

Abundance of *Stomaphis graffii* Cholod. (Hemiptera) on maple trees in Poland

Communication

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Abstract: The paper presents data on the remarkable abundance of *S. graffii* in the parks of the industrially transformed region of Upper Silesia, Poland. Ten new sites and 36 colonies were recorded, while only 6 sites were known so far from the whole territory of Poland. New host plant species and new ant species tending aphids were also recorded. The conclusion is that the abundance of *Stomaphis* species may be underestimated due to their cryptic life mode.

Keywords: Trophobiosis • Dispersal • Cryptic life mode • Aphid

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1. Introduction

The aphid genus *Stomaphis* Walker comprises about 30 species of Palaearctic origin, as proven by fossil material [1] and contemporary distribution. These aphids are distinct for their large body size and very long rostrum. Such a long rostrum, much longer than the body, enables them to probe through the bark of trees, mainly deciduous, on which they feed [2]. Through their host plants, this genus is connected with the biome of temperate broadleaf and mixed forests, typical for Europe and the Far East (Eastern Himalayas, China, Japan, Korea). Most of the genus' representatives are strictly oligophagous, feeding only on a single plant genus; however a few species may feed on the same plant genus (e.g. *S. quercus* and *S. radicola* on *Betula*, *S. mordvilko* and *S. juglandis* on *Juglans*). Yet there are also a few examples where one species may feed on various, though closely related plant genera: *S. quercus* on *Quercus* and *Betula*, *S. longirostris* on *Salix* and *Populus*.

The very long rostrum strongly disables the escape of these aphids in case of any disturbance. That is why all the species of this genus strongly depend on their mutualistic relation with ants, mostly from the genus

Lasius [3]. It is also why these aphids are located either in the bark crevices or under the bark in ant chambers, which makes them very difficult to be found by aphidologists. Body size also makes the dispersal of these aphids difficult, since the wings are in most species shorter than the body and alate females can fly only a distance of approximately 100 mm in the case of *S. japonica* [4] or are incapable of spreading by flying in the case of *S. quercus* [3].

All these features make these aphids considered to be rare. At least 5 European species of this genus are uncommon and known only from single sites (namely: *S. acquerinoi*, *S. bratislavensis*, *S. juglandis*, *S. knechteli*, *S. radicola* – [2,5,6] and www.aphidsonworldsplants.info). Although the other species are common in Europe, they occur only locally on very isolated sites, and that also concerns the distribution of the studied aphid species in Poland [7,8].

Stomaphis graffii Cholodkovsky 1894 is connected with different species of the genus *Acer*, which is Holarctic with its peak of diversity in temperate and subtropical zones of Asia [9]. In Europe various species of this genus are a crucial component of deciduous forests and also a significant part of urban greenery. What is surprising, although many and long

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term studies of aphids inhabiting urban greenery and parks were conducted [10–12], is that no *Stomaphis* species feeding on trees were ever recorded, nor were the alate morphs caught with Moericke traps [13]. However, after closer and very detailed field research *S. graffii* is revealed to be more frequent and occurring in more dense populations than it was ever presented in the literature.

2. Experimental Procedures

All the research was conducted in the province of Upper Silesia region, Poland. Most of this area is highly deteriorated and industrially transformed, with very little natural habitat [14]. The intense coal mining and smelting since the end of the XIX century caused irreversible changes in the environment by air, water and soil pollution with heavy metals, extreme deforestation combined with urbanization and disturbance of groundwater and terrain relief. The research was carried out in the central city of the province, Katowice, but also in the nearby cities of Siemianowice Śląskie, Piekary Śląskie and for comparison in the more distant and less polluted town of Koszęcin.

The intense search concerned all the maple and sycamore trees within a park but only when the presence of ants digging in the bark was noticed, usually on the basis of an ample amount of sawdust. After recognition of ant presence the bark was carefully removed with

a knife to uncover the chambers where aphids were feeding. In each of the studied cases no aphids were visible outside the ant chambers on the trunk or in the bark crevices. Sometimes there were aphids feeding in bark crevices, but then they were always covered by a soil vault made by ants.

3. Results

A total of 10 parks of varying acreage, ranging from 0.4–150 ha, were studied (Table 1). In nine of them the presence of *S. graffii* was recorded on different host plants. The presence or lack of aphids did not depend on the acreage of the studied parks, but on the presence of appropriate host plant trees. In one park in Piekary Śląskie which was quite big (4.8 ha) no *S. graffii* were recorded because all of the maple trees were either too small (less than 0.3 m in diameter on the height of 1.3 m – most of the trees infested by *S. graffii* were at least 0.4 m in diameter) or of inappropriate species – *Acer negundo*. On the other hand, in the smallest of all studied parks, in the city centre and near the main street, although there was only one maple tree surrounded by *Aesculus hippocastanum* trees, it was infested by *S. graffii* feeding under the bark.

