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Constancy of occurrence of aphid community (*Hemiptera*, *Aphididae*) on roses in the urban conditions of Lublin

Stałość występowania zespołu mszyc (*Hemiptera*, *Aphididae*)
zasiedlającego róże w warunkach miejskich Lublina

Summary. The purpose of the present studies was to determine the frequency of particular species from the aphid community colonizing roses of different utility groups (*Rosa rugosa* Thunb., *Rosa multiflora* Thunb., park rose cv. 'Grandhotel', cluster flowered roses) growing in the urban conditions of Lublin. The studies were conducted in the years 2001–2003. The highest constancy of occurrence was characteristic of *M. rosae*. This species was observed annually on all roses in each site. The lowest frequency was characteristic of *L. trirhodus*, *E. tiliae*, *M. euphorbiae*, *Aulacorthum* sp. and those aphids belonged to accidents. Establishing the total frequency of the studied aphid species gives a picture of the occurrence of these species in a definite area. However, only the analysis of the structure of occurrence constancy of these species on definite host plants in particular sites makes it possible to grasp their interrelations.

Key words: aphids, constancy of occurrence, frequency, roses

INTRODUCTION

With the aim of acquiring information on the commonness or rarity of a given species, its frequency – or, in other words, constancy of occurrence – is established. Frequency is multi-dimensional and it can inform about various aspects of species distribution. Constancy of occurrence is a narrower range of frequency, and its type is analyzed on the basis of estimation of frequency [Górny and Grűm 1981, Czachorowski 2004].

The purpose of the present studies was to determine the frequency of particular species from the aphid community colonizing roses of different utility groups growing in the urban conditions of Lublin.

MATERIAL AND METHODS

The studies were conducted in the years 2001–2003 in four sites of the Lublin green areas: a road site (A), a street site (B), a housing estate site (C) and a park site (D). In each of the sites fifteen shoots of similar length were analyzed on the following roses: a park variety 'Grandhotel', a cluster flowered rose of different varieties, a saltspray rose (*Rosa rugosa* Thunb.) and a multiflowered rose (*Rosa multiflora* Thunb.). In each season 28 samples were collected, from early spring (second 10-days' period of March) till late autumn (second 10-days' period of December) with about 10-days' intervals. The analysis of the obtained data was conducted on the basis of papers by Górny and Grűm [1981] and Czachorowski [2004]. In order to determine the constancy of occurrence of particular aphid species, index (*C*) was used, which expressed the relation of the number of samples where a given species occurred to the number of all samples:

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

where:

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

Five classes of frequency were distinguished:

I.	euconstants	≥71.0%
II.	constants	46.0–70.9%
III.	subconstants	26.0–45.9%
IV.	accessory species	11.0–25.9%
V.	accidents	≤ 10.9%

The present paper treats a single observation as a sample. Calculating the total frequency of aphids, number of all observations (3 seasons × 28 observations = 84) during three seasons was taken as value Q, while q was the number of observations where a given species was noted during three seasons. Calculating the constancy of occurrence of the observed aphid species on particular roses, Q value was like above, whereas q was the number of observations in which a given species was observed on a specific species or variety of rose. Besides, the constancy of occurrence of the studied aphid species was established on the analyzed roses in particular sites, where Q value was like above, while q was the number of observations where a given aphid species was noted on a definite species or variety of rose in a given site.

RESULTS

The observations performed in the years 2001–2003 on roses of selected utility groups in the urban conditions of Lublin found out the occurrence of 10 aphid species (*Hemiptera*, *Aphididae*): *Macrosiphum rosae* (L.), *Chaetosiphon tetrarhodus* (Walk.), *Metopolophium dirhodum* (Walk.), *Myzaphis rosarum* (Kalt.), *Maculolachnus submacula* (Walk.), *Longicaudus trirhodus* (Walk.), *Aphis fabae* Scop., *Macrosiphum euphorbiae* (Thom.), *Eucalipterus tiliae* (L.), *Aulacorthum* sp.

Total aphid frequency in the area of Lublin

The acquired results made it possible to classify the observed aphid species to 5 frequency classes (Tab. 1). The class of euconstants was made of *M. rosae*. It was the species which was observed annually on all roses in each site, while during the vegetation season it occurred on plants most often. The class of constants included *Ch. tetrarhodus* and *M. submacula.* The subconstants also included two species: *M. dirhodum* and *M. rosarum*. The accessory species was *A. fabae*. The class of accidents was made up of four species: *L. trirhodus*, *E. tiliae*, *M. euphorbiae* and *Aulacorthum* sp.

