

Arthropods settling *Crataegus xmedia* Bechst. in the landscape of Lublin City (South-Eastern Poland)

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ABSTRACT

Observations of the species composition and number of arthropods from various trophic groups settling the hawthorn species *Crataegus xmedia* Bechst. were conducted in the city of Lublin in the years 2009-2010. The research was carried out in two site, and the collected arthropods were divided into trophic groups with regard to their feeding preferences. Observations focused on the number of herbivore arthropods and beneficial predatory arthropods; they were carried out in urban conditions in various degree of anthropopressure. The research revealed that the sucking-piercing phytophags were the dominating trophic group settling *Crataegus xmedia*. Representatives of Psyllidae, Aphididae and Tetranychidae were the most numerous at both sites. Also, the presence of larvae of *Dasineura crataegi* (Winnertz 1853) was detected, causing disfiguration of leaves at the tips of young shoots. Mites from the Phytoseiidae family and spiders dominated in the predator group. Among predatory insects, representatives of Coccinellidae dominated in the housing estate site and representatives of Coccinellidae and Anthocoride in the by-the-road site. Parasites were found in very small numbers.

KEY WORDS: *Crataegus xmedia*, arthropods, hawthorn, trophic groups

INTRODUCTION

The natural environment in urban areas undergoes strong anthropogenic transformations, forming specific, often adverse conditions for plant life and growth. This manifests itself first of all in increased air pollution, changes in water management, as well as degradation and change in the physical and chemical properties of soils. In the formation of plant structure in the city, proper species composition plays a crucial role. Roadside trees are more exposed to increased air pollution resulting from traffic emissions and to saltiness resulting from salt use on icy roads (CHUDZICKA, 1979). Besides, due to limited space for the root system development and low level of ground water, trees dry out as they do not have access to water. For this reason, it is vital for urban tree plantings to be composed of tree species which are not vulnerable to inconveniences and can adapt to specific conditions. As follows from the research conducted on various urban tree species in Warsaw, Poznań and Lublin (CICHOCKA & GOSZCZYŃSKI, 1991; WILKANIEC, 1994; MACKOŚ, 2010), plants in urbanized areas are inhabited by greater numbers of herbivore arthropods which damage them by feeding on them. In the natural landscape, the number of phytophags remains balanced, while in sites with strong anthropogenic pressure, the mass emergence of a single species may occur (LUBIARZ & CICHOCKA, 2005). Many authors (CHUDZICKA, 1979; CZECHOWSKA *et al.*, 1979; PISARSKI, 1979; CICHOCKA *et al.*, 1990a; CICHOCKA & GOSZCZYŃSKI, 1991; CICHOCKA *et al.*, 1998; JAŚKIEWICZ, 2005; JAŚKIEWICZ, 2006) have demonstrated that by-the-road trees and shrubs are mostly infested with arthropods. According to LUBIARZ *et al.* (2011), it has been proven in many research studies that intensified urbanization and shrinking green areas result in the rise of the number of phytophags with sucking-piercing mouthparts and a drop in the number of phytophags with biting mouthparts.

Plants of the *Crataegus* genus are shrubs or small trees belonging to the Rosaceae family. These are very ornamental plants, particularly when blooming. One of the species numerously represented in the urban greenery of Lublin is *Crataegus xmedia* Bechst. It is a hybrid of two hawthorn species: *Crataegus monogyna* Jacq. and *Crataegus laevigata* (Poiret) DC (SENETA & DOLATOWSKI, 1997). In natural habitats, *Crataegus xmedia* grows in western, north-western and, sporadically, southern Poland (SOŁTYS-LELEK, 2011). For urban plantings in city squares and streets, two varieties are normally used: 'Paul's Scarlet' with red flowers and 'Rubra Plena' with pink flowers (BUGAŁA, 1991; SENETA & DOLATOWSKI, 1997). *Crataegus xmedia* is resistant to urban conditions; it tolerates drought and air pollution, resists low temperatures and is particularly tolerant to cutting and forming. However, as pointed out by BUGAŁA (1991), annual cutting aimed at canopy reduction is not recommended, as the cut tree does not blossom.