It is interesting that despite the presence of oaks – the host plant of the most common *Stomaphis* species, *S. quercus* - the latter species was found only in the biggest park in Świerklaniec, where four specimens of

date	locality	coordinates	acreage [ha]	number and species of infested trees	percentage of infested <i>Acer</i> trees [%]	ant species
23.08.2011	Katowice	N: 50° 14' 46.46" E: 19° 1' 30.18"	2.05	1 <i>A. pseudoplatanus</i> 4 <i>A. platanoides</i>	29.41	<i>L. brunneus</i>
22.08.2011	Katowice	N: 50° 15' 27.28" E: 19° 1' 50.32"	0.4	1 <i>A. platanoides</i>	100.00	<i>L. brunneus</i>
22.08.2011	Katowice	N: 50° 15' 12.09" E: 19° 1' 50.96"	1.8	3 <i>A. pseudoplatanus</i>	60.00	<i>L. brunneus</i> , <i>L. niger</i>
16.08.2011	Siemianowice Śl.	N: 50° 18' 25.91" E: 19° 1' 46.07"	17	7 <i>A. pseudoplatanus</i> 3 <i>A. platanoides</i>	34.48	<i>L. brunneus</i>
11.08.2011	Piekary Śl.	N: 50° 22' 13.98" E: 18° 58' 15.31"	0.75	1 <i>A. platanoides</i>	16.67	<i>M. rugulosa</i>
11.08.2011	Piekary Śl.	N: 50° 22' 3.77" E: 18° 59' 7.16"	4.8	lack of appropriate <i>Acer</i> trees	0.00	presence of <i>L. brunneus</i> detected
17.08.2011	Piekary Śl.	N: 50° 22' 56.56" E: 18° 56' 51.33"	10	3 <i>A. pseudoplatanus</i> 3 <i>A. platanoides</i> 2 <i>A. saccharinum</i>	57.14	<i>L. brunneus</i>
18.08.2011	Koszęcin	N: 50° 37' 59.99" E: 18° 50' 23.35"	10	1 <i>A. pseudoplatanus</i>	25.00	<i>L. brunneus</i>
12.08.2011	Świerklaniec	N: 50° 25' 56.39" E: 18° 57' 14.75"	150	2 <i>A. pseudoplatanus</i> 2 <i>A. platanoides</i>	36.36	<i>L. brunneus</i>
29.08.2011	Radzionków	N: 50° 23' 59.60" E: 18° 55' 0.74"	45	3 <i>A. pseudoplatanus</i>	23.08	<i>L. brunneus</i>

Table 1. The collection data of the studied *Stomaphis graffii* populations.

Quercus robur were infested by this species of aphid, visited by workers of *Lasius fuliginosus*.

One new host plant species – *Acer saccharinum* – was recorded, which is of American origin and not native to European flora. Also one new ant species tending aphids was recorded – *Myrmica rugulosa*, which is surprising because ants of this genus were not earlier recorded to visit *Stomaphis*. This ant is known rather as a soil forager, but the aphids were feeding near the trunk base, under the bark, and the ant nest was located about 0.2 m from the trunk base.

When the aphids' location on the trunk is considered, they fed throughout its length, from the ground level up to a height of about 2 meters, but only in the case of older trees of *A. platanoides* and *A. pseudoplatanus*. In the case of *A. saccharinum* the aphids fed only at the trunk base, just above ground level, up to 0.2 m where the bark was most thick and they were localised under it, in ant chambers.

It was difficult to establish the number of individuals feeding on a single tree, because it would require the vast removal of the bark and thus significant damage to the tree. Aphids were feeding usually either singly along a deep bark crevice covered by soil or in clusters of 2-9 individuals comprising adults and larvae in a single chamber under the bark.

4. Discussion

During only nineteen days of careful and detailed research 10 new sites and 36 separate colonies of *S. graffii* were recorded, while to date only 6 sites were known from Poland [7,8]. Their abundance is remarkable as all of the parks in Katowice were planted during the 1950s and 60s, so their presence must be the result of dispersal flights. The acreage of a park had no influence on the presence of aphids; it was rather the smaller parks that had more trees infested than the bigger parks. But it may result from the fact that in the bigger parks the dominant tree species were oaks and pines and only a few specimens were maple and sycamore trees. In smaller parks the opposite situation took place; the trees of the genus *Acer* were most common and abundant.

The main problem with detecting this aphid species is its cryptic life habit. It feeds either on the ground level, in ant chambers covered by soil or under the bark. When it feeds on *A. pseudoplatanus*, it was easy to be found as the bark of this plant species breaks into smaller scales with empty space under them. The edge of such a scale is covered by soil and aphids feed in ant chambers created in this way. Removal of the bark scale is easy, although aphids feed only in some of such chambers. It is much more difficult to find aphids on other *Acer* species, because their bark is hard and stiff. Yet ants manage to build chambers in their crevices, inside the bark or under it. However, removal of bark to uncover aphids is only possible with a solid knife and with some force. It is impossible to localise aphids on *A. platanoides* and *A. saccharinum* in other ways, so it is not surprising that *S. graffii* was not recorded during the field studies of aphids inhabiting *A. platanoides* [11].

