

OCCURRENCE OF APHIDS ON *Cornus alba* L.

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Abstract. The studies were conducted on *Cornus alba* L. in the years 1999–2001 in the green areas on two sites: with heavy traffic (site A) and no traffic (site B). *C. alba* was the host plant for two species of aphids: *Anoecia corni* (F.) and *Aphis salicariae* Koch. *A. corni* was dominating in the years of observations and it was most numerous in 2000, while *A. salicariae* in 1999. The weather had a significant effect on the aphid population. After a mild winter and warm spring aphids were more numerous. High temperatures (over 30°) and stormy rainfalls as well as autumn ground frosts limited their population. On the other hand, aphidophagous species did not limit the population of aphids in any considerable manner. *A. corni* lowered the ornamental values of *C. alba* shrubs, especially in autumn.

Key words: aphids, *Anoecia corni* (F.), *Aphis salicariae* Koch, shrubs of *Cornus alba* L., city green areas

INTRODUCTION

The shrubs of *Cornus alba* L. are characteristic because of their decorative value, even in winter. They have purple-green leaves, which in autumn change their colour into carmine red, bright red shoots, cream-white flowers (from May till autumn) and white or bluish round fruit. Although these shrubs are of foreign origin, they have been for a long time the basic plants in the area of parks, housing estates, squares and on the belts close to or between the roads [Bugala 1991]. Dogwood has small requirements as to the soil and it tolerates well the shading and air pollution or winter frost.

A big role in the functioning of green areas in cities is played by plant eating arthropods with a stinging-sucking mouth apparatus. The most dangerous are aphids [Cichocka and Goszczyński 1991].

Despite undisputable decorative values of white dogwood shrubs, there are few studies that would discuss the occurrence of aphids throughout the vegetation season.

The purpose of the present paper is to determine the species composition, population dynamics of aphids and their natural enemies on the shrubs of white dogwood in the city green areas.

MATERIAL AND METHODS

Observations were performed in Lublin on the shrubs of white dogwood *Cornus alba* L. in the years 1999–2001. The studies were conducted in a street site (A) – in front of the building of the Rector’s Office of Agricultural University (big traffic) and a park site (B) – the area of the Museum of the Lublin Countryside. Five shrubs growing close to each other were selected from each site. Non-winged aphids (including the larvae) and winged ones as well as their natural enemies were counted on five shrubs (of similar length) of each shrub. The annual observations were started at the moment when vegetation of shrubs began and they were stopped in late autumn after the leaves had fallen, with about 10 days’ intervals.

In order to designate the aphids, the studies made use of the keys of Blackman and Eastop [2000], Müller [1976] and Šapošnikow [1964].

Two ecological indexes were used, namely domination and constancy (frequency) of occurrence [Trojan 1977, Górny and Grüm 1981]. The domination (D) index was calculated according to the following formula:

$$D = \frac{n_a}{n} \cdot 100$$

where: n_a – number of individuals belonging to a given species in all samples
 n – number of individuals of a studied systematic group in all samples

The following classes of domination were distinguished:

Superdominants	>60%	Subdominants	10–20%
Eudominants	31–60%	Recedents	1–9%
Dominants	21–30%	Subrecedents	<1%

On the other hand, the constancy (C) of occurrence, or the frequency (F) index was calculated according to the formula:

$$C = \frac{q}{Q} \cdot 100$$

where: q – number of trials when a given species was noted
 Q – number of all samples.

4 classes of constancy (frequency) were distinguished:

- class I (euconstants) – 0.76–1 (76–100%),
- class II (constants) – 0.51–0.75 (51–75%),
- class III (accessory species) – 0.26–0.50 (26–50%),
- class IV (accidents) – ≤ 0.25 ($\leq 25\%$).

The meteorological data were obtained from the Chair of Agrometeorology of Agricultural University in Lublin.

RESULTS

Two aphid species were observed on the shrubs of white dogwood, namely *Anoecia corni* (F.) and *Aphis salicariae* Koch. (synonym: *Aphis corniella*). Figure 1 presents the course of the weather in the years of studies, figures 2 and 3 – the population dynamics of aphids, while figure 4 shows the proportion of particular aphid species in the examined sites. Table 1 includes the data on the occurrence of aphids, table 2 – the numbers, domination and frequency, and table 3 – the occurrence of predators.

Anoecia corni (F.)

