious; 1st degree oligophagous/poliphagous; mesohigrophiles/mesohigrophiles; sylvibiontic, xerothermobiontic, synanthropobiontic

Chorological elements: Holarctic with disjunction

Note: East Mediterranean species

158. ***Cryptomyzus (Cryptomyzus) ribis*** (Linnaeus, 1758)

Host plants: *Ribes uva-crispa*, *Stachys palustris*

Localities: Herianówka [village], Ojców – Skała Koźniowa [rock foothills]

Number of records: 2

Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous; mesohigrophiles/mesohigrophiles; xerothermobiontic, synanthropobiontic

Chorological elements: Holarctic

Note: East Mediterranean species

Genus: ***Delphiniobium*** Mordvilko, 1914

159. ***Delphiniobium junackianum*** (Karsch, 1887)

Host plants: *Aconitum firmum*

Localities: Ojców-Centrum [center of the village], Prądnik Korzkiewski [village]

Number of records: 3

Ecological elements: monoecious; 2nd degree oligophagous; mesohigrophiles; synanthropobiontic

Chorological elements: Euro-Siberian

Note: Euro-West Siberian montane species; species new to region Kraków-Wieluń Upland

References: Osiadacz, 2006

Genus: ***Dysaphis*** Börner, 1931

160. ***Dysaphis (Dysaphis) apiifolia petroselini*** (Börner, 1950)

Host plants: *Anethum graveolens*, *Pastinaca sativa*

Localities: Murownia [village]

Number of records: 2

Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous; mesohigrophiles/mesohigrophiles; herbosabiontic, synanthropobiontic

Chorological elements: Cosmopolitan

161. Dysaphis (Dysaphis) bonomii (Hille Ris Lambers, 1935)

Host plants: *Pastinaca sativa*

Localities: Lepianka Czajowska [village]

Number of records: 1

Ecological elements: monoecious; monophagous; mesohigrophiles; synanthropobiontic
Chorological elements: European

162. ***Dysaphis (Dysaphis) lappae*** (Koch, 1854)

Host plants: *Artemisia vulgaris*
Localities: Dolina Zachwytu 1 [upper portion]
Number of records: 1
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree xerophiles-mesohigrophiles; xerothermobiontic
Chorological elements: Cosmopolitan

163. ***Dysaphis (Dysaphis) newskyi aizenbergi*** (Shaposhnikov, 1949)

Host plants: *Heralceum sphodylium*
Localities: Ojców – Pstrągarnia [village, trout fish ponds]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree higrophiles; synanthropobiontic
Chorological elements: European
Note: species new to region Kraków-Wieluń Upland

164. ***Dysaphis (Dysaphis) ranunculi*** (Kaltenbach, 1843)

Host plants: Ranunculus repens
Localities: Ojców – Pstrągarnia [village, trout fish ponds]
Number of records: 1
Ecological elements: heteroecious; 1st degree oligophagous/1st degree oligophagous; mesohigrophiles/2nd degree higrophiles; synanthropobiontic
Chorological elements: European

165. ***Dysaphis (Pomaphis) plantaginea*** (Passerini, 1860)

Host plants: *Malus domestica*
Localities: Młynnik [village], Skała Jonaszówka [rock shelves], Skalska Droga [village]
Number of records: 3
Ecological elements: heteroecious; 1st degree oligophagous/1st degree oligophagous; mesohigrophiles/2nd degree xerophiles-mesohigrophiles; xerothermobiontic, synanthropobiontic
Chorological elements: Holarctic
Note: Irano-Turanian species
References: Osiadacz, 2006

166. ***Dysaphis (Pomaphis) pyri*** (Boyer de Fonscolombe, 1841)

Host plants: *Galium mollugo*
Localities: Pieskowa Skała [village], Skały Wernyhory 1 [foothill and lower slopes]
Number of records: 2
Ecological elements: heteroecious; monophagous/2nd degree oligophagous; mesohigrophiles/mesohigrophiles; xerothermobiontic
Chorological elements: Westpalearctic-steppe

Note: Irano-Turanian species

167. ***Dysaphis (Pomaphis) sorbi*** (Kaltenbach, 1843)

Host plants: *Sorbus aucuparia*
Localities: Skała Jonaszówka [rock shelves]
Number of records: 2
Ecological elements: heteroecious; monophagous/2nd degree oligophagous; mesohigrophiles/2nd degree xerophiles; xerothermobiontic
Chorological elements: Holarctic with disjunction
References: Moesz, 1919

Genus: ***Hayhurstia*** del Guercio, 1917

168. ***Hayhurstia atriplicis*** (Linnaeus, 1761)

Host plants: *Atriplex patula*, *Chenopodium album*
Localities: Ojców-Centrum [center of the village], Skalska Droga [village]
Number of records: 2
Ecological elements: monoecious; 2nd degree oligophagous; mesohigrophiles; synanthropobiontic
Chorological elements: Holarctic

Genus: ***Hyadaphis*** Kirkaldy, 1904

169. ***Hyadaphis foeniculi*** (Passerini, 1860)

Host plants: *Astrantia major*, *Chaerophyllum temulum*, *Lonicera periclymenum*
Localities: Pieskowa Skała [village], Skały Wernyhory 1 [foothill and lower slopes], Obserwatorium Sejsmologiczne [near Saspów village], Dolina Sąspowska 2 [mouth]
Number of records: 4
Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous; mesohigrophiles/2nd degree higrophiles; herbosabiontic, xerothermobiontic, sylvibiontic, synanthropobiontic
Chorological elements: Cosmopolitan
References: Osiadacz, 2006

170. ***Hyadaphis coriandri*** (B. Das, 1918)

Number of records: 0
Ecological elements: monoecious; monophagous; mesohigrophiles
Chorological elements: Euro-Siberian
Note: species recorded in OPN on Lonicera tatarica
References: Jakuczyn, 1972

Genus: ***Hyperomyzus*** Börner, 1933

171. ***Hyperomyzus (Hyperomyzus) lactucae*** (Linnaeus, 1758)

Host plants: *Sonchus arvensis*, *S. asper*, *S. oleraceus*
Localities: Sułoszowa [village], Pieskowa Skała [village], Ojców-Centrum [center of the village], Murownia [village]

Number of records: 7
Ecological elements: heteroecious; 1st degree oligophagous/1st degree oligophagous; mesohigrophiles/mesohigrophiles; synanthropobiontic
Chorological elements: Cosmopolitan
References: Osiadacz and Wojciechowski, 2005

172. ***Hyperomyzus (Hyperomyzus) pallidus*** Hille Ris Lambers, 1935

Host plants: *Sonchus arvensis*, *S. asper*
Localities: Pieskowa Skała [village], Grodzisko – Skała Długa [rock foothill and slopes], Poręba Sąspowska [village]
Number of records: 3
Ecological elements: heteroecious; 1st degree oligophagous/1st degree oligophagous; mesohigrophiles/mesohigrophiles; synanthropobiontic
Chorological elements: Holarctic with disjunction
Note: Carpathian species
References: Osiadacz and Wojciechowski, 2005

Genus: ***Impatientinum*** Mordvilko, 1914

173. ***Impatientinum (Impatientinum) asiaticum*** Nevsky, 1929

Host plants: *Impatiens parviflora*
Localities: Pieskowa Skała [village], Dolina Sąspowska 2 [mouth], Ojców-Centrum [center of the village], Brama Krakowska 1 [rock and slopes]
Number of records: 9
Ecological elements: monoecious; monophagous; mesohigrophiles; sylvibiontic, xerothermobiontic, synanthropobiontic
Chorological elements: Westernpalearctic
Note: Central Asian species

174. ***Impatientinum (Impatientinum) balsamines*** (Kaltenbach, 1862)

Host plants: *Impatiens noli-tangere*
Localities: Chełmowa Góra [top and slopes]
Number of records: 1
Ecological elements: monoecious; monophagous; 2nd degree higrophiles; sylvibiontic
Chorological elements: Amphipalearctic

Genus: ***Liosomaphis*** Walker, 1868

175. ***Liosomaphis berberidis*** (Kaltenbach, 1843)

Host plants: *Berberis vulgaris*
Localities: Pieskowa Skała [village]
Number of records: 1
Ecological elements: monoecious; 2nd degree oligophagous; mesohigrophiles; synanthropobiontic
Chorological elements: Cosmopolitan
References: Osiadacz, 2006

Genus: ***Lipaphis*** Mordvilko, 1928

176. ***Lipaphis (Lipaphis) erysimi*** (Kaltenbach, 1843)

Host plants: *Cardaminopsis arenosa*
Localities: Brama Krakowska 1 [rock and slopes]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: Cosmopolitan

177. ***Lipaphis (Lipaphis) rossi*** Börner, 1939

Host plants: *Arabis glabra*
Localities: Grodzisko – Skała Długa [rock foothill and slopes]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: European

Genus: ***Macrosiphoniella*** del Guercio, 1911

178. ***Macrosiphoniella (Macrosiphoniella) absinthii*** (Linnaeus, 1758)

Host plants: *Artemisia absinthium*
Localities: Skały Wernyhory 1 [foothill and lower slopes]
Number of records: 8
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: Holarctic with disjunction
Note: Pontic species
References: Osiadacz and Wojciechowski, 2005

179. ***Macrosiphoniella (Macrosiphoniella) artemisiae*** (Boyer de Fonscolombe, 1841)

Host plants: *Artemisia absinthium*, *A. vulgaris*
Localities: Pieskowa Skała [village], Skały Wernyhory 1 [foothill and lower slopes], Skały Wernyhory 2 [upper shelves], Młynnik [village], Dolina Zachwytu 1 [upper portion], Kaliski [village], Ojców-Centrum [center of the village], Miotełka [village], Grota Ciemna [rock shelves and slopes at the cave], Serpentyny [slopes]
Number of records: 21
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic, synanthropobiontic
Chorological elements: Holarctic with disjunction
References: Osiadacz and Wojciechowski, 2005

180. ***Macrosiphoniella (Macrosiphoniella) millefolii*** (de Geer, 1773)

Host plants: *Achillea millefolium*, *Leucanthemum vulgare*
Localities: Pieskowa Skała [village], Skały Wernyhory 1 [foothill and lower slopes], Skały Wernyhory 2 [upper shelves], Dolina Zachwytu 1 [upper portion], Dolina Zachwytu 3

[mouth], Kaliski [village], Grodzisko – Skała Długa [rock foothill and slopes], Skały Ciche [rock slopes], Poręba Sąspowska [village], Ojców-Centrum [center of the village], Miotełka [village], Ojców – Skała Koźniowa [rock foothills], Prądnik Korzkiewski [village], Wesoła – Enklawa OPN [village, OPN enclave]
Number of records: 24
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree xerophiles-mesohigrophiles; xerothermobiontic, herbosabiontic, synanthropobiontic
Chorological elements: Holarctic with disjunction
References: Osiadacz, 2006, Osiadacz and Wojciechowski, 2005

181. ***Macrosiphoniella (Macrosiphoniella) tanacetaria*** (Kaltenbach, 1843)
Host plants: *Tanacetum vulgare*
Localities: Miotełka [village]
Number of records: 2
Ecological elements: monoecious; monophagous; mesohigrophiles; synanthropobiontic
Chorological elements: Holarctic

182. ***Macrosiphoniella (Phalangomyzus) oblonga*** (Mordvilko, 1901
Host plants: *Artemisia vulgaris*
Localities: Pieskowa Skała [village], Skały Wernyhory 1 [foothill and lower slopes], Grodzisko – Skała Długa [rock foothill and slopes], Serpentyny [slopes]
Number of records: 5
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree xerophiles; xerothermobiontic, synanthropobiontic
Chorological elements: Westernpalearctic
References: Osiadacz and Wojciechowski, 2005

Genus: ***Macrosiphum*** Passerini, 1860

183. ***Macrosiphum (Macrosiphum) albifrons*** Essig, 1911
Host plants: *Lupinus polyphyllus*
Localities: Ojców-Centrum [center of the village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; synanthropobiontic
Chorological elements: Holarctic with disjunction
Note: species new to Poland

184. ***Macrosiphum (Macrosiphum) cholodkovskyi*** (Mordvilko, 1909)
Host plants: *Filipendula ulmaria*
Localities: Ojców – Pstrągarnia [village, trout fish ponds], Ojców – Źródło Miłości [spring]
Number of records: 2
Ecological elements: monoecious; monophagous; 1st degree higrophiles; sylvibiontic
Chorological elements: Westpalearctic-steppe

185. ***Macrosiphum (Macrosiphum) funestum*** (Macchiati, 1885)

Host plants: *Rubus hirtus*, *R. plicatus*

Localities: Młynnik [village]

Number of records: 2

Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles-2nd degree higrophiles; sylvibiontic

Chorological elements: Holarctic with disjunction

186. ***Macrosiphum (Macrosiphum) gei*** (Koch, 1855)

Host plants: *Geum rivale*, *G. urbanum*, *Anthriscus sylvestris*, *Chaerophyllum hirsutum*, *C. temulum*

Localities: Pieskowa Skała [village], Ojców – Kaplica na Wodzie [village, wooden chappel], Złota Góra [slopes and top, along the road], Wąwóz Słupianka [gorge], Poręba [village], Dolina Sąspowska 2 [mouth], Lepianka Czajowska [village], Ojców-Centrum [center of the village], Miotełka [village], Ojców – Pstrągarnia [village, trout fish ponds], Brama Krakowska 2 [gorge], Ojców – Źródło Miłości [spring]

Number of records: 18

Ecological elements: monoecious; poliphagous; mesohigrophiles-2nd degree higrophiles; sylvibiontic, xerothermobiontic, herbosabiontic, synanthropobiontic

Chorological elements: Holarctic with disjunction

187. ***Macrosiphum (Macrosiphum) rosae*** (Linnaeus, 1758)

Host plants: *Rosa canina*, *R. multiflora*, *R. rugosa*, *R. tomentosa*, *Valeriana officinalis*, *Dipsacus sylvestris*, *Knautia arvensis*, *Scabiosa ochroleuca*

Localities: Pieskowa Skała [village], Skały Wernyhory 1 [foothill and lower slopes], Skały Wernyhory 2 [upper shelves], Dolina Zachwytu 1 [upper portion], Dolina Zachwytu 3 [mouth], Grodzisko – Skała Długa [rock foothill and slopes], Skały Ciche [rock slopes], Obserwatorium Sejsmologiczne [near Saspów village], Poręba Sąspowska [village], Ojców-Centrum [center of the village], Skała Jonaszówka [rock shelves], Skała Krukowskiego [rock shelves], Grota Ciemna [rock shelves and slopes at the cave], Wapiennik [rock shelves], Okopy [top and rock shelves]

Number of records: 66

Ecological elements: heteroecious; 1st degree oligophagous/poliphagous; 2nd degree xerophiles-mesohigrophiles/2nd degree xerophiles-mesohigrophiles; xerothermobiontic, herbosabiontic, synanthropobiontic, limnobiontic

Chorological elements: Cosmopolitan

References: Osiadacz, 2006

188. ***Macrosiphum (Macrosiphum) sileneum*** Theobald, 1913

Host plants: *Myosoton aquaticum*

Localities: Brama Krakowska 2 [gorge]

Number of records: 1

Ecological elements: monoecious; 1st degree oligophagous; 2nd degree higrophiles; herbosabiontic

Chorological elements: European

Note: species listed from Poland (Wegierek & Wojciechowski, 2004), locality unknown; species new to region Kraków-Wieluń Upland

Genus: ***Megoura*** Buckton, 1876

189. ***Megoura litoralis*** F. P. Müller, 1952

Host plants: *Lathyrus pratensis*
Localities: Pieskowa Skała [village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; synanthropobiontic
Chorological elements: European
Note: species new to region Kraków-Wieluń Upland

190. ***Megoura viciae*** Buckton, 1876

Host plants: *Lathyrus pratensis*, *Vicia sepium*
Localities: Pieskowa Skała [village], Dolina Zachwytu 3 [mouth]
Number of records: 8
Ecological elements: monoecious; 2nd degree oligophagous; mesohigrophiles; xerothermobiontic, synanthropobiontic
Chorological elements: Cosmopolitan

Genus: ***Metopeurum*** Mordvilko, 1914

191. ***Metopeurum fuscoviride*** Stroyan, 1950

Host plants: *Tanacetum vulgare*
Localities: Pieskowa Skała [village], Skały Wernyhory 2 [upper shelves], Młynnik [village], Serpentyny [slopes], Skalska Droga [village], Wesoła – Enklawa OPN [village, OPN enclave]
Number of records: 8
Ecological elements: monoecious; monophagous; mesohigrophiles; xerothermobiontic, harbosabiontic, synanthropobiontic
Chorological elements: European
References: Osiadacz and Wojciechowski, 2005

Genus: ***Microlophium*** Mordvilko, 1914

192. ***Microlophium carnosum*** (Buckton, 1876)

Host plants: *Urtica dioica*
Localities: Młynnik [village], Drewniana Droga [gorge], Złota Góra [slopes and top, along the road], Dolina Sąspowska 1 [median portion], Ojców – Źródło Miłości [spring]
Number of records: 6
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, herbosabiontic, synanthropobiontic
Chorological elements: Cosmopolitan

Genus: ***Myzaphis*** DAN DER GOOT, 1913

193. ***Myzaphis rosarum*** (KALTENBACH, 1843)

Host plants: *Rosa canina*
Localities: Skała Krukowskiego [rock shelves]
Number of records: 1
Ecological elements: monoecious; 2nd degree oligophagous; mesohigrophiles; xerothermobiontic
Chorological elements: Cosmopolitan

Genus: ***Myzus*** PASSERINI, 1860

194. ***Myzus (Myzus) cerasi*** (FABRICIUS, 1775)

Host plants: *Prunus avium*, *P. padus*, *Galium mollugo*, *Euphrasia stricta*
Localities: Pieskowa Skała [village], Kapkazy [village], Wola Kalinowska [village], Poręba Sąspowska [village], Skała Jonaszówka [rock shelves], Murownia [village]
Number of records: 8
Ecological elements: heteroecious; 1st degree oligophagous/poliphagous; mesohigrophiles/ 2nd degree xerophiles-mesohigrophiles; sylvibiontic, xerothermobiontic, synanthropobiontic
Chorological elements: Cosmopolitan
References: Osiadacz, 2006

195. ***Myzus (Myzus) lythri*** (SCHRANK, 1801)

Host plants: *Lythrum salicaria*
Localities: Pieskowa Skała [village]
Number of records: 1
Ecological elements: heteroecious; 1st degree oligophagous/monophagous; mesohigrophiles/ 1st degree higrophiles; limnobiontic
Chorological elements: Cosmopolitan
References: Osiadacz, 2006

196. ***Myzus (Galilobium) langei*** (BÖRNER, 1933)

Host plants: *Galium mollugo*
Localities: Poręba Sąspowska [village]
Number of records: 3
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; xerothermobiontic
Chorological elements: Westpalearctic-steppe

197. ***Myzus (Nectarosiphon) ligustri*** (MOSLEY, 1841)

Host plants: *Ligustrum vulgare*
Localities: Ojców-Centrum [center of the village]
Number of records: 1
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; synanthropobiontic
Chorological elements: Holarctic with disjunction

Note: Mediterranean species
References: Osiadacz, 2006

198. ***Myzus (Nectarosiphon) myosotidis*** (Börner, 1950)

Host plants: *Myosotis palustris*
Localities: Pieskowa Skała [village]
Number of records: 1
Ecological elements: monoecious; monophagous; 2nd degree higrophiles; synanthropobiontic
Chorological elements: Holarctic with disjunction

199. ***Myzus (Nectarosiphon) persicae*** Sulzer, 1776

Host plants: *Mentha aquatica*, *Centaurea scabiosa*, *Chenopodium album*
Localities: Pieskowa Skała [village], Ojców-Centrum [center of the village]
Number of records: 3
Ecological elements: heteroecious; poliphagous/poliphagous; mesohigrophiles/2nd degree xerophiles-1st degree higrophiles; xerothermobiontic, synanthropobiontic, limnobiontic
Chorological elements: Cosmopolitan
Note: Pontic species

Genus: ***Nasonovia*** Mordvilko, 1914

200. ***Nasonovia (Nasonovia) compositellae compositellae*** Theobald, 1924

Host plants: *Hieracium murorum*
Localities: Okopy [top and rock shelves]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic
Chorological elements: European
Note: species listed from Poland (Wegierek and Wojciechowski, 2004), locality unknown; species new to region Kraków-Wieluń Upland

201. ***Nasonovia (Nasonovia) compositellae nigra*** (Hille Ris Lambers, 1931)

Host plants: *Hieracium murorum*
Localities: Pieskowa Skała [village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: Holarctic with disjunction
References: Osiadacz and Wojciechowski, 2005

202. ***Nasonovia (Nasonovia) pilosellae*** (Börner, 1933)

Host plants: *Hieracium murorum*, *H. pilosella*
Localities: Kamieniołom [rock slopes], Poręba Sąspowska [village]
Number of records: 2
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: European

203. ***Nasonovia (Nasonovia) ribisnigri*** (Mosley, 1841)

Host plants: *Cichorium intybus*, *Crepis tectorum*, *Hieracium bauhinii*
Localities: Kamieniołom [rock slopes], Kapkazy [village], Prądnik Korzkiewski [village]
Number of records: 3
Ecological elements: heteroecious; 1st degree oligophagous/poliphagous; mesohigrophiles/2nd degree xerophiles; xerothermobiontic, synanthropobiontic
Chorological elements: Cosmopolitan

Genus: ***Ovatus*** van der Goot, 1913

204. ***Ovatus (Ovatus) insitus*** (Walker, 1849)

Host plants: *Lycopus europaeus*
Localities: Pieskowa Skała [village]
Number of records: 1
Ecological elements: heteroecious; 1st degree oligophagous/monophagous; mesohigrophiles/1st degree higrophiles; limnobiontic
Chorological elements: Westpalearctic-steppe
Note: species new to region Kraków-Wieluń Upland

205. ***Ovatus (Ovatus) mentharius*** (van der Goot, 1913)

Host plants: *Mentha longifolia*
Localities: Brama Krakowska 2 [gorge], Ojców – Skała Koźniowa [rock foothills]
Number of records: 3
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree higrophiles; herbosabiontic, synanthropobiontic
Chorological elements: Westpalearctic-steppe

Genus: **Phorodon** Passerini, 1860

206. ***Phorodon (Phorodon) humuli*** (Schrank, 1801)

Host plants: *Prunus domestica*
Localities: Ojców-Centrum [center of the village], Wesoła – Enklawa OPN [village, OPN enclave]
Number of records: 2
Ecological elements: heteroecious; 1st degree oligophagous/monophagous; mesohigrophiles/2nd degree higrophiles; sylvibiontic, synanthropobiontic
Chorological elements: Holarctic
References: Osiadacz, 2006

Genus: ***Rhopalomyzus*** Mordvilko, 1921

207. ***Rhopalomyzus (Judenkoa) lonicerae*** (Siebold, 1839)

Host plants: *Lonicera periclymenum*, *L. xylosteum*
Localities: Skały Wernyhory 1 [foothill and lower slopes], Ojców-Centrum [center of the village]
Number of records: 3
Ecological elements: heteroecious; 1st degree oligophagous/2nd degree oligophagous;

mesohigrophiles/1st degree higrophiles; synanthropobiontic
Chorological elements: Holarctic with disjunction
References: Osiadacz, 2006

Genus: ***Semiaphis*** van der Goot, 1913

208. ***Semiaphis dauci*** (Fabricius, 1775)

Host plants: *Daucus carota*
Localities: Poręba Sąspowska [village]
Number of records: 1
Ecological elements: monoecious; monophagous; mesohigrophiles; xerothemobiontic
Chorological elements: Westernpalearctic

Genus: ***Sitobion*** Mordvilko, 1914

209. ***Sitobion (Sitobion) avenae*** (Fabricius, 1775)

Host plants: *Juncus bufonius*, *J. effusus*, *Carex sylvatica*, *Agrostis capillaris*, *A. stolonifera*, *Alopecurus pratensis*, *Apera spica-venti*, *Arrhenatherum elatius*, *Avena fatua*, *Brachypodium sylvaticum*, *Briza media*, *Bromus inermis*, *Cynosurus cristatus*, *Dactylis glomerata*, *Deschampsia caespitosa*, *Echinochloa crus-gali*, *Festuca gigantea*, *F. pallens*, *F. pratensis*, *Glyceria notata*, *Holcus lanatus*, *Lolium multiflorum*, *L. perenne*, *Melica transsilvanica*, *Phleum phleoides*, *P. pratense*, *Poa annua*, *P. compressa*, *P. nemoralis*, *P. pratensis*, *P. trivialis*, *Secale cereale*, *Triticum aestivum*
Localities: Pieskowa Skała [village], Maczuga Herkulesa [rock foothill], Skały Wernyhory 1 [foothill and lower slopes], Młynnik [village], Herianówka [village], Dolina Zachwytu 3 [mouth], Skały Ciche [rock slopes], Poręba Sąspowska [village], Poręba [village], Dolina Sąspowska 1 [median portion], Dolina Sąspowska 2 [mouth], Ojców-Centrum [center of the village], Miotełka [village], Zamkowa Droga [gorge], Skała Jonaszówka [rock shelves], Ojców – Pstrągarnia [village, trout fish ponds], Brama Krakowska 1 [rock and slopes], Góra Koronna [top and rock shelves], Brama Krakowska 2 [gorge], Okopy [top and rock shelves], Wąwóz Korytania (wierzchowina) [top of the rock surrounding the gorge], Murownia [village], Ojców – Caritas [village, southernmost part], Prądnik Korzkiewski [village]
Number of records: 70
Ecological elements: monoecious; poliphagous; 1st degree xerophiles-1st degree higrophiles; herbosabiontic, xerothermobiontic, limnobiontic, sylvibiontic, synanthropobiontic
Chorological elements: Cosmopolitan
References: Osiadacz, 2006

Genus: ***Trichosiphonaphis*** Takahashi, 1922

210. ***Trichosiphonaphis (Xenomyzus) corticis*** (Aizenberg, 1935)

Host plants: *Lonicera xylosteum*
Localities: Młynnik [village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; synanthropobiontic
Chorological elements: European

Genus: ***Uroleucon*** Mordvilko, 1914

211. ***Uroleucon (Uroleucon) achilleae*** (Koch, 1855)

Host plants: *Achillea millefolium*
Localities: Sułoszowa [village]
Number of records: 1
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; synanthropobiontic
Chorological elements: Holarctic with disjunction
References: Osiadacz and Wojciechowski, 2005

212. ***Uroleucon (Uroleucon) cichorii cichorii*** (Koch, 1855)

Host plants: *Cichorium intybus*
Localities: Grodzisko – Skała Długa [rock foothill and slopes]
Number of records: 1
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree xerophiles; synanthropobiontic
Chorological elements: Westpalearctic-steppe
References: Osiadacz and Wojciechowski, 2005

213. ***Uroleucon (Uroleucon) cichorii grossum*** (Hille Ris Lambers, 1939)

Host plants: *Crepis biennis*, *C. capillaris*, *C. tectorum*
Localities: Pieskowa Skała [village], Słoneczna Góra [hill top], Dolina Zachwytu 1 [upper portion], Dolina Zachwytu 3 [mouth], Grodzisko – Skała Długa [rock foothill and slopes], Skały Ciche [rock slopes], Kapkazy [village], Zabugaje [village], Obserwatorium Sejsmologiczne [near Saspów village], Dolina Sąspowska – Warzechówka [village], Poręba Sąspowska [village], Lepianka Czajowska [village], Ojców-Centrum [center of the village], Skała Jonaszówka [rock shelves], Ojców – Pstrągarnia [village, trout fish ponds], Prądnik Korzkiewski [village], Skalska Droga [village], Wesoła – Enklawa OPN [village, OPN enclave]
Number of records: 28
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles-mesohigrophiles; xerothermobiontic, herbosabiontic, synanthropobiontic
Chorological elements: European
References: Osiadacz and Wojciechowski, 2005

214. ***Uroleucon (Uroleucon) cirsii*** (Linnaeus, 1758)

Host plants: *Cirsium oleraceum*
Localities: Ojców – Źródło Miłości [spring]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; 2nd degree higrophiles; herbosabiontic
Chorological elements: Holarctic with disjunction
References: Osiadacz and Wojciechowski, 2005

215. ***Uroleucon (Uroleucon) hypochoeridis*** (Fabricius, 1779)

Host plants: *Hypochoeris radicata*, *Leontodon autumnalis*, *L. hispidus*

Localities: Pieskowa Skała [village], Młynnik [village], Dolina Zachwytu 3 [mouth], Kaliski [village], Poręba Sąspowska [village], Poręba [village]

Number of records: 10

Ecological elements: monoecious; 2nd degree oligophagous; mesohigrophiles; xerothermobiontic, herbosabiontic, synanthropobiontic

Chorological elements: European

References: Osiadacz and Wojciechowski, 2005

216. ***Uroleucon (Uroleucon) murale*** (Buckton, 1876)

