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Infestation of dendrological collection in central Poland by aphids

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Abstract: The study was aimed at determining the species composition of aphid fauna related to the dendroflora of Kórnik Arboretum as well as determining the infestation level of trees and shrubs. The infestation level was measured on a five-level scale. The material was collected on two sites: in a park and forest. 236 botanic taxa (species and cultivars) were confirmed to be infested by aphids in Kórnik Arboretum; the taxa belonged to 22 families and 46 genera of *Angiospermae* and 2 families and 6 genera of *Gymnospermae*. The collected aphid fauna included 96 species of *Aphidoidea* and *Phylloxeroidea* superfamilies. The botanic taxa most threatened with damage resulting from the insects feeding, and consequently a loss of decorative value, were defined.

Additional key words: dendroflora, aphifofauna, *Hemiptera*, *Sternorrhyncha*, *Aphidomorpha*, *Aphidoidea*, *Phylloxeroidea*.

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Introduction

Kórnik Arboretum is among Central European dendrological parks with the greatest number of tree species, and its history dates back to the 19th century. Tree and shrubs collections contain about 3,500 species and cultivars taking up 60 ha. They are grouped in the oldest part, the so called Old Arboretum, located by Kórnik Castle (35 ha), also in the New Arboretum (18 ha) and in Zwierzyniec Experimental Forest (4 ha). The fauna of Kórnik Arboretum is little known, so far only small mammals (Wilusz 1952) and birds (Bartkowiak 1968) have been described. So far no insect group, including aphids, has been described in terms of species composition. The only

studies mentioning aphids were those by Achremowicz (1967, 1972) concerning the occurrence on trees of only about a dozen species. The study purpose was aimed at compiling a list of trees and bushes growing in Kórnik Arboretum and infested by aphids, as well as determining botanical taxa most threatened with damage resulting from the insects' feeding.

Methods

The studies were conducted in Kórnik Arboretum during four vegetation seasons, in the years 2005–2008. The list of aphid-infested plants was compiled by checking all trees and shrubs and collecting aphids from them. Samples were taken from May

to October at ten-day intervals. Aphids were collected on two sites, the first of a park character, covering both the Old and New Arboretum, and the other one, of a forest character, located in Zwierzyniec Experimental Forest. The Old Arboretum is the oldest and historic part of the ancient castle park with old trees of domestic and foreign species. The New Arboretum, created after 1960, contains numerous collections of coniferous and deciduous trees and shrubs that require better soil and sunshine. Zwierzyniec Experimental Forest was created in 1960s as a new area with forest conditions, under the canopy of old oak and pine trees hosting new collections of coniferous trees and heath shrubs, as well as deciduous ones requiring soil of acid reaction. During observation the plant part infested by aphid feeding, the level of infestation and its signs were recorded. The extent of plant infestation by aphids was described with a five-level scale, where: level I – no aphids, level II – slight infestation (single specimens on plant organs), level III – medium infestation (small and middle-sized colonies on plants), level IV – considerable infestation (large colonies on plant organs), level V – very high infestation (aphids cover whole plant organs). The aphids were preserved in test tubes with 75% ethyl alcohol and then classified with the keys by Blackman and Eastop (1994), Szelegiewicz (1978, 1985), Taylor (1984), Bogdanowicz et al. (2004), Osiadacz and Hałaj (2009).

Results and discussion

The studies in Kórnik Arboretum helped to establish that 236 botanic taxa (species and cultivars) of deciduous and coniferous trees and shrubs were infested by aphids. The taxa belonged to 22 families and 46 genera of *Angiospermae* and 2 families and 6 genera of *Gymnospermae*. The collected aphid fauna included 96 species of two superfamilies, *Aphidoidea* and *Phylloxeroidea* (Table 1).

The largest number of aphid host plants among deciduous trees and shrubs, namely 10 botanic taxa, belonged to the *Rosaceae* family. Next came the families of *Caprifoliaceae* with 5 genera and *Elaeagnaceae* with 3 genera. Other families had fewer representatives. Among *Gymnospermae* group those which were aphid hosts belonged to *Pinaceae* and *Cupressaceae* families, in total representing 7 genera. A full list of host plants and aphids infesting them that occurred on both study sites is presented in Table 2.

In the park site (the Old and New Arboretum) in the years 2005–2008 aphid host plants constituted 217 botanical taxa (species and cultivars), on which 88 aphid species were recorded, and on the forest site (Zwierzyniec Experimental Forest) 31 botanic taxa were infested by 26 aphid species.

The plants infested by the most abundant aphid fauna were those belonging to *Picea*, from which 8

aphid and *Betula* species were collected, infested by 7 species of those *Hemiptera*.

A considerable difference in species composition of aphid fauna between the study sites can be explained with at least three reasons. This was mainly due to the species composition of plants and the area vastness. Varied collections of trees and shrubs on the park site (the Old and New Arboretum) rendered them very attractive for aphids, the insects whose development is closely or entirely connected with trees. In the world's aphid fauna among 493 genera as many as 270 develop completely or partly on trees and shrubs. Considerably more species are related to deciduous than coniferous trees. The dominance of coniferous and heath shrubs on the forest site (Zwierzyniec Experimental Forest) resulted in its considerably narrower spectrum of aphid species than the park one.

Out of 96 aphid species reported from the Arboretum 32 were recorded in all the study seasons, 46 species in three of them, 64 in two and 32 only in one season. Such differences may be explained with changing weather conditions between seasons, certain cyclic occurrence of some species, and small populations of some of them. During 4-year studies the richest aphidological material was collected in season 2008.

The community of 96 aphid taxa related to the dendroflora of Kórnik Arboretum was dominated by monoecious species (63), which made up 66% of the classified species. An analysis of the community's phagism proved that the majority, i.e. as many as 61 species, belonged to first-degree oligophages, i.e. the taxa infesting plants of one genus; together with monophages (29 species) they constituted 83% of aphid fauna. This proves very close relationships between the arboretum aphid fauna and dendroflora.

Assuming that plant-threatening species can be defined as one that meets two criteria: yearly occurrence and infesting plants to a degree higher than three, the group contained 32 aphid taxa on the park site, while on the forest site only 5 taxa.

In each season the aphids occurred most abundantly on the break of spring and summer, from mid-May to the beginning of July. In season 2008 the peak occurrence was in the first ten days of June, when 44 aphid species were recorded on 156 tree taxa on the park site and 18 aphid species were recorded on 28 botanical taxa on the forest site (Fig. 1).

The analysis showed that alien taxa were infested as often as domestic ones. This proves considerable adaptation abilities of the domestic aphid fauna.