In the past, research related to arthropods settling *Crataegus* plants was carried out, among other locations, in Warsaw and Gdańsk (GOSZCZYŃSKI *et al.*, 1999;

TYKARSKA, 2001a; TYKARSKA, 2001b; TYKARSKA, 2002; TYKARSKA & TYKARSKI, 2003) and in Lublin (SŁAWIŃSKA, 2003; JAŚKIEWICZ & SŁAWIŃSKA, 2004; SŁAWIŃSKA & JAŚKIEWICZ, 2004). SŁAWIŃSKA (2003) and SŁAWIŃSKA & JAŚKIEWICZ (2004) mainly focused on aphids connected with *Crataegus xmedia*.

In the course of this research, observations were made of the species composition and number of arthropods from various trophic groups settling *Crataegus xmedia* in the urban conditions of Lublin.

MATERIAL AND METHODS

The research was carried out in Lublin in the years 2009-2010 in two sites.

- Site 1 – situated by the road – a line of trees growing along a busy street
- Site 2 – situated in a housing estate - trees growing in a bigger complex of greenery, surrounded by other plants, at a distance from traffic routes.

In each site, 4-5 trees belonging to the *Crataegus xmedia* 'Paul's Scarlet' species were selected, and every 10-14 days, 100 leaves were collected from each of them together with green and wooden shoots. Samples were collected from the end of March until September, as this was the period when the trees had leaves. The collected material was viewed under the stereoscopic microscope and the arthropods were counted, described and photographed. Species were determined according to the keys developed by MÜLLER (1976), KROPczyńska (1999), SZADZIEWSKI (1999) and BLACKMAN & EASTOP (2000).

In the present study, the collected arthropods were divided into three trophic groups with respect to their feeding preferences: herbivore arthropods, predatory and parasitic arthropods, and arthropods feeding on mixed nutrients. Herbivore arthropods were additionally subdivided with respect to their mouthpart type (biting or sucking-piercing), as the manner of food intake by phytophags has a vital impact on the appearance and development of the settled plants.

Names of arthropod species are given according to FAUNA EUROPEA (2011).

RESULTS AND DISCUSSION

In the conducted research, the total number of arthropods collected in both years (2009 and 2010) in the housing estate site was almost the same as the number collected in the by-the-road site (Tab. 1). In 2009, the number of arthropods was greater for the by-the-road site than for the housing estate site, while in 2010 the reverse was recorded – almost twice as many arthropods were found in the housing estate site than in the by-the-road site (Tab. 1).

In the two research years, herbivore arthropods dominated both in the by-the-road site and in the housing estate site (Tab. 1). Similar data are found in

TYKARSKA & TYKARSKI (2003). In the housing estate site, the number and percentage share of phytophags remained on the same level in 2009 and 2010, amounting to almost 90% of all arthropods found (Tab. 1, Fig.2A). As for the by-the-road site, in 2009 the number of herbivores was similar to that in the housing estate site, while in 2010 it dropped almost by half. It should, however, be noted that in both research years, the percentage share of herbivore arthropods was almost the same and constituted nearly 95% of all collected specimens (Fig. 2B). The number of predators in the housing estate site was twice the number recorded for the by-the-road site (Tab. 1). In the housing estate site, the percentage of predators to phytophags was from 3.6% to 90% in 2009 and 5.3% to 89% in 2010, respectively. In the by-the-road site, the percentage of predatory arthropods to herbivores was less than 1.6%, up to 97.8% in 2009 and from 4.4% to 95.2% in 2010 (Fig. 1). Parasitic arthropods were found only sporadically – few of them were found in both sites in 2009, and none were observed in 2010 (Tab. 1). Arthropods feeding on mixed nutrients amounted to less than 7% in both research years in the housing estate site and were scarce in the by-the-road site (Fig.1). Their feeding probably had no impact on the appearance or development of trees or on the decrease in the number of phytophags.