No aphids of this species were observed in 1999, after a severe winter of 1998/1999. Bright yellow aphids with a dark spot on the back appeared in the first 10 days of August in site A, and in the third 10 days' period in site B, where they fed on the bottom part of the leaves. Further observations found out greater numbers of aphids in both sites. The maximum was found out in site A (641.4 aphids/shrub) and B (458 aphids/shrub) in the second 10 days' period of September. Warm September and the first half of October favoured the development of aphids. The consequences of their feeding were visible (numerous spots) and the shrubs began to lose their leaves. The end of October was cool and a sudden decrease of the number of aphids took place. The disappearance of colonies was observed in the first 10 days of November.

In 2000, the first scarce non-winged and winged (with a characteristic stamp on the wings) aphids appeared in site A in the first 10 days' period of July and in site B in the third. Successive observations found out a slow increase of their population. The showers in July and the heat in August did not favour the dynamic development of aphids. The maximum of their numbers in both sites was observed not earlier than in the first 10 days of October (A – 638 aphids/shrub, B – 1311.8 aphids/shrub). Although the period of vegetation was lengthened, the disappearance of aphids took place already in the first 10 days of November, which was probably caused by the frost on 22 October (-10°C).

In 2001, the first single dark aphid mothers appeared in sites A and B in the third 10 days' period of April. Then, aphids fed on young shoots, and later on flower umbels. They occurred for a very short time; in site A they were observed till the third 10 days' period, and in site B till the second. The disappearance of the spring colonies took place in the first 10 days of June and in the third 10 days' period of May, respectively. Aphids appeared again in August, in the second 10 days' period in site A and in the third in site B. The maximum was reached in the first 10 days of October (A – 485 aphids/shrub, B – 470.4 aphids/shrub). In site A, no aphids were observed since the first 10 days, and in site B since the second 10 days' period of November.

The total numbers of *A. corni* in the years of studies were comparable. 5,771 aphids/shrub (5049.6 non-winged individuals/shrub and 721.4 winged ones/shrub) were observed in site A, and 5687.6 aphids/shrub (5229.2 non-winged individuals/shrub and 458.4 winged ones/shrub) were found out in site B.

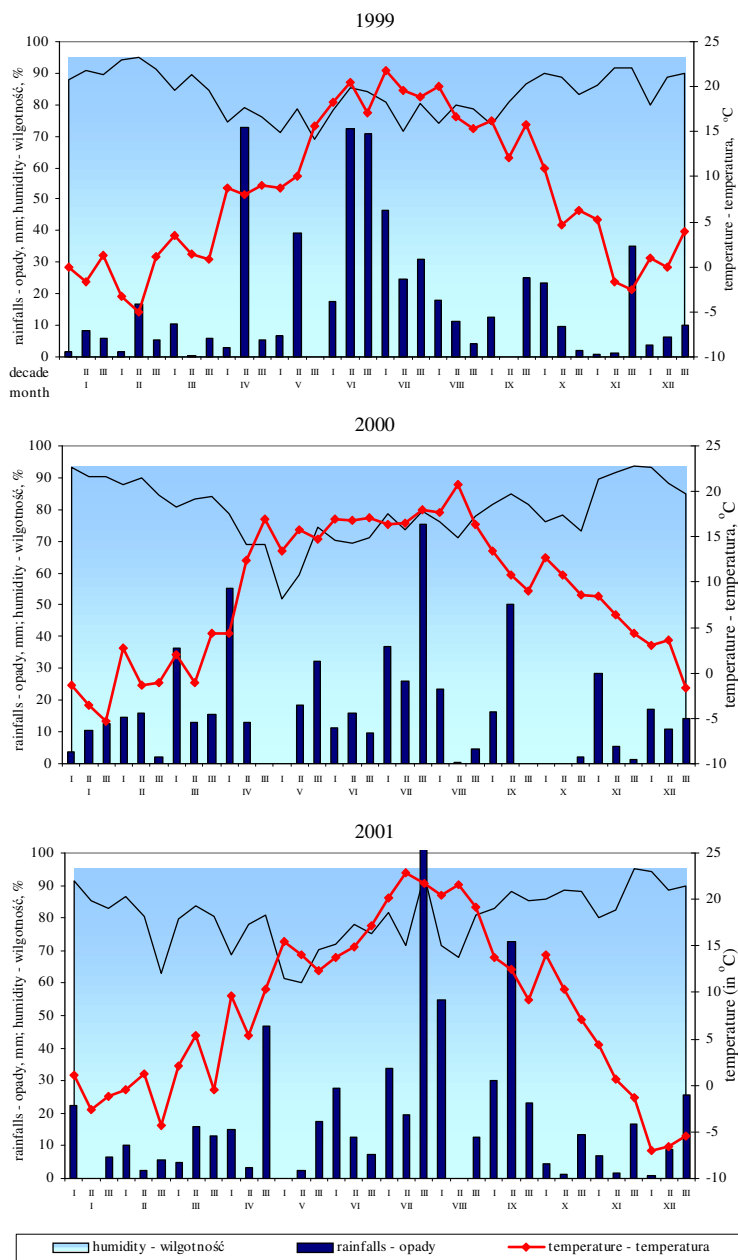


Fig. 1. General decadal information about weather (1999–2001)