In spring on the park site the cultivars *Fagus sylvatica* were abundantly infested by *Phyllaphis fagi*, a monoecious species which forms colonies on leaves and shoots; domestic and foreign maple species were infested by *Drepanosiphum platanoidis* and *Periphyllus testudinaceus*, also monoecious species feeding on

Table 1. A list of aphid species collected on trees and shrubs in the Kórnik Arboretum in 2005–2008

Superfamily/family	Species	Superfamily/family	Species
<i>Phylloxeroidea</i>		<i>Aphididae</i>	<i>Pterocomma populeum</i> (Kaltenbach)
<i>Adelgidae</i>	<i>Adelges laricis</i> Vallot		<i>Aphis craccivora</i> Koch
	<i>Adelges abietis</i> (Linnaeus)		<i>Aphis fabae</i> Scopoli
	<i>Adelges viridis</i> (Ratzeburg)		<i>Aphis farinosa</i> J.F.Gmelin
	<i>Aphrastasia pectinatae</i> (Cholodkovsky)		<i>Aphis hederæ</i> Kaltenbach
	<i>Dreyfusia nordmanniana</i> (Eckstein)		<i>Aphis pomi</i> de Geer
	<i>Dreyfusia piceae</i> (Ratzeburg)		<i>Aphis sambuci</i> Linnaeus
	<i>Gilletteella cooleyi</i> (Gilleette)		<i>Aphis schneideri</i> (Börner)
	<i>Pineus strobis</i> (Hartig)		<i>Aphis spiraephaga</i> F.P.Müller
<i>Phylloxeridae</i>	<i>Phylloxera glabra</i> (von Heyden)		<i>Aphis viburni</i> Scopoli
<i>Aphidoidea</i>			<i>Rhopalosiphum insertum</i> (Walker)
<i>Pemphigidae</i>	<i>Eriosoma ulmi</i> (Linnaeus)		<i>Rhopalosiphum padi</i> (Linnaeus)
	<i>Colopha compressa</i> (Koch)		<i>Acyrtosiphon caraganae</i> (Cholodkovsky)
	<i>Tetraneura ulmi</i> (Linnaeus)		<i>Brachycaudus helichrysi</i> (Kaltenbach)
	<i>Prociphilus xylostei</i> (de Geer)		<i>Brachycaudus spiraeae</i> Börner
<i>Anoeciidae</i>	<i>Anoecia corni</i> (Fabricius)		<i>Brachycaudus cardui</i> (Linnaeus)
<i>Hormaphididae</i>	<i>Mindarus abietinus</i> Koch		<i>Capitophorus elaeagni</i> (del Guercio)
<i>Drepanosiphidae</i>	<i>Drepanosiphum platanoidis</i> (Schrank)		<i>Capitophorus hippophaes</i> (Walker)
	<i>Appendiseta robiniae</i> (Gilleette)		<i>Cavariella aegopodii</i> (Scopoli)
	<i>Calaphis betulicola</i> (Kaltenbach)		<i>Cavariella pastinacae</i> (Linnaeus)
	<i>Calaphis flava</i> Mordvilko		<i>Cavariella theobaldi</i> (Gillette & Bragg)
	<i>Callipterinella tuberculata</i> (von Heyden)		<i>Ceruraphis eriophori</i> (Walker)
	<i>Clethriobius comes</i> (Walker)		<i>Chaetosiphon tetraerhodum</i> (Walker)
	<i>Eucallipterus tiliae</i> (Linnaeus)		<i>Corylobium avellanae</i> (Schrank)
	<i>Euceraphis betulae</i> (Koch)		<i>Cryptomyzus ribis</i> (Linnaeus)
	<i>Euceraphis punctipennis</i> (Zetterstedt)		<i>Dysaphis plantaginea</i> (Passerini)
	<i>Monaphis antennata</i> (Kaltenbach)		<i>Hyadaphis foeniculi</i> (Passerini)
	<i>Myzocallis carpini</i> (Koch)		<i>Hyperomyzus lactucae</i> (Linnaeus)
	<i>Myzocallis coryli</i> (Goeze)		<i>Hyperomyzus pallidus</i> Hille Ris Lambers
	<i>Myzocallis castanicola</i> Baker		<i>Hyperomyzus picridis</i> (Börner & Blunck)
	<i>Phyllaphis fagi</i> (Linnaeus)		<i>Illinoia azalea</i> (Mason)
	<i>Pterocallis alni</i> (de Geer)		<i>Liosomaphis berberidis</i> (Kaltenbach)
	<i>Pterocallis maculatus</i> (von Heyden)		<i>Macrosiphum rosae</i> (Linnaeus)
	<i>Symydobius oblongus</i> (von Heyden)		<i>Metopolophium dirhodum</i> (Walker)
	<i>Therioaphis tenera</i> (Aizennberg)		<i>Myzus cerasi</i> (Fabricius)
	<i>Tinocallis platani</i> (Kaltenbach)		<i>Myzus ligustri</i> (Mosley)
	<i>Tinocallis nevskyi</i> Remaudière, Quednau & Heie		<i>Nasonovia ribisnigri</i> (Mosley)
	<i>Tuberculatus annulatus</i> (Hartig)		<i>Ovatus crataegarius</i> (Walker)
	<i>Tuberculatus borealis</i> (Krzywicz)		<i>Ovatus insitus</i> (Walker)
	<i>Chaitophorus leucomelas</i> Koch		<i>Rhopalomyzus lonicerae</i> (Siebold)
	<i>Chaitophorus populeti</i> (Panzer)		<i>Trichosiphonaphis corticis</i> (Aizenberg)
	<i>Chaitophorus populiabae</i> (Boyer de Fonscolombe)	<i>Lachnidae</i>	<i>Lachnus roboris</i> (Linnaeus)
	<i>Chaitophorus salicti</i> (Schrank)		<i>Cinara costata</i> (Zetterstedt)
	<i>Chaitophorus salijaponicus niger</i> Mordvilko		<i>Cinara piceae</i> (Panzer)
	<i>Periphyllus lyropictus</i> (Kessler)		<i>Cinara pilicornis</i> (Hartig)
	<i>Periphyllus testudinaceus</i> (Ferne)		<i>Cinara pinea</i> (Mordvilko)
			<i>Cinara pini</i> (Linnaeus)
			<i>Cinara pruinosa</i> (Hartig)
			<i>Cinara juniperi</i> (de Geer)
			<i>Eulachnus agilis</i> (Kaltenbach)
			<i>Eulachnus rileyi</i> (Williams)
			<i>Schizolachnus pineti</i> (Fabricius)

Table 2. A list of host plant infested by aphids in park and forest locality in Kórnik Arboretum in 2005–2008