Table 1. Total number of arthropods of particular trophic groups collected in both research sites in 2009-2010

	housing estate site			by-the-road site		
	2009	2010	Total	2009	2010	Total
herbivore arthropods	2518	2659	5177	3782	1707	5489
predatory arthropods	100	158	258	61	79	140
parasitic arthropods	3	0	3	5	0	5
arthropods feeding on mixed nutrient	188	188	376	21	7	28
Total	2809	3005	5814	3869	1793	5662

A. Herbivore arthropods

Species with sucking-piercing mouthparts dominated among herbivorous arthropods (Fig.2). Similar data for other urban tree species were given by CHUDZICKA (1979), CICHOCKA *et al.* (1990a and b), CICHOCKA & GOSZCZYŃSKI (1991), WILKANIEC (1994) and MACKOŚ (2010). Sucking-piercing arthropods constituted approx. 99% of all phytophags in the housing estate site and almost 100% in the by-the-road site (Fig. 2).

Aphids were a dominant group among sucking-piercing arthropods. In 2009, their number in both sites was higher than in 2010 (Fig.3). Most numerous were aphids from the Aphididae family, among which species previously reported feed-

ing on *Crataegus xmedia* by other researchers were observed (TYKARSKA, 2002; SŁAWIŃSKA, 2003, TYKARSKA & TYKARSKI, 2003), such as: *Aphis pomi* De Geer 1773, *Rhopalosiphum insertum* (Walker 1849), *Ovatus crataegarius* (Walker 1850), *Dysaphis* sp. and the species so far not demonstrated in connection with hawthorn in Poland, namely *Aphis fabae* Scopoli 1763.

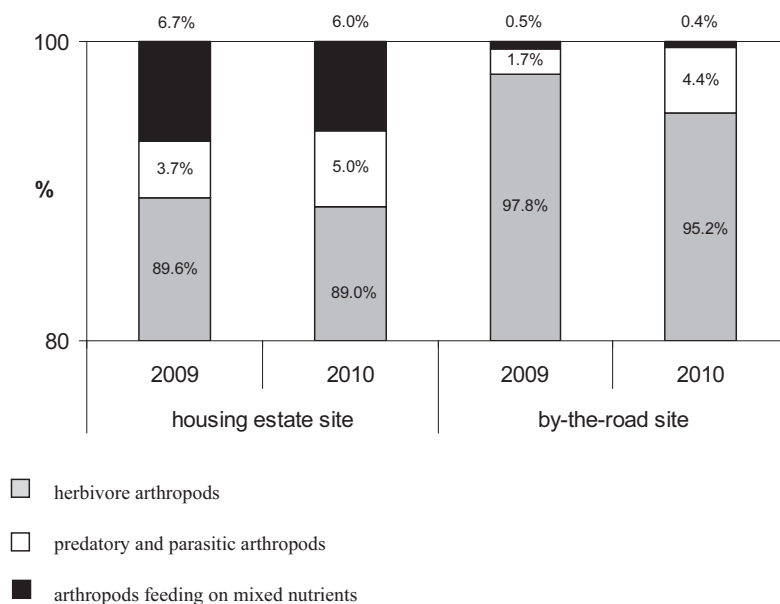


Figure 1. Percentage share of particular trophic groups of arthropods settling *Crataegus xmedia* in Lublin (2009-2010)

The percentage share of Aphididae in 2009 in the housing estate site was 78.6%, and in 2010 – 50.6% in relation to other sucking-piercing arthropods. In the by-the-road site, the percentage figure for Aphididae in 2009 was 83%, and it dropped to 47.8% in 2010. Also, in 2010 few *Prociphilus pini* (Burmeister 1835) individuals from the Pemphygidae family were observed in that site. This species settling *Crataegus xmedia* has also been reported by TYKARSKA (2002) and TYKARSKA & TYKARSKI (2003).