Host plants: *Mycelis muralis*

Localities: Lepianka Czajowska [village], Wawóz Pradła [gorge], Brama Krakowska 1 [rock and slopes], Ojców – Caritas [village, southernmost part]

Number of records: 6

Ecological elements: monoecious; monophagous; mesohigrophiles; sylvibiontic, xerothermobiontic, synanthropobiontic

Chorological elements: Holarctic with disjunction

References: Osiadacz and Wojciechowski, 2005

217. ***Uroleucon (Uroleucon) obscurum*** (Koch, 1855)

Host plants: *Hieracium laevigatum*

Localities: Poręba Sąspowska [village]

Number of records: 7

Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic

Chorological elements: European

References: Osiadacz and Wojciechowski, 2005

218. ***Uroleucon (Uroleucon) sonchi*** (Linnaeus, 1767)

Host plants: *Sonchus arvensis*, *S. asper*, *S. oleraceus*

Localities: Sułoszowa [village], Pieskowa Skała [village], Skały Wernyhory 1 [foothill and lower slopes], Dolina Zachwytu 3 [mouth], Poręba Sąspowska [village]

Number of records: 7

Ecological elements: monoecious; 2nd degree oligophagous; mesohigrophiles; xerothermobiontic, synanthropobiontic

Chorological elements: Cosmopolitan

References: Osiadacz and Wojciechowski, 2005

219. ***Uroleucon (Uroleucon) tanaceti*** (Linnaeus, 1758)

Host plants: *Tanacetum vulgare*

Localities: Kaliski [village], Serpentyny [slopes]

Number of records: 2

Ecological elements: monoecious; monophagous; mesohigrophiles; xerothermobiontic, harbosabiontic

Chorological elements: Holarctic with disjunction
References: Osiadacz and Wojciechowski, 2005

220. ***Uroleucon (Uroleucon) tussilaginis*** (Walker, 1850)

Host plants: *Petasites albus*
Localities: Pieskowa Skała [village]
Number of records: 1
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree higrophiles; sylvibiontic
Chorological elements: Euro-Siberian
References: Osiadacz and Wojciechowski, 2005

221. ***Uroleucon (Lambersius) erigeronense*** (Thomas, 1878)

Host plants: *Conyza canadensis*
Localities: Pieskowa Skała [village]
Number of records: 1
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree xerophiles; synanthropobiontic
Chorological elements: Cosmopolitan
Note: Nearctic species
References: Osiadacz and Wojciechowski, 2005

222. ***Uroleucon (Uromelan) aeneum*** (Hill Ris Lambers, 1939)

Host plants: *Carduus crispus*, *Cirsium arvense*, *C. oleraceum*
Localities: Pieskowa Skała [village], Dolina Sąspowska 1 [median portion], Ojców-Centrum [center of the village]
Number of records: 9
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree xerophiles-2nd degree higrophiles; xerothermobiontic, herbosabiontic, synanthropobiontic
Chorological elements: Westpalearctic-steppe
References: Osiadacz and Wojciechowski, 2005

223. ***Uroleucon (Uromelan) campanulae*** (Kaltenbach, 1843)

Host plants: *Campanula rotundifolia*
Localities: Maczuga Herkulesa [rock foothill], Skały Wernyhory 1 [foothill and lower slopes], Skała Jonaszówka [rock shelves], Brama Krakowska 1 [rock and slopes]
Number of records: 7
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: Westpalearctic-steppe

224. ***Uroleucon (Uromelan) jaceae jaceae*** (Linnaeus, 1758)

Host plants: *Centaurea jacea*, *C. scabiosa*
Localities: Grodzisko – Skamieniały Wędrowiec [rock slope], Skała Gęsia Szyja [sward at the rock foothill], Obserwatorium Sejsmologiczne [near Saspów village]
Number of records: 3

Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: Cosmopolitan

225. ***Uroleucon (Uromelan) jaceae henrichi*** (Börner, 1950)

Host plants: *Centaurea scabiosa*
Localities: Grodzisko – Skała Długa [rock foothill and slopes], Grodzisko – Skamieniały Wędrowiec [rock slope]
Number of records: 3
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: European
References: Osiadacz and Wojciechowski, 2005

226. ***Uroleucon (Uromelan) nigrocampanulae*** (Theobald, 1928)

Host plants: *Campanula trachelium*
Localities: Słupianka [gorge], Ojców – Park Zamkowy [village, park in the bottom of the Prądnik river valley], Dolina Sąspowska 2 [mouth], Ojców-Centrum [center of the village], Góra Koronna [top and rock shelves]
Number of records: 5
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, herbosabiontic, synanthropobiontic
Chorological elements: Westernpalearctic

227. ***Uroleucon (Uromelan) rapunculoidis*** (Börner, 1939)

Host plants: *Campanula rapunculoides*, *C. trachelium*
Localities: Pieskowa Skała [village], Brama Krakowska 1 [rock and slopes]
Number of records: 3
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; xerothermobiontic
Chorological elements: Westpalearctic-steppe

228. ***Uroleucon (Uromelan) simile*** (Hille Ris Lambers, 1935)

Host plants: *Erigeron acris*
Localities: Osicze [village], Skała Jonaszówka [rock shelves]
Number of records: 2
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: Westpalearctic-steppe
References: Osiadacz, and Wojciechowski, 2005

229. ***Uroleucon (Uromelan) solidaginis*** (Fabricius, 1779)

Host plants: *Solidago virgaurea*
Localities: Poręba Sąspowska [village], Góra Koronna [top and rock shelves]
Number of records: 3
Ecological elements: monoecious; monophagous; mesohigrophiles; sylvibiontic, xerothermobiontic
Chorological elements: Holarctic with disjunction

References: Osiadacz and Wojciechowski, 2005

230. ***Uroleucon (Uromelan) taraxaci*** (Kaltenbach, 1843)

Host plants: *Taraxacum officinale*
Localities: Pieskowa Skała [village], Ojców-Centrum [center of the village]
Number of records: 3
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; xerothermobiontic, synathropobiontic
Chorological elements: Holarctic with disjunction
References: Osiadacz and Wojciechowski, 2005

Family: Lachnidae
Subfamily: Lachninae

Genus: ***Lachnus*** Burmeister, 1835

231. ***Lachnus longirostris*** (Mordvilko, 1909)

Host plants: *Quercus robur*
Localities: Sokolec [village], Obserwatorium Sejsmologiczne [near Saspów village]
Number of records: 2
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; xerothermobiontic, synanthropobiontic
Chorological elements: Westpalearctic-steppe

232. ***Lachnus pallipes*** (Hartig, 1841)

Host plants: *Fagus sylvatica*
Localities: Góra Koronna [top and rock shelves]
Number of records: 1
Ecological elements: monoecious; monophagous; mesohigrophiles; sylvibiontic
Chorological elements: Westpalearctic-steppe
Note: Sub-Atlantic species

233. ***Lachnus roboris*** (Linnaeus, 1758)

Host plants: *Quercus petraea*
Localities: Murownia [village]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic
Chorological elements: Holarctic with disjunction

Genus: ***Stomaphis*** Walker, 1870

234. ***Stomaphis quercus*** (Linnaeus, 1758)

Host plants: *Quercus robur*
Localities: Skała Krzyżowa [rock slope and rock shelves]
Number of records: 1
Ecological elements: monoecious; 2nd degree oligophagous; mesohigrophiles; xerothermobiontic

Chorological elements: European
Note: Mediterranean species

Subfamily: Cinarinae

Genus: ***Cinara*** Curtis, 1835

235. ***Cinara (Cinara) brauni*** Börner, 1940

Host plants: *Pinus nigra*
Localities: Murownia [village]
Number of records: 1
Ecological elements: monoecious; monophagous; mesohigrophiles; synanthropobiontic
Chorological elements: Westpalearctic-steppe
Note: Mediterranean species
References: Osiadacz, 2006

236. ***Cinara (Cinara) confinis*** (Koch, 1856)

Host plants: *Abies alba*
Localities: Wąwóz Korytania (wierzchowina) [top of the rock surrounding the gorge]
Number of records: 1
Ecological elements: monoecious; monophagous; mesohigrophiles; sylvibiontic
Chorological elements: Cosmopolitan
Note: Boreal species; species new to region Kraków-Wieluń Upland

237. ***Cinara (Cinara) costata*** (Zetterstedt, 1828)

Host plants: *Picea abies*
Localities: Wąwóz Sokolec [gorge], Złota Góra [slopes and top, along the road], Ojców – Skała Koźniowa [rock foothills]
Number of records: 3
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, synanthropobiontic
Chorological elements: Cosmopolitan
Note: Boreal species
References: Osiadacz, 2006

238. ***Cinara (Cinara) cuneomaculata*** (del Guercio, 1909)

Host plants: *Larix decidua*
Localities: Pieskowa Skała [village], Poręba Sąspowska [village], Zamkowa Droga [gorge]
Number of records: 3
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, xerothermobiontic, synanthropobiontic
Chorological elements: Westernpalearctic

239. ***Cinara (Cinara) hyperophila*** (Koch, 1855)

Host plants: *Pinus sylvestris*
Localities: Poręba Sąspowska [village], Skała Krukowskiego [rock shelves]
Number of records: 6

Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: European
Note: species new to region Kraków-Wieluń Upland

240. ***Cinara (Cinara) laricis*** (Hartig, 1839)

Host plants: *Larix decidua*
Localities: Kamieniołom [rock slopes]
Number of records: 1
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles, xerothermobiontic
Chorological elements: Holarctic

241. ***Cinara (Cinara) nuda*** Mordvilko, 1895

Host plants: *Pinus sylvestris*
Localities: Kapkazy [village]
Number of records: 1
Ecological elements: monoecious; monophagous; 2nd degree xerophiles; xerothermobiontic
Chorological elements: Westpalearctic-steppe

242. ***Cinara (Cinara) pectinatae*** (Nördlinger, 1880)

Host plants: *Abies alba*
Localities: Chełmowa Góra [top and slopes], Wesoła – Enklawa OPN [village, OPN enclave]
Number of records: 2
Ecological elements: monoecious; monophagous; mesohigrophiles; sylvibiontic, synanthropobiontic
Chorological elements: Westpalearctic-steppe
References: Mordvilko, 1901

243. ***Cinara (Cinara) piceicola*** (Cholodkovsky, 1896)

Host plants: *Picea abies*
Localities: Ojców-Zazamcze [village], Ojców – Skała Koźniowa [rock foothills]
Number of records: 3
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; synanthropobiontic
Chorological elements: Holarctic

244. ***Cinara (Cinara) pilicornis*** (Hartig, 1841)

Host plants: *Picea abies*
Localities: Dąbrówka nad Młynnikiem [village], Ojców-Zazamcze [village], Zamkowa Droga [gorge], Ojców – Skała Koźniowa [rock foothills]
Number of records: 5
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, synanthropobiontic
Chorological elements: Cosmopolitan

245. ***Cinara (Cinara) pinea*** (Mordvilko, 1895)

Host plants: *Pinus sylvestris*

Localities: Grodzisko – Skała Długa [rock foothill and slopes], Osicze [village], Obserwatorium Sejsmologiczne [near Saspów village], Poręba Sąspowska [village], Miotełka [village], Skała Jonaszówka [rock shelves], Skała Krukowskiego [rock shelves], Ojców – Skała Koźniowa [rock foothills], Serpentyny [slopes]

Number of records: 14

Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles-mesohigrophiles; herbosabiontic, xerothermobiontic, sylvibiontic, synanthropobiontic

Chorological elements: Holarctic

References: Osiadacz, 2006

246. ***Cinara (Cinara) pini*** (Linnaeus, 1758)

Host plants: *Pinus sylvestris*

Localities: Grodzisko – Skała Długa [rock foothill and slopes], Skała Krukowskiego [rock shelves]

Number of records: 3

Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic, syanthropobiontic

Chorological elements: Euro-Siberian

247. ***Cinara (Cinara) pinihabitans*** (Mordvilko, 1895)

Host plants: *Pinus sylvestris*

Localities: Poręba Sąspowska [village]

Number of records: 1

Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic

Chorological elements: European

Note: species new to region Kraków-Wieluń Upland

248. ***Cinara (Cupressobium) juniperi*** (de Geer, 1773)

Host plants: *Juniperus communis*, *J. sabina*

Localities: Ojców-Centrum [center of the village], Skała Krukowskiego [rock shelves], Grota Ciemna [rock shelves and slopes at the cave]

Number of records: 13

Ecological elements: monoecious; 1st degree oligophagous; 2nd degree xerophiles; xerothermobiontic, synanthropobiontic

Chorological elements: Cosmopolitan

Note: South Siberian species

References: Osiadacz, 2006

Genus: ***Schizolachnus*** Mordvilko, 1909

249. ***Schizolachnus pineti*** (Fabricius, 1781)

Host plants: *Pinus sylvestris*

Localities: Złota Góra [slopes and top, along the road], Poręba Sąspowska [village], Ojców

– Skała Koźniowa [rock foothills], Serpentyny [slopes]
Number of records: 4
Ecological elements: monoecious; 1st degree oligophagous; mesohigrophiles; sylvibiontic, xerothermobiontic, herbosabiontic, synanthropobiontic
Chorological elements: Holarctic
References: Osiadacz, 2006

Subfamily: Traminae

Genus: ***Trama*** von Heyden, 1837

250. ***Trama (Trama) troglodytes*** von Heyden, 1837

Host plants: ***Crepis biennis***
Localities: Grodzisko – skrzyżowanie [crossroad on the bottom of the Prądnik river valley], Murownia [village]
Number of records: 2
Ecological elements: monoecious; 2nd degree oligophagous; 2nd degree xerophiles; herbosabiontic, synantropobiontic
Chorological elements: Euro-Siberian
Note: Caspian species
References: Osiadacz and Wojciechowski, 2005

During the whole period of studying the aphidofauna of the Ojców National Park, i.e. in the years 2003–2006, 1287 material samples were collected. In the collected material there was recorded the presence of 241 aphid taxons (229 species and 12 subspecies), belonging to two superfamilies, i.e. Phylloxeroidea and Aphidoidea (Fig. 3). The recorded species belong to 9 families, 11 subfamilies, 6 tribes and 76 species.

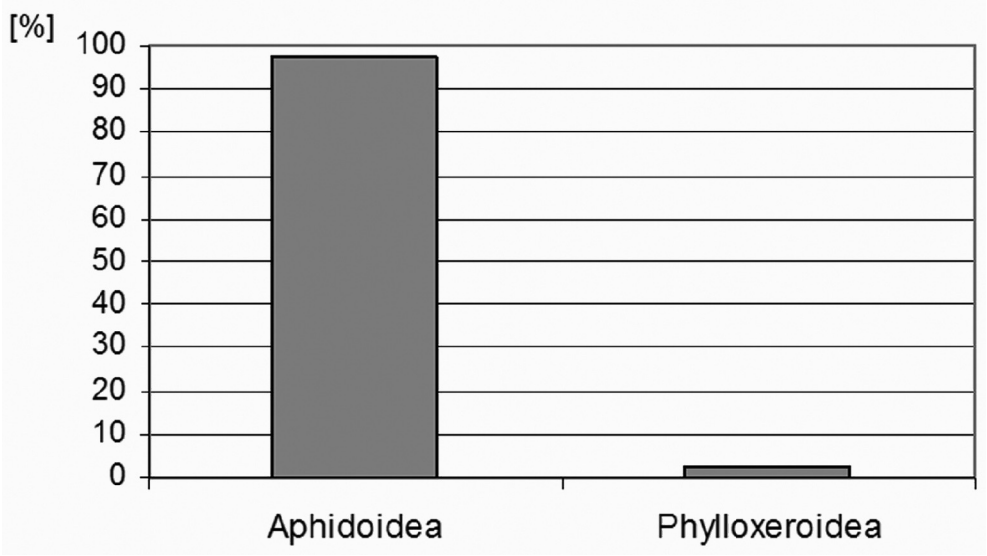


Fig. 3. Percentage of Aphidinea superfamilies in the fauna of the OPN

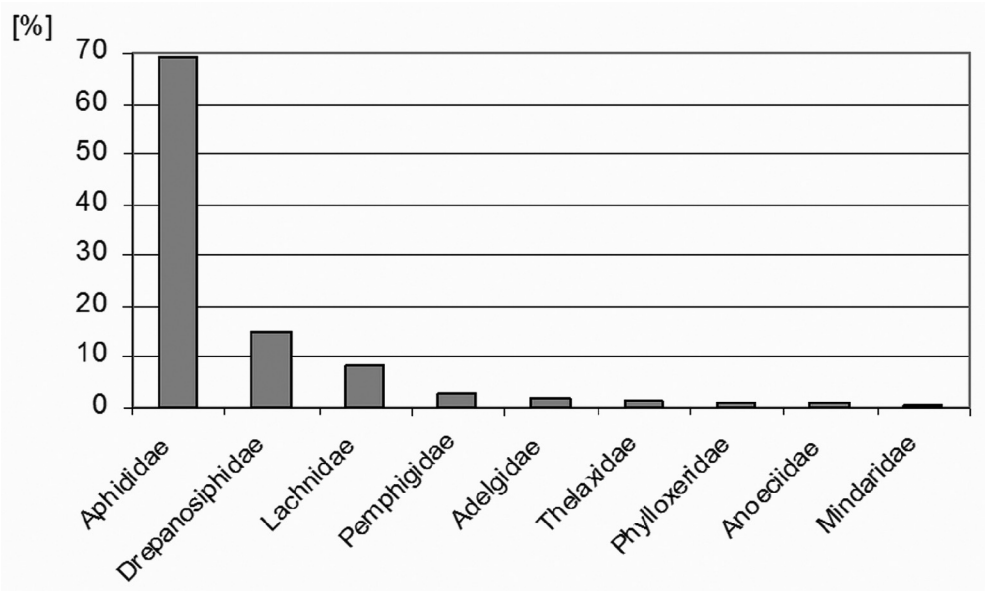


Fig. 4. Percentage of the Aphidinea families in the fauna of the OPN

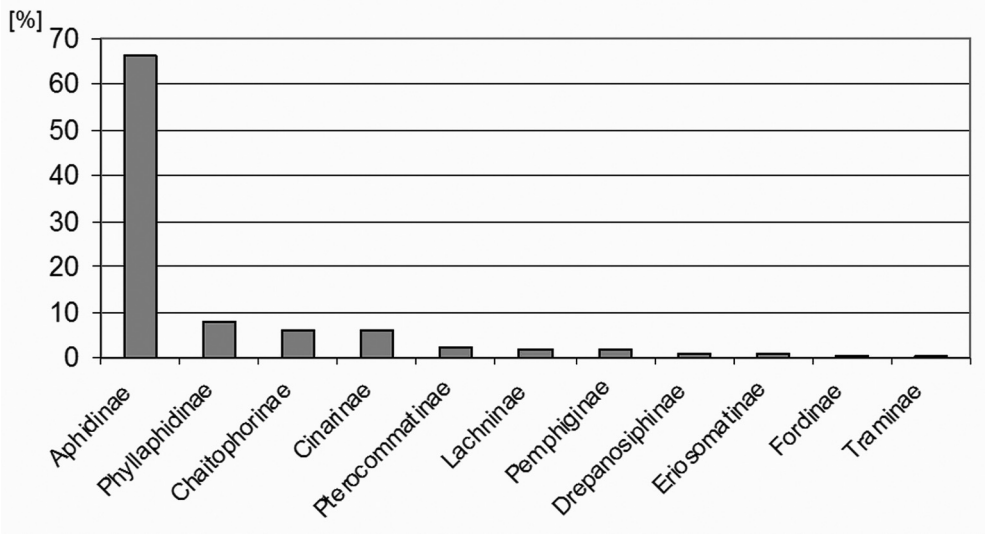


Fig. 5. Percentage of the subfamilies in the fauna of the OPN

Among the aphid species recorded in the area of the OPN there are three species that had never been recorded in Poland before: *Aphis lilago*, F. Müller, 1968, *Cavariella salicicola* (Matsumura, 1917) and *Macrosiphum albifrons* Essig, 1911. Furthermore, within the investigated area there were recorded 24 aphid species that had never been recorded in the region of Kraków-Wieluń Upland (Wyżyna Krakowsko-Wieluńska) before: *Eriosoma ulmi*, *Pemphigus borealis*, *Prociphilus bumeliae*, *Mindarus abietinus*, *Tinocallis platani*, *Chaitophorus mordvilkoi*, *Aphis affinis,*

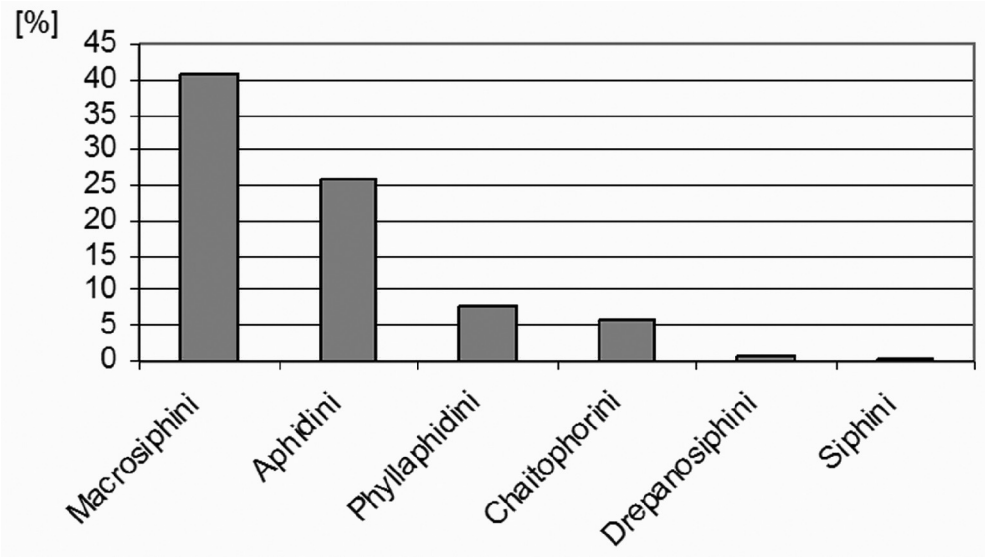


Fig. 6. Percentage of the tribes in the fauna of the OPN

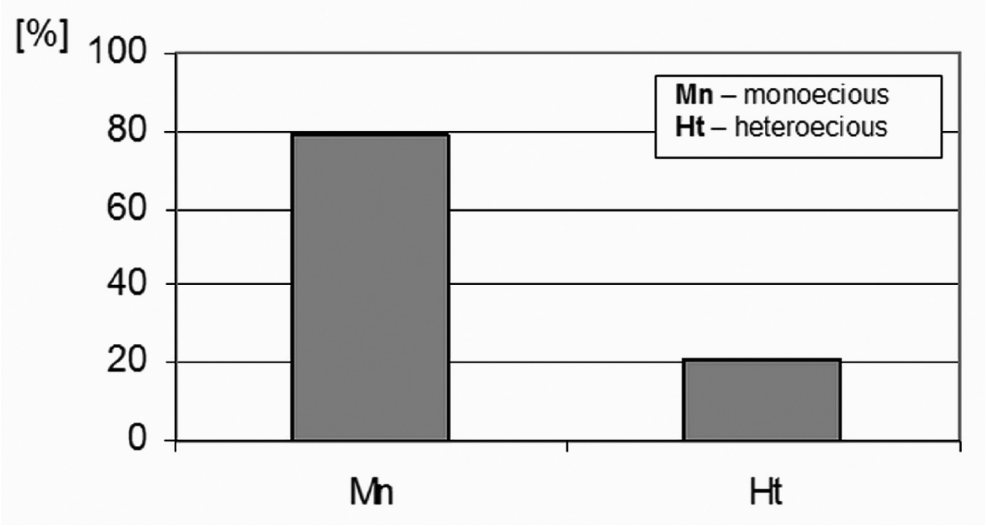


Fig. 7. Percentage of the monoecious and heteroecious aphids in the fauna of the OPN

A. brohmeri, *A. coronillae*, *A. fabae solanella*, *A. verbenae*, *Acyrthosiphon chelidonii*, *Brachycaudus lateralis*, *Capitophorus pakansus*, *Chaetosiphon tetrarhodum*, *Delphiniobium janackianum*, *Dysaphis newskyi aizenbergi*, *Macrosiphum sileneum*, *Megoura litoralis*, *Nasonovia compositellae compositellae*, *Ovatus insitus*, *Cinara confinis*, *C. hyperophila*, *C. pinihabitans*.

The species from Aphididae family constitute nearly 69% of the collected material (Fig. 4). Other families which are represented by many species in the area of the OPN include: Drepanosiphidae and Lachnidae, which together constitute 23%

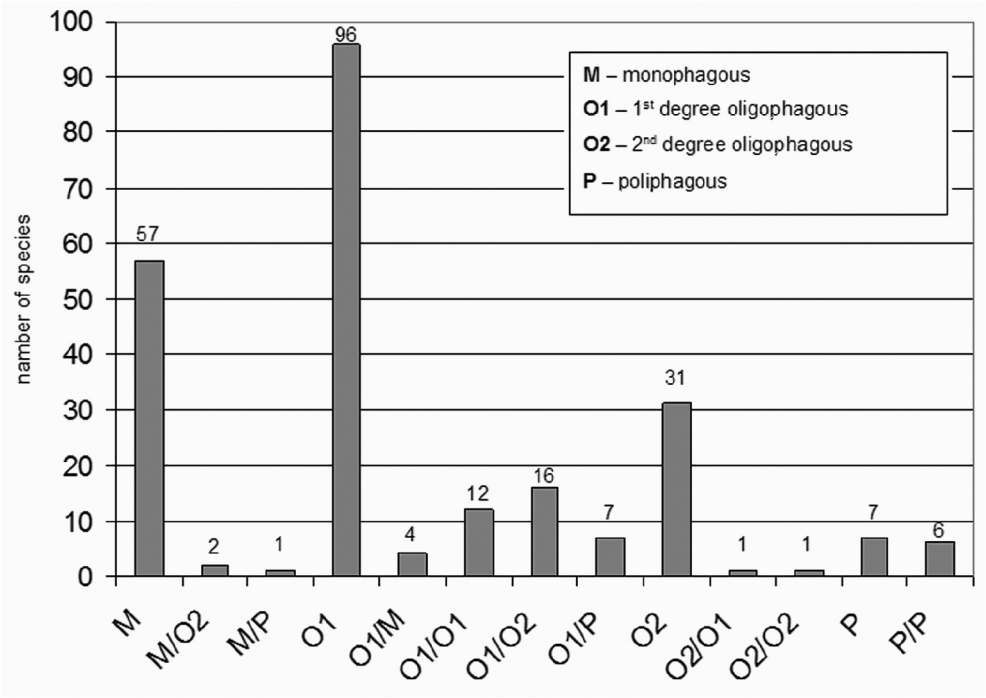


Fig. 8. Trophic structure of the fauna of Aphidinea of the OPN (number of species)

of the collected material. Mindaridae (0.41%) is the family represented by only one species, *Mindarus abietinus*.

Over 66% of the recorded species belong to the subfamily Aphidinae. The subfamilies represented by significantly fewer species include: Phyllaphidinae (7.88%), Chaitophorinae (6.22%) and Cinarinae (6.22%) (Fig. 5). The tribes which are represented by the largest number of species include: Macrosiphini (about 41%) and Aphidini (about 26%) (Fig. 6). Among the recorded genera *Aphis* is the one represented by most species. It encompasses 60 species present in the OPN area. The following genera are represented by signficantly fewer species: *Uroleucon* (20), *Cinara* (14), *Chaitophorus* (9) and *Dysaphis* (8).

Nearly 80% of aphid species recorded in the OPN area feed on a single host plant species (Fig. 7). The analysis of the collected material with regard to its trophic character shows that the systematic oligophags of first degree constitute a prevailing group, represented by 136 species. The second largest group is that of strict monophags, represented by 64 species. The smallest group is that of polyphags, represented by 21 species, regardless of whether we account for primary host or secondary host with reference to aphids that feed on various plant species. In the case of such aphids, while switching from the primary to secondary host, in the case of 26 aphid species there takes places the extension of their trophic spectrum. In the case of 5 aphid species the trophic spectrum narrows, and in the case of 19 aphid species it remains the same (Fig. 8).