Host plant	Aphid species	Degree of infestation
Park locality		
<i>Acer cappadocicum</i> Gled.	<i>Periphyllus testudinaceus</i>	II
<i>Acer carpiniifolium</i> Sieb. et Zucc.	<i>Periphyllus testudinaceus</i>	II–III
<i>Acer circinatum</i> Pursh	<i>Drepanosiphum platanoidis</i>	III
	<i>Periphyllus testudinaceus</i>	II–III
<i>Acer davidii</i> Franch.	<i>Periphyllus testudinaceus</i>	II–III
<i>Acer griseum</i> (Franch.) Pax.	<i>Periphyllus testudinaceus</i>	II–III
<i>Acer grosseri</i> Pax. var. <i>hersii</i>	<i>Periphyllus testudinaceus</i>	II–IV
<i>Acer hyrcanum</i> Fisch. et Mey	<i>Drepanosiphum platanoidis</i>	III–IV
	<i>Periphyllus testudinaceus</i>	II–III
<i>Acer japonicum</i> Thunb. ex Murray	<i>Periphyllus testudinaceus</i>	II
<i>Acer negundo</i> L.	<i>Periphyllus testudinaceus</i>	II–III
<i>Acer negundo</i> L. ‘Tadeusz Szymanowski’	<i>Periphyllus testudinaceus</i>	III–IV
<i>Acer negundo</i> L. ‘Variegatum’	<i>Periphyllus testudinaceus</i>	II–III
<i>Acer opalus</i> Mill.	<i>Drepanosiphum platanoidis</i>	II–V
	<i>Periphyllus testudinaceus</i>	II–III
<i>Acer opalus</i> ssp. <i>obtusatum</i> (Waldst. & Kit. ex Willd.) Gams	<i>Periphyllus testudinaceus</i>	II
	<i>Drepanosiphum platanoidis</i>	III
<i>Acer palmatum</i> Thunb. ex Murray ssp. <i>palmatum</i>	<i>Periphyllus testudinaceus</i>	II
<i>Acer pensylvanicum</i> L.	<i>Periphyllus testudinaceus</i>	III–IV
<i>Acer platanoides</i> L.	<i>Periphyllus testudinaceus</i>	II–IV
	<i>Drepanosiphum platanoidis</i>	II–IV
<i>Acer platanoides</i> L. ‘Crimson King’	<i>Periphyllus testudinaceus</i>	II
<i>Acer platanoides</i> L. ‘Waldensei’	<i>Periphyllus testudinaceus</i>	III
<i>Acer pseudoplatanus</i> L.	<i>Periphyllus testudinaceus</i>	II
<i>Acer pseudoplatanus</i> L. ‘Brilliantissimum’	<i>Periphyllus testudinaceus</i>	II–III
	<i>Drepanosiphum platanoidis</i>	II–III
<i>Acer pseudoplatanus</i> L. ‘Leopoldii’	<i>Drepanosiphum platanoidis</i>	II
	<i>Periphyllus testudinaceus</i>	II–III
<i>Acer rubrum</i> L.	<i>Drepanosiphum platanoidis</i>	II–III
<i>Acer rubrum</i> L. ‘Red Sunset’	<i>Drepanosiphum platanoidis</i>	III
	<i>Periphyllus testudinaceus</i>	II
<i>Acer shirasawanum</i> Koidz	<i>Periphyllus testudinaceus</i>	II
<i>Acer stevenii</i> Pojark.	<i>Periphyllus testudinaceus</i>	II
<i>Acer tataricum</i> L. ssp. <i>ginnala</i> (Maxim.) Wesm.	<i>Periphyllus testudinaceus</i>	II–III
<i>Acer triflorum</i> Komar.	<i>Periphyllus lyropictus</i>	II
	<i>Periphyllus testudinaceus</i>	II–IV
<i>Aesculus glabra</i> Willd.	<i>Periphyllus testudinaceus</i>	II–IV
<i>Aesculus hippocastanum</i> L. ‘Partyzant’	<i>Periphyllus testudinaceus</i>	II–III
<i>Aesculus octandra</i> Marsh.	<i>Periphyllus testudinaceus</i>	II
<i>Alnus glutinosa</i> (L.) Gaertn.	<i>Pterocallis alni</i>	III–IV
	<i>Pterocallis maculatus</i>	III–IV
	<i>Clethrobium comes</i>	II
<i>Alnus glutinosa</i> (L.) Gaertn. ‘Imperialis’	<i>Pterocallis alni</i>	II
	<i>Pterocallis maculatus</i>	II–III
<i>Alnus glutinosa</i> (L.) Gaertn. ‘Laciniata’	<i>Pterocallis alni</i>	II
<i>Alnus japonica</i> (Thunb.) Steud.	<i>Pterocallis alni</i>	II
<i>Alnus maximowiczii</i> Callier ex C. K. Schneid.	<i>Pterocallis alni</i>	III
<i>Alnus viridis</i> (Chaix) DC.	<i>Pterocallis alni</i>	III

Host plant	Aphid species	Degree of infestation
<i>Berberis thunbergii</i> DC.	<i>Liosomaphis berberidis</i>	III
<i>Betula coerulea-grandis</i> Blanch.	<i>Euceraphis betulae</i>	II–V
	<i>Euceraphis punctipennis</i>	II
<i>Betula glandulosa</i> Michx.	<i>Calaphis flava</i>	II
	<i>Callipterinella tuberculata</i>	III–IV
	<i>Symydobius oblongus</i>	III–IV
	<i>Euceraphis betulae</i>	II
<i>Betula litvinowii</i> Doluch.	<i>Calaphis flava</i>	III–V
	<i>Euceraphis betulae</i>	II–V
	<i>Euceraphis punctipennis</i>	IV
	<i>Symydobius oblongus</i>	II
<i>Betula pendula</i> Roth	<i>Calaphis betulicola</i>	II
	<i>Euceraphis betulae</i>	II
<i>Betula pendula</i> Roth 'Purpurea'	<i>Euceraphis betulae</i>	IV
	<i>Euceraphis punctipennis</i>	III
	<i>Monaphis antenata</i>	II
<i>Betula utilis</i> var. <i>jacquemontii</i> (Spach) Winkl.	<i>Symydobius oblongus</i>	IV
	<i>Calaphis flava</i>	II
	<i>Euceraphis betulae</i>	II
	<i>Euceraphis punctipennis</i>	II
<i>Betula</i> 'Hoseri'	<i>Euceraphis betulae</i>	II
<i>Caragana arborescens</i> Lam.	<i>Acyrtosiphon caraganae</i>	II–III
	<i>Therioaphis tenera</i>	III–IV
<i>Carpinus betulus</i> L.	<i>Myzocallis carpini</i>	II
<i>Carpinus betulus</i> L. 'Columnaris'	<i>Myzocallis carpini</i>	II–III
<i>Carpinus betulus</i> L. 'Fastigiata'	<i>Myzocallis carpini</i>	II
<i>Carpinus betulus</i> L. 'Quercifolia'	<i>Myzocallis carpini</i>	II–III
<i>Carpinus caroliniana</i> Walt.	<i>Myzocallis carpini</i>	II–III
<i>Carpinus cordata</i> Blume	<i>Myzocallis carpini</i>	II
<i>Carpinus japonica</i> Blume	<i>Myzocallis carpini</i>	III
<i>Carpinus orientalis</i> Mill.	<i>Myzocallis carpini</i>	II–IV
<i>Chaenomeles cathayensis</i> (Hemsl.) C. K. Schneid.	<i>Aphis pomi</i>	II
	<i>Rhopalosiphum padi</i>	III
<i>Chaenomeles japonica</i> (Thunb.) Lindl. Ex Spach var. <i>alpina</i>	<i>Aphis pomi</i>	IV
	<i>Brachycaudus helichrysi</i>	II
<i>Chaenomeles speciosa</i> (Sweet) Nakai	<i>Aphis pomi</i>	III–IV
<i>Chaenomeles</i> × <i>superba</i> (Frahm) Rehder	<i>Aphis pomi</i>	III
<i>Cornus alba</i> L. 'Aurea'	<i>Anoecia corni</i>	II–III
<i>Cornus alba</i> L. 'Elegantissima'	<i>Anoecia corni</i>	II–III
<i>Cornus alba</i> L. 'Sibirica'	<i>Anoecia corni</i>	II–III
<i>Cornus amomum</i> Mill.	<i>Anoecia corni</i>	III
<i>Cornus controversa</i> Hemsl.	<i>Anoecia corni</i>	III
<i>Cornus florida</i> L.	<i>Anoecia corni</i>	II
<i>Cornus macrophylla</i> Wall.	<i>Anoecia corni</i>	II–IV
<i>Cornus mas</i> L.	<i>Anoecia corni</i>	III
<i>Cornus rugosa</i> Lam.	<i>Anoecia corni</i>	II–IV
<i>Cornus sanguinea</i> L.	<i>Anoecia corni</i>	III
<i>Cornus sericea</i> L. 'Flaviramea'	<i>Anoecia corni</i>	IV
<i>Corylus avellana</i> L. 'Aurea'	<i>Corylobium avellana</i>	III
	<i>Myzocallis coryli</i>	III