The number of Psyllidae in the housing estate site in 2009 was four times less than in 2010. In the by-the-road site, psyllids were infrequent in 2009, while in 2010 their number increased over 14 times as compared with the previous year (Fig. 3).

Apart from aphids and psyllids, arachnids from the family Tetranychidae were very numerous; their number in the by-the-road site in the years 2009 and 2010 was twice the number in the housing estate site (Fig. 3). The representatives of

Tetranychidae were *Amphitetranychus viennensis* (Zacher 1920), *Tetranychus urticae* Koch 1836 and *Bryobia rubrioculus* (Scheuten 1857).

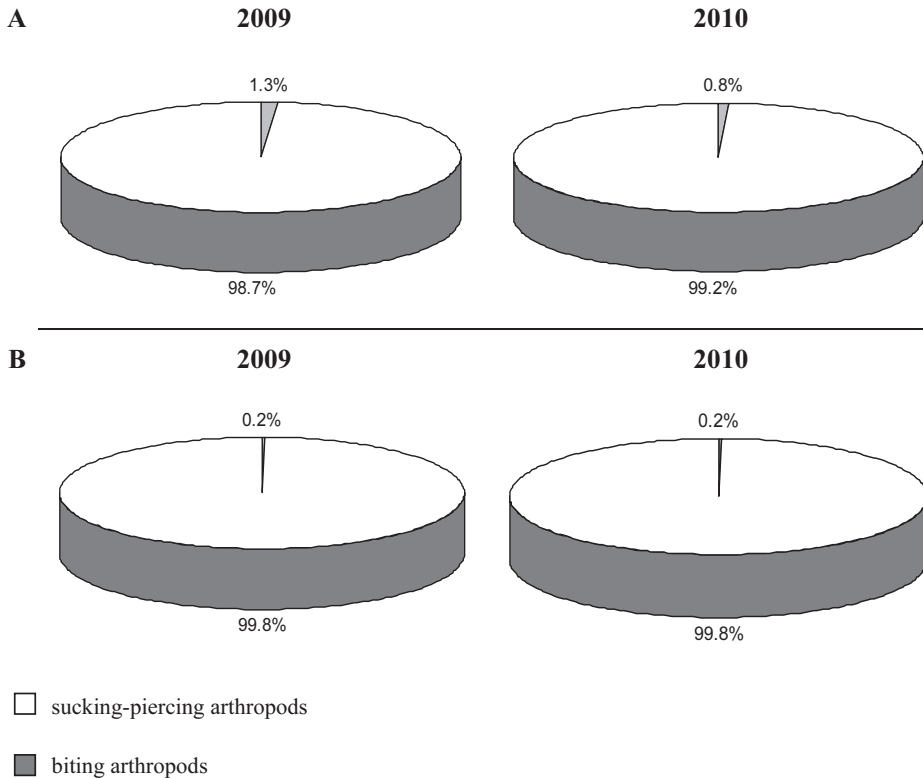


Figure 2. Percentage share of sucking-piercing and biting arthropods settling *Crataegus xmedia* in Lublin (2009-2010). **A** – housing estate site, **B** – by-the-road site

In both sites, the larvae of dipteran gall midge *Dasineura crataegi* (Winnertz 1853) were found, belonging to Cecidomyiidae, whose feeding caused the emergence of rosette-shaped galls at the tips of young shoots (Fig. 4). More *D. crataegi* larvae were observed in the by-the-road site, less in the housing estate site. However, in the latter site, representatives of Thysanoptera appeared, which were absent in the by-the-road site. Similar data were given by MACKOŚ (2010) from her research on *Tilia cordata* Mill.