Rys. 1. Informacja o pogodzie w latach 1999–2001

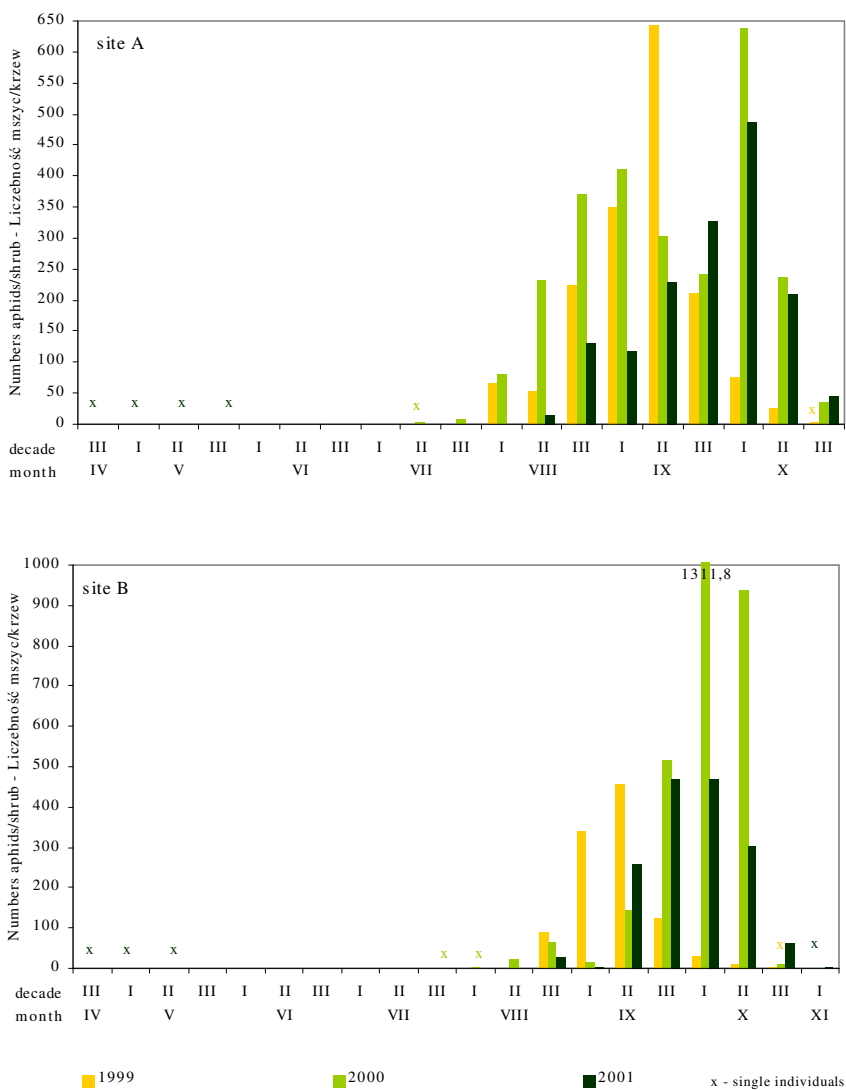


Fig. 2. Dynamics of number *Anoezia corni* (F.) on *Cornus alba* L. in the years 1999–2001
 Rys. 2. Dynamika zmian liczebności *Anoezia corni* (F.) na *Cornus alba* L. w latach 1999–2001