Host plant	Aphid species	Degree of infestation
<i>Corylus avellana</i> L. 'Barceloński'	<i>Myzocallis coryli</i>	II-IV
<i>Corylus avellana</i> L. 'Contorta'	<i>Corylobium avellana</i>	III
	<i>Myzocallis coryli</i>	II-IV
<i>Corylus avellana</i> L. 'Fuscorubra'	<i>Corylobium avellana</i>	II-III
	<i>Myzocallis coryli</i>	II-III
<i>Corylus avellana</i> L. 'Pendula'	<i>Corylobium avellana</i>	II-III
	<i>Myzocallis coryli</i>	II-III
<i>Cotoneaster divaricatus</i> Rehder et E.H. Wilson	<i>Aphis pomi</i>	IV
<i>Cotoneaster harrismithii</i> Flinck et Hylmö	<i>Aphis pomi</i>	III-V
<i>Cotoneaster horizontalis</i> Decne.	<i>Aphis pomi</i>	IV
<i>Cotoneaster multiflorus</i> Bunge var. <i>calocarpus</i>	<i>Aphis pomi</i>	III-IV
<i>Cotoneaster nanshan</i> Mottet	<i>Aphis pomi</i>	III-IV
<i>Cotoneaster pekinensis</i> (Koehne) Zabel	<i>Aphis pomi</i>	III
<i>Cotoneaster sikangensis</i> Flinck et Hylmö	<i>Aphis pomi</i>	III
<i>Cotoneaster sternianus</i> (Turill) Boom	<i>Aphis pomi</i>	III
<i>Crataegus monogyna</i> Jacq. 'Compacta'	<i>Aphis pomi</i>	III-IV
<i>Deutzia scabra</i> Thunb.	<i>Aphis fabae</i>	III-IV
<i>Dipelta floribunda</i> Maxim.	<i>Macrosiphum rosae</i>	II-III
<i>Elaeagnus angustifolia</i> L.	<i>Capitophorus elaeagni</i>	III-V
<i>Elaeagnus umbellata</i> Thunb.	<i>Capitophorus hippophaes</i>	IV-V
<i>Euonymus alatus</i> (Thunb.) Siebold 'Compactus'	<i>Aphis fabae</i>	II-IV
<i>Euonymus atropurpureus</i> Jacq.	<i>Aphis fabae</i>	IV
<i>Euonymus europaeus</i> L.	<i>Aphis fabae</i>	V
<i>Euonymus fortunei</i> (Turcz.) Hand.-Mazz.	<i>Aphis fabae</i>	III-IV
<i>Euonymus fortunei</i> (Turcz.) Hand.-Mazz. 'Coloratus'	<i>Aphis fabae</i>	V
<i>Euonymus hamiltonianus</i> Wall.	<i>Aphis fabae</i>	V
<i>Euonymus latifolius</i> (L.) Mill.	<i>Aphis fabae</i>	III-V
<i>Euonymus verrucosus</i> Scop.	<i>Aphis fabae</i>	IV -V
<i>Fagus sylvatica</i> L.	<i>Phyllaphis fagi</i>	II-IV
<i>Fagus sylvatica</i> L. 'Asplenifolia'	<i>Phyllaphis fagi</i>	III-V
<i>Fagus sylvatica</i> L. 'Gorzyń'	<i>Phyllaphis fagi</i>	II-IV
<i>Fagus sylvatica</i> L. ssp. <i>orientalis</i> (Lipsky) Greuter et Burdet	<i>Phyllaphis fagi</i>	II-III
<i>Fagus sylvatica</i> L. 'Pendula'	<i>Phyllaphis fagi</i>	III-IV
<i>Fagus sylvatica</i> L. 'Purpurea'	<i>Phyllaphis fagi</i>	II-IV
<i>Fagus sylvatica</i> L. 'Purpurea Gorzyń'	<i>Phyllaphis fagi</i>	III-IV
<i>Fagus sylvatica</i> L. 'Purpurea Tricolor'	<i>Phyllaphis fagi</i>	III-V
<i>Fagus sylvatica</i> L. 'Rohanii'	<i>Phyllaphis fagi</i>	III-IV
<i>Fagus sylvatica</i> L. 'Rohan Obelisk'	<i>Phyllaphis fagi</i>	II-III
<i>Fagus sylvatica</i> L. 'Rohan Trompenburg'	<i>Phyllaphis fagi</i>	III-IV
<i>Fagus sylvatica</i> L. 'Tricolor'	<i>Phyllaphis fagi</i>	II-IV
<i>Fagus sylvatica</i> L. 'Zlatia'	<i>Phyllaphis fagi</i>	IV
<i>Forsythia</i> × <i>intermedia</i> Zabel	<i>Aphis fabae</i>	III
<i>Hamamelis japonica</i> Siebold et Zucc.	<i>Hyperomyzus pallidus</i>	III
<i>Hedera helix</i> L.	<i>Aphis hederae</i>	III
<i>Hippophae rhamnoides</i> L.	<i>Capitophorus elaeagni</i>	II-V
	<i>Capitophorus hippophaes</i>	II
<i>Juniperus communis</i> L. 'Gold Cone'	<i>Cinara juniperi</i>	II
<i>Juniperus communis</i> L. 'Hornibrookii'	<i>Cinara juniperi</i>	II
<i>Larix kaempferi</i> (Lamb.) Carrière	<i>Adelges laricis</i>	III-V
<i>Ligustrum vulgare</i> L. 'Chlorocarpum'	<i>Myzus ligustri</i>	III