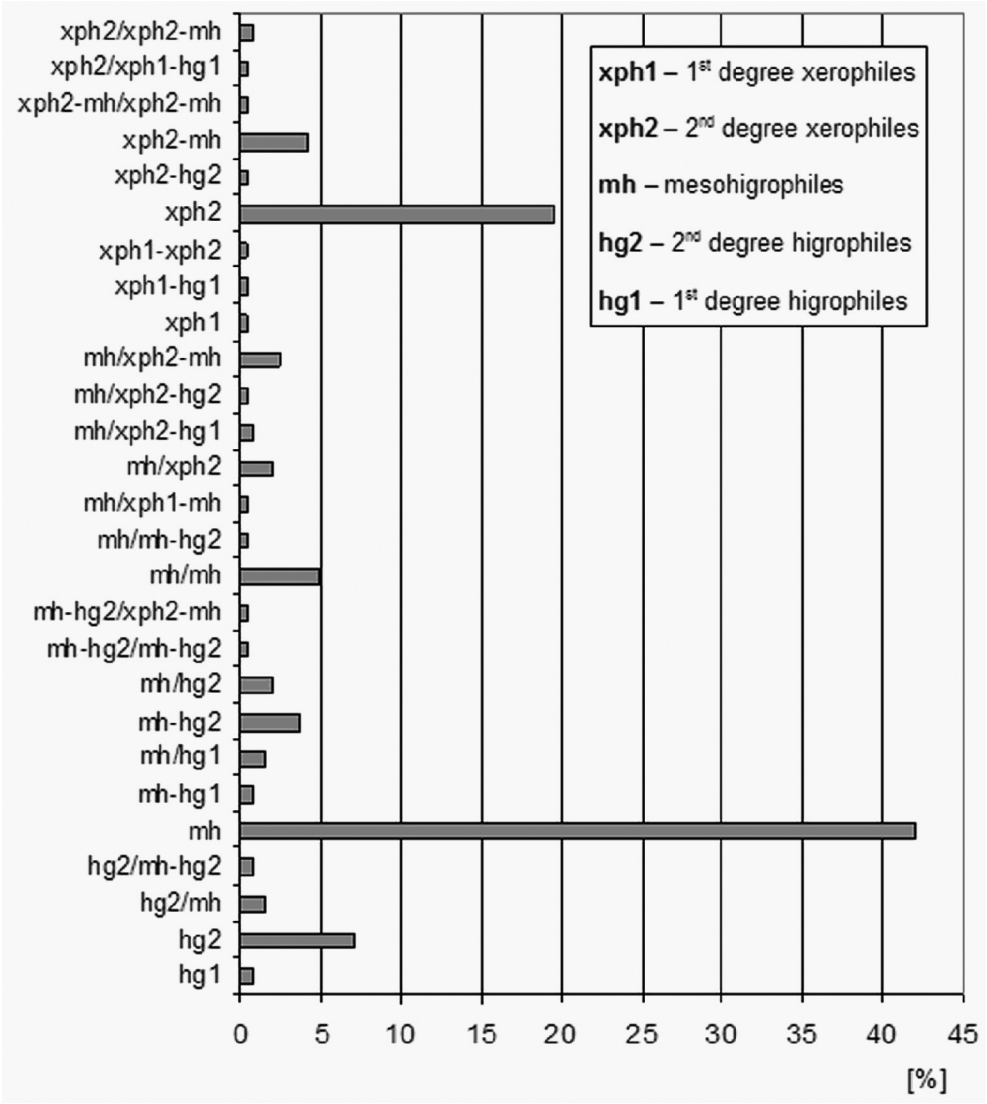


Fig 9. Percentage of hygrophiles, mezohigrophiles and xerophiles species in the fauna of Aphidinea of the OPN

As for moist requirements, in the collected material there is a strong representation of mezohygrophilous species (41% of the whole), i.e. ones connected with moist environments. Xerophilous species (xph1+xph2) constitute slightly less than 21% of the whole material, while hygrophilous species (hg1+hg2) constitute less than 8%. The change of moist requirements coinciding with the change of host plants takes place in the case of about 14% of aphid species. More or less the same percentage of species change their living environment for less moist one. The remaining species do not show any differences in their moist requirements in connection with change of host plants (Fig. 9).

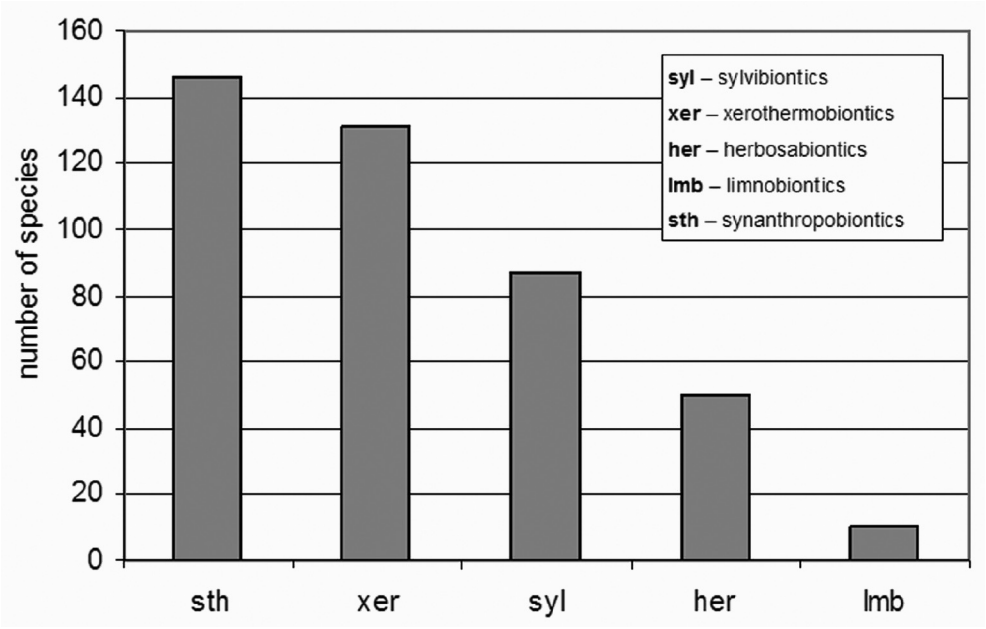


Fig. 10. Number of species of Aphidinea in particular habitats of the OPN

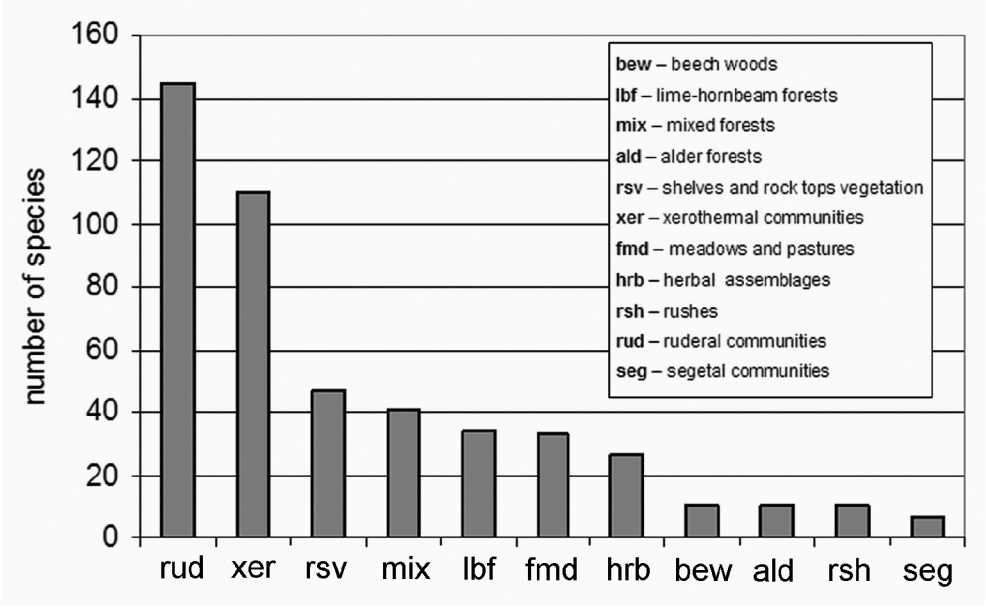


Fig. 11. Number of species of Aphidinea in particular plant communities of the OPN

As far as the environmental criteria are concerned, the largest number of species has been recorded among synanthrops (sth) and xerothermobionts (xer), i.e. 146 and 131 aphid species respectively. There have been recorded much fewer sylvicolous (syl) species, namely 87. Among the identified species there are also 50 herbivores

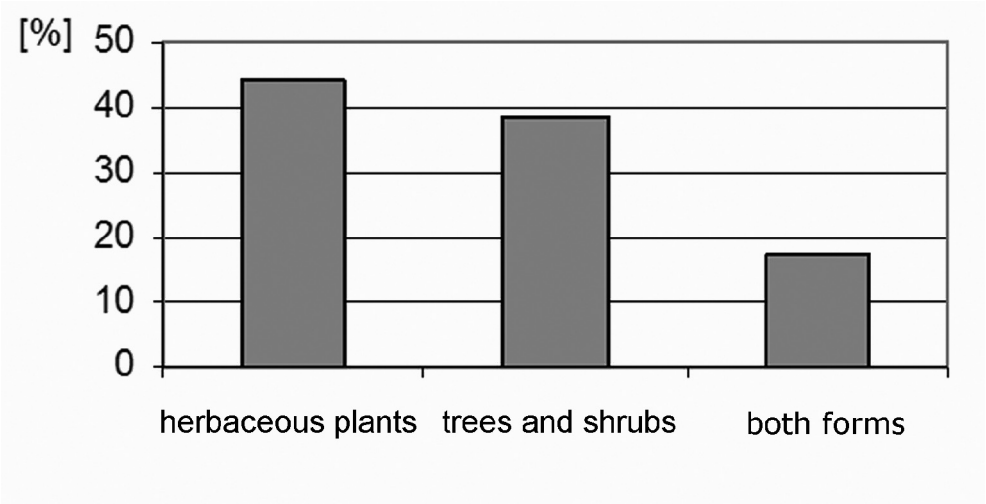


Fig. 12. Percentage of Aphidinea of the OPN related to particular forms of host plants.

(her), while the lowest number of species have been identified as limnobionts (lmb) (10) (Fig. 10).

In xerothermic communities 110 aphid species have been identified. The synanthropic communities (ruderal and segetal ones) turned out to be much richer in aphid species, since the presence of 152 species has been recorded there. Forest communities of the OPN are much poorer as far as the number of aphid species is concerned. The largest number of species have been recorded in mixed forests (41) and broad-leaved forests (34). In meadow communities only 33 aphid species have been recorded, while merely 26 species are connected with tall-herb communites (Fig. 11).

In the collected material both the widespread elements and the elements characteristic of limited areas have comparatively large representations. As for the widespread ones, there have been identified 55 cosmopolitic species, and 65 holarctic and non-continuous holarctic species. As for the less widespread ones, 51 European species have been identified. Among the elements restricted to comparatively limited areas, the steppe west-paleoarctic element, represented by 16 species, is most common. The least common elements in the collected material include the palearctic and amphipalearctic elements, represented by 2 and 3 species respectively. The share of particular chorological elements in all aphidofauna of the OPN is shown in Figure 13.

While analyzing the frequency classes of aphid species in the area of the OPN (Fig. 14) it can be noticed that over 70% of species are either very rare, or their presence has been recorded merely once. The frequent and very frequent species constitute slightly less than 4% of the overall material. There is only one common species, i.e. *Aphis fabae fabae*, whose presence has been recorded 146 times.

On the basis of detailed inventory of vascular plant species of the OPN it has been discovered that in the area of the park there are present 530 species which belong to 92 families. More than half of this group, i.e. 282 species belonging to 58

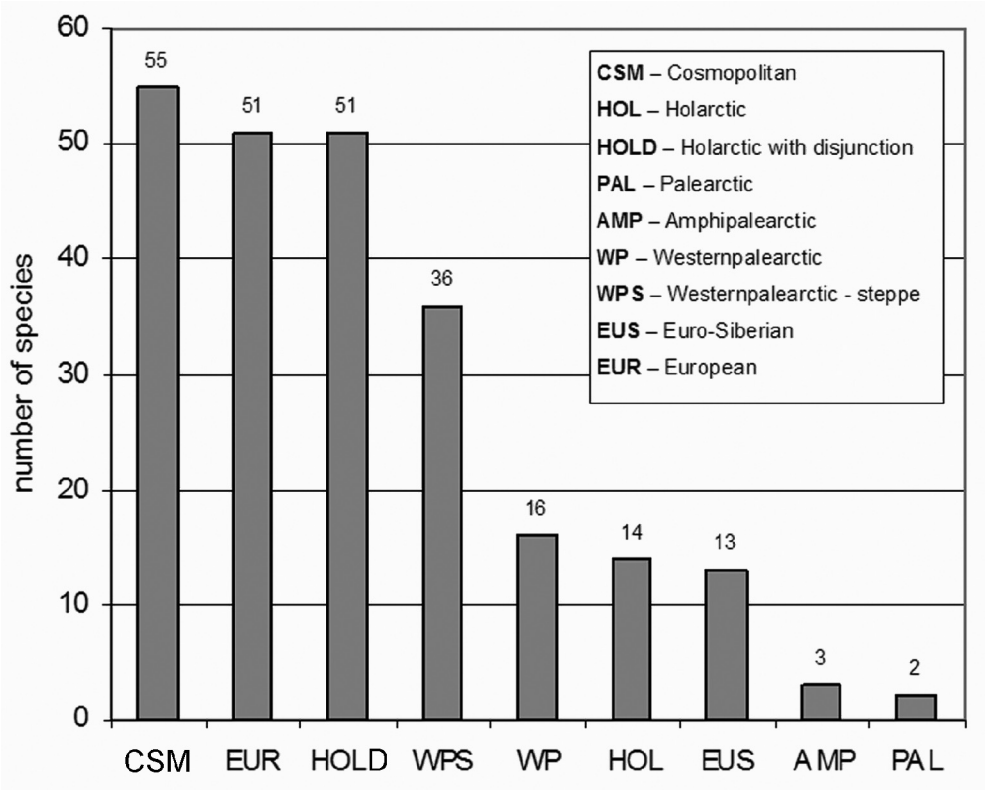


Fig. 13. Chorological structure (number of species) of fauna of Aphidinea of the OPN

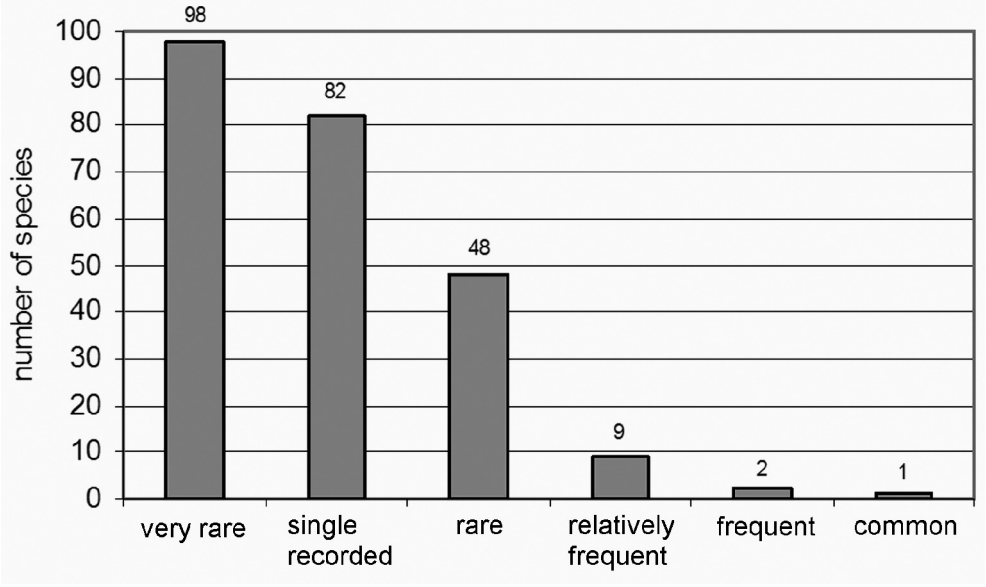


Fig. 14. Frequency of records (number of species) of Aphidinea of the OPN

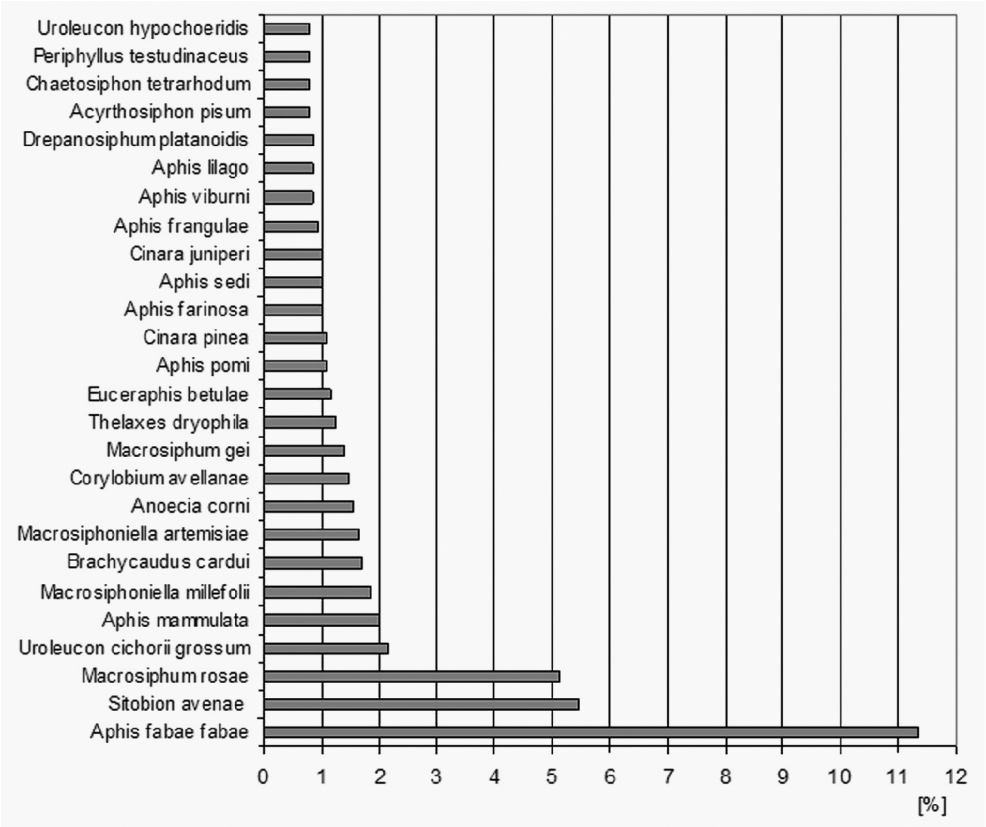


Fig. 15. Frequency of aphid species (percentage) in the area of the OPN

families turned out to be hosts of 241 aphid species.

Almost 44% of the species feed solely on herbaceous plants. Species that feed on trees and scrubs constitute slightly less than 39% of the collected material (Fig. 12). Having analysed frequencies of appearance of particular aphid species in the collected material it was discovered that the species *Aphis fabae fabae* was the most frequent, constituting 11.34% of the whole material. The frequency was half lower for such species as *Macrosiphum rosae* and *Sitobion avenae*, amounting to about 5%. For another 15 aphid species the frequency was between 1% and 2%, while for the remaining ones it was lower than 1%. The frequencies of aphid species whose presence was recorded 10 and more times are shown by Figure 15.

The most plant species which are aphid host plants belong to the following families: Asteraceae (47 out of 67), Poaceae (34 out of 45), Fabaceae (18 out of 37), Rosaceae (22 out of 37) and Lamiaceae (18 out of 31). The number of aphid species feeding on plants that belong to the above families was large only in the case of the Asteraceae family (52 aphid species) and Rosaceae family (23). As for the Poaceae family, which is represnted by many species in the OPN, it provides hosts for only 7 aphid species, most of them polyphagous. The situation is different with such families as: Pinaceae, Salicaceae, Betulaceae, Fagaceae or Aceraceae, where the number of

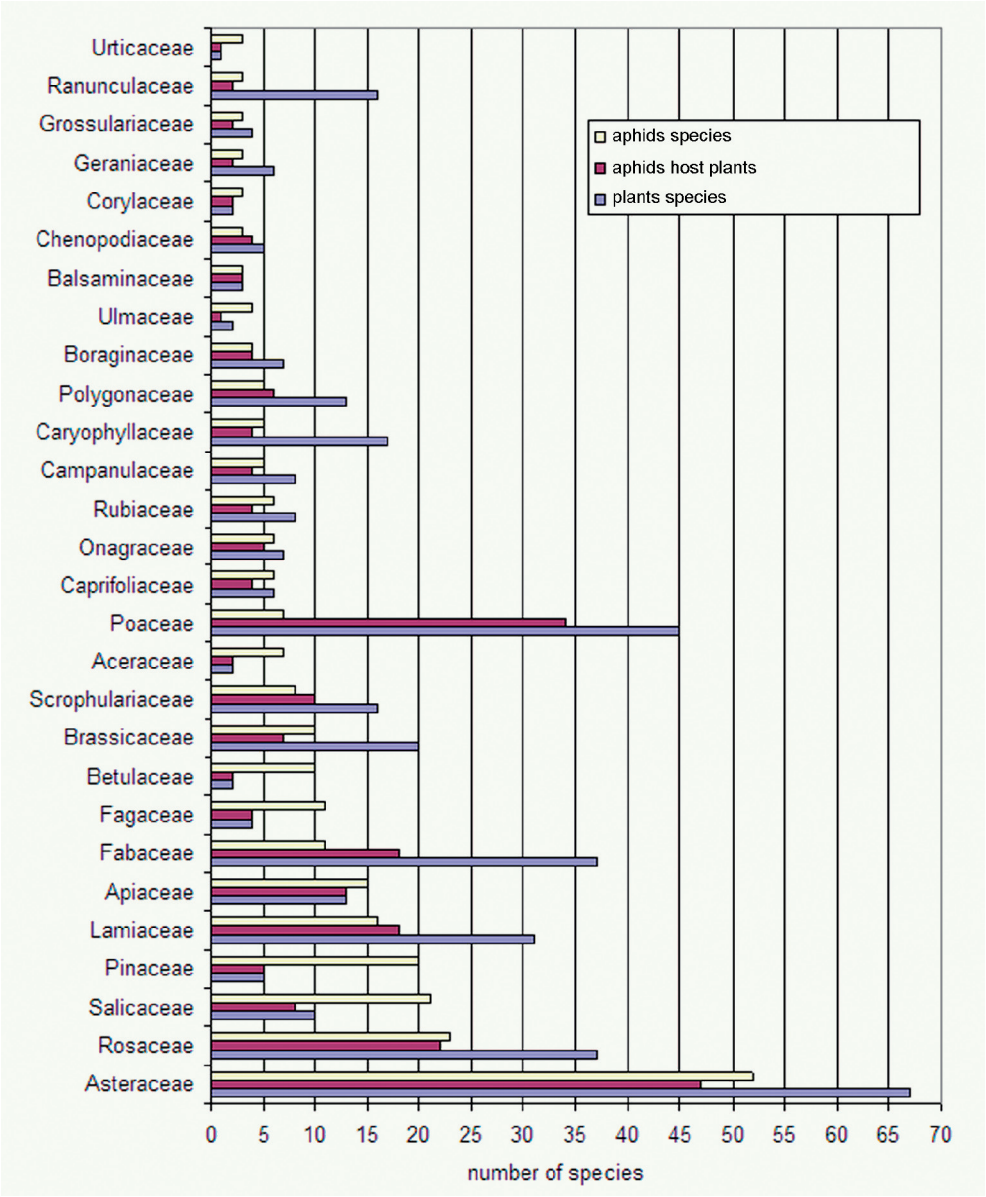


Fig. 16. Comparison of numbers of plants, aphids host plants and aphids related to them in particular plant families

recorded aphid species is much higher than the number of their host plant species. In the above mentioned families (with the exception of the family Salicaceae), aphids have been found on all plant species that underwent investigation. Data concerning the number of plant species, host plant species and aphid species in particular plant families is displayed in Figure 16.

The largest frequency of aphid presence, amounting nearly to 21%, is characteristic of the Asteraceae family. Lower frequencies of aphid presence are

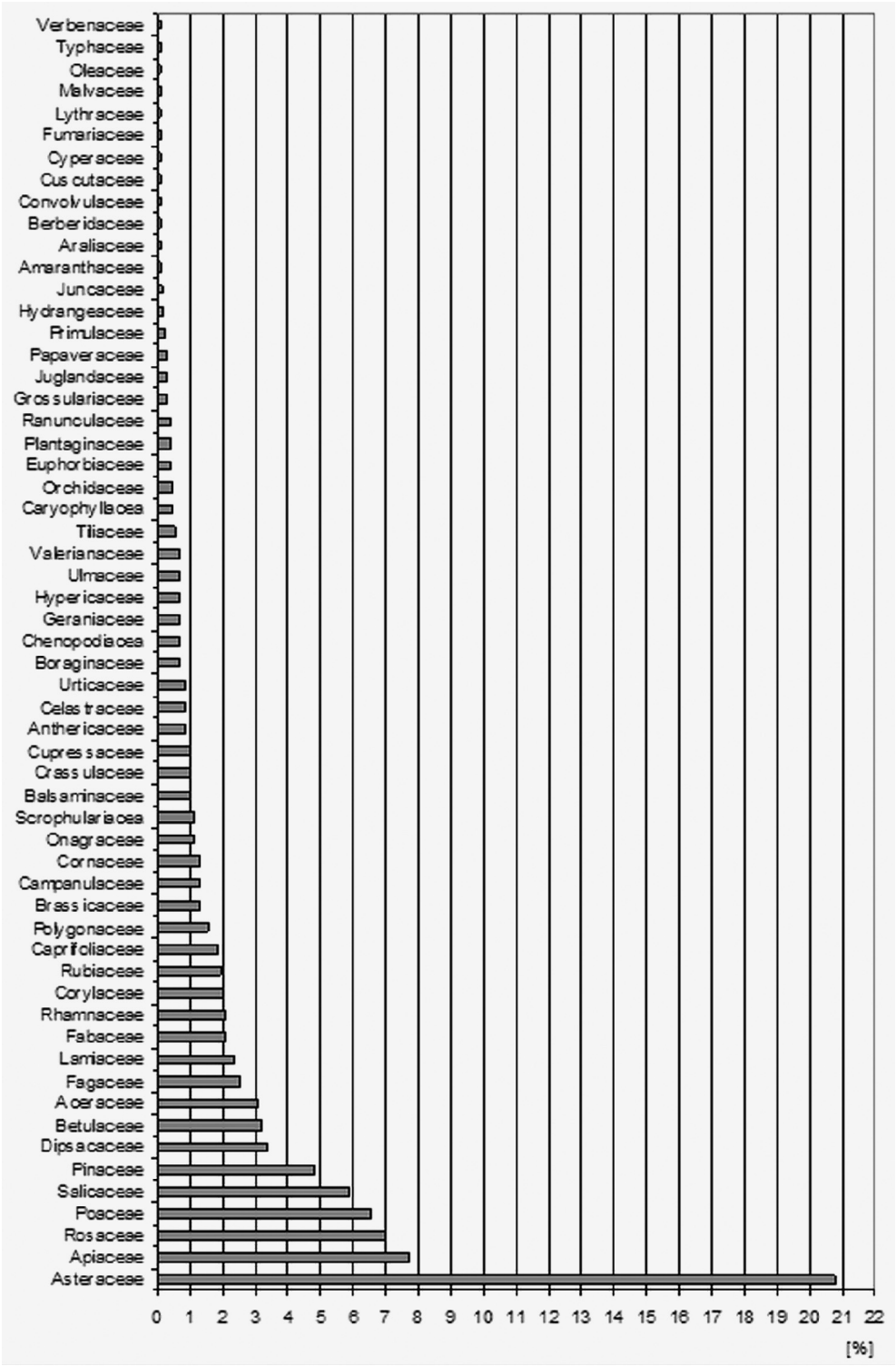


Fig. 17. Frequency of Aphidinea of the OPN for particular host plant families

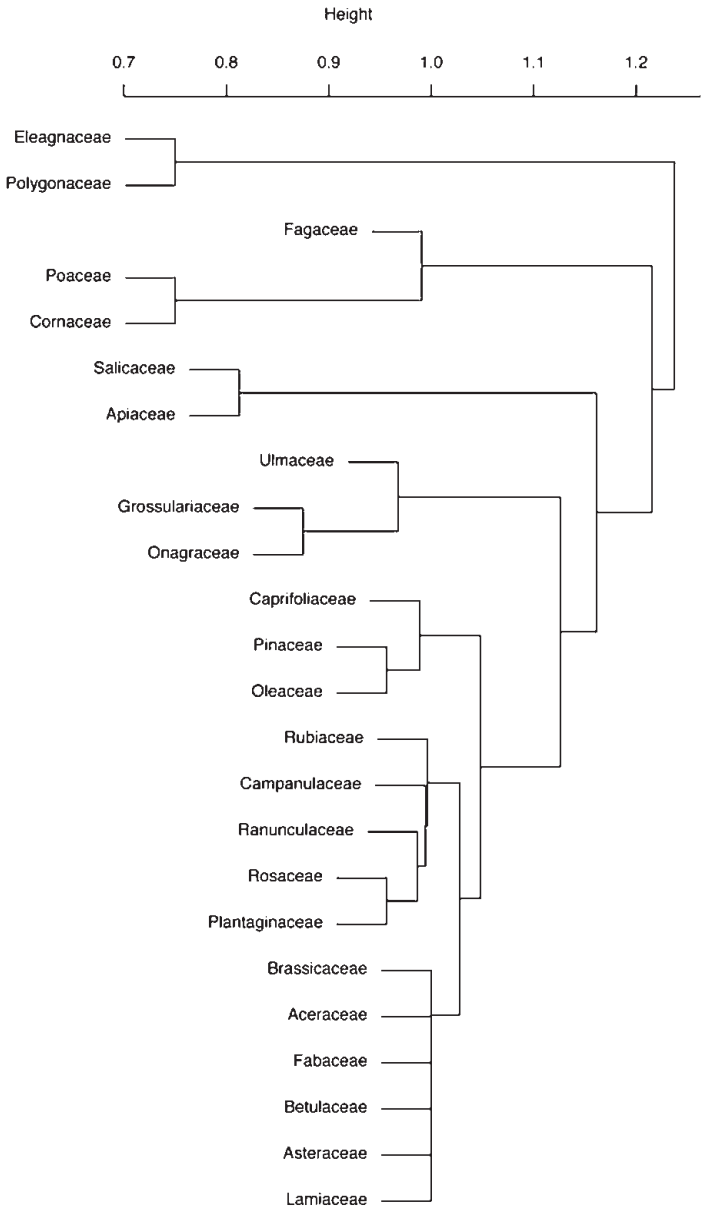


Fig. 18. Similarity diagram of aphid species composition in the particular families of the host plants present in the area of the OPN

connected with the following families: Apiaceae (about 8%), Rosaceae (about 7%), Poaceae (about 6.5%), Salicaceae (about 6%) and Pinaceae (about 5%). The lowest frequency of aphid presence has been recorded in the following families: Amaranthaceae, Araliaceae, Berberidaceae, Cuscutaceae, Cyperaceae, Fumariaceae, Lythraceae, Malvaceae, Oleaceae, Typhaceae and Verbenaceae. In the case of plant