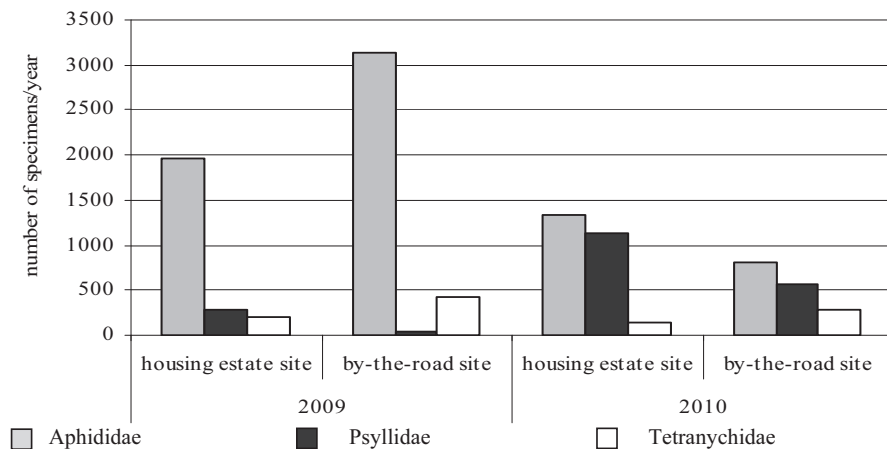


Figure 3. The number of the most numerous families of sucking-piercing arthropods settling *Crataegus xmedia* in Lublin (2009-2010)



Figure 4. Galls caused by the *Dasineura crataegi* larvae on *Crataegus xmedia*

Arthropods with biting mouthpart were found in greater numbers in the housing estate site than in the by-the-road site, which confirms the observations made by other authors (CICHOCKA & GOSZCZYŃSKI, 1991; WILKANIEC, 1994; MACKOŚ, 2010;). In the housing estate site, the percentage share of biting arthropods in relation to sucking-piercing arthropods was greater in 2009 than in 2010, and in the by-the-road site it was similar in both research years (Fig. 2). Larvae of butterflies

from the family Yponomeutidae were the most numerous in the housing estate site, accounting for approx. 80% of all the biting arthropods collected in that site in 2009 and 2010. The representatives of that family were the *Yponomeuta padella* (Linnaeus 1758) larvae which were feeding in cocoons on hawthorn twigs. It is worth mentioning that they were not observed in any of the research years in the by-the-road side. Among the remaining arthropods with biting mouthparts that were found in research sites, there were Curculionidae beetles, larvae of hymenopterons from the family Tenthredinidae and larvae of several butterfly species belonging to Geometridae, Lymantriidae and Tortricidae. In the by-the-road site, few biting arthropods from the Curculionidae family and Tortricidae, Geometridae larvae were noted.

B. Predatory and parasitic arthropods

In both years of research, the by-the-road site had a smaller number of predatory arthropods than the housing estate site (Fig. 5). Parasitic arthropods were very few and they were observed only in 2009 in both sites, in the form of parasitized aphid mummies.

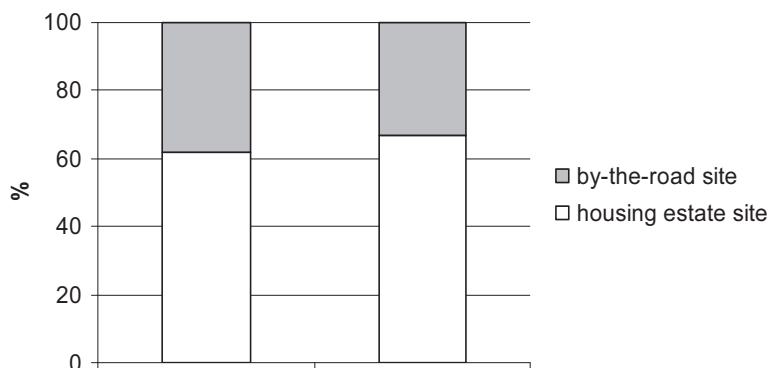


Figure 5. Percentage share of predatory arthropods settling *Crataegus xmedia* in Lublin (2009-2010)