Host plant	Aphid species	Degree of infestation
<i>Liriodendron tulipifera</i> L.	<i>Aphis fabae</i>	II–III
<i>Lonicera alpigena</i> L.	<i>Rhopalomyzus lonicerae</i>	III
	<i>Hyadaphis foeniculi</i>	II
<i>Lonicera involucrata</i> var. <i>ledebourii</i> Esch.	<i>Rhopalomyzus lonicerae</i>	III
	<i>Trichosiphonaphis corticis</i>	II
<i>Lonicera maackii</i> (Rupr.) Herder	<i>Rhopalomyzus lonicerae</i>	III
	<i>Trichosiphonaphis corticis</i>	III
<i>Lonicera maximowiczii</i> Maxim.	<i>Rhopalomyzus lonicerae</i>	III
<i>Lonicera nigra</i> L.	<i>Trichosiphonaphis corticis</i>	III
	<i>Rhopalomyzus lonicerae</i>	IV–V
	<i>Trichosiphonaphis corticis</i>	II
<i>Lonicera tatarica</i> L.	<i>Rhopalomyzus lonicerae</i>	III–IV
	<i>Trichosiphonaphis corticis</i>	II
<i>Lonicera xylosteum</i> L. ‘Compacta’	<i>Hyadaphis foeniculi</i>	II
	<i>Prociphilus xylostei</i>	III
	<i>Rhopalomyzus lonicerae</i>	III–IV
	<i>Trichosiphonaphis corticis</i>	III
<i>Mahonia aquifolium</i> (Pursh) Nutt.	<i>Liosomaphis berberidis</i>	II
<i>Mahonia aquifolium</i> (Pursh) Nutt. ‘Undulata’	<i>Liosomaphis berberidis</i>	III
<i>Mahonia</i> × <i>wagneri</i> (Jouin) Rehd. ‘Vicaryi’	<i>Liosomaphis berberidis</i>	III
<i>Malus baccata</i> L. ‘Gracilis’	<i>Aphis pomi</i>	III–V
	<i>Ovatus crataegarius</i>	II
	<i>Ovatus insitus</i>	II
	<i>Aphis pomi</i>	III–IV
<i>Malus floribunda</i> Siebold ex Van Houtte	<i>Rhopalosiphum insertum</i>	II
	<i>Aphis pomi</i>	II
<i>Malus hupehensis</i> Rehder	<i>Dysaphis plantaginea</i>	II
	<i>Aphis pomi</i>	II
<i>Malus platycarpa</i>	<i>Aphis pomi</i>	II
<i>Malus</i> × <i>purpurea</i> (Barbier et al.) Rehder	<i>Ovatus crataegarius</i>	II
<i>Malus</i> × <i>purpurea</i> ‘Lizet’	<i>Aphis pomi</i>	III – IV
	<i>Ovatus crataegarius</i>	II
	<i>Rhopalosiphum insertum</i>	II
<i>Parrotia persica</i> (DC.) C.A. Mey.	<i>Hyperomyzus lactucae</i>	II
<i>Philadelphus coronarius</i> L. ‘Aureus’	<i>Aphis fabae</i>	II–IV
<i>Philadelphus</i> ‘Vozdushnyi desant’	<i>Aphis fabae</i>	III–IV
<i>Physocarpus opulifolius</i> ‘Diabolo’	<i>Aphis fabae</i>	II
<i>Picea abies</i> (L.) H. Karst.	<i>Adelges abietis</i>	II–IV
<i>Picea abies</i> (L.) H. Karst. ‘Cupressina’	<i>Adelges laricis</i>	II–III
	<i>Cinara costata</i>	III
	<i>Cinara pilicornis</i>	III
	<i>Adelges abietis</i>	II–IV
	<i>Cinara pruinosa</i>	II
	<i>Adelges abietis</i>	II
<i>Picea abies</i> (L.) H. Karst. ‘Procumbens’	<i>Adelges laricis</i>	II
	<i>Cinara costata</i>	III
	<i>Adelges abietis</i>	III
<i>Picea abies</i> (L.) H. Karst. ‘Pygmaea’	<i>Adelges laricis</i>	II–III
	<i>Cinara costata</i>	III
	<i>Cinara pilicornis</i>	II–III
	<i>Adelges abietis</i>	II–III

Host plant	Aphid species	Degree of infestation
<i>Picea abies</i> (L.) H. Karst. 'Rotenhausii'	<i>Adelges abietis</i>	II
<i>Picea abies</i> (L.) H. Karst. 'Virgata'	<i>Adelges laricis</i>	II–III
	<i>Cinara costata</i>	III
	<i>Cinara pilicornis</i>	II–IV
	<i>Adelges viridis</i>	II
	<i>Cinara pilicornis</i>	III
<i>Picea asperata</i> Mast.	<i>Adelges abietis</i>	II–IV
<i>Picea omorika</i> (Pančić) Purk.	<i>Adelges abietis</i>	II–IV
<i>Picea pungens</i> Engelm.	<i>Cinara pilicornis</i>	III
	<i>Adelges abietis</i>	II–IV
<i>Picea pungens</i> Engelm. 'Białobok'	<i>Cinara pilicornis</i>	II–III
<i>Picea pungens</i> Engelm. 'Glauca Białobok'	<i>Cinara pilicornis</i>	III
	<i>Adelges abietis</i>	II
	<i>Adelges laricis</i>	II
<i>Picea pungens</i> Engelm. 'Spek'	<i>Adelges abietis</i>	II
	<i>Adelges laricis</i>	II
<i>Pinus heldreichii</i> H. Christ	<i>Eulachnus rileyi</i>	II
	<i>Schizolachnus pineti</i>	III
<i>Pinus mugo</i> Turra 'Mops'	<i>Cinara pinea</i>	II
	<i>Eulachnus rileyi</i>	III–IV
	<i>Schizolachnus pineti</i>	II–IV
	<i>Schizolachnus pineti</i>	III
<i>Pinus nigra</i> J.F. Arnold	<i>Schizolachnus pineti</i>	III
<i>Pinus uncinata</i> Ramond ex Mirb.	<i>Schizolachnus pineti</i>	III
	<i>Eulachnus rileyi</i>	II
	<i>Chaitophorus populeti</i>	II–IV
<i>Populus alba</i> L.	<i>Chaitophorus populialbae</i>	IV
	<i>Chaitophorus populialbae</i>	IV
<i>Populus lasiocarpa</i> Oliv.	<i>Chaitophorus leucomelas</i>	III
	<i>Chaitophorus populeti</i>	III
	<i>Chaitophorus populialbae</i>	III
	<i>Chaitophorus leucomelas</i>	II–III
	<i>Chaitophorus populeti</i>	III
<i>Populus violascens</i> Dode	<i>Pterocomma populeum</i>	III
	<i>Chaitophorus leucomelas</i>	II
	<i>Chaitophorus populialbae</i>	II
<i>Populus wilsonii</i> C.K. Schneid.	<i>Aphis fabae</i>	III
	<i>Rhopalosiphum padi</i>	II
<i>Potentilla fruticosa</i> L.	<i>Rhopalosiphum padi</i>	II–IV
<i>Prunus padus</i> L.	<i>Rhopalosiphum padi</i>	IV–V
<i>Prunus padus</i> L. 'Coloratus'	<i>Brachycaudus cardui</i>	II
<i>Prunus padus</i> L. var. <i>besseyi</i>	<i>Rhopalosiphum padi</i>	III–IV
<i>Prunus padus</i> L. var. <i>pubescens</i>	<i>Rhopalosiphum padi</i>	II
<i>Prunus subhirtella</i> Miq.	<i>Rhopalosiphum padi</i>	III–IV
<i>Prunus virginiana</i> L.	<i>Myzocallis castanicola</i>	III–IV
<i>Prunus × yedoensis</i> Matsum.	<i>Gilletteella cooleyi</i>	III–IV
<i>Pseudotsuga menziesii</i> (Mirb.) Franco	<i>Aphis fabae</i>	II–III
<i>Pyrus salicifolia</i> Pall.	<i>Rhopalosiphum padi</i>	II–III
	<i>Myzocallis castanicola</i>	III
<i>Quercus aliena</i> Bl.	<i>Tuberculatus borealis</i>	III–IV
	<i>Myzocallis castanicola</i>	III
<i>Quercus dentata</i> Thunb.	<i>Phylloxera glabra</i>	IV–V