An interesting conclusion of the presented observations is the strict correlation between the presence and life mode of aphids and their host ant species. Although numerous oak trees were planted in four of the studied parks (Siemianowice Śląskie, Koszęcin, Radzionków and Świerklaniec) only one population of *S. quercus* was observed. But neither in the Siemianowice Śląskie nor in Koszęcin and Radzionków was *L. fuliginosus* detected, only in Świerklaniec, where they were attending *S. quercus* on oaks. In contrast, in each of the studied parks numerous populations of *L. brunneus* were observed, and *S. graffii* was always associated with them.

When the life mode is considered, *S. quercus* feeds in bark crevices of oaks but not under the bark and may be easily noticed, in accordance with the life mode of its ant host, which is an above ground forager [15]. On the contrary, *L. brunneus* is a timid and fugitive species, nesting in the interior of old trees and building chambers under the bark, and *S. graffii* strictly follows its life mode, feeding in ant chambers under the bark or under the soil cover.

As a summary, it seems that *S. graffii* may be more frequent and abundant than it was considered, not only in Poland but also throughout Europe, but only due to its very cryptic life mode it is under-recorded during field studies.

References

- [1] Węgierek P., Mamontova V.A., A new fossil species of the genus *Stomaphis* Walk. (Aphidoidea: Lachnidae), Ann. Up. Siles. Mus. (Ent), 1993, 1, 37-50
- [2] Blackman R.L., Eastop V.F., Aphids on the World's trees, An identification and information guide, CAB International & The Natural History Museum, London, 1994

- [3] Lorenz H., Scheurer S., Biology and generation-order of *Stomaphis quercus* (Lachnidae) living on *Betula pendula* near Berlin, Germany, In: Nieto Nafria J.M., Dixon A.F.G. (Eds.) *Aphids in natural and managed ecosystems*, 1998
- [4] Takada H., Life cycles of three *Stomaphis* species (Homoptera: Aphididae) observed in Kyoto, Japan: possible host alternation of *S. japonica*, *Entomol. Sci.*, 2008, 11, 341-348
- [5] Petrović O., A new species of *Stomaphis* Walker (Aphididae) from Serbia. In: *Aphids in natural and managed ecosystems*, In: Nieto Nafria J.M., Dixon A.F.G. (Eds.) *Aphids in natural and managed ecosystems*, 1998
- [6] Binazzi A., Blackman R.L., *Acer*-feeding *Stomaphis*, *Redia*, 2004, 86, 7-16
- [7] Szelegiewicz H., *Aphids (Aphidoidea, Lachnidae), The keys to determination of Polish insects*, Warsaw, 1978 (in Polish)
- [8] Osiadacz B., Hałaj R., The aphids (Hemiptera: Sternorrhyncha: Aphidinea) of Poland. A distributional checklist, *Pol. Entomol. Monogr.*, 2009, 6, 1-96
- [9] Li J., Yue J., Shoup S., Phylogenetics of *Acer* (Aceraceae, Sapindaceae) based on nucleotide sequences of two chloroplast non-coding regions, *Harv. Paper. Bot.*, 2006, 11, 101-115
- [10] Osiadacz B., Wieczorek K., Aphids (Hemiptera, Aphidoidea) of parks in Bytom (Upper Silesia, Poland) [Mszyce (Hemiptera: Aphidoidea) wybranych parków Bytomia], *Acta Entomol. Siles.*, 2003, 11, 39-46 (in Polish)
- [11] Mackoś E., Aphids (Hemiptera: Aphidoidea) on maple *Acer platanoides* in the Urban Green areas of the city of Lublin, *Aphids and Other Hemipterous Insects*, 2008, 14, 73-81
- [12] Borowiak-Sobkowiak B., Wilkaniec B., Occurrence of aphids (Hemiptera, Aphidoidea) on tree and shrubs in Cytadela Park in Poznań, *Aphids and Other Hemipterous Insects*, 2010, 16, 27-35
- [13] Ratajczak J., Wilkaniec B., Structure of aphid communities (Hemiptera: Aphidoidea) in the Kórnik Arboretum near Poznań (West Poland), *Pol. J. Entomol.*, 2011, 80, 429-442
- [14] Klimaszewski S.M., Czyłok A., Herczek A., Wojciechowski W., The composition and structure of aphid consortia (Aphidinea) on birches (*Betula pendula*) as indicators of the habitat condition in regions of industrial activity (The agglomerations of Silesia and Cracow), *Acta Biol. Siles.*, 1995, 27, 7-19
- [15] Collingwood C.A., The Formicidae (Hymenoptera) of Fennoscandia and Denmark, *Fauna Entomol. Scand.*, 1979, 8, 1-174