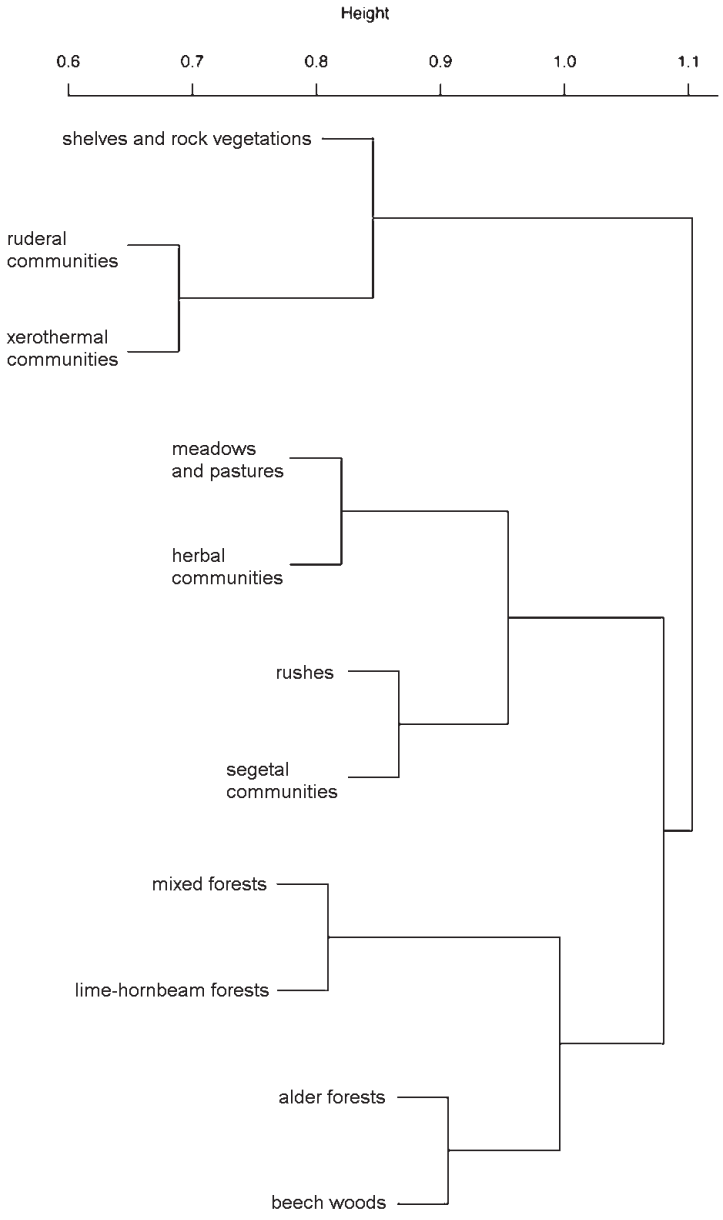


Fig. 19. Similarity diagram of the aphid species composition in particular plant assemblages recorded in the area of the OPN.

species belonging to these families there have been single presence records of single aphid species. The frequencies of aphid presence with reference to particular plant families are shown in Figure 17.

The analysis of aphid species composition in different types of communities and habitats of the OPN has shown the presence of three clearly noticeable concentrations.

The first of them encompasses the xerothermic and ruderal communities, as well as ones connected with rock ledges (Fig. 19). The second one encompasses the communities of tall perennials: meadows and pastures, tall-herb vegetation, and segetal and rush communities related to them as far as aphid species composition is concerned (Fig. 19). The third concentration encompasses forest communities, i.e. mixed forests and broad-leaved forests, as well as riparian and beech forests (Fig. 19).

The analysis of aphid species composition with reference to particular families of host plants clearly distinguishes the pairs of families between which there takes place the migration of aphid species that switch host plants: Elaeagnaceae and Polygonaceae, Poaceae and Cornaceae, Salicaceae and Apiaceae, Grossulariaceae and Onagraceae, Rosaceae and Plantaginaceae (Fig. 18). The family pair (Poaceae+Cornaceae) is remotely associated with Fagaceae family, while the pair (Salicaceae+Apiacae) is remotely associated with the family Ulmaceae. Another group of associations encompasses (Caprifoliaceae+(Pinaceae+Oleaceae)), but in this case the associations are rather remote. The most numerous group of associations encompasses (Rubiaceae+(Campanulaceae+(Ranunculaceae+(Rosaceae+Plantaginaceae)))). The group which encompasses such families as: Brassicaceae, Aceraceae, Fabaceae, Asteraceae and Lamiaceae is homogeneous, but nevertheless clearly distinguished (Fig. 18).

DISCUSSION

The investigation of aphidophauna in the area of the Ojców National Park resulted in identifying the presence of 250 taxons, out of which 234 had never been recorded before in the OPN. The expected presence of 9 aphid species could not be confirmed. Eight of these had been recorded by Piechota (1990): *Glyphina jacutensis*, *Drepanosiphum aceris*, *Betulaphis quadrituberculata*, *Euceraphis punctipennis* (it might have been incorrectly identified as *E. betulae*), *Pterocallis albidus*, *Terioaphis trifolii*, *Sminthuraphis ulrichi*, *Subsaltusaphis intermedia.* Moreover, Jakuczyn (1972) had recorded the presence of *Hyadaphis coriandri* (under the name *Hyadaphis tatarica*).

Let it be mentioned, for the sake of comparison, how many aphid species have been identified in other national parks in Poland for which faunistic lists have been developed. In Bieszczadzki National Park there have been identified 147 aphid species (Węgierek & Czylok, 2000), in Babiogórski National Park 140 species (Celary, 2003), and in Białowieski National Park 59 species (Węgierek & Wojciechowski, 2001). Ojców National Park is presently the most throughly studied national park in Poland with reference to aphidofauna.

Aphid species identified in the OPN constitute over 35% of all Aphidinae whose presence has been recorded in Poland (Węgierek & Wojciechowski, 2004; Osiadacz & Wieczorek, 2006). This fact means that Kraków-Wieluń Upland is the third region in Poland with reference to the number of identified aphid species, following

Masurian Lakeland (Pojezierze Mazurskie) and Great Poland-Kujawy Lowland (Nizina Wielkopolsko-Kujawska), where the presence of over 450 aphid species has been recorded. So far, it has been stated that in the area of the Kraków-Wieluń Upland there are present 398 aphid species (Hałaj & Węgierek, 1998). However, this statement refers only to the central part of the Upland, i.e. Częstochowa Upland, and not to its southern part, where the Ojców National Park is situated. Until the research for the purposes of the present study commenced, the OPN had been considered as one of the most extensively studied national parks with reference to the order Homoptera (Banaszak *et al.*, 2004). However, the situation had not been exactly the same with reference to its aphidofauna, since a complex faunistic research aimed strictly at the aphids had never been conducted in the park.

The species richness of aphids in the OPN becomes still more clearly visible if we take into account the average number of species per area (Szelegiewicz, 1978b). The average number of aphid species per square kilometre in the OPN amounts to 11.65, while the area of the park is 21.46 km^2. In the region of Kraków-Wieluń Upland, whose area is over 2500 km^2, the average number of aphid species per square kilometre is 0.16. It is also worth mentioning that from the area of the OPN, which takes up less than 1% of the whole region, there are absent many plant communities popular in the area of the Kraków-Wieluń Upland, for example psammophilous grass communities, sedge communites and pine forests (Babczyńska-Sendek *et al.*, 1992), in which a large number of aphid species can be encountered, since in these communities there grow many typical aphid host plants.

In the area of the OPN there have been identified for the first time in Poland three aphid species. The first of them is *Aphis lilago* F. Müller, 1968 which belongs to the Aphididae family, Aphidinae subfamily, Aphidini tribe. Apart from Poland its presence has been recorded only in Czech Republic and Germany (Holman, 1966; Heie, 1986). It is a monophagous species which does not switch host plants. It feeds on the shoots of *Anthericum* spp. In the area of the OPN this species has been found 11 times, always in small colonies, on the shoots of *Anthericum ramosum*, in seven xerothermic stands (rock ledges).

Another aphid species that has been identified for the first time in Poland is *Cavariella salicicola* (Matsumura, 1917), which belongs to Macrosiphini tribe. Apart from Poland, its presence has been recorded only in the Far East, in Primorsky Krai in the Russian Far East, in the Kuril Islands (Kunashir) and in Buriatia. It has also been encountered in Japan, Korea and in China, in the following provinces: Jilin, Liaoning, Ningxia, Hebei, Henan, Shandong, Jiangsu, Jiangxi, Zhejiang, Fuijan, Guangdong, Guizhou, Sichuan, Yunnan, Zizang, and also in Taiwan (Pashchenko, 1987, 1988; Hua, 2000). It is a migratory species characterized by switching host plants from the Salicaceae family in favour of those from Apiaceae family. In the Far East its presence has been recorded on the following host plants from the willow family: *Salix nipponica*, *S. rorida*, *S. udensis*, *S. babylonica*, *S. warburgi*, *Salix* sp. and *Chosenia arbutifolia*. It usually feeds on the leaf bottoms and shoot tops, rarely also on leaf surfaces. After host switch the aphid species in question feeds on both

surfaces and bottoms of leaves of the following representatives of the Umbelliferae: *Angelica maximowiczii*, *Sium suave*, *S. tenue*, *Apium* sp., *Levisticum officinale*, *Pastinaca sativa* and *Oenanthe javanica* (Pashchenko, 1987, 1988; Hua, 2000). In the OPN the presence of *Cavariella salicicola* has been recorded on a swamp meadow, on the shoots of *Salix triandra*. It was probably brought to Poland together with some decorative willow species. This is the first reorded presence of this aphid species in west paleoarctics and its presence in Polish fauna ought to be monitored in the nearest future.

The third aphid species new to Poland is *Macrosiphum albifrons* Essig, 1911 (Macrosiphini), also encountered in Sweden, Denmark and England. This is a North American species that had been brought to Europe, where it was recorded for the first time in England in 1981 (Heie, 1994a). In the OPN its presence has been recorded once, but in great numbers, on the plant *Lupinus polyphyllus*, growing on a ruderal stand. It is a species which does not switch hosts, an oligophag of first degree feeding on the *Lupinus* plants.

The Aphididae family is represented by the largest number of species in the aphidofauna of the OPN (68.9%), followed by Drepanosiphidae (14.9%) and Lachnidae (8.3%). The remaining families, namely: Adelgidae, Mindaridae, Pemphigidae, Phylloxeridae and Thelaxidae are mostly represented by single species.

Although there exists a wide range of publications concerning the relation of aphids with plant associations (Klimaszewski *et al.*, 1980a, b; Czylok, 1983; Czylok & Wojciechowski, 1987; Hałaj & Wojciechowski, 1996, 1997), as well as ones studying the zoocenotic structure of local aphidofauna and its development (Durak & Wojciechowski, 2006), publications which can be counted among faunistic studies are rare (Achremowicz, 1975; Szelegiewicz, 1978c).

The problem of trophic associations of aphids seems to be a very important one, since aphids belong to a group of insects so tightly connected with plants. In the studies preceding the present one trophic associations of aphids with their host plants had been studied mainly with reference to cultivated plants Cichocka, 1980; Rakauskas & Cichocka, 2005; Osiadacz, 2006), decorative plants (Achremowicz, 1978; Jaśkiewicz, 2006), urban trees (Cichocka & Goszczyński, 1991; Wilkaniec, 1999, 2005), midfield thickets (Barczak *et al.*, 2000; Wilkaniec *et al.,* 2006) or dendrophilous aphids (Jaśkiewicz & Cichocka, 2004; Tykarska, 2001; Wilkaniec & Piekarska-Boniecka, 1996; Osiadacz & Wieczorek, 2003; Wieczorek & Osiadacz, 2005).

Aphids had never been extensively studied with respect to their association with host plant families from the coevolutional and philogenetic point of view. The only exceptions are the studies on trophic associations of chosen aphid species with the Asteraceae family (Holman, 1981, 1998), and also an attempt at the study of aphids associated with this plant family in Poland (Osiadacz & Wojciechowski, 2005). The number of complex faunistic and faunological studies on aphids is also scarce, which is due, among other reasons, to the fact that there are quite a few difficulties to overcome while performing these kinds of study. One of them is the

choice of a proper method of aphid collection. For the purposes of many studies, in order to acquire aphid samples (e.g. Hałaj & Wojciechowski, 1996, 1997; Durak & Wojciechowski, 2005; Czylok & Wojciechowski, 1987) or samples of other insects (e.g. Klimaszewski *et al.*, 1980a, b; Cmoluchowa & Lechowski, 1994; Gorczyca & Hreczek, 1988; Pokuta, 2000) the sweeping net was implemented. However, because the bodies of aphids are soft and delicate, this method is not always a perfect one. It is also inconvenient that implementing the sweeping net is often connected with shaking branches or shoots of host plants, which results in a loss of relevant data concerning host plants and exact parts of the host plants on which the aphids feed. Therefore, for the purposes of the present study there has been implemented the method of careful combing through the whole host plants (Szelegiewicz, 1959), even though this method is a laborious and time-consuming one.

One might ask: do aphids recognize precisely particular plant species? The answer to such a question is difficult and can hardly be explicit. Studies on "aphid botanizing", types and atrength of associations between aphids and host plants, were conducted by Hille Ris Lambers (1979). A strong association between host plants and aphids is a fact, but at the same time the results of a study of such associations for aphid species which feed on two hosts are confusing, since it is difficult to find a clear rule followed by such aphid species while choosing their secondary host (Szelegiewicz, 1978d; Moran, 1988; Heie, 1994b; von Dohlen & Moran, 2000; von Dohlen *et al.*, 2006). Further difficulties arise due to the coevolutional history of aphids and plants, the specific mode of aphid reproduction, their large flexibility reflected by creation of biotypes (Eastop, 1973; Szelegiewicz, 1976a), as well as comparative easiness as far as the switching of host plants is concerned. In spite of all these interpretational difficulties, the answer to the question whether aphids are able to recognize particular plant species, ought to be affirmative. Aphids are specifically oriented towards both plants and the habitats where they grow. This specific association of aphids and their host plants is easy to observe also in the case of aphids from the area of the OPN.

Analyzing aphid associations with related groups of host plants (on the taxonomic level of a family), an attempt can be made at specifying the character and strength of such associations. In zoocenological studies the aphid associations with particular plant communities are usually referred to as a category of assemblage. According to Weiner (2005), the term "assemblage" denotes a group of species which inhabit a common area. At the same time this term is often used to refer to a group of species which belong to the same taxon of a higher rank (order, suborder or family) and are associated with a particular type of habitat (plant community), usually characterized by a specific trophic, ecological and chorological structure. So far the importance of aphid association with related groups of host plants has not been brought into focus. The term "community" seems to be more appropriate, however it can be interpreted in a variety of ways. The official definition of the term, provided by Nomenclature Committee of the Ecological Society of America in 1933 is the following: "Community is a general term for all sociological entities from the simplest ones (such as the non-rooted bacterial mat) to the most complex biocenoses (such as the multi-layer

rainforest)" (Weiner 2005). Most frequently in this way the term "community" is used by zoologists, while in botany, especially in phytosociology, "community" is defined as an abstract typological unit characterized by precisely specified species composition, represented by specific patches of vegetation (Matuszkiewicz W., 2001; Weiner, 2005). Neither can the term "guild" be applied here, since guild is "group of species characterized by a similar way of feeding and utilizing the same, or similar, resources of the habitat" (Łabno, 2006). As for the term "taxocene", it is utilized only in quantitative studies and denotes all members of a taxonomic group of a rank higher than a species, and associated with a particular type of habitat. Moreover, implementation of the taxocene analysis demands additional analysis of the status of particular species in the biocenotic composition (Trojan, 1992). As for the term "consortium" it has been utilized in the studies of aphid group association with a particular species of a host plant (especially *Betula*) and referred mainly to the monitoring of environment Klimaszewski *et al.*, 1989, 1995; Węgierek & Węgierek, 2003). Thus, in biocenologic terminology there exists a number of terms, usually interpreted in more than one way, for denoting a group of organisms which belong to various species and share a common habitat (Weiner, 2005). None of these terms is completely appropriate in the context of the present study, which investigates the associations of particular aphid species with particular plant families. For this reason throughout the study there are used only general terms to refer to such associations.
In the world aphidopfauna there prevail species which do not switch hosts, feeding on one or sveral species of a given type of host plant (Eastop, 1972). About 10% of aphid species switch hosts, feeding on the primary host in spring and autumn, and in summer switching to a secondary host, often one which belongs to another plant family (Dixon, 1987). Also among the aphid species of the OPN there clearly dominate ones that do not switch hosts, since they constitute nearly 80% of the park's aphidpfauna (Fig. 7). The percentage of such species is similar in the aphidofauna of the whole area of Poland (Szelegiewicz, 1968b, 1978c; Węgierek & Wojciechowski, 2004). The fact that some aphid species switch hosts has been disussed in many publications (Szelegiewicz, 1978d; Moran, 1988; Heie, 1994b; von Dohlen & Moran, 2000; von Dohlen *et al.*, 2006). Single host plant species seem to represent an initial stage of the evolutional development of aphids (Moran, 1988; Heie, 1996; von Dohlen & Moran, 2000). Probably the oldest aphid species of the Mesozoic Era fed on gymnospermous plants (Heie, 1996; Zherikhin, 2002; Węgierek, 2004). Host alternation in aphids can be viewed in terms of an evolutional response to the effect of selectional factors, as a peculiar type of oligophagy connected with extending the range of possible host plants. In the evolutional history of aphids the tendency for host alternation has revealed itself at least three times (Heie, 1994b). Among Phylloxeroidea, host alternation was already common in the Early Cretaceous period. Probably in this period host alternation became popular also among the ancestors of Pemphigidae+Hormaphididae+Anoeciidae (Heie, 1994b; von Dohlen & Moran, 2000). A sudden adaptational reaction of the Aphidinae, which began in Paleogene, may be connected with the development of host alternation tendencies (von Dohlen

& Moran, 2000; von Dohlen *et al.*, 2006). Thus, the aphid species which tend to switch hosts, being highly specilized organisms, can be connected with historical changes that have taken place in the investigated area, since their presence remains in a rather close relationship with paleofloristic and paleobotanical data, with the appearance and continuous presence of both primary and secondary host plants.

The analysis of ecological structure of aphids in the investigated areas, or the aphids associated with particular groups (families) of host plants is very rarely conducted. The major problem with such analysis lies in the fact that it is difficult to specify the degree of phagism in aphids, especially in the case of species which show preference for two hosts (Achremowicz, 1975). Achremowicz proposed a system and a set of definitions of trophic associations in aphids, which facilitated conducting the analysis of aphids of Great Poland-Kujawy Lowland (Niznina Wielkopolsko-Kujawska). In this region there dominated aphid species with a narrow feeding specialization (Achremowicz, 1975).

Similarly, as far as the trophic associations of aphids in the OPN are concerned, monophags (with reference to any host plant) constitute about 25% of the species whch do not switch hosts, while the oligophags of first degree, i.e. ones that are related to a specific type of host plants, are a prevailing group and constitute almost 40% of all aphid species that do not switch hosts (Fig. 8). Strict monophagy is often associated with a single plant species representing a certain type of plants in Polish flora, for example: *Phyllaphis fagi* associated with *Fagus sylvatica*, *Myzocallis carpini* associated with *Carpinus betulus*, *Mindarus abietinus* associated with *Abies alba*, or *Aphis origani* associated with *Origanum vulgare*. On the other hand, most species which have been considered monophagous so far, are in reality oligophags of first degree. It is so because the trophic associations of aphid material collected over an area are usually specified only with respect to types of host plants, especially as far as critical taxons are concerned. Even seemingly common plant species, such as birches, willows or poplars can be difficult to identify, especially when we have to do with suckers, i.e. the parts where aphids usually cluster. It demands excellent floristic knowledge in order to specify the actual degree of association between aphids and host plants, especially in order to distinguish monophags from oligophags of first degree.

In the OPN area polifagous aphid species constitute the smallest group, about 9% of the whole, regardless of which host is analyzed in the case of aphids that show preference for host alternation. Strictly monophagous aphid species constitute 23% of aphid species in the whole material collected in the OPN, while the group of monophags feeding on a primary host and oligophags of second degree is represented by merely two species: *Dysaphis pyri* and *D. sorbi*. Primary hosts of these species are the garden pear and the mountain ash respectively, while their secondary hosts are plants from the families Rubiaceae and Campanulaceae respectively. Only one aphid species in the OPN area, namely *Aphis frangulae*, is monophagous while feeding on the primary host *Frangula alnus* and polyphagous while feeding on the secondary host (*Acinos arvensis*, *Chamaenerion angustifolium*, *Capsella bursa-pastoris*, *Digitalis*

grandiflora, *Malva sylvestris*, *Melapyrum nemorosum*, *M. pratense*, *Scrophularia nodosa*, *Sonchus arvensis*). This species is considered as pest, acting as a vector of viral diseases of the potato (Szelegiewicz, 1968). The most numerous group of aphids in the OPN is that of oligophags of first degree (96 species). Oligophags of second degree are also quite numerous (31 species). Polyphags are represented by merely 7 species (Fig. 8). Aphid species with preference for host alternation from groups O1/M, O2/O1 and O2/O2 are represented by single species. The remaining trophic groups O1/O2, O1/P and P/P are represented by 16, 7, and 6 species respectively (Fig. 8). While switching from primary to secondary host, 26 aphid species extend their trophic spectrum. In the case of 5 species their trophic spectrum becomes narrower, and for 19 other species the trophic spectrum remains the same.

The ability of aphids to frequently and actively alternate hosts is a characteristic feature of this group of insects. At the same time aphids show a highly developed trophic specialization and nutritional selectivity. The studies of associations between aphids and their primary and secondary host plants have been conducted, among others, by Moran (1992), Kindlman & Dixon (1994), Dixon & Kundu (1994) and Eastop (1998). It seems, however, that aphids represent several various models of host alternation, which have developed independently at different times (Szelegiewicz, 1978d; Heie, 1994b; Eastop, 1995; von Dohlen & Moran, 2000; von Dohlen *et al.*, 2006). Seemingly, the prevailing evolutional direction among aphids consists in active extension of host plant range, from monophagy to oligophagy to polyphagy related to the development, along some evolution lines, of the peculiar form of oligophagy connected with host alternation (Szelegiewicz, 1978d; Heie, 1994b; von Dohlen & Moran, 2000; von Dohlen *et al.*, 2006). Fang *et al.* (2006) have reviewed the diversity of host plants and places where aphids fed. The presence of the largest (on worldwide scale) number of aphid species has been recorded on plants belonging to the family Asteraceae (Fang *et al.*, 2006), which is also reflected in the taxonomic composition of the aphids from the OPN. The Asteraceae family is one of the youngest groups of plants, which probably became aphid hosts in Paleogene (Heie, 1996; Moran *et al.*, 1999; von Dohlen & Moran, 2000; von Dohlen *et al.*, 2006). On worldwide scale plant species that belong to this family are most often hosts to aphids from Macrosiphini tribe (von Dohlen *et al.*, 2006). The present study of aphids from the OPN has confirmed this fact. This relation results from the evolution of aphids and their associations with host plants, as both Asteraceae and Macrosiphini are evolutionally the youngest groups. Thus, data gathered from the investigation of such a small area as the OPN still confirm some general patterns of aphid evolution.

In a majority of cases aphids show very tight associations with their host plants. On the other hand, the plants also require rather specific environmental conditions, so it can be assumed that there exists a correlation between aphid host preferences and host environmental preferences. It is believed that aphids are insects for which the optimal environment, with reference to the level of humidity, are moist communities, characterized by moderate level of humidity. A large share of mezohygrophilous

species in the aphidofauna of the OPN, amounting to 42% (Fig. 9) is certainly connected with the general preferences of aphids as such, the presence of their host plants, the peculiarity of the relief and the diversity of microhabitat conditions. The share of all mezohygrophilous species associated with moist communities constitutes 47% of the whole (Fig. 9). Exclusively hydrophilous species (hg1+hg2) constitute less than 8% of the whole, which is due to the fact that there are very few aphid species associated with host plants that require a high level of humidity (Fig. 9). This group constitutes of merely 19 species, including: *Macrosiphum cholodkovskyi*, *Pterocallis alni*, *Aphis janischi*, *Chaitophorus mordvilkoi*, *Myzus myosotidis*, and *Ovatus mentharius*. The aphid species with preference for host alternation also rarely switch hosts in favour of ones recquiring a high level of humidity. Among others, they include such species as *Cryptomyzus similis*, *Dysaphis newskyi aizenbergi*, and *Pemphigus borealis*. The change of requirements regarding the level of humidity while switching hosts concerns about 14% of the identified aphid species. More or less the same number of species change their conditions of life leaving the moist communities in favour of less moist ones. Among xerophilous species (xph1+xph2), which together constitute nearly 21% of the whole, there can be distinguished a group with wider preference range with respect to humidity, represented by 10 species. Merely one species, i.e. *Aphis sedi*, is associated with very dry and warm habitats of the *Festucetum pallentis* community. In most aphid species alternating between two hosts there are observed no changes concerning humidity preferences while switching hosts (e.g. C*apiotophorus hippophaes*, *Cryptomyzus galeopsidis*, *Aphis grossulariae*, *Macrosiphum rosae*).

The largest number of aphid species in the OPN have been identified in synanthropic and xerothermic environments, while the fewest species have been identified on rush and water plants (Fig. 10). Large faunistic diversity of aphids in xerothermic habitats is the result of diversified nutrition base. Wide diversity of species in synanthropic communities is mainly the result of initial and xenospontaneous character of such communities. Synanthropic habitats of the OPN, especially road sides, are characterized by a slightly different floristic composition, caused by the absorption of species from nearby meadows. Low species diversity in beech woods is caused solely by the character of the community as such (dominance of *Fagus sylvatica*, scarce herb layer), while in the case of marshy and moist meadows it is caused by the fact that these communities are gradually diminishing in size in the area of the OPN.

Special attention ought to be paid to aphid species associated with xerothermic habitats. The ecosystems of xerothermic grasslands, although quite numerously represented in southern and eastern Poland, are endangered with extinction on a larger scale. Only small part of them is of natural character, and constitutes relics of the early Oligocene (rock grasslands of the OPN), while the rest is mostly of anthropogenic origin (Mazur & Kubisz, 2000; Perzanowska & Kujawa-Pawlaczyk, 2004). These habitats provide shelter for many species of xerothermophilous flora and fauna (Wiśniowski, 2003b; Wąsala & Nowacki, 2006; Kuśka, 2006), and since

they usually cover only little areas and are isolated from one another, thus they are easily threatened with destruction. In the OPN xerothermic habitats are associated with aphidofauna that is not encountered elsewhere. Among the aphid species which live only in xerothermic thickets and on xerothermic meadows there can be listed, among others, the following species: *Aphis affinis*, *A. chloris*, *A. clinopodii*, *A. origani*, *A. cytisorum sarothamni*, *A. molluginis*, *A. profti*, *A. serpylli*. As for the group of species characteristic of the communities of plants growing on rock walls and ledges, there belong the following species: *Aphis lilago*, *A. mammulata*, *A stachydis*, *A. verticillatae*, *A. sedi*, *Myzaphis rosarum*, and *Nasonovia compositellae nigra*. Most species characteristic of these habitats are stenotopic species, in many cases ones which are extremely stenotopic. Xerothermic thickets and meadows, since they cover a comparatively extensive area in comparison with rock ecosystems, and are also characterized by larger diversity of plant species and aphid species, seem to be endangered with extinction to a much Małopolska degree. The main danger lies in the fact that they spontaneously overgrow or change into forests (Michalik, 2006; Medwecka-Kornaś, 2006). This is reflected by the appearance of characteristic aphid species, for example: *Laingia psammae* associated with *Calamagrostis epigejos*, and many dendrophilous species: *Glyphina betulae*, *Euceraphis betulae*, *Thelaxes dryophila*, *Aphis farinosa* and others.