Host plant	Aphid species	Degree of infestation
<i>Quercus frainetto</i> (Ten.)	<i>Myzocallis castanicola</i>	III
	<i>Tuberculatus annulatus</i>	II–III
	<i>Tuberculatus borealis</i>	II–III
<i>Quercus libani</i> Oliv.	<i>Myzocallis castanicola</i>	III
	<i>Tuberculatus annulatus</i>	II
	<i>Tuberculatus borealis</i>	III
<i>Quercus macranthera</i> Fisch. et Mey. ex Hohen.	<i>Myzocallis castanicola</i>	II–IV
<i>Quercus macrocarpa</i> Michx.	<i>Myzocallis castanicola</i>	II
	<i>Tuberculatus borealis</i>	III
<i>Quercus pubescens</i> Willd.	<i>Myzocallis castanicola</i>	III–IV
	<i>Tuberculatus annulatus</i>	II–IV
<i>Quercus robur</i> L.	<i>Lachnus roboris</i>	III
	<i>Myzocallis castanicola</i>	II–III
	<i>Tuberculatus annulatus</i>	II–IV
	<i>Tuberculatus borealis</i>	IV
<i>Quercus robur</i> L. 'Fastigiata'	<i>Tuberculatus annulatus</i>	III
<i>Ribes alpinum</i> L.	<i>Cryptomyzus ribis</i>	III
	<i>Hyperomyzus lactucae</i>	III
	<i>Hyperomyzus picridis</i>	III
<i>Ribes alpinum</i> L. 'Schmidt'	<i>Hyperomyzus picridis</i>	III
	<i>Nasonovia ribisnigri</i>	III
<i>Ribes fasciculatum</i> Siebold et Zucc.	<i>Aphis schneideri</i>	II–III
	<i>Hyperomyzus lactucae</i>	III
	<i>Hyperomyzus pallidus</i>	III
	<i>Nasonovia ribisnigri</i>	II
<i>Ribes komarowii</i> Pojark.	<i>Aphis schneideri</i>	II–III
	<i>Hyperomyzus lactucae</i>	III
	<i>Hyperomyzus pallidus</i>	III
<i>Robinia pseudoacacia</i> L.	<i>Appentiseta robiniae</i>	II
	<i>Aphis craccivora</i>	II–III
<i>Robinia pseudoacacia</i> L. 'Tortuosa'	<i>Aphis craccivora</i>	II–III
<i>Rosa</i> 'Alba'	<i>Macrosiphum rosae</i>	II–IV
<i>Rosa</i> 'Flamendance'	<i>Macrosiphum rosae</i>	II–IV
	<i>Metopolophium dirhodum</i>	III
	<i>Chaetosiphon tetrarhodum</i>	II
<i>Rosa pimpinellifolia</i> L.	<i>Macrosiphum rosae</i>	II
	<i>Metopolophium dirhodum</i>	III
	<i>Macrosiphum rosae</i>	III–IV
<i>Rosa wichuraiana</i> Crépin	<i>Macrosiphum rosae</i>	III–IV
<i>Salix aurita</i> L.	<i>Chaitophorus salicti</i>	III
<i>Salix babylonica</i> L. 'Crispa'	<i>Aphis farinosa</i>	II–IV
<i>Salix fragilis</i> L.	<i>Cavariella aegopodii</i>	III
	<i>Chaitophorus salijaponicus niger</i>	II
<i>Salix melanostachys</i> Mak. 'Kurome'	<i>Aphis farinosa</i>	III
<i>Salix x meyeriana</i> Rostk. ex Willd.	<i>Cavariella pastinacea</i>	III–IV
<i>Salix x sepulcralis</i> Simonk. 'Chrysocoma'	<i>Cavariella theobaldi</i>	IV
<i>Sambucus nigra</i> L.	<i>Aphis sambuci</i>	IV
<i>Shepherdia argentea</i> (Pursh) Nutt.	<i>Capitophorus elaeagni</i>	II–V
<i>Spiraea japonica</i> L.f. 'Goldflame'	<i>Aphis fabae</i>	III
	<i>Aphis spiraeaphaga</i>	III–IV
	<i>Brachycaudus spiraeae</i>	II–III

Host plant	Aphid species	Degree of infestation
<i>Spiraea nipponica</i> Maxim.	<i>Aphis fabae</i>	II
<i>Spiraea trichocarpa</i> Nakai.	<i>Aphis fabae</i>	III
	<i>Aphis spiraeaphaga</i>	III–IV
	<i>Brachycaudus spiraeae</i>	III
<i>Spiraea</i> 'Queen Mary'	<i>Brachycaudus spiraeae</i>	III
<i>Symphoricarpos albus</i> (L.) S.F. Blake	<i>Trichosiphonaphis corticis</i>	II–IV
<i>Symphoricarpos</i> × <i>doorenbosii</i> Krüssm. 'Mother of Pearl'	<i>Trichosiphonaphis corticis</i>	II–IV
<i>Tilia americana</i> L.	<i>Eucallipterus tiliae</i>	II–III
<i>Tilia americana</i> L. var. <i>nichou</i>	<i>Eucallipterus tiliae</i>	II–III
<i>Tilia cordata</i> Mill.	<i>Eucallipterus tiliae</i>	II
<i>Tilia japonica</i> (Miq.) Simonk.	<i>Eucallipterus tiliae</i>	II
<i>Tilia platyphyllos</i> Scop.	<i>Eucallipterus tiliae</i>	II
<i>Tilia platyphyllos</i> 'Laciniata'	<i>Eucallipterus tiliae</i>	II–IV
<i>Ulmus</i> × <i>hollandica</i> Mill. 'Wredei'	<i>Colopha compressa</i>	III
	<i>Eriosoma ulmi</i>	II–III
	<i>Tetraneura ulmi</i>	II–IV
<i>Ulmus laevis</i> Pall.	<i>Tinocallis platani</i>	III
<i>Viburnum burejaeticum</i> Reg. et Herd.	<i>Ceruraphis eriophori</i>	III
<i>Viburnum carlesii</i> Hemsl.	<i>Aphis fabae</i>	III–IV
	<i>Ceruraphis eriophori</i>	III–IV
<i>Viburnum lentago</i> L.	<i>Aphis fabae</i>	III
<i>Viburnum opulus</i> L.	<i>Aphis fabae</i>	III–IV
<i>Viburnum opulus</i> L. 'Sterile'	<i>Aphis fabae</i>	II
	<i>Ceruraphis eriophori</i>	IV
<i>Viburnum opulus</i> 'Xanthocarpa'	<i>Aphis viburni</i>	III
<i>Viburnum prunifolium</i> L.	<i>Aphis fabae</i>	III
	<i>Ceruraphis eriophori</i>	III
<i>Viburnum</i> × <i>burkwoodii</i> Burkwood et Skipwith	<i>Ceruraphis eriophori</i>	II
Forest locality		
<i>Abies alba</i> Mill.	<i>Aphrastasia pectinatae</i>	II
	<i>Dreyfusia nordmanniana</i>	II
	<i>Dreyfusia piceae</i>	II
	<i>Mindarus abietinus</i>	II
<i>Abies concolor</i> (Gordon et Glend.) Lindl. ex Hildebr.	<i>Mindarus abietinus</i>	II
<i>Abies grandis</i> (Douglas ex D. Don) Lindl.	<i>Aphrastasia pectinatae</i>	II
	<i>Mindarus abietinus</i>	II
<i>Abies nebrodensis</i> (Locaj-Poj.) Mattei	<i>Aphrastasia pectinatae</i>	II
	<i>Mindarus abietinus</i>	II
<i>Abies pinsapo</i> Boiss.	<i>Aphrastasia pectinatae</i>	II
	<i>Mindarus abietinus</i>	II
<i>Abies</i> × <i>pardei</i> Gauss.	<i>Aphrastasia pectinatae</i>	II
	<i>Mindarus abietinus</i>	II
<i>Acer argutum</i> Maxim.	<i>Periphyllus testudinaceus</i>	II
<i>Acer campestre</i> L.	<i>Periphyllus testudinaceus</i>	II–III
<i>Acer griseum</i> (Franch.) Pax.	<i>Periphyllus testudinaceus</i>	III
<i>Acer japonicum</i> Thunb. ex Murray	<i>Periphyllus testudinaceus</i>	III
<i>Acer palmatum</i> Thunb. ex Murray	<i>Periphyllus testudinaceus</i>	II
	<i>Drepanosiphum platanoidis</i>	II
<i>Acer pensylvanicum</i> L.	<i>Periphyllus testudinaceus</i>	II
	<i>Drepanosiphum platanoidis</i>	II