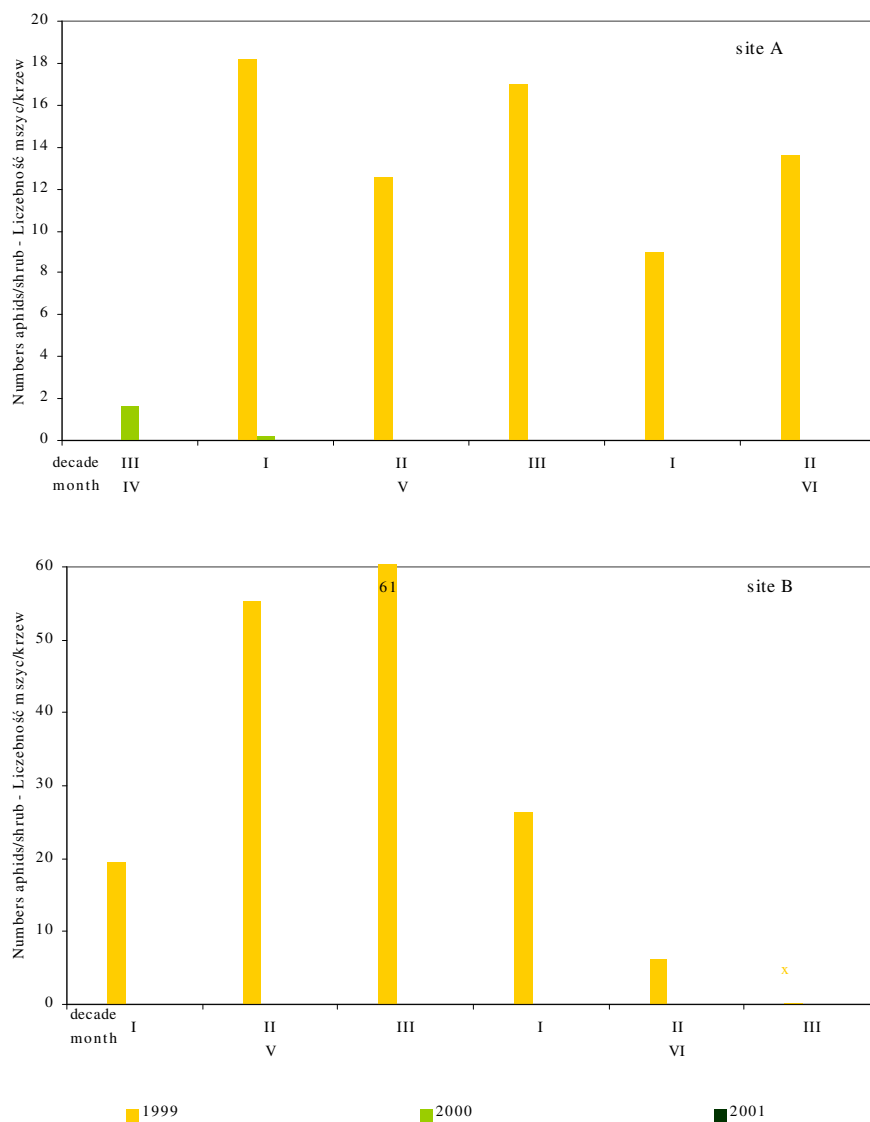


Fig. 3. Dynamics of number *Aphis salicariae* Koch on *Cornus alba* L. in the years 1999–2001
 Rys. 3. Dynamika zmian liczebności *Aphis salicariae* Koch na *Cornus alba* L. w latach 1999–2001