The natural ecosystems which can be encountered on rock walls and ledges are much more likely to extinct, due to the fact that they cover small areas and are not very diversified as for their flora and aphidofauna. It is an unsettling fact that in these communes there has been frequently recorded the presence of polyphagous and eurytopic aphid species, such as: *Aphis fabae*, *Sitobion avenae* and *Macrosiphum rosae*, which can supplant, or are already supplanting, aphid species potentially associated with such host plants as: *Libanotis pyrenaica*, *Festuca pallens*, *Melica transsilvanica*, or *Valeriana tripteris*. Such a situation certainly proves that the habitats in question are becoming endangered. Since these habitats are very specific and cover small areas, all changes that take place within them are comparatively easy to notice. Xerothermic rock grasslands in the OPN require, apart from the passive protection, also some active protection consisting in reducing the tourist access and the shading of rocks.

Among the 530 plant species (belonging to 92 families) identified in the OPN, 282 species (belonging to 58 families) are host plants for 241 aphid species. In the light of this fact it becomes clear that not all plant species are aphid host plants. One of the reasons for this fact is that not all plant species are nutritionally advantageous for aphids. Furthermore, the distribution of particular plant species can also be an important factor, since some species are widely dispersed (e.g. *Carex* ssp., *Carlina acaulis*) or grow in isolated individual communes (e.g. *Genianella ciliata*, *Centaurea mollis*).

Almost 44% of aphid species identified in the area of the OPN feed solely on herbaceous plants, while the species that feed on trees and shrubs constitute slightly less than 39% of the whole (Fig. 12). Such a proportion is connected with evolutional

diversification of the park's habitats. On the one hand they include open habitats, such as meadows, xerothermic grasslands and rock ledges, and on the other forests and thickets, which cover a considerable area of the park.

The diversification of aphid species (241 identified species) is mostly conditioned by the diversity of host plant species in particular families. However, the proportion is distorted in families which include solely tree species (Pinaceae, Salicaceae, Betulaceae, Aceracae, Ulmaceae, Grossulariaceae, Fagaceae), or ones in which tree species prevail, as is the case with Rosaceae family (Fig. 16). It probably results from the fact that these plant families are phylogenetically older, which is connected with the fact that a longer period of time is required for a larger number of aphid species to select members of these families as their host plants. It is worth noting that older aphid species are associated with phylogenetically older plant species. For example, such aphid species as *Cinara*, *Adelges*, *Sacchiphantes* are associated with the Pinaceae family; *Lachnus*, *Stomaphis*, *Phyllaphis* are associated with the Fagaceae family; *Pterocomma*, *Plocamaphis*, *Chaitophorus* with the Salicaceae family; *Glyphina*, *Clethrobius*, *Symydobius*, *Calaphis* with the Betulaceae family; *Periphyllus* and *Drepanosiphum* with the Aceraceae family.

The most plant species have been identified in the following families: Asteraceae (67), Poacae (45), Fabaceae (37), Rosaceae (37) and Lamiaceae (31). As for the number of host plant species, it is consierably large only in such families as Asteraceae (47 plant species), Poaceae (34) and Rosaceae (22) (Fig. 16). The Asteraceae family includes host plants for 52 aphid species, i.e. more than any other plant family. Among aphid species associated with the Asteraceae family there prevail oligophags of second degree (19 species) followed by oligophags of first degree and monophags (each group represented by 12 species), while polyphags consitute a minority (9 species). There have been identified 23 aphid species associated with the Rosaceae family, including 13 oligophags of first degree, 6 monophags, 1 oligophag of second degree and 3 polyphags. As for the Poaceae family, which is represented by a comparatively large number of species in the OPN (i.e. 34), it provides host plants for merely 7 aphid species, including 2 polyphags and 5 oligophags of second degree. The situation is quite different in the case of such plant families as Pinaceae, Salicaceae, Betulaceae, Fagaceae or Aceraceae, where the number of identified aphid species considerably exceeds the number of host plant species (Fig. 16). These families provide host plants mainly for oligophags of first degree (e.g. *Chaitophorus truncatus*, *Euceraphis betulae*, *Thelaxes dryophila*, *Drepanosiphum platanoidis*) and monophags (e.g. *Phyllaphis fagi*, *Cinara brauni*, *Mindarus abietinus*, *Chaitophorus tremulae*). All plant species from the families: Pinceae, Betulaceae, Fagaceae and Aceraceae are aphid host plants.

Another issue considered in this study is the frequency of aphids on particular plant families. The highest frequency, amounting to nearly 21% concerns the Asteraceae family (Fig. 17). Much lower frequencies (between 4.8% and 7.69%) concern such families as: Pinaceae, Salicaceae, Poaceae, Rosaceae and Apiaceae (Fig. 17). The frequency above 3% is characteristic of aphid species associated with

the families Dipsacaceae, Betulaceae and Aceraceae, while the frequency above 2% is characteristic of the species associated with such families as Fagaceae, Lamiaceae, Fabaceae, Rhamnaceae and Corylaceae. The frequencies between 1% and 1.94% concern the following plant families: Rubiaceae, Caprifoliaceae, Polygonaceae, Brassicaceae, Campanulaceae, Coranceae, Onagraceae, Scrophulariaceae, Balsaminaceae, Crassulaceae and Cupressaceae. As for the remaining 33 plant families that have been examined, the frequency of aphid presence was lower than 1% (the number of records from 1 to 11). The lowest frequency of aphid presence is connected with such plant families as Amaranthaceae, Araliaceae, Berberidaceae, Cuscutaceae, Cyperaceae, Fumariaceae, Lythraceae, Malvaceae, Oleaceae, Typhaceae and Verbenaceae. In the case of these families only an individual record of the presence of just one aphid species has taken place.

The highest frequencies in the aphid sample collected in the OPN are those of the following species: *Aphis fabae fabae* (11.34%), *Sitobion avenae* (5.44%), and *Macrosiphum rosae* (5.13%) (Fig. 15). *Aphis fabae fabae* is a polyphagous species which feeds on 49 host plant species. Its presence has been recorded 146 times and thus it was classified as a common species. *Sitobion avenae* and *Macrosiphum rosae* are also polyphagous species, and have been classified as frequent ones, since their presence has been recorded 70 and 66 times respectively. The presence of 82 aphid species has been recorded only once in the area of the OPN, while a similar number of species, i.e. 98, have been classified as very rare (Fig. 14). In the case of these groups, which together constitute 74.7% of the whole sample, most species are oligophags of first degree. The large number of species characterized by narrow trophic spectrum in comparison to the number of polyphagous species confirms the fact that the aphidofauna of the OPN is very rich and diversified. However, not just the number of polyphagous species seems to be of primary importance, but how many times their presence has been recorded. It is a worrying fact that these species constituted 32.55% of the whole aphid sample collected in the area of the park, since the large number of polyphagous species, especially in synanthropic habitats, can be an indicator of changes taking place in the park's environment. In a well-balanced structure of natural ecosystems, polyphagous and eurytopic species are also present, but they constitute the so-called faunistic background. When the structure of ecosystems becomes imbalanced, the number of such species is rising. The polyphagous aphids can constitute the so-called reservoir of aphids for the crops and gardens in the OPN and its protection zone. These species can become pests from the point of view of human activity, but only if the ecological structure of the park's habitats becomes distorted. An adverse situation is also possible, when the crops are a reservoir of aphids, being dominated by the presence of polyphags and eurybionts in the absence of highly specialized stenotypic species. Such a situation can be one of the factors which affect the natural structure of ecosystems and cause their distortion or even destruction. In the case of the OPN this situation seems to be more probable, since the aphid species associated with anthropogenic habitats diffuse into neighboring natural or semi-natural habitats, supplanting the monophagous and

highly specialized species. A very good illustration of such a situation is provided by *Sitobion avenae*, a species previously associated with grain crops. In the area of the OPN its presence has been recorded on the representatives of the Poaceae family in all types of habitats, which means that it had supplanted other highly specialized aphid species associated with this plant family. This hypothesis is further supported by the fact that such aphid species as *Sipha*, *Atheroides*, *Metopolophium*, *Paracletus*, or *Atheroides*, potentially associated with various grass species, have not been found in the area of the OPN, even though they were carefully looked for. In the light of these facts, it seems to be a well justified conclusion, at least with reference to the OPN, that anthropogenic habitats are a reservoir of polyphagous aphid species, which can supplant the highly specialized species characteristic of natural habitats.
Contrary to other national parks, in the OPN there are present two types of anthropopressure. The first one, i.e. external anthropopressure, consists in the fact that eurybiontic and polyphagous species diffuse into the park area from the surrounding farming areas and villages via communication routes. The other one, i.e. internal anthropopressure, consists in diffusing into and restructuring of aphid taxocenoses in natural plant communities by aphid species migrating from gardens and other places where decorative plants are being grown. Discussing these conditionings acquires new importance if we consider the fact that the OPN constitutes an island-like area, which has no natural connection, via ecological corridors, with larger forest habitats, and is characterized by a set of specific geological features, as well as specific relief and climatic conditions. Mainly due to these conditionings the park can be threatened with mass appearance of aphids. Thus, in the area of the OPN there can take place the same phenomena which are observed on the islands, resulting from such factors as the founder effect, the increased probability of extinction of small populations, or lower resistance to temporary changes leading to more serious environmental consequences.

In order to acquire a fuller picture of the aphidophauna of the OPN, it is worth considering the associations of aphids with their host plants, but with reference to geographical and historical groups according to the modified classification proposed by Urbisz (2004). Definitely the largest number of aphid recordings (213 species) took place within the group of apophytes, i.e. native species, often occurring also in anthropogenic habitats. However, the aphid recordings on other groups of plants seem to be more important. As for the archeophytes, i.e. plant species which arrived in Poland before the 15th century, the presence of 26 aphid species has been recorded 43 times. The presence of aphids on epecophytes, growing in artificial habitats, has been recorded 14 times, and 11 aphid species have been identified. In the remaining groups of kenophytes, i.e. hemiagrophytes (growing in artificial and semi-natural habitats) and holoagriophytes (growing in artificial, semi-natural and natural habitats), the presence of aphids has been recorded 9 times. There have been identified four native aphid species: *Anoecia corni*, *Myzus ligustri*, *Aphis fabae fabae*, *Thelaxes dryophila*, and three foreign aphid species: *Uroleucon erigeronense*, *Impatientiunum asiaticum*, *Macrosiphum albifrons*. The aphid recordings on ergasiophygophytes (crop plants

going back to the wild) have also been rare, with mass occurrences of *Aphis pomi*, *Brachycaudus cardui*, *Phorodon humuli*, and *Cianra brauni*. As many as 15 aphid species are associated only with crop plants. In the process of material collection there have been 23 aphid recordings on crop plants, mainly of polyphagous species, such as *Aphis fabae fabae* or *Sitobion avenae*. As for natyphytes (non-synanthropic species that prefer natural and semi-natural habitats) there have been 28 aphid recordings. It is a worrying fact that among 19 aphid species whose presence has been recorded on plants from this group, eurytopic species are comparatively frequent, being represented by such species as *Aphis fabae fabae*, *Acyrthosiphon malvae*, *Aulacorthum solani*, *Macrosiphum gei*, *Cryptomyzus galeopsidis* and *Sitobion avenae*. The above facts seem to confirm the belief that there exists a reservoir of polyphagous aphid species within the boundaries of anthropogenic communities.

The chorological analysis has shown a slight prevalence of holarctic elements (65 species) over geopolitical ones (55) (Fig. 13). It is mainly due to the fact that, contrary to other groups of Sternorrhyncha (Bink-Moenen & Mount, 1990; Klimaszewski, 1975), aphids live mostly in the temperate zone of the northern hemisphere (Węgierek & Wojciechowski, 2004). The significant representation of European species in the fauna of the OPN (51 such species have been identified; Fig. 13) can reflect the natural character of at least some habitats, the presence of host plants only in limited areas, as well as the very specific habitat and trophic requirements of aphids. Examples can be found both among species characteristic of dry and warm habitats (xph2), such as *Aphis clinopodii*, *A. coronillae*, *A. genistae*, *A. mammulata*, *Uroleucon obscurum*, *Lipaphis rossi*, and also among species characteristic of moist habitats (hg2), such as *Macrosiphum sileneum*, *Aphis janischi*, *Drepanosiphum acerinum*. The species belonging to the latter group, i.e. ones associated with moist habitats (hg2) are less numerous. It is due to the fact that such habitats are disappearing (Michalik, 2006), which suggests the influence of human activity on the changes taking place in the habitats of the OPN.

Among the elements characterized by narrower geographical distribution there can be distinguished the west palearctic steppe-like element (represented by 36 species), which may reflect the genetic processes of populating the area of the OPN by aphids. A similar phenomenon may concern two palearctic species that have been recorded in the OPN, namely *Eriosoma ulmi* and *Pterocomma pilosum konoi*. As for the amphipalearctic species *Cavariella salicicola*, it seems to have arrived in Poland with decorative willow cultivars. The remaining two amphipalearctic species are *Impatientinum balsamines* and *Acyrthosiphon chelidonii*. The distribution of the first of these species is probably connected with the distribution of its host plant, *Impatiens noli-tangere* (Dostál, 1989). The distribution of the other species, namely *Acyrthosiphon chelidonii*, in the absence of actual data, is also speculatively identified on the basis of distribution of its host plant *Chelidonium majus* (Dostál, 1989; Rothmaler, 2005).

A significant share of the widely dispersed geopolitical and holarctic elements (Fig. 13) is connected with the high dynamics of aphid distribution, as well as the

introduction of aphids to new areas which they permanently populate. In the area of the OPN such species include *Uroleucon erigeronense*, *Myzus persice*, and *Macrosipum albifrons*, which is a new species in Poland.

The analysis of similarities in aphid species composition in various types of habitats and communities of the OPN has clearly shown the presence of three concentrations which illustrate the taxonomic diversity and habitat connections of aphid species identified in the OPN. The first of them encompasses xerothermic and ruderal communities, as well as the rock ledge communities (Fig. 19). Xerothermic and ruderal habitats of the OPN are frequently similar with respect to flora. Many aphid species with specific demands concerning the habitat can be encountered both in xerothermic habitats and in rock ledge habitats. Also meadow and pasture habitats, as well as tall herb habitats in the OPN show clear floristic similarities, which is reflected by the species composition of aphids that populate these habitats. The rush and segetal habitats, whose aphidophauna is similar to the above mentioned ones, are characterized by the presence of polyphagous aphid species, not very specific as for their habitat requirements (Fig. 19). As for the clearly separate group of forest habitats (Fig. 19), it is characterized by the presence of sylvicolous aphids, and at the same time monophags or oligophags of first degree.

The analysis of differences in aphid species composition with reference to individual host plant families (Fig. 18) shows that there can be differentiated concentrations of families between which there alternate the aphids which prefer host alternation: Elaeagnaceae and Polygonaceae, Poaceae and Cornaceae, Salicaceae and Apiaceae, Grossulariaceae and Onagraceae. Apart from these, the remaining associations seem to be strongly dependent on the fact that only a small number of aphid species select certain plant families as their hosts, as well as on the limited representation of these families in the flora of both the OPN and Poland.

Aphids can be an indicator species, useful for the evaluation of the state and changes of the environment. Considerble usefulness of aphids for such studies results from species richness, close associations with host plants, diversified habitat requirements, and the availability of extensive knowledge concerning the bionomy and ecological requirements of aphids.

THE GENESIS OF APHIDOFAUNA IN THE OPN AGAINST THE BACKGROUND OF KRAKÓW-CZĘSTOCHOWA UPLAND

The present composition of Polish fauna began to take shape about 20000 years ago, i.e. originated in the period of maximum extent of the last glaciation (Pawłowski, 1999). The considerably detailed information on the changes that have been taking place in land fauna is based on paleonthological, chorological and ecological data. However, information that can be retrieved from fossil material concerns only some groups of animals, especially vertebrates, e.g. reptiles and amphibians (Młynarski & Szyndlar, 1989), birds (Bocheński, 1989), or mammals, which have been studied

most extensively (Rzebik-Kowalska, 1989; Wołoszyn, 1989; Nadachowski, 1989; Wolsan, 1989). As far as the invertebrates are concerned, the studies of fauna that has lived since the period of Late Vistulian up to the presence are focused on snails (Stworzewicz, 1989), and as for insects, only some data on beetles is available (Pawłowski, 1989; Mazur, 2001).

An attempt at the reconstruction of aphidofauna was made by Achremowicz (1975), but his study focused on the Great Poland-Kujawy Lowland (Nizina Wielkopolsko-Kujawska), which differs from the Ojców National Park with respect to geology, geomorphology and geobotany.

The changes of plant cover in the OPN are the appropriate starting point for a discussion about the genesis of aphidofauna in the park. Reconstruction of these changes is possible due to close association of aphids with their host plants, since the number of polyphags among aphids is rather small. On the basis of paleobotanical data concerning plant composition an attempt can be made at describing the process of aphidofauna development. The knowledge about the original character of aphidofauna can be useful in specifying the changes it has undergone as a result of human activity.

During the last glacial period (North Polish Glaciation, Vistulian Glaciation, Würm Glaciation), the area of the OPN was situated in the arctic zone, characterized by cold and dry climate. The area was covered by arctic mountain tundra vegetation, which encompassed shrubby willows and birches (*Salix retusa* and *Betula nana*), mountain avens (*Dryas octopetala*), Sudeten thyme (*Thymus sudetica*), fairies thimble (*Campanula pusilla*), and others. Since this period in which no forest existed in the area in question, there have survived in the Kraków-Wieluń Upland some relic heliophilous plant species, for instance the three-leaved valerian (*Valeriana tripteris*) which grows on rocks in the OPN. During the warmer periods (interstadials) coniferous and deciduous trees appeared several times in the Ojców area, and in the colder periods (stadials) they receded. The traces of such forest communities have survived in the silt-covered caves of Ojców as carbides of Swiss pine (*Pinus cembra*) and Polish larch (*Larix polonica*) (Szafer, 1956; Michalik, 1977; Mojski, 1993).

During the whole Late Vistulian period for the area of the Kraków-Częstochowa Upland there was characteristic the continuous presence of sylvicolous fauna. This fact justifies referring to the area in question as to a local refugium of sylvicolous fauna (Pawłowski, 1999), while in the area of the present OPN the plant cover looked slightly different.

After the glacial retreat (about 11500 years ago) took place the recuperation of flora, initially in the shape of shrubby steppe-tundra dominated by birches, then in the shape of willow thickets, which began to develop into sparse trees and parkland in which there prevailed birches, with admixture of hazels, aspens and willows. The last preparatory stage for the development of forest cover in Holocene was the development of birch-pine forests. They constituted open tree stands with admixture of aspens, rowans and willows in the scrub layer. On the uplands of southern Poland such tree stands consisted of irregular patches which encompassed pines, birches

and larches as well as patches of steppe vegetation and juniper and sea-buckthorn thickets. The plant succession was taking place from the south towards the north, since in the south there were situated important refuge areas for floristic elements. An important role in the recuperation of plant cover was played by inland dunes, where the first herbaceous plants could grow (Ralska-Jasiewiczowa, 1999; Kozarski & Nowaczyk, 1999).

In the post-glacial development of plant cover the diffusion of plants from the south and south east was an important factor. Vast, forestless areas facilitated the migration of steppe plants, as also did the dry, even if cold, continental climate. Among the first plants which spread over Central Europe there were ones which were not susceptible to draught and low temperatures and belonged to the genera *Stipa*, *Poa*, *Festuca*, *Artemisia*, *Album*, *Chenopodium*, *Helianthemum,* and *Hippophaë*. From the Podole refugium, through the Lublin Upland (Wyżyna Lubelska) and Małopolska Upland (Wyżyna Małopolska), over the limestone hills there arrived, among others, such plant species as *Cerasus fruticosa* and *Peucedanum cervaria*. Some plant species, for instance *Melica transsilvanica* and *Stipa Joannie*, arrived straight from the south migrating across the Beskidy Mountains from Spisz through antecedent valleys of the Danube and Poprad rivers. Through the important migration route traversing the Moravian Gate, from the areas situated on the south and south west from the Carpathians and the Sudety Mountains, there arrived, among other species, *Verbascum chaixii* subsp. *austriacum* (Pawłowska, 1977; Środoń, 1977; Madeyska, 1998).

Towards the end of the Pleistocene the first forests began to grow on the Kraków-Wieluń Upland. Having analysed the deposits of fossil flora it can now be stated that these forests consisted of Swiss stone pines (*Pinus cembra*), Polish larches (*Larix polonica*), junipers (*Juniperus*), birches (*Betula pubescens*, *B. carpatica*, *B.* x *oycoviensis*), pines (*Pinus sylvestris*) and many boreal shrub species. It is claimed that nowadays, on the relic stands scattered over inaccessible rocks, there still grow *Pinus sylvestris* and *Larix polonica* (Szafer, 1977; Michalik, 1977; Madeyska, 1998).

The migration of plants was accompanied by migration of fauna. At the beginning of the Holocene, the species associated with popular trees of the time, i.e. birches, willows, pines, larches and junipers could migrate together with their hosts. Probably less common were aphid species associated with riparian forests situated along rivers and consisting mainly of willows and poplars. The oldest aphidofauna complex on the area of the Kraków-Częstochowa Upland and the OPN consists of species that belong to older families, such as *Adelgidae*, *Drepanosiphidae*, *Lachnidae*, while from the evolutionally youngest *Aphididae* family in the area in question only the representatives of the subfamily *Pterocommatinae* can be encountered. They are associated almost solely with the Salicaceae. All these aphid species are either monophags or oligophags of first degree.

The first elements of the aphidofauna in the contemporary OPN area could be associated with birches: *Symydobius oblongus*, *Euceraphis betulae*, *Glyphina*

betulae, *Callipterinella caliptera*, *C. tuberculata*, *Callaphis betulicola*, *C. flava*, *Betulaphis quadrituberculata*, *Monaphis antennata*; and willows: *Chaitophorus capreae*, *Ch. truncatus*, *Ch. hypogaeus*, *Pterocomma konoi*, *P. jacksoni*, *P. pilosum*, *P. salicis*, *Plocamaphis brachysiphon*. The Pontic species *Chaitophorus mordvilkoi*, as well as Pontic-Siberian species: *Ch. salicti* and *Ch. vitellinae* arrived much later, when the climate became significantly warmer.

Analogically, among aphid species feeding on coniferous trees there arrived *Pineus pini* (*Adelgidae* family) associated with pines, and many species from the *Lachnidae* family: *Cinara nuda*, *C. pinea*, *C. pinihabitans*, *C. pini*, *Schizolachnus pineti*. The only species feeding on junipers was *Cinara juniperi*, while there arrived two aphid species feeding on larches, namely *Cinara laricis* and *C. cuneomaculata*. Other aphid species, *Adelges laricis* and *Sacchiphantes viridis*, belonging to *Adelgidae* family, also associated with larches, might arrive not earlier than their primary host, i.e. spruce, arrived in the area. Aspens were probably host plants of *Chaitophorus tremulae*, while other poplars hosted solely *Ch. populeti*, since the aphids associated with poplars preferred host alternation and thus required the presence of secondary hosts. For *Thecabius affinis* it was the genus *Rannunculus*, and for *Pemphigus borealis* it was the genus *Bidens*.

Among aphids associated with herbaceous plants the oldest taxons which could arrive in the area in question are the ones which can be encountered on sedges, usually growing in swampy areas, e.g. *Subsaltusaphis intermedia*. In dry areas aphids, e.g. *Forda marginata*, feed on the roots of meadow grass, bent grass and dwarf mountain pines. As for the inland dunes, where marram grass and clubawn grass prevail, the oldest aphid species is *Laingia psammae*. The plants belonging to the genera *Artemisia* and *Chenopodium* constituted one of the erliest occurring elements of the plant cover which was recuperating at that time. Among the aphid species associated with the native motherwort species (e.g. *Artemisia vulgaris*) there are *Coloradoa artemisiae*, *Macrosiphoniella artemisiae* and *M. oblonga*, while the species associated with goosefoot and other representatives of the *Chenopodiaceae* include *Hayhurstia artiplicis*.

Elm was the first representative of mixed deciduous forests which appeared in the preboreal period of Early Holocene (ca. 10000 BP). It migrated from the south east, along the Carpathians range, and also through lower passes (Ralska-Jasiewiczowa, 1999). Together with elms there could arrive aphid species belonging to the *Pemphigidae* family, such as *Tetraneura ulmi*, which then changed its host to feed on grass roots. Another aphid species, *Eriosoma ulmi*, could arrive only following the arrival of its secondary host, the *Ribes* genus. Among single host plant aphids feeding on elms there are also such species as *Tinocallis platani* and *T. saltans*, but they require a rather warm climate and their arrival must have taken place much later. Towards the end of the preboreal period along the rivers there began to grow riparian forests with alders, ash trees and the admixture of hazels (Podbielkowski, 1995). At that time the conditions could also be favourable for such aphid species as *Pterocallis alni*, associated with alders, and *Clethrobius comes*,

associated with alders and birches. The stenothermal species, such as *Pterocallis albida* and *Glyphina jacutensis*, had to arrive later. As for the *Prociphilus bumeliae*, associated with the freshly arrived ash trees, there still was no secondary host yet, i.e. fir trees. Hazel trees became hosts of *Myzocallis coryli*, and later also of *Corylobium avellanae*, which arrived from the Mediterranean area.

The boreal period (9300–8400 BP) was characterized by further temperature and humidity raising, which was conducive to the spreading of steppe vegetation followed by stenothermal tree species, such as lime trees, pedunculate oaks, cherry trees, maples and also ivies. Main migration routes of trees led from the south east, along the range of Carpathian Mountains and through passes, as well as from the south west through the Moravian Gate. The developing mixed deciduous forest partly reduced the xerothermic grass vegetation, but at the same time contributed to the spreading of many stenothermic forest species, for example *Arum maculatum*, *Omphalodes scorpioides* or *Hacquetia epipactis*, which are still present nowadays in relic stands in the Jura. At that time there also began the slow expansion of the spruce (Michalik, 1977; Szafer, 1977; Podbielkowski, 1995; Ralska-Jasiewiczowa, 1999).

Together with limes and oaks there arrived new aphid species: *Eucallipterus tiliae* (the monophag feeding on limes), as well as *Thelaxes dryophila* and *Tuberculatus annulatus*, associated with oaks. Other stenothermic aphid species associated with oaks, namely the genus *Phylloxera*, *Tuberculatus querceus*, *Lachnus roboris*, *L. longirostris* and the Mediterranean *Stomaphis quercus* probably arrived later, in the Atlantic period. In the Atlantic period there also probably arrived *Aphis hederae* associated with *Hedera helix*.

In this period (8400–5100 BP) there took place the optimum development of plant cover. In the forests prevailed deciduous trees with large share of the oak, lime and ash trees, but the share of maple, elm and hazel trees also increased. The attitude of man towards the natural environment was also undergoing gradual changes. At the beginning of the Atlantic period in the area of the Kraków-Wieluń Upland there were living Mesolithic peoples who led the nomadic life of hunter-gatherers. Together with the appearance of Neolithic peoples, who raised crops and animals for food, the man gradually began to adjust the natural environment to his needs. The beginnings of such changes took place ca. 6500 BP, when the early Neolithic peoples wandered from the catchment area of the middle region of Danube, mainly through the Moravian Gate, and settled down in the uplands of the southern Poland (Podbielkowski 1995; Ralska-Jasiewiczowa, 1999).

As for the aphids associated with maples, the first to appear were the comparatively stenothermal species characteristic of the shady deciduous forest, including *Drepanosiphum aceris*, *D. platanoides*, *D. acerinum*, *Periphyllus aceris*, *P. lyropictus*, *P. acericola*, *P. testudinaceus*, and later on also the more stenothermal species *Periphyllus coracinus*.

The following significant changes in the structure of flora were caused by the cooling and moistening of the climate. The changes took place in the Subboreal (5100–

2800 BP) and Subatlantic period (5100–2800 BP). From the south east there arrived the hornbeam, together with just a single aphid species: *Myzocallis carpini*. At the next stage there took place the closing of forests, stenothermal and light-demanding vegetation was forced to very sunny rock walls, and their habitats were taken over by shade-seeking plants. Especially the considerable cooling and moistening of climate, which took place towards the end of the Subboreal period (ca. 2800 BP) resulted in the appearance of some Carpathian plants in the area which presently belongs to the OPN: *Fagus sylvatica*, *Abies alba* and *Picea abie*, accompanied by *Aconitum moldavicum*, *Dentaria glandulosa*, *Lunaria rediviva*, and *Galium rotundifolium*. The plant species listed here to this day play an important role in this area (Michalik, 1977; Szafer, 1977; Ralska-Jasiewiczowa, 1999). One of the aphid species which could then arrive in the area in question is *Delphiniobium junackianum*, associated with the genus *Aconitum*, of Euro-western Siberia mountain origin. Together with beeches there arrived in the Prądnik Valley the Subatlantic aphid species *Phyllaphis fagi* and *Lachnus pallipes*, while together with firs there arrived *Mindarus abietinus*, *Cinara confinis* and *C. pectinatae*. Both beeches and firs arrived from the south west (Podbielkowski, 1995).