Host plant	Aphid species	Degree of infestation
<i>Acer pseudoplatanus</i> L.	<i>Drepanosiphum platanoidis</i>	IV
<i>Acer rufinerve</i> Siebold et Zucc.	<i>Periphyllus testudinaceus</i>	II
<i>Corylus avellana</i> L.	<i>Corylobium avellana</i>	II
	<i>Myzocallis coryli</i>	II–III
<i>Fagus sylvatica</i> L.	<i>Phyllaphis fagi</i>	II–IV
<i>Hedera helix</i> L.	<i>Aphis hederæ</i>	III
<i>Larix kaempferi</i> (Lamb.) Carrière	<i>Adelges laricis</i>	III–IV
<i>Picea abies</i> (L.) H. Karst.	<i>Adelges laricis</i>	II
	<i>Cinara pilicornis</i>	II
	<i>Adelges abietis</i>	II
	<i>Adelges laricis</i>	II
<i>Picea abies</i> (L.) H. Karst. 'Virgata'	<i>Cinara costata</i>	III
	<i>Cinara picea</i>	III
	<i>Cinara pilicornis</i>	II–III
	<i>Cinara pini</i>	III
	<i>Adelges abietis</i>	II–III
	<i>Adelges laricis</i>	II
	<i>Cinara pilicornis</i>	II–III
	<i>Adelges abietis</i>	II
<i>Picea breweriana</i> S. Waston	<i>Adelges laricis</i>	II
	<i>Cinara pilicornis</i>	II–III
	<i>Adelges abietis</i>	II
<i>Picea omorika</i> (Pančić) Purk.	<i>Cinara costata</i>	II–III
	<i>Cinara pilicornis</i>	II
	<i>Adelges abietis</i>	II–III
<i>Picea orientalis</i> (L.) Link	<i>Cinara costata</i>	II–III
	<i>Cinara pilicornis</i>	II
	<i>Cinara pruinosa</i>	II
	<i>Dreyfusia nordmannianae</i>	III
<i>Picea wilsonii</i> Mast.	<i>Adelges laricis</i>	II
	<i>Cinara costata</i>	II
	<i>Adelges abietis</i>	II–IV
<i>Pinus nigra</i> J.F. Arnold	<i>Eulachnus agilis</i>	II–III
	<i>Eulachnus rileyi</i>	II
	<i>Schizolachnus pineti</i>	III
<i>Pinus strobus</i> L.	<i>Pineus strobus</i>	IV
<i>Pinus sylvestris</i> L.	<i>Schizolachnus pineti</i>	III
<i>Pseudotsuga menziesii</i> (Mirb.) Franco	<i>Gilletteella cooleyi</i>	III–IV
<i>Rhododendron ponticum</i> L.	<i>Illinoia azalea</i>	II–III
<i>Tilia cordata</i> Mill.	<i>Eucallipterus tiliae</i>	II
<i>Ulmus minor</i> Mill.	<i>Tinocallis nevskyi</i>	II–III

leaves; mock orange was infested by *Aphis fabae*, a heteroecious and polyphagous species that causes strong twisting of the shrubs' leaves. In autumn dogwood bushes were infested numerously by *Anoecia corni*, and sea buckthorn and Silverberry were affected by *Capitophorus elaeagni* (Table 2). The infestation level on those plants reached the fifth, highest grade on the scale applied in the study. In summer the number of infested trees and shrubs and aphid species as well as their abundance were small; mainly monophagous species were reported, such as *Eucallipterus tiliae* from

lime trees, *Myzocallis coryli* from hazel, *Aphis pomi* from cotoneaster and *Macrosiphum rosae* from rose shrubs.

In the forest site the trees were not heavily infested. The exception was Douglas fir, abundantly infested by *Gilletteella cooleyi*, and spruce, infested by *Adelges abietis*.

The biggest damage to plants resulting from aphid feeding and causing a significant loss of their decorative value was observed in the Arboretum on several tree and shrub species and concerned the following species:

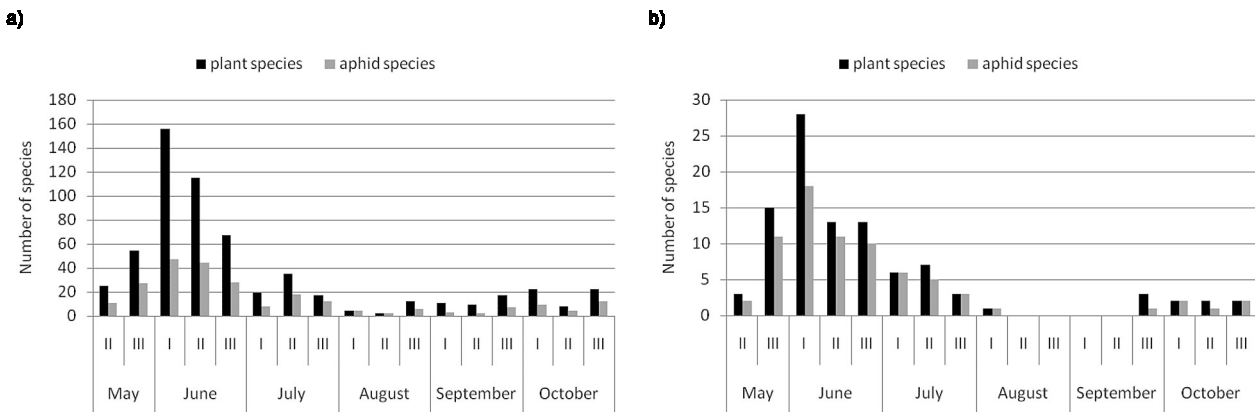


Fig. 1. Infestation of trees and shrubs in a vegetation season based on the number of trees and shrubs infested by aphids and number of aphid species occurring on plants in (a) park and (b) forest locality in Kórnik Arboretum in 2008