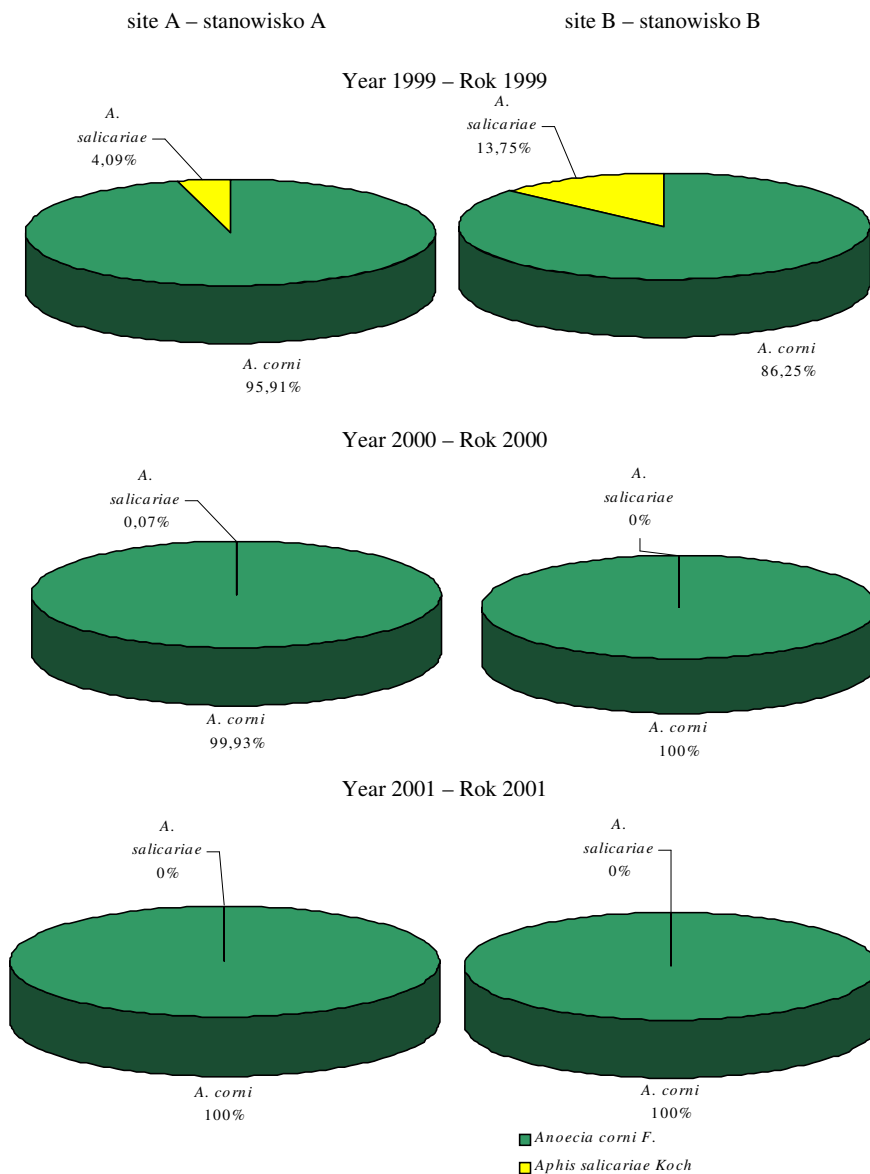


Fig. 4. Percent of particular species of aphids on *Cornus alba* L. in sites A and B in the years 1999–2001

Rys. 4. Procentowy udział gatunków mszyc na *Cornus alba* L. na stanowiskach A i B w latach 1999–2001

Table 1. The occurrence of aphids on *Cornus alba* L.
Tabela 1. Występowanie mszyc na *Cornus alba* L.

Year Rok	Site Stanowisko	Species of aphids Gatunek mszyc	The appearance of aphids (decade/month) Pojaw mszyc (dekada/miesiąc)		Number of aphids Liczebność mszyc		Summer disappearance of aphids (decade/month) of aphids (decade/month) Letni zamik mszyc (dekada/miesiąc)	Autumn disappearance of aphids (decade/month) Jesienny zamik mszyc (dekada/miesiąc)	Term of maximum (decade/month) Termin maksimum (dekada/miesiąc)
			Bs	Us	Bs	Us			
1999	A	<i>Anoezia corni</i> (F.)	I d VIII	1417.2	233.4	-	I d XI	II d IX	
		<i>Aphis salicariae</i> Koch	I d V	66.8	3.6	III d VI	-	I d V	
	B	<i>Anoezia corni</i> (F.)	III d VIII	977	81	-	I d XI	II d IX	
2000	A	<i>Aphis salicariae</i> Koch	I d V	166.2	2.4	I d VII	-	III d V	
		<i>Anoezia corni</i> (F.)	II d VII	2320.2	240	-	I d XI	I d X	
	B	<i>Aphis salicariae</i> Koch	III d IV	1.8	0	II d V	-	III d IV	
		<i>Anoezia corni</i> (F.)	III d VII	2839.4	192	-	I d XI	I d X	
		<i>Aphis salicariae</i> Koch	-	-	-	-	-	-	
2001	A	<i>Anoezia corni</i> (F.)	III d IV, II d VIII	1312.2	248	I d VI	I d XI	I d X	
	B	<i>Aphis salicariae</i> Koch	-	-	-	-	-	-	
		<i>Anoezia corni</i> (F.)	III d IV, III d VIII	1412.8	185.4	III d V	II d XI	I d X	
Total	A	<i>Anoezia corni</i> (F.)	III d IV, II d VII-II d VIII	5049.6	721.4	I d VI	I d XI	II d IX-I d X	
		<i>Aphis salicariae</i> Koch	III d IV-I d V	68.6	3.6	II d V-III d VI	-	III d IV-III d V	
	B	<i>Anoezia corni</i> (F.)	III d IV, III d VII-III d VIII	5229.2	458.4	III d V	I d XI-II d XI	II d IX-I d X	
		<i>Aphis salicariae</i> Koch	I d V	166.2	2.4	I d VII	-	III d V	

d – decade, Bs – wingless aphids, Us – winged aphids
d – dekada, Bs – mszyce bezskrzydłe, Us – mszyce uskrzydłone