Table 1. Total aphid frequency in the area of Lublin in the years 2001–2003
Tabela 1. Ogólna frekwencja mszyc na terenie Lublina w latach 2001–2003

Class of frequency Klasa frekwencji	Species of aphid Gatunek mszyc	Index *C*, %			
		2001	2002	2003	total
Euconstants Eukonstanty	*Macrosiphum rosae*	78.6	78.6	71.4	76.2
Constants Konstanty	*Chaetosiphon tetrarhodus*	71.4	64.3	75.0	70.2
	Maculolachnus submacula	78.6	64.3	46.4	63.1
Subconstants Subkonstanty	*Metopolophium dirhodum*	57.1	42.8	35.7	45.2
	Myzaphis rosarum	35.7	60.7	32.1	42.8
Accessory species Gatunki akcesoryczne	*Aphis fabae*	25.0	17.8	17.8	20.2
Accidents Akcydenty	*Longicaudus trirhodus*	14.3	17.8	0	10.7
	Eucalipterus tiliae	7.1	14.3	7,1	9.5
	Macrosiphum euphorbiae	17.8	3.6	0	7.1
	Aulacorthum sp.	1	0	0	1.2

The structure of occurrence constancy of aphid community on particular roses

Analyzing the obtained results, significant differences were found out in the length of the period of the analyzed aphid species staying on a given rose. The most differentiated structure of occurrence constancy was marked on the park rose 'Grandhotel' and saltspray rose, where four constancy classes were distinguished on each (no class of euconstants).

The greatest differences in the content of particular classes were found in the case of *M. rosae* and *Ch. tetrarhodus* (Tab. 2). The first species on the park rose 'Grandhotel' belonged to constants, while on the *R. rugosa* – to subconstants. *Chaetosiphon tetrarhodus*, which on the saltspray rose constituted the class of constants, on the park rose 'Grandhotel' belonged to accessory species with almost three times lower frequency as compared to the above mentioned rose. Relatively high frequency of *M. submacula* on the park rose made it possible to include it within subconstants. On the other hand, the other aphid species observed on those roses were included in the same classes of constancy. Only two constancy classes were isolated on multiflowered rose and cluster flowered roses. *Macrosiphum rosae* was included in accessory species, while the other aphid species were accidents.

Table 2. The structure of occurrence constancy (*C*) of aphid community on particular roses in the years 2001–2003
Tabela 2. Struktura stałości występowania (*C*) zespołu mszyc na poszczególnych różach w latach 2001–2003

Class of frequency Klasa frekwencji	Saltspray rose Róża pomarszczona	*C*, %	Park rose 'Grandhotel' Róża parkowa	*C*, %	Multiflowered rose Róża wielokwiatowa	*C*, %	Cluster flowered roses Róże rabatowe	*C*, %
Euconstants Eukonstanty								
Constants Eukonstanty	*Ch. tetrarhodus*	57.1	*M. rosae*	48.8				
Subconstants Subkonstanty	*M. rosae*	31.2	*M. submacula*	27.4				
Accessory species Gatunki akcesoryczne	*M. dirhodum*	24.4	*Ch. tetrarhodus* *M. dirhodum* *M. rosarum*	19.9 22.7 13.4	*M. rosae*	14.9	*M. rosae*	23.2
Accidents Akcydenty	*L. trirhodus* *M. euphorbiae*	2.1 1.2	*L. trirhodus* *A. fabae* *M. euphorbiae* *E. tiliae*.	5.0 9.2 1.5 2.7	*Ch. tetrarhodus* *M. dirhodum* *Aulacorthum* sp.	9.5 3.0 0.3	*Ch. tetrarhodus* *M. dirhodum* *M. rosarum* *M. submacula* *M. euphorbiae* *E. tiliae*	0.9 5.6 5.3 9.5 0.6 0.6

Structure of occurrence of aphid community on the analyzed roses in particular sites

Analyzing occurrence constancy on the studied roses in particular sites presented in Table 3, preferences of those insects were very clearly found out towards the host plant (also seen in Table 2). On the other hand, the studies did not find any significant effect of the type of site on their constancy of occurrence with an exception of two aphid species. The most differentiated structure of constancy was characteristic of *M. submacula* on the park rose. In the street site, it belonged to constants, in the road site – to subconstants, in the housing estate – to accessory species, while in the park site it was not present on this rose. The species if *M. rosarum* on the park rose in the road site belonged to subconstants, while in the other sites it belonged to accidents. In the case of the other aphid species differences in the constancy of occurrence between particular sites were insignificant or not present at all.

Table 3. Structure of occurrence constancy of aphid community on the analyzed roses in particular sites in the years 2001–2003
Tabela 3. Struktura stałości występowania zespołu mszyc na analizowanych różach w poszczególnych stanowiskach w latach 2001–2003