- at the beginning of summer the leaves of *Quercus dentata* were damaged by the holocyclic and monoecious species *Phylloxera glabra*. Its presence resulted in small yellow spots on leaves, which later became brown and spread all over the leaf. The leaves dried and fell;
- in autumn on various species and cultivars of dogwood: *Cornus alba* 'Aurea', *C. alba* 'Elegantissima', *C. alba* 'Sibirica', *C. amomum*, *C. controversa*, *C. florida*, *C. macrophylla*, *C. mas*, *C. rugosa*, *C. sanguinea*, *C. sericea* 'Flaviramea' – *Anoecia corni*, the holocyclic and heteroecious species occurred in great numbers on the leaves, fruit clusters and terminal shoots, causing massive browning and drying of the leaves;
- various species and cultivars of *Rosa* and *Dipelta ventricosa* were infested by the holocyclic and heteroecious *Macrosiphum rosae*, which forms large colonies on the tops of young shoots, spreading onto leaves and flower buds, which significantly weakened the blossoming;
- various species and cultivars of *Picea* were affected by the anholocyclic and monoecious *Adelges abietis*, whose feeding resulted in cone-shaped growths at the base of young shoots, which later dried and considerably lowered the trees' decorative value;
- in spring and early summer on the leaves and young shoots of *Fagus sylvatica* cultivars the holocyclic and monoecious species of *Phyllaphis fagi* was observed. Damaged leaves browned, twisted and fell prematurely. The plants were covered with a large amount of honeydew excreted by the aphids;
- the leaves of *Ulmus laevis* were infested by the holocyclic and monoecious *Tinocallis platani*, whose feeding resulted in leaves' yellowing and necrotic spots;
- various species of *Chaenomeles*, *Cotoneaster* and *Malus* were infested by the holocyclic and monoecious oligophagus *Aphis pomi*, which formed numerous colonies on leaves and shoots, and whose feeding resulted in the twisting of the shoots;
- in spring and autumn on many species of various families, mainly of *Euonymus*, *Viburnum* and *Phila-*

delphus genera, the holocyclic and heteroecious poliphagus *Aphis fabae* occurred, infesting the terminal shoots of the shrubs and causing leaf twisting;

- on *Spiraea trichocarpa* the holocyclic and monoecious species of *Brachycaudus spiraeae* caused strong twisting of leaves and internodes;
- on *Ulmus* 'Wredei' the feeding by the holocyclic and heteroecious *Tetraneura ulmi* caused green galls on the upper part of leaves, which browned and dried later on. The infestation was so heavy that the trees lost leaves very early.

The four-year studies in Kórnik Arboretum confirm the occurrence of abundant aphid fauna there, which results directly from the abundance of plant life. The area, so valuable in terms of its flora, has not yet been studied in respect of any insect group, including aphids. Therefore, the study results can be compared only with previous studies of aphid fauna in various urban parks (Jaśkiewicz 1997, Wilkaniec 2001, 2004, Sztukowska and Wilkaniec 2005, Wiczorek and Osiadacz 2005, Wilkaniec et al. 2005, Borowiak-Sobkowiak and Wilkaniec 2010). In comparison with those studies it is worth noting a significant species similarity of dendrophile aphid fauna of Kórnik Arboretum and floristically rich parks such as the University's Botanical Garden, Poznań or the Dendrological Garden, Poznań. It may be seen that the number of 96 taxa, whose presence was confirmed on trees and shrubs in Kórnik Arboretum, considerably exceeds the number of species recorded from the previously mentioned sites. The same study method yielded the result of 41 aphid species in A. Mickiewicz University Botanical Garden in Poznań (Wilkaniec 2004), and 57 species in Dendrological Garden in Poznań (Wilkaniec et al. 2005). Such abundant study results in Kórnik Arboretum can undoubtedly be attributed to unusually rich collection of plants and the study period, which lasted 4 years and considerably exceeded those which constituted the basis for other papers.

It should also be noted that the study results presented in the paper do not describe all the aphid fauna of the place, as the method of direct checking of trees and bushes for aphids does not report species developing on herbaceous plants or the species which form small populations. The application of Moericke traps enabled to expand the list of species occurring in Kórnik Arboretum by further 90 taxa (Ratajczak and Wilkaniec 2011).

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References

- Achremowicz J. 1967. Mszyce (*Hemiptera, Aphidoidea*) Niziny Wielkopolsko-Kujawskiej. *Fragmenta Faunistica* 13: 261–298.
- Achremowicz J. 1972. Mszyce (*Hemiptera, Aphidoidea*) Niziny Wielkopolsko-Kujawskiej.II. *Fragmenta Faunistica* 18: 361–392.
- Bartkowiak S. 1965. Ptaki Arboretum Kórnickiego. *Acta Ornithologica* 9: 137–142.
- Blackman R.L., Eastop V.F. 1994. Aphids on the World's Trees. An identification and Information. Guide. CAB The International & The Natural History Museum, London.
- Bogdanowicz W., Chudzicka E., Pilipiuk I., Skibińska E. 2004. Fauna of Poland. Characteristics and checklist of species. Tom I. PAN, Warszawa, pp. 254–266.
- Borowiak-Sobkowiak B., Wilkaniec B. 2010. Occurrence of aphids (*Hemiptera, Aphidoidea*) on tree and shrubs in Cytadela Park in Poznań. *Aphids and Other Hemipterous Insects*, 16: 27–35.
- Jaśkiewicz B. 1997. Skład gatunkowy i dynamika pojawu mszyc na wybranych krzewach ozdobnych w latach 1973–1993. Wyd. AR Lublin, *Rozprawy Naukowe* 183.
- Osiadacz B., Hałaj R. 2009. The Aphids (*Hemiptera: Sternorrhyncha: Aphidinea*) of Poland. A Distributional checklist. *Polish Entomological Monographs* 6: 96 pp.
- Sztukowska K., Wilkaniec B. 2005. Obserwacje nad występowaniem mszyc (*Hemiptera: Aphidoidea*) na drzewach i krzewach ozdobnych w Ogrodzie Dendrologicznym Akademii Rolniczej w Poznaniu. *Wiadomości Entomologiczne* 24: 133–146.
- Ratajczak J., Wilkaniec B. 2011. Fauna mszyc (*Hemiptera: Aphidoidea, Phylloxeroidea*) w Arboretum Kórnickim (Wielkopolska). *Wiadomości Entomologiczne* 30: 17–26.
- Szelegiewicz H. 1978. Klucze do oznaczania owadów Polski. Pluskwiaki równoskrzydłe – *Hemiptera, Mszyce – Aphidoidea, Wstęp i Lachnidae*. PWN, Warszawa.
- Szelegiewicz H. 1985. Klucze do oznaczania owadów Polski. Pluskwiaki równoskrzydłe – *Hemiptera, Mszyce – Aphidoidea, Chaitophoridae*. PWN, Warszawa.
- Taylor L.R. 1984. A handbook for Aphid Identification. *Euraphid – Rothamsted Experimental Station, Harpenden*.
- Wieczorek K., Osiadacz B. 2005. Mszyce (*Hemiptera, Aphidoidea*) urządzonej zieleni miejskiej Katowic – część I parku im. T. Kościuszki. *Acta Entomologica Silesiana* 12–13: 155–160.
- Wilkaniec B. 2001. Afidofauna Ogródu Dendrologicznego w Poznaniu. [In]: *Bioróżnorodność i ekologia populacji zwierzęcych w środowiskach zurbanizowanych*. NICE, Bydgoszcz: 32–37.
- Wilkaniec B. 2004. Afidofauna Ogródu Botanicznego w Poznaniu. [In]: *Fauna miast Europy Środkowej 21. wieku*, LOGO, Bydgoszcz: 167–177.
- Wilkaniec B., Piekarska-Boniecka H., Trzciniński P. 2005. Mszyce jako stały element entomofauny zieleni parkowej Poznania. *Progress in Plant Protection Research* 45: 516–523.
- Wilusz Z. 1952. Spostrzeżenia nad ekologią drobnych ssaków w sadzie i Arboretum Kórnickim. *Zakład Dendrologii i Pomologii*. Kórnik.