Photo 1. *Anoecia corni* (F.) on *Cornus alba* L. (spring)

Fotografia 1. *Anoecia corni* (F.) na *Cornus alba* L. (wiosna)



Photo 2. *Anoecia corni* (F.) on *Cornus alba* L. (autumn)

Fotografia 2. *Anoecia corni* (F.) na *Cornus alba* L. (jesień)



Photo 3. *Aphis salicariae* Koch on *Cornus alba* L. (spring)
Fotografia 3. *Aphis salicariae* Koch na *Cornus alba* L. (wiosna)



Photo 4. Larva of *Syrphidae* and *Cecidomyiidae* in the colony of *Anoecia corni* (F.)
Fotografia 4. Larwy *Syrphidae* i *Cecidomyiidae* w kolonii na *Anoecia corni* (F.)

***Aphis salicariae* Koch (photo 3)**

In 1999, the first brown aphids on the shrub leaves were observed in both sites in the first 10 days of May. They were most numerous in site A (18.2 aphids/shrub) in the first 10 days, while in site B (61 aphids/shrub) in the third 10 days' period of May. The heat and numerous stormy rainfalls inhibited the dynamic development of those insects, especially in June. They disappeared in site A in the third 10 days' period of June, and in site B since the first 10 days of July. This is a two-home aphid but its appearance was not observed in autumn.

Table 2. Numbers, domination and frequency of aphid species inhabiting *Cornus alba* L.
Tabela 2. Liczebność, dominacja i frekwencja gatunków mszyc zasiedlających *Cornus alba* L.

Species of aphids Gatunek mszyc	Year Rok	Site A – Stanowisko A			Site B – Stanowisko B		
		L	D	C	L	D	C
<i>Anoecia corni</i> (F.)	1999	8253	95.9 (SD)	0.429 (III)	5290	86.25 (SD)	0.333 (III)
	2000	12801	99.92 (SD)	0.458 (III)	15157	100 (SD)	0.375 (III)
	2001	7801	100 (SD)	0.375 (III)	7991	100 (SD)	0.375 (III)
	Total	28855	98.66 (SD)	0.42 (III)	28438	94.47 (SD)	0.362 (III)
<i>Aphis salicariae</i> Koch	1999	352	4.09 (R)	0.238 (IV)	843	13.74 (SuD)	0.286 (III)
	2000	9	0.07 (SuR)	0.083 (IV)	0	0	0
	2001	0	0	0	0	0	0
Total	361	1.33 (R)	0.101 (IV)	843	5.51 (R)	0.087 (IV)	

L – Number (in specimen) – Liczebność (w sztukach)

D – Domination – Dominacja, %:

SD – Superdominants – Superdominant

E – Eudominants – Eudominant

D – Dominants – Dominant

SuD – Subdominants – Subdominant

R – Recedents – Recedent

SuR – Subrecedents – Subrecedent

C – Constancy of aphid appearance – Stałość występowania:

(I) – class I (euconstant) – klasa I (eukonstanty)

(II) – class II (constant) – klasa II (konstanty)

(III) – class III (accessory species) – klasa III (gatunki akcesoryczne)

(IV) – class IV (accident) – klasa IV (akcydenty)

In 2000 the number of this species of aphids was very low and the period of its occurrence was very short (at the turn of April and May). Its presence was found out in the course of two observations and it was only in site A.

Despite numerous observations in 2001, the presence of *A. salicariae* was not observed on the examined plants. There were twice as many aphids of *A. salicariae* in site B, namely 168.6 aphids/shrub (166.2 non-winged individuals/shrub and 2.4 winged ones/shrub) as compared to site A – 72.2 aphids/shrub (68.6 non-winged individuals/shrub and 3.6 winged ones).

The most numerous species on *Cornus alba* was *A. corni*, which appeared in each year of the studies. On the other hand, *A. salicariae* occurred only scarcely and it was observed only in some years.