Presently in the area of the OPN there can be encountered 6 aphid species associated with the spruce. They include the representatives of the *Adelgidae* family: *Scchiphantes abietis* (single host plant species), as well as *Sacchiphantes viridis* and *Adelges laricis*, which alternate hosts and select the larch as their secondary host. They also include the representatives of *Lachnidae* family: *Cinara costata*, *C. pilicornis*, *C. piceicola*. These 6 aphid species arrived together with the fir from the south east (Podbielkowski, 1995).

The above mentioned aphid species from the area of the OPN, associated mainly with forest and steppe habitats, seem to provide the original picture of the park's aphidofauna and are concentrated mostly in the philogenetically oldest aphid families.

The latest early-history and history period remained under the growing influence of man and his expanding activity, resulting in yet another rebuilding of the plant cover in the area of the Kraków-Wieluń Upland. Gradually, it has arrived at its present state.

The first traces of human presence found in the cave Jaskinia Ciemna come from the Paleolithe, and were left towards the close of Middle Polish Glaciation (120,000–115,000 BC). Their presence seems to suggest that in the area of the park at that time dwelt a group of animal hunters. After the glacial retreat, in Mesolith (8000–4800 BC) in the area of the Kraków-Wieluń Upland there already existed larger human settlements, but they belonged to nomadic peoples, hunter-gatherers who lived in harmony with the natural forest biocenosis. The conflict between man and nature originated in Neolith (4800–1700 BC), when the agricultural peoples, representing the shepherd-farmer culture, came from the south and began to spread dynamically over the area in question (Michalik, 1974b; Partyka, 2006). The first traces of intense human activity in the Ojców Upland come from the Roman period

which followed the Neolith. In the open meadow habitats, which freshly came into being due to deforestation, there could be encountered, apart from grain species (*Secale* and *Triticum*), also other plants which indicated cultivation (*Fagopyrum*, *Centaurea cyanus*), as well as *Asteraceae*, *Ranunculaceae*, *Rumex acetosa*, *Plantago lanceolata* and *P. major*. The settlements of the more developed Neolithic peoples which followed were connected with field and garden cultivation, and cattle was grazing on artificially created pastures. In the deforested areas there could develop *Prunetalia spinosae* thicket communities, and the original plant cover of deciduous forests could in some places change into stenothermal thicket communities with xerothermic grass sites, nowadays considered as typical natural flora of the area (Ralska-Jasiewiczowa, 1999; Dobrzańska, 2006).

Resulting from the human activity in the area in question, its aphidofauna has also been subject to changes. If we take into account the anthropogenic landscape changes, such as the extension of open areas with the simultaneous forest reduction, it has to be acknowledged that a number of new environments are man-induced, and some of them feature foreign plant species. Some aphid species probably arrived in the area of the park together with their host plants, either consciously cultivated, or incidentally spread by man. These aphid species usually concentrate in the farmland, in gardens and orchards, or other ruderal habitats, but some of them also diffuse into the more or less natural communities.

Serious changes in the aphidofauna of the OPN had to be caused by the introduction of many fruit trees and shrubs, which certainly affected the aphid species associated with *Malus domestica*. Some of the orchard apple varieties grown nowadays are the hybrid of species from the south-eastern Europe and south-western Asia, especially from the Caucasus. The case is similar with the *Pyrus communis*, which came into being after many centuries of hybridization with cultivars that were introduced in the area by the agricultural peoples (Seneta & Dolatowski, 1997). For this reason, the Iran-Turan aphid species: *Dysaphis pyri*, *Dysaphis plantaginea* ought to be considered as new to the area in question (Janiszewska-Cichocka, 1970, 1971).

Furthermore, another result of introducing the cultivation of tress that belong to the *Rosaceae* family is probably the increase in number of aphids which had previously fed on native hawthorns and mountain-ashes, such as the *Aphis pomi* (known as the apple aphid). The case is similar with *Prunus domestica*, the species whose initial forms frequently developed in south-western Asia and Caucasus (Seneta & Dolatowski, 1997). When this species arrived in the area of the park, it was followed by the foreign aphid species *Myzus lythri*. The cultivated plum hybrids turned out to be attractive hosts for aphids that had been feeding on the native plants *Prunus spinosa – Hyalopterus pruni*, *Brachycaudus cardui*, *B. helichrysi* or *Phorodon humuli*, and thus they became pests (Janiszewska-Cichocka, 1966). The popularity of cultivars from the *Grossulariaceae* family contributed to the extensive spread of aphids belonging to such genera as *Hyperomyzus*, *Nasonovia* or the East Mediterranean *Cryptomyzus*. For these aphids secondary hosts are usually plants from ruderal habitats (Janiszewksa-Cichocka, 1965). Furthermore, together with

Juglans regia there arrived *Panaphis juglandis* and *Chromaphis juglandicola*, i.e. Subpontian elements.

The human influence on the Prądnik Valley flora has practically been limited to the destruction of forest habitats. However, since the 14th century the forests in the valley were royal property, which until the 19th century to some extent protected them from strong exploitation. During the following 150 years the natural forests were almost completely destroyed. This period was characterized by the receding of the shade-seeking and hygrophilous flora and the expansion of xerothermic and photophilous species. During the last 50 years, i.e. since the establishment of the OPN, the exactly opposite trends have been present (Michalik, 1974a, 2006).

The change of forest habitats into medows and pastures has resulted in the fact that some aphid species prefer these new habitats to the old ones. Since the majority of meadows have developed from riparian forests and are situated in the Prądnik and Sąspówka valleys, they mostly host aphid species associated with willows. An example of aphid species that alternate between willows and plants that belong to the family *Apiaceae* is the genus *Cavariella – Cavariella aegopodi*, *C. archangelicae*, *C. konoi*, *C. pastinaceae*, *C. salicicola*, *C. theobaldi*. Meadows constituted the primary habitat also for the aphid species feeding on plants from the *Fabaceae* family: *Aphis craccivora*, *Acyrthosiphon pisum*, *Terioaphis trifolii trifolii*. Presently in such meadows there is most frequently encountered the polyphagous species *Sitobion avena*, originally associated with grain cultivars.

As a result from the deforestation of a considerably large areas of the OPN, especially as far as valley sides and the hilltop are concerned, the man has indirectly contributed to the expansion of xerophilous, thermophilous and heliophilous plants and the development of new habitats, such as dry grasslands or xerothermic thickets (Michalik, 1974a). These new environments have provided excellent living conditions for some draught resistant aphid species, e.g. *Aphis chloris*, *A. verbasci*, *A. verticillatae*, *A. confusa*, *Myzus ligustri*, *Nasonovia compositellae nigra*, *Uroleucon simile*, *U. jaceae*. It is worth noting that the aphidofauna of such habitats significantly exceeds the aphidofauna of other habitats with reference to species richness. With the genus *Hieracium* there are associated such aphid species as *Aphis hieracii*, *A. pilosellae*, *Nasonovia pilosellae*, *Uroleucon obscurum*. With the genus *Campanula* there are associated *Uroleucon campanulae* and *U. nigrocampanulae*. The species of Mediterranean origin include: *Aphis origani* feeding on *Origanum vulgare*, *A. euphorbiae* feeding on *Euphorbia ssp.*, *A. genistae* feeding on *Genista tinctoria*, or *A. serpylli*, associated with the genus *Thymus*. In this group especially numerous are the aphid species associated with the *Asteraceae* and *Rosaceae* families. However, a number of host plant species, as well as aphids associated with xerothermic grasslands and thickets, can also be encountered in ruderal habitats. Those ruderal communities which are xenospontaneous are characterized by the richest diversity of aphid species. The expansion of synanthropic species in the OPN in most cases has been a direct result of human activity. They have been introduced either incidentally, or intentionally both into natural habitats and farmlands. Going back to the wild they

became permanent ingredients of the park's flora (Michalik, 1974a). Together with such plants there appeared many new aphid species. Such a situation may be true in the case of *Artemisia absithium*, a host plant for the aphid species *Macrosiphoniella absinthi*, as well as *Sinapis arvensis*, which hosts *Brevicoryne brassicae*, *Lamium purpureum*, which hosts *Aphis lamiorum*, or *Sonchus oleraceus* and *S. asper* which host such aphid species as *Hyperomyzus pallidus*, *H. lactucae* and *Uroleucon sonchi*. Other plants characteristic of the habitats in question provided an opportunity for expanasion for such species as *Aphis fabae* or *Brachycaudus cardui*. Among the synanthropic plants that have been brought to the OPN during the last 200 years and became permanent ingredients of the flora there can be counted the following kenophytes: *Chamomilla suaveolens*, *Conyza canadensis*, *Erigeron annuus*, *Impatiens parviflora*, *I. glandulifera*, *Juncus tennuis*, *Medicago sativa*, *Lupinus polyphyllus*, *Lolium multiflorum*, *Robinia pseudoacacia*, *Sedum spurium*, *Rosa rugosa*, *Galinsoga ciliata*, *Veronica persica*, *Solidago gigantea* and *Reynoutria japonica* (Michalik, 1974b, 2006; Zając *et al.*, 1998). Foreign aphid species associated with synanthropic plants are: *Uroleucon erigeronense* – a North American species, associated with *Conyza canadensis*, which arrived in Poland from the west in the second half of the 20th century, and *Impatientinum asiaticum* – a Centroasiatic species associated with *Impatiens parviflora*, which arrived from the east. *Macrosiphum albifrons*, also present in the park, is an aphid species associated with the North American *Lupinus polyphyllus*. Another foreign aphid species in the OPN is *Cinara brauni*, originally from the Mediterranean, which feeds on *Pinus nigra*.

Several native aphid species are associated with foreign plant species. For instance, the presence of *Acyrthosiphon pisum* has been recorded on the Centroasiatic species *Medicago lupulina*, the presence of *Brachycaudus lateralis* has been recorded on the North American species *Galinsoga ciliata*, and the presence of *Aphis fabae fabae* has been recorded on the East Asian species *Reynoutria Japonia*.

Human activity in the area of the park results in mass appearance of aphids, which can be observed in monocultural grain habitats (*Sitobion avenae*), as well as young copses of spruce (the genus *Sacchiphantes*) and sycamore (the genus *Periphyllus*). It can be concluded that some aphid species owe their presence in the area of the OPN to human activity.

In summary, the contemporary aphidofauna of the OPN is of typically Holocene origin. It does not include pre-glacial elements, even though in other groups of fauna, e.g. cockchafers (Pawłowski *et al.*, 1994), springtails (Szeptycki & Warchałowska-Śliwa, 1992), myriapodans (Rafalski, 1990) and snails (Falniowski & Steffek, 1989) there can be encountered some Pliocene and Early Pleistocene relics. The presence of only one aphid species, namely *Aphis fabae fabae*, has been recorded on *Valeriana tripteris*, the presently oldest representative of relic flora in the OPN, originating from the last (Vistulian) glaciation. This aphid species is evolutionally young, polyphagous and geopolitical.

Another issue worth investigating is the reconstruction of possible migration routes of aphidofauna elements that arrived in the area of the park. There have been

found no fossil deposits of aphids from the area in question, although such deposits of cockchafers, scarce as they are, do exist (Pawłowski, 1989; Pawłowski *et al.*, 1994; Mazur, 2001). Thus, while analyzing the problem with reference to aphids, one has to rely on data concerning the history of host plants. The flora of vascular plants in the OPN has a diversified geographical character, resulting from the complicated history of its development. During the postglacial history of plant migration into the area of Ojców there arrived plant species that belonged to various migration waves, representing different geographical elements (Michalik, 1978). Analyzing a number of botanical studies (Pawłowska, 1977; Środoń, 1977; Ralska-Jasiewiczowa, 1999; Babczyńska-Sendek, 2005), as well as some studies on the migration routes of cockchafers (Pawłowski *et al.*, 1994; Mazur, 2001), it can be concluded that in the shaping of the OPN aphidofauna the most important role was played by:

– from the south: Moravian route (the Moravian Gate), which leads from the Hungarian Lowland through the Moravia, into the Silesian Upland (Wyżyna Śląska) and Małopolska Upland (Wyżyna Małopolska); Pannonian-Transcarpathian route – the Carpathian depression between the Tatra Mountains and the Bieszczady Mountains;
– from the east: Podolian route (Podolian-Volynian route), which leads from the steppe areas of Podole and Bessarabia, through the Lublin Upland (Wyżyna Lubelska) and Małopolska Upland. Another route, but not as important as the already mentioned ones is
– from the south-east: Scepusian route, which leads from Spisz through the valleys of Danube and Poprad.

Taking into account the scarcity of available information about the origin of some aphid species, as well as the incomplete data on the aphid distribution worldwide, it can only be hypothesized about the actual migration directions of particular aphid species.

In the model of routes and directions of aphid migration into the OPN proposed in this study the original character of aphidofauna was taken into account, without accounting for the considerable role played by human activity in the area.

The earliest expansion of aphids into the area of the OPN encompassed the species characterized by wide distribution: subboreal – *Chaitophorus capreae*, *Ch. hypogaeus*, *Ch. populeti*, *Ch. tremulae*, *Ch. truncatus*, *Plcamaphis floccuosa brachysiphon*, *Pterocomma pilosum*, *Aphis forbesi*; boreal – *Cinara confinis* and *C. costata*; boreal euroasiatic – *Calaphis betulicola*, *C. flava*, *Aphis sedi*. Then there followed warmer and moister periods, which facilitated the diffusion of stenothermal and steppe aphid species into the OPN. From the south, through the Moravian Gate, there could arrive the subatlantic elements – *Phyllaphis fagi*, *Lachnus pallipes* and *Aphis hederae*; as well as the Mediterranean ones – *Aphis cytisorum sarothamni*, *A. euphorbiae*, *A. genistae*, *A. origani*, *A. serpylli*, *Corylobium avellanae*, *Myzus ligustri*, *Stomaphis quercus*, *Cinara brauni*, and also *Adelges laricis*, which originally populated the mountain regions of Southern Europe. From the south there arrived the Carpathian elements – *Clethrobius comes* and *Hyperomyzus pallidus*,

as well as the Euro-West Siberian, mountain species *Delphiniobium janackianum*. Form the east, through the Volynian-Podolian route, there could arrive the following elements: South Siberian – *Cinara juniperi*, Pont Siberian – *Chaitophorus salicti*, *Ch, vitellinae* i *Periphyllus lyropictus*, and the West Palearctic steppe species *Aphis viburni*. The Caspian elements – *Drepanosiphum acerinum*, *D. platanoidis*, *Laingia psammae* and *Trama troglotydes* could arrive through the Podolian route or through the Carpathian depression. Through the Carpathian depression, and also through the Scepusian route, there could arrive the East Mediterranean elements – *Cryptomyzus alboapicalis*, *C. galeopsidis*, *C. ribis*, as well as the Iranian-Anatolian species *Aphis verbenae*. The remaining elements, such as: the Subpontian element – *Chromaphis juglandicola*, *Panaphis juglandis*, *Aphis stachydis*, *Hyalopterus pruni*; the Pontian element – *Chaitophorus mordvilkoi*, *Macrosiphoniella absinthii*, *Myzus persicae* and the Iranian-Turanian element – *Brachycaudus helichrysi*, *B. cardui*, *B. prunicola*, *Dysaphis plantaginea* and *D pyri* probably arrived either through the Carpathian depression or through the Scepusian route; the Volynian-Podolian route is also possible. There is no doubt about the fact that the Nearctic species *Pemphigus borealis* and *Uroleucon erigeronense*, Centralasiatic species *Impatientinum asiaticum* and Far East species *Chaitophorus salijaponicus niger* constitute elements which arrived together with their host plants (Szelegiewicz, 1978c).

Natural migration routes of aphids, similarly as it is in the case of plants, are usually river valleys (in the case of Ojców these are the Prądnik and Sąspówka valleys). In such valleys there can be encountered a variety of habitats – from the moistest ones next to the river bed to the driest ones on the valley sides and terraces. Such habitats are crowded into a limited area, and they are usually oriented crosswise to the river, but they can also be oriented lengthwise, along the river banks. Thus, river valleys constitute excellent migration routes not only for various plants (especially xerothermic ones). These natural migration routes are often crossed by artificial, i.e. man-made routes (e.g. communication routes, fields). In the case of the OPN we have to do with anthropogenic migrations, which are more frequent and faster in comparison with natural ones, but in this particular case they are being thwarted by the insular character of the park itself. The park is surrounded by farmland, motor roads and buildings, and thus it is deprived of a natural connection with any larger forest complex via ecological corridors. Human activity facilitated and accelerated the migration of species associated with deforested areas. The initial stage of deforestation resulted in the widening of open river banks (primary communication routes). It is suggested that the Moravian Gate was the first to undergo such a process, since it was the route of primary importance in connection with the xerothermic fauna of the OPN since the closing of the Vistulian period till the end of the 20th century (Pawłowski *et al.*, 1994). The Podolian route probably became important from the point of view of the OPN only after the clearance of latitudinal routes connecting the upper Vistula with the lower Dniestr (late Holocene), while the Transcarpathian routes probably gained importance in the 17th century, when human settlements in the Carpathian Foothills expanded into the upper mountain zone and deforested

communication routes came into being (Pawłowski *et al.*, 1994).

Due to the fact that the information on distribution and origin of aphids in the OPN is scarce, and no earlier studies of the problem had been conducted, the only way to illustrate the local migration routes of aphids into the area of the OPN is by reference to the hypotheses formulated by koleopterologists (Pawłowski *et al.*, 1994). An attempt at the reconstruction of migration routes of the aphid species that can be presently encountered in the Ojców area leads to the differentiation of five major routes (Fig. 2):

– from the west: the western hilltop route and the northwestern valley route (from the direction of the Silesian Upland, excluding Kraków and the Garb Tenczyński) – for the Moravian route;
– from the south-west: the southwestern valley route (through Kraków, the Rudawa Valley and the Kluczwoda Valley) – for the Moravian route;
– from the east: the eastern hilltop route and the northern valley route (through the Ponidzie area and the Miechowska Upland) – for the Podolian route and possibly also the Scepusian route, but rather from the southern direction;
– from the south-east: the southeastern and southern valley routes (from Kraków through the Dłubnia Valley and Prądnik Valley – for the Transcarpathian route and the Scepusian route;
– from the north: the northwestern and northern valley routes (from the direction of the Częstochowa Upland) – for the northern route.

Considering the fact that the vascular flora of the Ojców area is well known (there have been written a number of detailed studies on the subject), an attempt can be made at estimating the share of particular migration routes of the aphidofauna which arrived via these routes in the area in question. Excluding the species that arrived in the area from the north after the glacial retreat, it seems that the largest share in the shaping of the park's aphidofauna have had: the Moravian route (especially as far as the stenothermal species are concerned), and the Transcarpathian routes (especially as far as the hygrophilous and mountain species are concerned). Much less important has been the Podolian route, and the Scepusian route has been the least important. However, it has to be borne in mind that these are all merely hypotheses, since the actual plant distribution in the OPN is mostly the result of human activity and does not reflect the natural conditionings (Michalik, 1983, 2006).

Presently the river valleys still constitute migration routes for aphids, but their importance is diminishing in favour of anthropogenic communication routes. This conclusion is confirmed by the distribution of aphids in the area of the Ojców National Park (Fig. 1). The largest concentration of aphids has been recorded in the Prądnik Valley, in the section of Pieskowa Skała – Prądnik Korzkiewski, but nevertheless, along the bank of the Prądnik river in this particular section there runs an asphalt road, which is much frequented by motor vehicles. In the closed section of the Ojców – Murownia route and in the Sąspowska Valley, the number of aphid stands is considerably lower. The lowest number of aphid stands can be found in gorges (they are almost non-existent in the coolest and moistest gorges Jamki and

Pradło) and in small, closed valleys.

In general, it can be concluded that within the boundaries of the OPN aphid migrations take place mainly along roads, tourist routes and large, open valleys.

SUMMARY

▪ Ojców National Park is presently the most extensively studied national park in Poland. Species diversity in the OPN exceeds that of any other Polish national park which has been studied so far;

▪ Among the three aphid species new to the Polish fauna which have been identified in the course of the study, *Aphis lilago* deserves special attention, since it may be difficult to encounter in other regions of Poland due to the special characteristics of its habitat and the fact that its host plant is rare in Poland;

▪ The considerable prevalence of oligophags of first degree and monophags confirms the fact that the aphidocenoses of the OPN still display a non-distorted structure which remains close to the natural one; however, the fact that the polyphagous species with wide ecological spectrum are encountered much more frequently may indicate that in the studied habitats there are taking place some unfavourable changes and the structure of aphidocenoses is being distorted;

▪ Prevalence of mezohygrophilous and xerophilous aphid species bespeaks the fact that the habitats of the OPN are very diversified; on the one hand they offer proper ecological conditions and host plants for mezohygrophilous species, especially in the river valleys and forest habitats; on the other hand they offer as much to the xerophilous species, which find proper conditions in xerothermic grasslands on the open slopes as well as on the rock ledges;

▪ Species richness of the aphidofauna in ruderal and xerothermic communities, as opposed to beechwood and rush communities, indicates a clear correlation with the richness of flora;

▪ The aphidocenoses of rock ledges are the most valuable ones due to the existence of a large number of species on a strictly limited area. The species encountered here are characterized by narrow ecological spectrum and narrow distribution. These aphidocenoses are endangered, on the one hand, by the growing presence of polyphagous, geopolitical species, which can supplant the natural elements, and on the other by the uniqueness of this type of habitat within the country;

▪ Considerable prevalence of aphid species that have been encountered either rarely or just one single time in the course of material collection confirms the fact that the habitats of the OPN have a highly specific, mosaic character;

▪ The fact that less than a half of plant species in the OPN have not been host plants of aphids suggests that the aphids, especially monophagous and stenobiotic ones, are characterized by a much larger nutritional selectivity than it used to be assumed; the studies on the nutritional associations between aphids and their host plants ought to be continued;

▪ The clear difference with reference to the number of aphid species associated

with the young and floristically rich families *Asteraceae* and *Poaceae* can indicate the existence of strong competition from other sucking phytophagous insects feeding on grasses;

▪ In the case of phylogenetically older families of host plants the prevailing number of dendrophilous aphid species over the number of host plant species confirms the strength and tightness of coevolutional associations, since the older phytogenetically a given plant family is, the more aphid species have had an opportunity to adjust themselves to be fit for populating it;

▪ The analysis comparing aphid species composition populating various types of communities and habitats has shown the existence of three concentration ranges which confirm the existence of real correlations between the groups of aphid species with similar trophic and habitat requirements and their corresponding phytocenoses;

▪ The analysis of the similarities in aphid composition with reference to particular host plant families has led to distinguishing groups of botanical families between which migrate the aphids that practice host alternation; it confirms the fact that such associations actually function in the environment and have a permanent character;

▪ The chorological analysis indicates a considerable share of holarctic aphid species in the aphidofauna of the OPN, while the share of geopolitical and European species is slightly lower. The wide distribution characterizing some aphid species (i.e. holarctic and geopolitical ones), which are poliphags or oligophags of second degree, is either conditioned by the original, natural distribution of these species in the Holarctics, or by the large migratory potential of aphids. The considerable share of European elements which are monophags or oligophags of first degree suggests that there must exist some limiting factors; they probably include the absence of host plants and convenient communities, or associations with cultivars. Indirectly, it can also bespeak the good condition of habitats within the OPN;

▪ The aphidofauna of the OPN is comparatively young, as it took shape in the Holocene, after the glacial retreat. Its oldest elements include dendrophilous species, associated mostly with the Betulaceae, Salicaceae and Pinaceae families;

▪ Aphid species associated with the forest and wetland communities constitute the original aphidofauna of the OPN. Together with the development of human activity there increased the share of aphid species associated with meadow and ruderal habitats;

▪ Foreign host plant species have been arriving in the OPN together with foreign aphid species. Simultaneously, the kenophytes are populated by native species characterized by the wide ecological spectrum;

▪ According to the results of the study a considerable number of the OPN aphidofauna representatives owe their presence in the area to human activity;

▪ In the shaping of the original aphidofauna of the OPN the major role was played by four migration routes, i.e. Moravian, Panonian-Transcarpathian, Podolian-Volynian and Scepusian routes;

▪ In the shaping of contemporary aphidofauna of the OPN the importance of river valleys for the migration of aphids diminishes in favour of anthropogenic

communication routes. Aphid migrations observed nowadays within the boundaries of the OPN generally take place along roads, tourist routes and large, open valleys;

▪ It seems that in the OPN the anthropogenic habitats are the reservoir of polyphagous aphid species, which can supplant the more highly specialized aphid species populating natural habitats.