Predatory arthropods were most numerous represented by the mites from the Phytoseiidae family. In the housing estate site in both years of research they constituted over 80% of all predators, while in the by-the-road site they were less numerous (68% in 2009, 44% in 2010). It is worth noting that the housing estate site featured a large number of individuals from the Phytoseiidae family and a small number of spider mites, while the reverse was observed in the by-the-road site. Spiders were very numerous in both sites. The most numerous insects were beetles from the Coccinellidae family and in the by-the-road site there were also predatory hemipterans from the Anthocoridae family, as numerous as Coccinelli-

dae. As stated by CZECHOWSKA *et al.* (1979), insects from the Coccinellidae family are the least sensitive to urbanization pressure factors.

C. Arthropods feeding on mixed nutrients

Arthropods feeding on mixed nutrients accounted for over 6% of all arthropods collected in the housing estate site, but were scarce in the by-the-road site (Tab. 1). In the housing estate site in both research years, the *Czenspinksia lordi* Nesbitt mite prevailed among mixed feeders (approx. 90%). However, this species was not found in the by-the-road site. Moreover, a small number of Psocoptera and Tydeidae representatives were observed in both sites.

CONCLUSION

From the research conducted in the years 2009-2010 it follows that herbivore arthropods with sucking-piercing mouthparts were a dominating trophic group settling *Crataegus xmedia*. In both research sites, aphids, psyllids and spider mites were the most numerous. *Dasineura crataegi* were also found in both sites, whose larvae caused disfiguration of leaves at the top of young shoots. Representatives of Thysanoptera appeared in the housing estate site, but they were not observed in the by-the-road site. Biting arthropods were more numerous in the housing estate site than in the by-the-road site. In the predator group, mites from the Phytoseiidae family and spiders prevailed. Among predatory insects, the representatives of Coccinellidae dominated in the housing estate site and the representatives of Coccinellidae and Anthocoridae in the by-the-road site.

Numerously appearing herbivore arthropods caused leaf damage. The feeding of sucking-piercing arthropods caused deformation and yellowing of leaves and the formation of disfiguring galls. Arthropods with biting mouthparts damaged leaf blades when biting off leaf skin or making holes in leaves.

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**Stawonogi zasiedlające głóg pośredni (*Crataegus xmedia* Bechst.)
w zieleni miejskiej Lublina (południowo-wschodnia Polska)**

STRESZCZENIE

Obserwacje nad składem gatunkowym i liczebnością stawonogów z różnych grup troficznych zasiedlających głóg pośredni (*Crataegus xmedia* Bechst.) prowadzono na terenie Lublina, w latach 2009-2010. Badania prowadzono w dwóch stanowiskach, a zebrane stawonogi podzielono na grupy troficzne ze względu na preferencje pokarmowe. Obserwacje dotyczą liczebności występowania stawonogów roślinożernych oraz pożytecznych w warunkach miejskich, w zależności od nasilenia antropopresji. Z przeprowadzonych badań wynika, że dominującą grupą troficzną zasiedlającą *Crataegus xmedia* były fitofagi o kłująco-ssącym aparacie gębowym. W obu stanowiskach najliczniej występowały przedstawiciele Psyllidae, Aphididae i Tetranychidae. Ponadto, stwierdzono występowanie larw *Dasineura crataegi* (Winnertz, 1853), które powodowały zniekształcanie liści na końcach młodych pędów. Wśród drapieżców dominowały roztocze z rodziny Phytoseiidae oraz pająki. Wśród owadów drapieżnych, w stanowisku osiedlowym, dominowali przedstawiciele Coccinellidae, natomiast w stanowisku przyulicznym przedstawiciele Coccinellidae i Anthocoride. Pasożyty były bardzo nieliczne.