Table 3. The occurrence of aphid pests on *Cornus alba* L. in sites A and B
 Tabela 3. Występowanie drapieżców mszyc na *Cornus alba* L. na stanowiskach A i B

Aphidophags Afidofagi	Site A – Stanowisko A					Site B – Stanowisko B								
	Period of occurrence (decade/month) Okres występowania (dekada/miesiąc)		Number/shrub Liczebność/krzew		Total	Period of occurrence (decade/month) Okres występowania (dekada/miesiąc)		Number/shrub Liczebność/krzew		Total				
	1999	2000	2001	1999		2000	2001	1999	2000		2001			
<i>Araneida</i>	young and adults młode i dorosłe	II d V- I d IX	-	III d IV	2	-	0.4	2.4	-	I d VIII- II d IX	-	-	0.8	-
<i>Coleoptera</i>	adults	-	III d IV	III d IV	-	0.8	1.2	2	I d V	-	-	0.4	-	0.4
<i>Coccinellidae</i>	larvae and adults larwy i dorosłe	-	-	-	-	-	-	-	-	III d VIII	I d X	-	0.4	0.8
<i>Diptera</i>	larvae	II d IX	I d IX- I d X	I d X	0.4	4	0.4	4.8	-	I d X- III d X	I d X- II d X	-	8	12.8
<i>Cecidomyiidae</i>	larvae	III d VIII- III d IX	I d VIII- III d X	I d X- II d X	2.8	25.6	0.8	29.2	I d IX- II d IX	II d VIII- II d X	I d X	3.6	66.8	0.4
<i>Syrphidae</i>	eggs jaja	II d IX- II d X	III d VIII- III d X	I d X- II d X	4.4	14.4	2	20.8	II d IX- II d X	II d IX- III d X	II d X- III d X	4	8	1.2
<i>Chamaemyiidae</i>	larvae larwy	-	-	-	-	-	-	-	-	II d IX	-	-	1.2	-
<i>Neuroptera</i>	eggs jaja	II d VIII	III d VII	-	0.4	0.8	-	1.2	-	-	-	-	-	-
<i>Chrysopidae</i>	larvae larwy	-	-	II d X	-	-	0.4	0.4	-	II d IX	-	-	0.4	-

d – decade – dekada

The structure of domination and the constancy (frequency) of aphids' occurrence

A. corni was a superdominant in all the years of studies (tab. 2). Its proportion on *C. alba* ranged from 86.25% to 100% (fig. 4). Considering the constancy of its occurrence, it can be included in class III of frequency – accessory species.

Contrary to the previous species, *A. salicariae* did not appear annually on the observed *C. alba* shrubs. Taking into account its numbers in all the years of studies, it can be included in the group of recedents or subprecedents. Exceptionally in 1999 it was a subdominant in site B. This species belongs to class IV of frequency – accident.

Symptoms of injuries. *A. corni* aphids occurred in spring only in 2001 and then they fed on the young shoots and in flower umbels of *C. alba*. Their small numbers and short visits on the plant did not cause any visible damage. On the other hand, in late summer and in autumn, when they inhabited in great numbers the bottom part of the leaves, their feeding caused that the leaves got discoloured and they fell earlier.

A. salicariae, whose presence was observed only in spring, did not cause any visible injuries on the shrubs; only slight twisting of the leaves was found out.

On the shrubs of *C. alba* which were observed the following were found out: young and adult individuals of *Araneida*; adult *Coccinellidae*; larvae and adults of *Dermaptera*; larvae of *Cecidomyiidae* (photo 4); eggs and larvae of *Syrphidae* (photo 4); larvae of *Chamaemyiidae*; eggs and larvae of *Chrysopidae* (tab. 3). The greatest number of predators (mainly larvae of *Cecidomyiidae*; the eggs and larvae of *Syrphidae*) was observed in 2000 (especially in site B), and the lowest in 2001. In autumn, the colonies of *A. corni* most frequently contained the eggs and next the larvae of *Syrphidae*. The majority of aphidophagous species appeared when aphids occurred in great numbers (before and during the maximum); hence they probably did not have any greater significance in limiting their numbers.

DISCUSSION

Two aphid species, namely *Anoecia corni* (F.) and *Aphis salicariae* Koch, fed on *Cornus alba* L.

The occurrence of *A. corni* on white dogwood has been often confirmed [Tomilova 1962, Szelegiewicz 1968, Haine and Eastop 1969, Karwańska and Wojciechowski 1973, Ziarkiewicz and Kozłowska 1973, Klimaszewski and Płachta 1977, Bogatko 1984, Cano et al. 1998, Ripka et al 1998, Jaśkiewicz 2000, Jaśkiewicz et al. 2001]. This aphid occurred more rarely in spring (May, June) inhabiting young leaves and shoots as well as flower umbels. In each season it was more numerous on the bottom part of the leaves between July and October. Similar observations are made by Jaśkiewicz et al. [2001]. This aphid was a superdominant in each site and in each year of studies. Its numbers on one shrub was never lower than 1,000 individuals. Nevertheless, these numbers were considerably higher than it followed from earlier studies [Jaśkiewicz et al. 2001].