BOTANICAL LIST OF APHID HOST PLANTS

(* - plant species on which no aphids were discovered)

Abies alba Mill.: *Cinara confinis*, *C. pectinatae*, *Mindarus abietinus*, *Prociphilus bumeliae*
Acer platanoides L.: *Drepanosiphum platanoidis*, *Periphyllus aceris*, *P. coracinus*, *P. lyropictus*, *P. testudinaceus*
Acer pseudoplatanus L.: *Drepanosiphum acerinum*, *D. platanoidis*, *Periphyllus acericola*, *P. aceris*, *P. coracinus*, *P. testudinaceus*
Achillea millefolium L.: *Aphis vandergooti*, *Brachycaudus cardui*, *B. helichrysi*, *Macrosiphoniella millefolii*, *Uroleucon achilleae*
Acinos arvensis (Lam.) Dandy: *Aphis frangulae*
Aconitum firmum Rchb.: *Delphiniobium junackianum*
Aconitum moldavicum Hacq.: *
Actaea spicata L.: *
Adoxa moschatellina L.: *
Aegopodium podagraria L.: *Aphis fabae fabae*, *A. podagrariae*, *Aulacorthum solani,* ***Cavariella aegopodii***
Aesculus hippocastanum L.: *
Agrimonia eupatoria L.: *Aphis proffti*
Agrostemma githago L.: *
Agrostis capillaris L.: *Sitobion avenae*
Agrostis stolonifera L.: *Sitobion avenae*
Ajuga genevensis L.: *
Ajuga reptans L.: *
Alchemilla glabra Neygenf.: *
Alchemilla gracilis Opiz: *
Alliaria petiolata (M. Bieb.) Cavara & Grande: *
Allium oleraceum L.: *
Allium montanum F. W. Schmidt: *
Alnus glutinosa (L.) Gaertn.: Pterocallis alni
Alopecurus pratensis L.: Sitobion avenae
Amaranthus retroflexus L.: *Aphis fabae fabae*
Anagallis arvensis L.: *
Anemone nemorosa L.: *
Anemone ranunculoides L.: *
Anethum graveolens L.: *Dysaphis apiifolia petroselini*
Anthemis tinctoria L.: *Brachycaudus cardui*

Anthericum ramosum L.: *Aphis lilago*
Anthoxanthum odoratum L.: *
Anthriscus sylvestris (L.) Hoffm.: *Aphis brohmeri*, *Cavariella aegopodii*, *Macrosiphum gei*
Apera spica-venti (L.) P. Beauv.: *Rhopalosiphum padi*, *Sitobion avenae*
Arabis glabra (L.) Bernh.: *Lipaphis rossi*
Arctium lappa L.: *Aphis fabae fabae*
Arctium tomentosum Mill.: *Aphis fabae fabae*
Arenaria serpyllifolia L.: *
Armoracia rusticana P. Gaertn., B. Mey. & Scherb.: *Aphis nasturtii*
Arrhenatherum elatius (L.) P. Beauv. Ex J. Presl & C. Presl: *Anoecia vagans*, *Forda marginata*, *Rhopalosiphum padi*, *Sitobion avenae*, *Tetraneura ulmi*
Artemisia absinthium L.: *Macrosiphoniella absinthii*, *M. artemisiae*
Artemisia vulgaris L.: *Coloradoa artemisiae*, *Dysaphis lappae*, *Macrosiphoniella artemisiae*, *M. oblonga*
Arum alpinum Schott & Kotschy: *
Aruncus sylvestris Kostel.: *
Asarum europaeum L.: *
Asperula cynanchica L.: *
Asperula tinctoria L.: *Aphis fabae fabae*, *A. galiiscabri*
Asplenium ruta-muraria L.: *
Asplenium trichomanes L.: *
Aster amellus L.: *
Astragallus glycyphyllos L.: *
Astrantia major L.: *Hyadaphis foeniculi*
Athyrium filix-femina (L.) Roth: *
Atriplex patula L.: *Aphis fabae fabae*, *Hayhurstia atriplicis*
Atropa belladonna L.: *
Avena fatua L.: *Sitobion avenae*
Avena sativa L.: *
Ballota nigra L.: *Cryptomyzus alboapicalis*
Barbarea vulgaris R. Br.: *
Bellis perennis L.: *
Berberis vulgaris L.: *Liosomaphis berberidis*
Berula erecta (Huds.) Coville: *Aphis fabae fabae*
Beta vulgaris L.: *Aphis fabae fabae*
Betonica officinalis L.: *
Betula pendula Roth: *Calaphis betulicola*, *C. flava*, *Callipterinella calliptera*, *C. tuberculata*, *Clethrobius comes*, *Euceraphis betulae*, *Glyphina betulae*, *Monaphis antennata*, *Symydobius oblongus*
Bidens cernua L.: *Pemphigus borealis*
Brachypodium pinnatum (L.) P. Beauv.: *
Brachypodium sylvaticum (Huds.) P. Beauv.: *Sitobion avenae*
Brassica napus L.: *Aphis fabae fabae*

Briza media L.: *Sitobion avenae*
Bromus inermis Leyss.: *Sitobion avenae*
Bromus tectorum L.: *
Calamagrostis epigejos (L.) Roth: *Laingia psammae*
Calendula officinalis L.: *Aphis fabae fabae*
Calluna vulgaris (L.) Hull.: *
Caltha palustris L.: *
Calystegia sepium (L.) R. Br.: *
Campanula glomerata L.: *
Campanula patula L.: *
Campanula persicifolia L.: *
Campanula rapunculoides L.: *Uroleucon rapunculoidis*
Campanula rotundifolia L.: *Uroleucon campanulae*
Campanula trachelium L.: *Cryptomyzus galeopsidis*, *Uroleucon nigrocampanulae*, *U. rapunculoidis*
Capsella bursa-pastoris (L.) Medik.: *Acyrthosiphon pisum*, *Aphis fabae fabae*, *A. frangulae*, *A. sambuci*, *Aulacorthum solani*
Caragana arborescens Lam.: *Aphis craccivora*
Cardamine amara L.: *
Cardamine pratensis L.: *
Cardaminopsis arenosa (L.) Hayek: *Lipaphis erysimi*
Cardaminopsis halleri (L.) Hayek: *
Carduus acanthoides L.: *
Carduus crispus L.: *Aphis fabae fabae*, *Uroleucon aeneum*
Carex brizoides L.: *
Carex echinata Murray: *
Carex hirta L.: *
Carex ovalis Gooden.: *
Carex pallescens L.: *
Carex rostrata Stokes: *
Carex sylvatica Huds.: *Sitobion avenae*
Carlina acaulis L.: *
Carlina vulgaris L.: *
Carpinus betulus L.: *Myzocallis carpini*
Centaurea cyanus L.: *
Centaurea jacea L.: *Uroleucon jaceae jaceae*
Centaurea mollis Waldst. & Kit.: *
Centaurea scabiosa L.: *Myzus persicae*, *Uroleucon jaceae henrichi*, *U. jaceae jaceae*
Centaurium erythraea Rafn subsp. ***erythraea***: *
Cephalantera damasonium (Mill.) Druce: *Aphis ilicis*
Cerastium arvense L.: *
Cerastium holosteoides Fr. emend. Hyl.: *
Chaenorhinum minus (L.) *Lange*: *

Chaerophyllum hirsutum L.: *Cavariella archangelicae*, *Macrosiphum gei*
Chaerophyllum temulum L.: *Hyadaphis foeniculi*, *Macrosiphum gei*
Chamaecytisus ratisbonensis (Schaeff.) Rothm.:
Chamaenerion angustifolium (L.) Scop.: *Aphis fabae fabae*, *A. frangulae*
Chamomilla recutita (L.) Rauschert: *
Chamomilla suaveolens (Pursh) Rydb.: *Aphis fabae fabae*, *Brachycaudus helichrysi*
Chelidonium majus L.: *Acyrthosiphon chelidonii*
Chenopodium album L.: *Aphis fabae fabae*, *Hayhurstia atriplicis*, *Myzus persicae*
Chenopodium hybridum L.: *
Chenopodium strictum Roth: *Aphis fabae fabae*
Chrysosplenium alternifolium L.: *
Cichorium intybus L.: *Aphis intybi*, *Nasonovia ribisnigri*, *Uroleucon cichorii cichorii*
Circaea lutetiana L.: *
Cirsium arvense (L.) Scop.: *Aphis fabae fabae*, *A. fabae solanella*, *Brachycaudus cardui*, ***Uroleucon aeneum***
Cirsium oleraceum (L.) Scop.: *Aphis fabae fabae*, *A. fabae solanella*, *A. janischi*, *Brachycaudus cardui*, *Uroleucon cirsii*, *U. aeneum*
Cirsium rivulare (Jacq.) All.: *Aphis fabae cirsiiacanthoidis*, *A. fabae solanella*
Cirsium vulgare (Savi) Ten.: *Aphis fabae fabae*
Clematis vitalba L.: *
Clinopodium vulgare L.: *Aphis clinopodii*
Consolida regalis Gray: *
Convallaria majalis L.: *
Convolvulus arvensis L.: Aphis fabae fabae
Conyza canadensis (L.) Cronquist: *Uroleucon erigeronense*
Cornus alba L.: *Anoecia corni*
Cornus sanguinea L.: *Anoecia corni*
Coronilla varia L.: *Acyrthosiphon pisum*
Corydalis cava Schweigg. & Körte: *
Corylus avellana L.: *Corylobium avellanae*, *Myzocallis coryli*
Cotoneaster horizontalis Decne.: *Aphis pomi*
Cotoneaster intergerrimus Medik.: *
Crataegus monogyna Jacq.: *Aphis pomi*, *Prociphilus pini*
Crepis biennis L.: *Aphis crepidis*, *Trama troglodytes*, *Uroleucon cichorii grossum*
Crepis capillaris (L.) Wallr.: *Uroleucon cichorii grossum*
Crepis tectorum L.: *Nasonovia ribisnigri*, *Uroleucon cichorii grossum*
Cruciata glabra (L.) Ehrend.: *
Cuscuta europaea L.: *Aphis fabae fabae*
Cynosurus cristatus L.: *Sitobion avenae*
Dactylis glomerata L.: *Rhopalosiphum padi*, *Sitobion avenae*
Daphne mezereum L.: *
Datura stramonium L.: *
Daucus carota L.: *Aphis lambersi*, *Cavariella aegopodii*, *Semiaphis dauci*

Dentaria glandulosa Waldst. & Kit.: *
Deschampsia caespitosa (L.) P. Beauv.: *Sitobion avenae*
Deutzia scabra Thunb.: *
Dianthus carthusianorum L.: *Aphis sambuci*
Dianthus deltoides L.: *
Digitalis grandiflora Mill.: *Aphis frangulae*
Dipsacus sylvestris Huds.: *Macrosiphum rosae*
Dryopteris filix-mas (L.) Schott: *
Echinochloa crus-gali (L.) P. Beauv.: *Sitobion avenae*
Echinops sphaerocephalus L.: *
Echium vulgare L.: *
Elymus repens (L.) Gould: *Rhopalosiphum padi*
Epilobium hirsutum L.: *Aphis epilobii*, *A. grossulariae*
Epilobium montanum L.: *Aphis praeterita*, *A. epilobii*, *A. grossulariae*
Epilobium roseum Schreb.: *Aphis praeterita*, *A. epilobii*
Epipactis helleborine (L.) Crantz: *Aphis ilicis*
Equisetum arvense L.: *
Equisetum palustre L.: *
Equisetum sylvaticum L.: *
Erigeron acris L.: *Brachycaudus helichrysi*, *Uroleucon simile*
Erigeron annuus (L.) Pers.: *
Erysimum cheiranthoides L.: *
Euonymus europaeus L.: *Aphis fabae evonymi*, *A. fabae fabae*
Euonymus verrucosa Scop.: *
Euphorbia cyparissias L.: *Aphis euphorbiae*
Euphorbia esula L.: *Aphis euphorbiae*
Euphorbia helioscopia L.: *
Euphorbia peplus L.: *Aphis euphorbiae*
Euphrasia stricta D. Wolff ex J. F. Lehm.: *Myzus cerasi*
Fagopyrum tataricum (L.) Gaertn.: *
Fagus sylvatica L.: *Lachnus pallipes*, *Phyllaphis fagi*
Fallopia convolvulus (L.) Á. Löve: *
Festuca gigantea (L.) Vill.: *Sitobion avenae*, *Tetraneura ulmi*
Festuca ovina L.: *
Festuca pallens Host.: *Sitobion avenae*
Festuca pratensis Huds.: *Sitobion avenae*
Ficaria verna Huds.: *
Filipendula ulmaria (L.) Maxim.: *Macrosiphum cholodkovskyi*
Forsythia x intermedia Zabel.: *
Fragaria vesca L.: *Aphis forbesi*
Frangula alnus Mill.: *Aphis frangulae*
Fraxinus excelsior L.: *
Fumaria officinalis L.: *Aphis fabae fabae*

Gagea lutea (L.) KER GAWL.: *
Galanthus nivalis L.: *
Galeobdolon luteum HUDS.: *Cryptomyzus galeopsidis*
Galeopsis pubescens BESSER: *Cryptomyzus galeopsidis*
Galeopsis tetrahit L.: *
Galinsoga ciliata (RAF.) S. F. BLAKE: *Brachycaudus lateralis*
Galium aparine L.: *Aphis fabae fabae*, *A. molluginis*
Galium mollugo L.: *Aphis fabae fabae*, *A. molluginis*, *Dysaphis pyri*, *Myzus langei*, *M. cerasi*
Galium odoratum (L.) SCOP.: *
Galium schultesii VEST: *Aphis galiiscabri*
Galium verum L.: *
Genista tinctoria L.: *Aphis genistae*
Gentianella ciliata (L.) BORKH.: *
Geranium palustre L.: *
Geranium phaeum L.: *Acyrthosiphon malvae*, *Aulacorthum solani*, *Prociphilus xylostei*
Geranium pratense L.: *
Geranium robertianum L.: *Acyrthosiphon malvae*
Geranium sanguineum L.: *
Geranium sylvaticum L.: *
Geum rivale L.: *Macrosiphum gei*
Geum urbanum L.: *Macrosiphum gei*
Glechoma hederacea L.: *
Glyceria notata CHEVALL.: *Sitobion avenae*
Gnaphalium sylvaticum L.: *
Gnaphalium uliginosum L.: *
Hedera helix L.: *Aphis hederae*
Helianthemum nummularium subsp. ***obscurum*** (ČELAK.) HOLUB: *
Helianthus annuus L.: *Aphis fabae fabae*
Hepatica nobilis SCHREB.: *
Heralceum sphodnylium L.: *Aphis brohmeri*, *A. fabae fabae*, *Cavariella pastinacae*, *C. theobaldi*, *Dysaphis newskyi aizenbergi*
Hesperis matronalis L.: *
Hieracium bauhinii SCHULT.: *Nasonovia ribisnigri*
Hieracium caespitosum DUMORT.: *
Hieracium lachenalii C. C. GMEL.: *Aphis hieracii*
Hieracium laevigatum WILLD.: *Aphis hieracii*, *A. pilosellae*, *Uroleucon obscurum*
Hieracium murorum L.: *Aphis hieracii*, *A. pilosellae*, *Nasonovia compositellae compositellae*, *N. compositellae nigra*, *N. pilosellae*
Hieracium pilosella L.: *Aphis pilosellae*, *Nasonovia pilosellae*
Hippophaë rhamnoides L.: *
Holcus lanatus L.: *Sitobion avenae*
Holcus mollis L.: *

Humulus lupulus L.: *
Hypericium maculatum Crantz: *
Hypericium perforatum L.: *Aphis chloris*
Hypochoeris radicata L.: *Uroleucon hypochoeridis*
Impatiens glandulifera Royle: *Aphis fabae fabae*
Impatiens noli-tangere L.: *Aphis fabae fabae*, *Impatientinum balsamines*
Impatiens parviflora DC.: *Aphis fabae fabae*, *Impatientinum asiaticum*
Inula conyza DC.: *Capitophorus pakansus*
Inula hirta L.: *
Isopyrum thalictroides L.: *
Jasione montana L.: *
Jovibarba sobolifera (Sims) Opiz: *Aphis sedi*
Juglans regia L.: *Chromaphis juglandicola*, *Panaphis juglandis*
Juncus bufonius L.: *Sitobion avenae*
Juncus compressus Jacq.: *
Juncus conglomeratus L. emend. Leers: *
Juncus effusus L.: *Sitobion avenae*
Juncus tenuis Willd.: *
Juniperus communis L.: *Cinara juniperi*
Juniperus sabina L.: *Cinara juniperi*
Knautia arvensis (L.) J. M. Coult.: *Aphis confusa*, *Macrosiphum rosae*
Lactuca serriola L.: *
Lamium album L.: *Cryptomyzus alboapicalis*
Lamium amplexicaule L.: *
Lamium maculatum L.: *Cryptomyzus galeopsidis*
Lamium purpureum L.: *Aphis lamiorum*
Lappula squarrosa (Retz.) Dumort.: *Aphis triglochinis*, *Brachycaudus cardui*
Lapsana communis L.: *
Larix decidua Mill.: *Adelges laricis*, *Cinara cuneomaculata*, *C. laricis*
Laserpitium latifolium L.: *Aphis fabae fabae*
Lathraea squamaria L.: *
Lathyrus niger (L.) Bernh.: *
Lathyrus pratensis L.: *Aphis craccivora*, *A. pseudocomosa*, *Megoura litoralis*, *M. viciae*
Lathyrus vernus (L.) Bernh.: *
Leontodon autumnalis L.: *Aphis leontodontis*, *Uroleucon hypochoeridis*
Leontodon hispidus L.: *Uroleucon hypochoeridis*
Leucanthemum vulgare Lam.: *Brachycaudus cardui*, *Macrosiphoniella millefolii*
Libanotis pyrenaica (L.) Bourg.: *Aphis fabae fabae*
Ligustrum vulgare L.: *Myzus ligustri*
Lilium martagon L.: *
Linum catharticum L.: *
Listera ovata (L.) R. Br.: *
Lolium multiflorum Lam.: *Sitobion avenae*

Lolium perenne L.: *Sitobion avenae*
Lonicera periclymenum L.: *Hyadaphis foeniculi*, *Rhopalomyzus lonicerae*
Lonicera xylosteum L.: *Prociphilus xylostei*, *Rhopalomyzus lonicerae*, *Trichosiphonaphis corticis*
Lotus corniculatus L.: *
Lunaria rediviva L.: *
Lupinus polyphyllus Lindl.: *Macrosiphum albifrons*
Luzula luzuloides (Lam.) Dandy & Wilmott: *
Luzula pilosa (L.) Willd.: *
Lychnis flos-cuculi L.: *
Lycopus europaeus L.: *Ovatus insitus*
Lysimachia nummularia L.: *
Lysimachia punctata L.: *
Lysimachia vulgaris L.: *Aphis fabae fabae*
Lythrum salicaria L.: *Myzus lythri*
Majanthemum bifolium (L.) F. W. Schmidt:
Malus domestica Borkh.: *Aphis pomi*, *Dysaphis plantaginea*
Malva alcea L.: *
Malva sylvestris L.: *Aphis frangulae*
Matricaria maritima L. subsp. ***inodora*** (L.) Dostál: *Aphis fabae fabae*, *Brachycaudus cardui*, *B. helichrysi*
Medicago falcata L.: *
Medicago lupulina L.: *Acyrthosiphon pisum*
Medicago sativa L.: *
Melampyrum nemorosum L.: *Aphis frangulae*
Melampyrum pratense L.: *Aphis frangulae*
Melandrium album (Mill.) Gracke: *Brachycaudus lychnidis*
Melica nutans L.: *
Melica transsilvanica Schur: *Sitobion avenae*
Melica uniflora Retz.: *
Melilotus alba Medik.: *
Melilotus officinalis (L.) Pall.: *
Melittis melissophyllum L.: *
Mentha aquatica L.: *Myzus persicae*
Mentha arvensis L.: *Aphis affinis*
Mentha longifolia (L.) L.: *Aulacorthum solani*, *Ovatus mentharius*
Mentha spicata L. emend. L.: *
Mercurialis perennis L.: *
Milium effusum L.: *
Moehringia trinervia (L.) Clairv.: *
Mycelis muralis (L.) Dumort.: *Uroleucon murale*
Myosotis arvensis (L.) Hill: *Aphis triglochinis*, *Aulacorthum solani*, *Brachycaudus cardui*
Myosotis palustris (L.) L. emend. Rchb.: *Aulacorthum solani*, *Brachycaudus cardui*, *Myzus*

myosotidis
Myosotis sparsiflora Pohl: *
Myosoton aquaticum (L.) Moench: *Aphis nasturtii*, *Macrosiphum sileneum*,
Nardus stricta L.: *
Nasturtium officinale R. Br.: *
Neottia nidus-avis (L.) Rich.: *
Oenothera fruticosa L.: *Aphis sambuci*
Oenothera glazioviana Micheli in Mart.:
Onobrychis arenaria (Kit.) DC.: *
Onopordum acanthium L.: *Aphis fabae solanella*
Origanum vulgare L.: *Aphis origani*
Orobanche caryophyllacea Sm.: *
Orthilia secunda (L.) House: *
Oxalis acetosella L.: *
Oxalis fontana Bunge: *
Papaver rhoeas L.: *Aphis fabae fabae*
Papaver somniferum L.: Aphis fabae fabae
Paris quadrifolia L.: *
Parthenocissus quinquefolia (L.) Planch.: *
Pastinaca sativa L.: *Cavariella theobaldi*, *Dysaphis apiifolia petroselini*, *D. bonomii*
Petasites albus (L.) Gaertn.: *Capitophorus similis*, *Uroleucon tussilaginis*
Petasites hybridus (L.) P. Gaertn., B. Mey. & Scherb.: *
Phalaris arundinacea L.: *Hyalopterus pruni*, *Rhopalosiphum padi*
Philadelphus coronarius L.: *Aphis fabae fabae*
Philadelphus pubescens Loisel.: *Aphis fabae fabae*
Phleum phleoides (L.) H. Karst.: *Sitobion avenae*
Phleum pratense L.: *Sitobion avenae*, *Tetraneura ulmi*
Phragmites australis (Cav.) Trin. ex Steud.: *Hyalopterus pruni*
Physocarpus opulifolius (L.) Maxim.: *
Phyteuma spicatum L.: *Aphis fabae fabae*
Picea abies (L.) H.Karst.: *Cinara costata*, *C. piceicola*, *C. pilicornis*, *Sacchiphantes abietis*, *S. viridis*
Pinus nigra J.F. Arnold: *Cinara brauni*
Pinus sylvestris L.: *Cinara hyperophila*, *C. nuda*, *C. pinea*, *C. pinihabitans*, *C. pini*, *Pineus pini*, *Schizolachnus pineti*
Pisum sativum L.: *Acyrthosiphon pisum*
Plantago lanceolata L.: *
Plantago major L.: *Aphis plantaginis*, *A. vandergooti*
Plantago media L.: *
Poa annua L.: *Sitobion avenae*
Poa compressa L.: *Sitobion avenae*
Poa nemoralis L.: *Sitobion avenae*
Poa pratensis L.: *Sitobion avenae*

Poa trivialis L.: *Sitobion avenae*
Polygala oxyptera Rchb.: *
Polygala vulgaris L.: *
Polygonatum odoratum (Mill.) Druce: *
Polygonum aviculare L.: *Aphis fabae fabae*
Polygonum hydropiper L.: *
Polygonum lapathifolium L.: *
Polygonum persicaria L.: *Aphis nasturtii*, *Capitophorus hippophaes*
Polypodium vulgare L.: *
Polystichum aculeatum (L.) Roth: *
Populus nigra L.: *Chaitophorus populeti*, *Thecabius affinis*
Populus tremula L.: *Chaitophorus populeti*, *C. tremulae*
Potentilla alba L.: *
Potentilla anserina L.: *
Potentilla arenaria Borkh.: *
Potentilla argentea L.: *
Potentilla erecta (L.) Raeusch.: *
Potentilla recta L.: *
Potentilla reptans L.: *
Primula elatior (L.) Hill: *
Primula veris L.: *
Prunella grandiflora (L.) Scholler: *
Prunella vulgaris L.: *Aphis brunellae*
Prunus avium (L.)L.: *Myzus cerasi*
Prunus domestica L.: *Aphis pomi*, *Brachycaudus cardui*, *Phorodon humuli*
Prunus padus L.: *Myzus cerasi*, *Rhopalosiphum padi*
Prunus spinosa L.: *Aphis pomi*, *Brachycaudus cardui*, *B. prunicola*, *Hyalopterus pruni*
Pteridium aquilinum (L.) Kuhn: *
Pterocarya fraxinifolia (Poir.) Spach: *
Pulmonaria mollis Wulfen ex A. Karen: *
Pyrola rotundifolia L.: *
Pyrus communis L.: *
Quercus petraea (Matt.) Liebl.: *Lachnus roboris*, *Thelaxes dryophila*
Quercus robur L.: *Anoecia corni*, *Lachnus longirostris*, *Phylloxera coccinea*, *P. glabra*, *Stomaphis quercus*, *Thelaxes dryophila*, *Tuberculatus querceus*, *T. annulatus*
Quercus rubra L.: *Thelaxes dryophila*
Ranunculus acris L.: *
Ranunculus bulbosus L.: *
Ranunculus lanuginosus L.: *
Ranunculus repens L.: *Dysaphis ranunculi*, *Thecabius affinis*
Ranunculus sceleratus L.: *
Raphanus raphanistrum L.: *
Reynoutria japonica Houtt.: *Aphis fabae fabae*

Rhamnus catharticus L.: *Aphis mammulata*
Ribes alpinum L.: *
Ribes nigrum L.: *Aphis grossulariae*, *A. schneideri*
Ribes rubrum L.: *
Ribes uva-crispa L.: *Aphis grossulariae*, *Cryptomyzus ribis*
Robinia pseudoacacia L.: *
Rorippa palustris (L.) Besser: *Aphis triglochinis*
Rosa canina L.: *Anoecia corni*, *Chaetosiphon tetrarhodum*, *Macrosiphum rosae*, *Myzaphis rosarum*
Rosa multiflora Thunb.: *Macrosiphum rosae*
Rosa rugosa Thunb.: *Macrosiphum rosae*
Rosa tomentosa Sm.: *Chaetosiphon tetrarhodum*, *Macrosiphum rosae*
Rubus bifrons Vest.: *Aphis ruborum*
Rubus caesius L.: *Amphorophora rubi*
Rubus hirtus Waldst. & Kit. agg.: *Macrosiphum funestum*
Rubus idaeus L.: *Amphorophora idaei*, *A. rubi*, *Aphis idaei*
Rubus plicatus Weihe & Nees: *Macrosiphum funestum*
Rumex acetosa L.: *
Rumex acetosella L.: *
Rumex conglomeratus Murray.: *Aphis rumicis*
Rumex crispus L.: *Aphis fabae solanella*, *A. rumicis*
Rumex obtusifolius L.: *Aphis fabae fabae*, *A. rumicis*
Rumex thyrsiflorus Fingerh.: *
Salix alba L.: *Aphis farinosa*, *Cavariella konoi*, *C. theobaldi*, *Chaitophorus truncatus*, *Plocamaphis flocculosa brachysiphon*, *Pterocomma pilosum konoi*, *P. pilosum pilosum*, *P. rufipes*
Salix caprea L.: *Aphis farinosa*, *Cavariella theobaldi*, *Chaitophorus capreae*, *C. salicti*, *Pterocomma jacksoni*, *P. pilosum konoi*, *P. salicis*
Salix elaeagnos Scop.: *
Salix fragilis L.: *Aphis farinosa*, *Cavariella theobaldi*, *Chaitophorus hypogaeus*, *C. salijaponicus niger*, *C. truncatus*, *C. vitellinae*, *Pterocomma pilosum pilosum*, *P. rufipes*
Salix purpurea L.: *Cavariella aegopodii*, *Chaitophorus mordvilkoi*, *C. truncatus*, *Pterocomma pilosum konoi*
Salix triandra L.: *Cavariella salicicola*, *Chaitophorus truncatus*, *Pterocomma rufipes*
Salix viminalis L.: *
Salix x sepulcralis Simonk. «Chrysocoma»: *Chaitophorus hypogaeus*, *C. salijaponicus niger*, *C. vitellinae*
Salvia pratensis L.: *
Salvia verticillata L.: *Aphis verticillatae*
Sambucus nigra L.: *Aphis sambuci*
Sambucus racemosa L.: *
Sanguisorba minor Scop.: *
Sarothamnus scoparius (L.) W.D.J.Koch: *Aphis cytisorum sarothamni*

Saxifraga tridactylites L.: *
Scabiosa ochroleuca L.: *Aphis confusa*, *Macrosiphum rosae*
Scirpus sylvaticus L.: *
Scleranthus annuus L.: *
Scrophularia nodosa L.: *Aphis frangulae*
Secale cereale L.: *Sitobion avenae*
Sedum acre L.: *
Sedum maximum (L.) Hoffm.: *Aphis sedi*
Sedum sexangulare L.: *
Sedum spurium M. Bieb.: *Aphis sedi*
Senecio jacobaea L.: *Aphis jacobaeae*, *Brachycaudus cardui*
Senecio ovatus (P. Gaertn., B. Mey. & Scherb.) Willd.: *
Silene nutans L.: *
Silene otites (L.) Wibel: *
Sinapsis arvensis L.: *Brevicoryne brassicae*
Sisymbrium officinale (L.) Scop.: *
Solanum tuberosum L.: *
Solidago gigantea Aiton: *
Solidago virgaurea L.: *Uroleucon solidaginis*
Sonchus arvensis L.: *Aphis frangulae*, *Hyperomyzus lactucae*, *H. pallidus*, *Uroleucon sonchi*
Sonchus asper (L.) Hill: *Aphis fabae fabae*, *Hyperomyzus lactucae*, *H. pallidus*, *Uroleucon sonchi*
Sonchus oleraceus L.: *Hyperomyzus lactucae*, *Uroleucon sonchi*
Sorbus aucuparia L.: *Dysaphis sorbi*
Sorbus intermedia (Ehrh.) Pers.: *
Spergula arvensis L.: *
Spiraea salicifolia L.: *
Stachys palustris L.: *Cryptomyzus ribis*
Stachys recta L.: *Aphis stachydis*
Stachys sylvatica L.: *
Stellaria graminea L.: *
Stellaria holostea L.: *
Stellaria media (L.) Vill.: *Aulacorthum solani*
Stipa joannis Čelak.: *
Symphoricarpos albus (L.) S.F.Blake: *
Symphytum officinale L.: *Brachycaudus carduis*
Syringa vulgaris L.: *
Tanacetum parthenium (L.) Sch. Bip.: *Brachycaudus cardui*
Tanacetum vulgare L.: *Macrosiphoniella tanacetaria*, *Metopeurum fuscoviride*, *Uroleucon tanaceti*
Taraxacum officinale F. H. Wigg.: *Aphis taraxacicola*, *Uroleucon taraxaci*
Taxus baccata L.: *

Thesium linophyllon L.: *
Thlapsi arvense L.: *
Thuja orientalis L.: *
Thymus kosteleckyanus Opiz: *
Thymus praecox Opiz: *
Thymus pulegioides L.: *Aphis serpylli*
Tilia cordata Mill.: *Anoecia corni*, *Eucallipterus tiliae*
Tilia platyphyllos Scop.: *
Torillis japonica (Houtt.) DC.: *Aphis fabae fabae*
Tragopogon pratensis L.: *
Trifolium alpestre L.: *
Trifolium arvense L.: *
Trifolium aureum Pollich: *Aphis coronillae*
Trifolium campestre Schreb.: *Acyrthosiphon pisum*
Trifolium dubium Sibth.: *Acyrthosiphon pisum*
Trifolium hybridum L.: *
Trifolium montanum L.: *
Trifolium pratense L.: *Acyrthosiphon pisum*
Trifolium repens L.: *Acyrthosiphon pisum*
Trifolium rubens L.: *Aphis craccivora*
Triticum aestivum L.: *Sitobion avenae*
Tussilago farfara L.: *
Typha latifolia L.: *Hyalopterus pruni*
Ulmus glabra Huds.: *Eriosoma ulmi*, *Tetraneura ulmi*, *Tinocallis platani*, *T. saltans*
Ulmus laevis Pall.: *
Urtica dioica L.: *Aphis fabae fabae*, *A. urticata*, *Microlophium carnosum*
Vaccinium myrtillus L.: *
Valeriana officinalis L.: *Aphis fabae fabae*, *Macrosiphum rosae*
Valeriana tripteris L.: *Aphis fabae fabae*
Verbascum chaixii Vill. subsp. *austriacum* (Schott ex Roem. & Schult.) Hayek: *Aphis fabae fabae*
Verbascum lichnitis L.: *
Verbascum nigrum L.: *
Verbascum thapsus L.: *Aphis verbasci*
Verbena officinalis L.: *Aphis verbenae*
Veronica austriaca L.: *
Veronica beccabunga L.: *Aphis nasturtii*, *Aulacorthum solani*
Veronica chamaedrys L.: *Aphis vandergooti*
Veronica montana L.: *
Veronica persica Poir.: *Brachycaudus lychnidis*
Viburnum opulus L.: *Aphis viburni*
Vicia angustifolia L.: *
Vicia cracca L.: *Acyrthosiphon pisum*

Vicia dumentorum L.: *
Vicia faba L.: *Aphis fabae fabae*
Vicia hirsuta (L.) Gray: *
Vicia sepium L.: *Megoura viciae*
Vicia sylvatica L.: *Aphis craccae*
Vicia tetrasperma (L.) Schreb.: *
Vinca minor L.: *
Vincetoxicum hirudinaria Medik.: *
Viola arvensis Murray: *
Viola reichenbachiana Jord. ex Boreau: *
Viola riviniana Rchb.: *
Viola tricolor L.: *

ACKNOWLEDGEMENTS

We would like to thank the Management and Employees of the Ojców National Park for facilitating the research, especially Ms Anna Klasa, PhD, and Mr Bogdan Wiśniowski, DSc, for their valuable help and useful remarks concerning the area where the research was being conducted.