Species of aphid Gatunek mszyc	Roses/Róże															
	saltspray pomarszczona				park 'Grandhotel' parkowa				multiflowered wielokwiatowa				cluster flowered rabatowa			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Ch. tetrarhodus	II	II	II	III	IV	IV	IV	IV	IV	V	IV	V	V	V	-	-
M. rosae	III	III	III	III	III	III	II	II	IV	IV	IV	V	III	IV	IV	IV
M. dirhodum	IV	III	IV	IV	IV	III	IV	IV	V	V	-	-	V	V	V	V
M. rosarum	-	-	-	-	III	V	V	V	-	-	-	-	V	V	V	V
M. submacula	-	-	-	-	III	II	IV	-	-	-	-	-	IV	V	V	V
L. trirhodus	V	V	V	-	V	V	V	V	-	-	-	-	-	-	-	-
A. fabae	-	-	-	-	V	IV	-	IV	-	-	-	-	-	-	-	-
M. euphorbiae	-	V	V	-	V	V	V	-	-	-	-	-	V	-	V	-
E. tiliae	-	-	-	-	V	V	-	-	-	-	-	-	-	V	-	-
Aulacorthum	-	-	-	-	-	-	-	-	-	V	-	-	-	-	-	-

Sites/Stanowiska: A – road/przyjezdniowe, B – street/przyuliczne, C – housing estate/osiedlowe, D – park/parkowe; – no aphids/brak mszyc.
Constancy of aphid appearance/Stałość występowania mszyc:
Class I – euconstants/eukonstanty ≥71.0%; Class II – constants/konstanty 46.0–70.9%; Class III – subconstants/subkonstanty 26.0–45.9%; Class IV – accessory species/gatunki akcesoryczne 11.0–25.9%; Class V – accidents/akcydenty ≤10.9%

DISCUSSION

The results discussed above testify to the multidimensional character of frequency and, at the same time, to the possibility of calculating it in reference to various levels, which is pointed to by Czachorowski [2004].

Macrosiphum rosae is a common species on roses which usually remains on the shrubs throughout most of the vegetation period [Jaśkiewicz 2003].

The species that occurred on all roses in most sites included *Ch. tetrarhodus* and *M. dirhodum.* The former was characterized by high total frequency; however, its frequency on particular roses was differentiated since this is a species with clearly marked preferences in relation to the host plant [Jaśkiewicz and Kmieć 2005]. *Metopolophium dirhodum*, although a host-alternating species, occurred relatively often on the shrubs.

High total frequency was characteristic of *M. submacula,* but this is a species preying mostly on "noble roses" and it is closely associated with the specified site [Jaśkiewicz *et al*. 2001, Jaśkiewicz and Kmieć 2004]. Relatively high total frequency was found for *M. rosarum*, but it was caused by its frequent occurrence on the park rose 'Grandhotel' only in the road site. *Aphis fabae* were observed only on the park rose 'Grandhotel', where in summer it preyed at the base of the petals. *Longicaudus trirhodus*, enumerated by Cichocka and Jaśkiewicz [2003] as belonging to the species associated with rose (*Rosa* L.) was observed fairly rarely and only on certain shrubs.

Very low frequency was characteristic of *E. tiliae, M. euphorbiae* and *Aulacorthum* sp., which should be considered accidental species. The first one is connected to linden through its feeding, while the second is a polyphagous species and it is observed on roses in greater numbers mainly under covers [Wojdyła *et al*. 2002]. On the other hand, aphid larvae of *Aulacorthum* genus were found only in one observation on one shrub of *R. multiflora*.

Establishing the total frequency of the studied aphid species gives a picture of the occurrence of these species in a definite area – in this case in the area of Lublin. However, only the analysis of the structure of occurrence constancy of these species on definite host plants in particular sites makes it possible to grasp their interrelations.

CONCLUSIONS

1. The highest constancy of occurrence was characteristic of *M. rosae*. This species was observed annually on all roses in each site.

2. The lowest frequency was characteristic of *L. trirhodus*, *E. tiliae*, *M. euphorbiae*, *Aulacorthum* sp. and those aphids belonged to accidents.

3. Establishing the total frequency of the studied aphid species gives a picture of the occurrence of these species in a definite area. The analysis of the structure of occurrence constancy of these species on definite host plants in particular sites makes it possible to grasp their interrelations.

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Streszczenie. Celem przeprowadzonych badań było ustalenie frekwencji poszczególnych gatunków z zespołu mszyc zasiedlającego róże z różnych grup użytkowych (róża pomarszczona – *Rosa rugosa*, róża wielokwiatowa – *Rosa multiflora*, róża parkowa 'Grandhotel', róże rabatowe), rosnące w warunkach miejskich Lublina. Badania prowadzono w latach 2001–2003. Najwyższą stałością występowania charakteryzował się gatunek *M. rosae*, który notowano corocznie na wszystkich badanych różach w każdym ze stanowisk. Najniższą frekwencją charakteryzowały się gatunki *L. trirhodus*, *E. tiliae*, *M. euphorbiae*, *Aulacorthum* sp. należące do klasy akcydentów. Ustalenie ogólnej frekwencji badanych gatunków mszyc daje pewien obraz ich występowania na określonym obszarze. Jednak dopiero analiza struktury stałości występowania tych gatunków na określonych roślinach żywicielskich w poszczególnych stanowiskach pozwala określić ich wzajemne powiązania.

Słowa kluczowe: mszyce, stałość występowania, frekwencja, róże