A. salicariae has been so far observed in a few sites in Poland [Szelegiewicz 1968], but it has not been found out in the Lublin area. This aphid inhabited white dogwood in small numbers (recedent) and only in spring. Its population on one plant in the vegeta-

tion period ranged from a few to more than a hundred specimens. Although it is considered a two-home species [Szełęgiewicz 1968, Müller 1976], no autumn generations have ever been found on the examined dogwood shrubs.

A. corni was more numerous in the street site (A) in 1999; in other years its population was comparable in both sites or it was a bit more numerous in the park site (B). On the other hand, greater numbers of *A. salicariae* were found in the park site. Similar data are given by Jaśkiewicz [2001]. Other aphid species also occurred more numerous on other species of decorative shrubs in the street site [Cichočka and Goszczyński 1991, Wilkaniec 1994, Jaśkiewicz 2001]. Weather conditions had a significant effect on the aphid population in the years of studies. After a mild winter and a warm spring, *A. corni* aphids were observed already in April (2001), while *A. salicariae* aphids were found at the turn of April and May. Cichočka [1980, 1995], Westigars and Madsen [1964] and Jurek [1980] state that high temperatures of more than 30°C with minimum rainfalls or no rainfalls at all are disadvantageous for the development of aphids, which was confirmed by the results of the present studies. The showers, which wash off or even kill aphids, cause high death rate. Autumn ground frosts lasting for a few days can considerably limit the population of aphids, like it was the case in 2000. A slight influence on limiting the aphid population on *C. alba* could have been exerted by the predatory *Diptera* (*Syrphidae* and *Cecidomyiidae*), while the other aphidophagous species appeared individually. The injuries caused by *A. salicariae* were very small, which was due to their short stay in small numbers: only slight twisting of the leaves was noticed. Szełęgiewicz [1968] and Schneider [1976] state that in spring this aphid can twist the leaves into nests.

In spring, *A. corni* fed on young shoots and flower umbels, which did not cause any visible injuries. In autumn, they inhabited the bottom part of the leaves in great numbers, causing discoloration and earlier fall. Similar results are given by Jaśkiewicz [2001].

CONCLUSIONS

1. The shrubs of *Cornus alba* were inhabited by *Anoecia corni* (F) and *Aphis salicariae* Koch.
2. *A. corni* was most numerous in 2000, while *A. salicariae* in 1999.
3. The numbers of *A. corni* was comparable in all the studied years totally, with an exception of 1999, when these aphids were more numerous in site A. *A. salicariae* was more numerous in the park site only in 1999.
4. *A. corni* lowered the ornamental values of *C. alba* shrubs, especially in autumn.
5. The weather had a significant effect on the aphid population. After a mild winter and warm spring aphids were more numerous. High temperatures (over 30°C) and stormy rainfalls as well as autumn ground frosts limited their population. On the other hand, aphidophagous species did not limit the population of aphids in any considerable manner.

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MSZYCE WYSTĘPUJĄCE NA *Cornus alba* L.

Streszczenie. Badania prowadzono na krzewach *Cornus alba* L. w latach 1999–2001 na terenie zieleni miejskiej w Lublinie (stanowisko przyuliczne A i parkowe B). Ustalono, że krzewy *C. alba* są roślinami żywicielskimi dla dwóch gatunków mszyc: *Anoecia corni* (F.) i *Aphis salicariae* Koch. Dominującym gatunkiem w latach badań na stanowisku A i B była mszyca *A. corni*, najliczniej wystąpiła w roku 2000. Liczebność mszyc *A. corni* na stanowisku A była wyższa w roku 1999, w pozostałych latach badań jej liczebność na obydwu stanowiskach była porównywalna. Natomiast mszyce *A. salicariae* liczniej występowały w roku 1999 na stanowisku B.

Wyraźny wpływ na dynamikę liczebności mszyc miały warunki pogodowe. Po łagodnej zimie i ciepłej wiosnie mszyce występowały liczniej. Temperatury powyżej 30°C i opady typu burzowego oraz jesienne przymrozki hamowały rozwój populacji. Niewielki wpływ na ograniczenie liczebności mszyc miały afidofagi.

Dekoracyjność krzewów znacznie obniżała *A. corni*, zwłaszcza jesienią.

Słowa kluczowe: mszyce, *Anoecia corni* (F.), *Aphis salicariae* Koch, krzewy *Cornus alba* L., miejskie tereny zielone

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