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STRESZCZENIE

Mszyce (Aphidinea) to grupa fitofagów ssących należąca do rzędu pluskwiaków (Hemiptera) podrzędu Sternorrhyncha, Owady te charakteryzują bardzo ścisłe związki z roślinami żywicielskimi, prawie 90% gatunków mszyc to monofagi lub wąsko wyspecjalizowane oligofagi. Najwięcej gatunków związanych jest z roślinami okrytozalążkowymi, gdzie żerują na wszystkich organach roślin, nie wyłączając ich części podziemnych oraz kory. W odróżnieniu od pozostałych pluskwiaków opanowały one głównie strefę umiarkowaną półkuli północnej, chociaż występują również w tropiku, subtropiku i strefie umiarkowanej półkuli południowej. Z punktu widzenia gospodarki człowieka mszyce są uznawane za groźne szkodniki roślin uprawnych w związku z przenoszeniem chorób wirusowych a także wywoływaniem deformacji pędów, liści, oraz tworzeniem galasów. Jednak z punktu widzenia ogólnoprzyrodniczego mszyce stanowią bardzo ważne ogniwo wszystkich ekosystemów, m. in. odgrywają dużą rolę jako pokarm dla wielu gatunków (w tym rzadkich i chronionych) owadów, a także pająków i ptaków. Nie można też pominąć znaczenia gatunków wydzielających spadź, ważnych nie tylko dla mrówek, czy innych owadów melitofagicznych, lecz także dla człowieka.

Z terenu Polski wykazano dotychczas 706 gatunków mszyc, co stanowi niemal 50% europejskiej afidofauny. Afidofauna naszego kraju jest dość dobrze, choć nierównomiernie zbadana. Pod względem stopnia poznania korzystnie wyróżniają się: Pojezierze Mazurskie i Nizina Wielkopolsko-Kujawska (ponad 450 gatunków mszyc). Słabiej zbadana jest południowa część Polski. Wyjątek stanowi północna część Wyżyny Krakowsko-Częstochowskiej, gdzie stwierdzono występowanie 398 taksonów mszyc. Natomiast jej część południowa, wraz z wchodzącym w jej skład Ojcowskim Parkiem Narodowym, pomimo długiej, historii badań faunistycznych nie była dotąd kompleksowo badana.

Przeprowadzone badania afidofauny OPN miały na celu: inwentaryzację fauny Aphidinea, określenie jej struktury ekologicznej i chorologicznej oraz przedstawienie jej genezy.

Ojcowski Park Narodowy (OPN) – usytuowany jest w południowej części Wyżyny Krakowsko-Częstochowskiej, w odległości około 20 km na północny zachód od miasta Krakowa i utworzony został jako szósty w Polsce, w 1956 roku. Powierzchnia Parku wynosi aktualnie blisko 2146 ha i w związku z tym, OPN jest najmniejszym parkiem narodowym w Polsce. W obecnym zarysie OPN obejmuje centralną część Doliny Prądnika, dolną i środkową część Doliny Sąspowskiej, a także przylegające do dolin fragmenty wierzchowiny jurajskiej. Urozmaicona rzeźba terenu i ogromne zróżnicowanie warunków klimatycznych warunkują znaczne bogactwo flory i powstanie licznych siedlisk. Z terenu Ojcowskiego Parku Narodowego wraz z otuliną podaje się występowanie około 950 gatunków roślin naczyniowych. Charakteryzując faunę – z terenu Parku i okolic wykazano dotychczas ok. 5,5 tyś. gatunków zwierząt z czego przeszło 80% stanowią gatunki owadów.

Badania prowadzono w sezonach wegetacyjnych 2003 – 2006 na obszarze całego OPN. Obserwacjami objęto 530 gatunków roślin naczyniowych, stwierdzonych na terenie OPN, należących do 92 rodzin. Materiał zebrano z 134 stanowisk, rozmieszczonych na obszarze całego OPN i reprezentujących różne typy siedlisk: buczyna karpacka Dentario glandulosae–Fagetum i ciepłolubna buczyna naskalna Fagus sylvatica-Cruciata glabra; grądy Tilio

cordatae-Carpinetum betuli; bory mieszane Querco roboris-Pinetum; łęgi nadrzeczne ze związku Alno-Ulmion; półki i ściany skalne porośnięte murawami naskalnymi Festucetum pallentis, czasami przechodzące w murawy kserotermiczne Origano-Brachypodietum lub ciepłolubne zarośla z pogranicza związków Geranion sanguinei i Potentilio albae-Quercion petraeae, kwieciste murawy kserotermiczne Origano-Brachypodietum na pograniczu z ciepłolubnymi zaroślami kserotermicznymi Pruno-ligustretum i zbiorowisko z pogranicza związków Geranion sanguinei i Potentilio albae-Quercion petraeae, łąki świeże Arrhenathereteum elatioris i żyzne pastwiska Lolio–Cynosuretum; ziołorośla z rzędu Molinietalia ceruleae i wilgotne łąki ostrożeniowe Cirsietum rivularis; szuwar trzcinowy Phragmitetum australis i szuwar potokowy Glycerietum plicatae; siedliska ruderalne z klasy Artemisietea vulgaris; siedliska segetalne z klasy Stellarietea mediae. Do wykonania analizy ekologicznej ustalono i posłużono się następującymi kryteriami: zmiana żywiciela, powiązania troficzne, kryterium wilgotnościowe i środowiskowe. W celu przeprowadzenia analizy chorologicznej wyróżniono następujące elementy: cosmopolityczny, holarktyczny, holarktyczny nieciągły, palearktyczny, amfipalearktyczny, zachodniopalearktyczny, zachodniopalearktycznostepowy, eurosyberyjski, europejski. W pracy zamieszczono również informacje dotyczące rozmieszczenia stwierdzonych gatunków mszyc na terenie Polski. Do obliczenia częstotliwości występowania gatunków w próbach zastosowano współczynnik ogólnej frekwencji. Obliczono również frekwencję mszyc związanych z określonymi rodzinami roślin żywicielskich (współczynnik obsadzalności rodzin roślin żywicielskich przez mszyce). Ponadto dokonano analiz podobieństwa składu gatunkowego mszyc w poszczególnych typach siedlisk oraz ich występowania na roślinach należących do poszczególnych rodzinbotanicznych. W pracy zamieszczono również pełną listę gatunków roślin stwierdzonych w OPN wraz z żerującymi na nich gatunkami mszyc.

W czasie badań łącznie zebrano 1287 prób, gdzie stwierdzono 241 taksonów mszyc (229 gatunków i 12 podgatunków), należących do dwóch nadrodzin: Phylloxeroidea oraz Aphidoidea. Nie udało się potwierdzić występowania 9 gatunków mszyc na 16 podawanych z tego obszaru przed 2003 rokiem. Wśród mszyc stwierdzonych na terenie OPN są 3 gatunki nowe dla Polski: *Aphis lilago*, F. Müller, 1968, *Cavariella salicicola* (Matsumura, 1917) oraz *Macrosiphum albifrons* Essig, 1911. Ponadto na badanym obszarze wykazano 24 gatunki nowe dla regionu Wyżyny Krakowsko-Wieluńskiej. Prawie 80% gatunków mszyc stwierdzonych na terenie OPN to gatunki jednodomne. Z analizy charakteru troficznego zebranego materiału wynika, że przeważający udział mają oligofagi 1. stopnia – 136 gatunków. Drugą grupę stanowią ścisłe monofagi – 64 gatunki. Najmniej liczną grupę stanowią gatunki polifagiczne (21), niezależnie czy uwzględnimy żywiciela pierwotnego czy wtórnego w odniesieniu do gatunków różnodomnych. Pod względem wymagań wilgotnościowych, w zebranym materiale zaznacza się duży udział gatunków mezohigrofilnych, tj. związanych ze środowiskami świeżymi – 47%. Gatunki kserofilne (xph1+xph2) stanowią łącznie niecałe 21%, natomiast gatunki wyłącznie higrofilne (hg1+hg2) stanowią niespełna 8%. Analizując kryteria środowiskowe, największe liczby stwierdzonych gatunków odnoszą się do synantropobiontów (sth) i kserotermobiontów (xer), do których zaliczono odpowiednio 146 i 131 gatunki mszyc. Mniejsza liczba stwierdzonych gatunków odnosi się do sylwibiontów (syl) – 87. Wśród stwierdzonych gatunków 50 to herbosabionty (her), zaś najmniejsza liczba gatunków odnosi

się do limnobiontów (10). W zbiorowiskach kserotermicznych stwierdzono występowanie 110 gatunków mszyc. Znacznie bogatsze w gatunki mszyc okazały się zbiorowiska synantropijne (ruderalne i segetalne), gdzie występowało 152 gatunków. Zbiorowiska leśne w OPN są znacznie uboższe w gatunki. Spośród zbiorowisk leśnych największą liczbę gatunków stwierdzono w lasach mieszanych (41) i grądach (34). W zbiorowiskach łąkowych stwierdzono występowanie 33 gatunków mszyc, natomiast 26 związanych jest ze zbiorowiskami ziołoroślowymi. W całości zebranego materiału znaczny i zbliżony udział miały elementy o szerokim rozprzestrzenieniu: kosmopolityczny (55 gatunków), holarktyczny i holarktyczny nieciągły (łącznie 65 gatunków), jak i ograniczonym – element europejski (51 gatunków). Na podstawie szczegółowej inwentaryzacji flory naczyniowej OPN stwierdzono występowanie 530 gatunków, należących do 92 rodzin. Ponad połowę tej grupy tj. 282 gatunki należące do 58 rodzin okazały się żywicielami dla 241 gatunków mszyc. Najwyższą frekwencję 11,34% w zebranym materiale zanotowano dla *Aphis fabae fabae*. Połowę niższą frekwencję stwierdzono dla *Macrosiphum rosae* oraz *Sitobion avenae* (ok. 5%). Najwięcej gatunków roślin zasiedlonych przez mszyce zgrupowanych było w rodzinach: Asteraceae (47 spośród 67), Poaceae (34 spośród 45), Fabaceae (18 spośród 37), Rosaceae (22 spośród 37) i Lamiaceae (18 spośród 31). Liczba stwierdzonych gatunków mszyc w bogatych pod względem gatunkowym rodzinach botanicznych wysoka była jedynie w rodzinie Asteraceae (52 gatunki mszyc) oraz Rosaceae (23). W bogatej gatunkowo na terenie OPN rodzinie Poaceae znaczna część gatunków (34) zasiedlana była jedynie przez 7 gatunków mszyc głównie polifagicznych. Odmienny obraz obserwowany jest w przypadku rodzin: Pinaceae, Salicaceae, Betulaceae, Fagaceae czy Aceraceae, gdzie liczba stwierdzonych gatunków mszyc znacznie przewyższa liczbę gatunków roślin, na których żerowały. Największa, prawie 21% frekwencja występowania mszyc charakterystyczna jest dla rodziny Asteraceae. Kolejne, znacznie mniejsze frekwencje występowania mszyc dotyczą rodzin: Apiaceae (ok. 8%), Rosaceae (ok. 7%), Poaceae (ok. 6,5%), Salicaceae (ok. 6%) i Pinaceae (ok. 5%). Najniższą frekwencję występowania mszyc odnotowano na roślinach z rodzin: Amaranthaceae, Araliaceae, Berberidaceae, Cuscutaceae, Cyperaceae, Fumariaceae, Lythraceae, Malvaceae, Oleaceae, Typhaceae i Verbenaceae. Analiza podobieństwa składu gatunkowego mszyc w różnych typach zbiorowisk i siedlisk OPN wykazała obecność trzech wyraźnych skupień. Pierwsze obejmuje bliskie sobie zbiorowiska kserotermiczne i zbiorowiska ruderalne, oraz nawiązujące do nich zbiorowiska półek skalnych. Kolejne skupienie obejmuje zbiorowiska wysokich bylin – łąki i pastwiska, ziołorośla, oraz nawiązujące do nich pod względem składu gatunkowego mszyc zbiorowiska segetalne i szuwarowe. Trzecią grupą są zbiorowiska leśne, tj. lasy mieszane i grądy oraz ubogie w gatunki mszyc łęgi i buczyny. Analiza podobieństwa składu gatunkowego mszyc stwierdzonych w poszczególnych rodzinach roślin żywicielskich wyraźnie wyodrębniła skupienia rodzin, pomiędzy którymi występuje migracja mszyc różnodomnych: Elaeagnaceae i Polygonaceae, Poaceae i Cornaceae, Salicaceae i Apiaceae oraz Grossulariaceae i Onagraceae, Rosaceae i Plantaginaceae.

Ważnym problemem w określeniu genezy mszyc OPN jest odtworzenie ewentualnych dróg migracji afidofauny na badany teren. Nie dysponujemy żadnym materiałem kopalnym mszyc, wobec czego w omówieniu tego problemu pomóc może jedynie historia roślin żywicielskich. Flora roślin naczyniowych OPN odznacza się zróżnicowanym charakterem

geograficznym, który jest efektem skomplikowanej historii jej kształtowania się. W postglacjalnej historii wędrówek roślin na teren Ojcowa wkraczały gatunki należące do rozmaitych fal migracyjnych, reprezentujące odrębne elementy geograficzne. Analizując szereg prac botanicznych jak również prace dotyczące szlaków migracji chrząszczy możemy wnioskować, że w kształtowaniu się afidofauny OPN najważniejszą rolę odegrały:

- od południa: szlak morawski (tzw. Brama Morawska) – prowadzący z Niziny Węgierskiej przez Morawy, na Wyżynę Śląska i Małopolską; szlak pannońsko-transkarpacki – obniżenia karpackie między Tatrami a Bieszczadami;
- od wschodu: szlak podolski (podolsko-wołyński) – wiodący z obszarów stepowych Podola i Besarabii, przez Wyżynę Lubelską i Małopolską; oraz o znacznie mniejszym znaczeniu;
- od południowego-wschodu: szlak spiski – prowadzący ze Spiszu dolinami Dunajca i Popradu.

Biorąc pod uwagę nieliczne informacje o hipotetycznym pochodzeniu niektórych gatunków mszyc, jak również niepełne dane dotyczące ich rozmieszczenia w świecie, można jedynie domniemywać, z jakich kierunków następowała migracja poszczególnych gatunków. W zaproponowanym modelu dróg i kierunków wnikania wybranych gatunków na teren OPN wzięto pod uwagę głównie pierwotny charakter afidofauny bez uwzględnienia znacznej roli człowieka. Można zatem założyć, że najwcześniejsza ekspansja mszyc na teren OPN objęła gatunki o szerokich areałach: subborealne – *Chaitophorus capreae*, *Ch. hypogaeus*, *Ch. populeti*, *Ch. tremulae*, *Ch. truncatus*, *Plocamaphis floccuosa brachysiphon*, *Pterocomma pilosum*, *Aphis forbesi*; borealne – *Cinara confinis* i *C. costata*; borealnoeurazjatyckie – *Calaphis betulicola*, *C. flava*, *Aphis sedi*. Późniejsze, znacznie cieplejsze i wilgotniejsze okresy sprzyjały wnikaniu głównie gatunków ciepłolubnych i stepowych. Od południa przez Bramę Morawską wędrować mogły elementy: subatlantyckie – *Phyllaphis fagi*, *Lachnus pallipes* i *Aphis hederae*; śródziemnomorskie – *Aphis cytisorum sarothamni*, *A. euphorbiae*, *A. genistae*, *A. origani*, *A. serpylli*, *Corylobium avellanae*, *Myzus ligustri*, *Stomaphis quercus*, *Cinara brauni* oraz pochodzący z górskich rejonów Europy Południowej *Adelges laricis*. Od południa przywędrowały elementy karpackie – *Clethrobius comes* i *Hyperomyzus pallidus*, oraz eurozachodniosyberyjski, górski gatunek *Delphiniobium janackianum*. Od wschodu, szlakiem wołyńsko-podolskim przybyć mogły elementy: południowosyberyjski – *Cinara juniperi*, pontosyberyjskie – *Chaitophorus salicti*, *Ch, vitellinae* i *Periphyllus lyropictus* oraz zachodniopalearktycznostepowy gatunek *Aphis viburni*. Elementy kaspijskie – *Drepanosiphum acerinum*, *D. platanoidis*, *Laingia psammae* i *Trama troglotydes* przybyć mogły szlakiem podolskim lub przez obniżenie Karpat. Poprzez obniżenie Karpat, jak również szlakiem spiskim przybyć mogły elementy wschodniośródziemnomorskie – *Cryptomyzus alboapicalis*, *C. galeopsidis*, *C. ribis* oraz irańsko-anatolijski *Aphis verbenae*. Pozostałe, jak choćby: subpontyjski – *Chromaphis juglandicola*, *Panaphis juglandis*, *Aphis stachydis*, *Hyalopterus pruni*; pontyjski – *Chaitophorus mordvilkoi*, *Macrosiphoniella absinthii*, *Myzus persicae* oraz irańsko-turański – *Brachycaudus helichrysi*, *B. cardui*, *B. prunicola*, *Dysaphis plantaginea* i *D. pyri* prawdopodobnie przybyły przez obniżenie Karpat lub szlakiem spiskim; nie można również wykluczyć szlaku wołyńsko-podolskiego. Nie ulega natomiast żadnej wątpliwości, iż gatunki o pochodzeniu: nearktycznym – *Pemphigus borealis* i *Uroleucon erigeronense*, centralnoazjatyckim – *Impatientinum asiaticum* oraz dalekowschodnim –

Chaitophorus salijaponicus niger, to elementy zawleczone wraz z roślinami żywicielskimi. Naturalne szlaki migracji mszyc, podobnie jak w przypadku roślin, to przede wszystkim doliny rzek (dla Ojcowa: Prądnik i Sąspówka). Te naturalne drogi migracji, często krzyżują się ze szlakami stworzonymi przez człowieka (szlaki komunikacyjne, pola). W przypadku OPN mamy, z jednej strony migracje antropogenne, częstsze i szybsze w stosunku do naturalnych, ale z drugiej zaś hamowane przez wyspowy charakter samego parku. Obszar OPN jest otoczony użytkami rolnymi, drogami jezdnymi, zabudowaniami i pozbawiony jest naturalnej łączności poprzez korytarze ekologiczne z większymi kompleksami leśnymi. Gospodarka ludzka ułatwiła i przyspieszyła przede wszystkim migracje gatunków związanych z terenami bezleśnymi. Początkowy etap wylesiania tego terenu powodował rozszerzenie otwartych pobrzeży rzek (pierwotne szlaki komunikacyjne). Sugeruje się, iż w pierwszej kolejności dotyczyło to Bramy Morawskiej, i to właśnie ten szlak migracyjny miał największe znaczenie dla fauny kserotermicznej OPN od schyłku Vistulianu aż do końca XX wieku. Szlak podolski dla OPN na znaczeniu zyskał prawdopodobnie dopiero po przetarciu równoleżnikowych traktów łączących górną Wisłę z górnym Dniestrem (późny holocen), natomiast szlaki transkarpackie nabrały znaczenia prawdopodobnie w XVII wieku, kiedy to osadnictwo podkarpackie dotarło w wyższe partie gór i powstały bezleśne ciągi komunikacyjne. W próbie odtworzenia szlaków migracyjnych gatunków mszyc w rejonie Ojcowa wyróżnić można pięć zasadniczych dróg:

- od zachodu: droga wierzchowinowa zachodnia i droga dolinowa północno-zachodnia (z Wyżyny Śląskiej z pominięciem Krakowa i Garbu Tenczyńskiego) – dla szlaku morawskiego;
- od południowego-zachodu: droga dolinowa południowo-zachodnia (poprzez Kraków, Dolinę Rudawy, Dolinę Kluczwody) – dla szlaku morawskiego;
- od wschodu: droga wierzchowinowa wschodnia i dolinowa północna (przez Pondzie i Wyżynę Miechowską) – dla szlaku podolskiego i ewentualnie spiskiego, ale bardziej od strony południowej;
- od południowego-wschodu: droga dolinowa południowo-wschodnia i południowa (od Krakowa poprzez Dolinę Dłubni i Prądnika) – dla szlaków transkarpackiego i spiskiego;
- od północy: droga dolinowa północno-zachodnia i dolinowa północna (z Wyżyny Częstochowskiej) – dla szlaku północnego.

Pomijając gatunki, które weszły od północy po opuszczeniu tego terenu przez lodowiec; wydaje się, iż największy udział w jej tworzeniu się miały: szlak morawski (przede wszystkim dla gatunków ciepłolubnych) oraz szlaki transkarapackie (przede wszystkim dla gatunków wilgociolubnych i górskich). Znacznie mniejsze znaczenia odegrał szlak podolski, najmniejsze natomiast szlak spiski. Aktualnie, w obrębie OPN, migracje mszyc odbywają się głównie wzdłuż dróg, szlaków turystycznych, oraz dużych otwartych dolin.

Podsumowując:

- OPN jest aktualnie najlepiej poznanym parkiem narodowym w Polsce. Różnorodność gatunkowa OPN znacznie przewyższa inne zbadane polskie parki narodowe;
- spośród trzech stwierdzonych gatunków nowych dla fauny Polski, na uwagę zasługuje *Aphis lilago* ze względu na to, że odnalezienie go w innych rejonach Polski może być trudne ze względu na specyfikę siedliska, w którym występuje i rzadkie występowanie rośliny żywicielskiej;

▪ stwierdzona znaczna przewaga oligofagów 1. stopnia i monofagów świadczy o tym, że afidocenozy OPN nadal wykazują strukturę niezaburzoną, zbliżoną do naturalnej, jednak zaobserwowana większa częstość notowań gatunków polifagicznych o szerokim spektrum ekologicznym, może świadczyć o zachodzeniu niekorzystnych zmian w badanych siedliskach i (zakłóceniu) zaburzeniu struktury afidocenoz;

▪ przewaga mezohigrofilów i kserofilów świadczy o dużym zróżnicowaniu siedlisk OPN, które z jednej strony oferują odpowiednie warunki ekologiczne i rośliny żywicielskie dla gatunków mezohigrofilnych, szczególnie w dolinach rzecznych i zbiorowiskach leśnych, z drugiej zaś strony dla gatunków kserofilnych, znajdujących dogodne dla siebie warunki na odsłoniętych murawach kserotermicznych i półkach skalnych;

▪ bogactwo gatunkowe afidofauny zbiorowisk ruderalnych i kserotermicznych, w przeciwieństwie do buczyn i szuwarów, wykazuje wyraźną korelację z bogactwem florystycznym;

▪ afidocenozy półek skalnych są najcenniejsze z powodu występowania dużej liczby gatunków na skrajnie ograniczonej powierzchni. Gatunki tu występujące charakteryzują się wąskim spektrum ekologicznym i wąskim rozprzestrzenieniem. Zagrożenia tych afidocenoz z jednej strony wynikają z obserwowanego wzrostu częstości notowań gatunków polifagicznych, geopolitycznych, mogących wypierać elementy naturalne, z drugiej z unikatowości siedlisk tego typu w skali kraju;

▪ znacząca przewaga gatunków notowanych rzadko i pojedynczo potwierdza istniejącą mozaikowatość i specyficzność siedlisk OPN;

▪ stwierdzony fakt, że niespełna połowa gatunków roślin OPN nie była zasiedlona przez mszyce sugeruje, że mszyce, głównie monofagiczne i stenobiotyczne, charakteryzują się jednak znacznie większą wybiórczością pokarmową i siedliskową niż zwykło się powszechnie przyjmować; badania tego typu dotyczące powiązań pokarmowych układów mszyca – roślina żywicielska powinny być kontynuowane;

▪ zdecydowana różnica pod względem liczby gatunków mszyc związanych z młodymi i bogatymi florystycznie rodzinami Asteraceae i Poaceae, może wskazywać na istniejącą silną konkurencję ze strony innych fitofagów ssących żerujących na trawach;

▪ w starszych filogenetycznie rodzinach roślin żywicielskich przewaga liczebna dendrofilnych gatunków mszyc nad gatunkami roślin żywicielskich dowodzi o sile i ścisłości istniejących związków koewolucyjnych, ponieważ im starsza filogenetycznie jest dana rodzina roślin, tym więcej gatunków mszyc miało szansę przystosować się do życia jej kosztem;

▪ przeprowadzona analiza podobieństw składu gatunkowego mszyc w poszczególnych typach zbiorowisk i siedlisk wykazała istnienie trzech kręgów zgrupowań potwierdzających występowanie realnych zależności pomiędzy zestawem gatunków mszyc o podobnych wymaganiach siedliskowych i troficznych a odpowiadającym im fitocenozom;

▪ przeanalizowane podobieństwo składu gatunkowego mszyc w poszczególnych rodzinach roślin wyróżniło grupy rodzin botanicznych, pomiędzy którymi migrują mszyce różnodomne, co potwierdza, że związki takie realnie funkcjonują w przyrodzie i mają trwały charakter;

▪ z analizy chorologicznej wynika znaczny udział gatunków holarktycznych, a nieznacznie niższy cosmopolitycznych i europejskich. W przypadku gatunków

o szerokim rozprzestrzenieniu (holarktycznych i geopolitycznych), będących polifagami lub oligofagami 2. stopnia uwarunkowane jest to pierwotnym, naturalnym rozmieszczeniem gatunków w Holarktyce lub dużym potencjałem migracyjnym mszyc. Znaczny udział elementów europejskich będących monofagami lub oligofagami 1. stopnia, sugeruje, że muszą istnieć jakiejś czynniki ograniczające, prawdopodobnie są to: brak żywiciela i dogodnych siedlisk, czy powiązań z roślinami uprawnymi. Pośrednio, może to również świadczyć o dobrej kondycji siedlisk OPN;

▪ fauna mszyc OPN jest stosunkowo młoda, ukształtowana w holocenie po ustąpieniu lodowca. Jej najstarsze elementy to gatunki dendrofilne, związane przede wszystkim z rodzinami Betulaceae, Salicaceae i Pinaceae;

▪ pierwotną faunę OPN tworzą gatunki związane ze zbiorowiskami leśnymi i podmokłymi. Wraz z rozwojem działalności człowieka zwiększał się udział gatunków związanych z siedliskami łąkowymi i ruderalnymi;

▪ wraz z wkraczającymi na tren OPN obcymi roślinami żywicielskimi pojawiają się obce gatunki mszyc. Jednocześnie kenofity zasiedlane są przez rodzime gatunki o szerokim spektrum ekologicznym;

▪ z przedstawionej genezy wynika, że znaczna część przedstawicieli afidofauny OPN zawdzięcza swoje istnienie człowiekowi;

▪ w kształtowaniu pierwotnej afidofauny OPN główną rolę odegrały cztery szlaki migracyjne: morawski, panońsko-transkarpacki, podolsko-wołyński i spiski;

▪ w kształtowaniu współczesnej afidofauny OPN znaczenie dolin rzek dla migracji mszyc znacznie zmniejsza się na korzyść antropogenicznych szlaków komunikacyjnych. W obrębie OPN obserwowane migracje afidofauny odbywają się głównie wzdłuż dróg, szlaków turystycznych oraz dużych, otwartych dolin;

▪ wydaje się, że w OPN siedliska antropogeniczne są rezerwuarem dla gatunków polifagicznych, mogących wypierać bardziej wąsko wyspecjalizowane gatunki mszyc zasiedlające siedliska naturalne.

INSTRUCTIONS FOR AUTHORS

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Examples: Mazur S. 1984. A world catalogue of Histeridae. Polskie Pismo Entomologiczne, 54: 1–379.

Mulsant E., Rey A. 1844a. Histoire Naturelle des Coléopteres de France. Maison, Paris: vii + 1–196, pl. 1.

Lawrance J. F. 1982. Coleoptera. [in:] Parker S.P. (ed.). Synopsis and Classification of Living Organisms. Vol. 2, McGraw-Hill, New York: 482–553.

Ponomarenko, A. G. 1985. [Beetles from the Jurassic of Siberia and western Mongolia]. Trudy Paleontologicheskogo Instituta, 211: 47–87. [In Russian].

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