

Tetraneura ulmi (L.) (*Hemiptera, Eriosomatinae*)
on elm as its primary host

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Introduction

All over the world so far over 4000 aphid species have been recorded, of which 700 make galls on coniferous and deciduous trees (BLACKMAN & EASTOP, 1994; FORREST, 1987). On elm leaves galls are formed by 6 host alternating (heteroecius) aphid species from the *Eriosomatinae* family (BOGDANOWICZ *et al.*, 2004; MÜLLER, 1976; SZELEGIEWICZ, 1968). *Tetraneura ulmi* (L.) is one of those species and is widely spread across Asia and Europe and it migrates from elms onto grass roots (BLACKMAN & EASTOP, 1994). In Poland so far no detailed research concerning the presence and harm of this species on elms has been carried out. There are also few foreign publications that concern this issue.

For this reason the research was taken up with the aim to monitor the development of *T. ulmi* and the effects of its feeding on English elm (*Ulmus minor* Mill.).

Material and methods

The research was carried out in 2006-2007 in the city of Lublin. The observations were concerned with *U. minor* that grow in the Saski Garden (Ogród Saski) that is located in the city centre. Lustration started in the beginning of

the growth season and samples were collected since the moment of first excrescence appearance until winged migrants completely left the galls. A sample consisted of 100 leaves collected from 5 trees (20 leaves from a plant). Intervals between the observations were usually 7-10 days and were conditioned by the tempo of gall development. In the laboratory, damaged leaves and the number of galls on one leaf were counted. With the use of binocular precise measurements of galls were made (height and width in the widest place), and then aphids that were present on them were counted. Their identification was made on the basis of papers by BLACKMAN & EASTOP (1994), MÜLLER (1976) and RUPAJS (1969).

Results and discussion

On the basis of the research carried out in 2006-2007 it was observed that in spring in the galls on English elm leaves only two generations of *T. ulmi* developed, i.e. fundatrix and winged migrants which is in accordance with conclusions by FORREST (1987) and URBAN (2003).

Fundatrices were light green, slightly waxed and deprived of siphunculi. One fundatrix made only one gall in which it developed and fed along with its offspring. The development of aphids of the first generation involved 4 larvae stages (in galls accumulation of subsequent exuviae was recorded) and lasted for about 3 weeks which confirms earlier research by URBAN (2003). Fundatrices reached sexual maturity in the beginning of the third decade of May, and their fecundity ranged from 15 to 85 larvae. In the Czech Republic the fecundity of this species ranged from 3 to 78 larvae (URBAN, 2003), whereas in Lithuania from 20 to 60 (RUPAJS, 1989). URBAN (2003) stated that the larvae of the 2nd generation took 3 weeks to develop. After 4th the moulting (in the beginning of June) they became winged migrants which left the galls. From this research it followed that the winged migrants appeared since mid-June (Tab. 1.), when also first cracks of galls were observed. The development of aphids of two generations on the primary host lasted for about 6 weeks. The average number of aphids in one gall in the years of research was similar and amounted to 14.22 specimens in 2006 and 16.67 specimens in 2007 (Tab. 1.). The size of galls had an important effect on the number of aphids. For instance, in the gall the height of which was 10.0-14.9 mm the average number of aphids was 2.3 times higher than in galls the height of which was 9.0-11.9 mm. With the width of 6.5-7.9 mm the number of aphids was 1.9 times higher in comparison with galls the width of which was 5.0-6.4 mm (Tab. 2.).

As a result of *T. ulmi* feeding on English elm leaves at first formed only cone-shaped galls, which as they grew took on a form of bean-shaped galls settled in a narrow 'stalk'. FORREST (1987) stated that in these 'bag-like' galls

which were formed by for e.g. *T. ulmi*, the microclimate was favourable for aphid development, as they were not susceptible to drying. The presence of predators from the *Anthocoridae* family was recorded especially at the time of galls cracking.

The percentage share of leaves with galls ranged from 26.5 to 36.8% depending on the research year (Tab. 1.). Damaged leaves contained from 1 to 8 galls. The leaves with one gall constituted over 74% of all damaged leaves, while those in which from 5 to 8 galls were found constituted totally 0.8% (Tab. 3.). In the Czech Republic up to 16 galls per one leaf were recorded however, the leaves with one galas only were registered to be the most numerous (URBAN, 2003). In own research, in the initial period of aphid feeding the galls were green, when first winged migrants appeared they started to yellow and after they were left by aphids they dried along with a part of leaf blade. In galls, apart from aphids also their numerous exuviae as well as honeydew in a form of regular balls covered with wax were observed. This wax protected aphids from direct contact with their excrements. Winged migrants left the gall via a hole which was made as a result of cracking and unrolling of the gall walls to the outside. Most galls opened in the bottom part just above the 'stalk'.

Table 1. The number of *Tetraneura ulmi* (L.) on *Ulmus minor* Mill. in 2006-2007

Year	Date of observation	Share of damaged leaves in a sample		Total number of galls	Total number of aphids	Average number of aphids in one gall
		number	%			
2006	22.05	21	21	32	29	0.91
	2.06	59	59	92	366	3.98
	12.06	48	48	72	1645	22.85
	19.06	31	31	42	1488	35.43
	28.06	40	40	49	864 (including 237 winged)	17.63
	5.07	22	22	25	46 (including 34 winged)	1.84
	Total	221	36.8	312	4438	14.22
2007	8.05	36	36	48	50	1.04
	15.05	18	18	25	26	1.04
	22.05	36	36	65	82	1.26
	31.05	29	29	48	1782	37.12
	5.06	32	32	38	1783	46.92
	12.06	33	33	33	1267 (including 362 winged)	38.39
	14.06	20	20	23	340 (including 51 winged)	14.78
	18.06	25	25	32	71 (including 11 winged)	2.22
	21.06	10	10	12	0	0.0
Total	239	26.5	324	5401	16.7	

Table 2. The number of *Tetraneura ulmi* (L.) depending on gall developmental stage in 2006-2007

Height of galls [mm]	The highest number of aphids in one gall [ind.]	An average number of aphid [ind./gall]	Width of galls in the widest part of them [mm]	The highest number of aphids in one gall [ind.]	An average number of aphids [ind./gall]
≤5.9	1	1.0	≤3.4	1	1.0
6.0-8.9	22	2.5	3.5-4.9	64	5.9
9.0-11.9	53	6.7	5.0-6.4	69	10.5
12.0-14.9	86	15.3	6.5- 7.9	68	19.9
15.0-17.9	70	28.7	8.0-9.4	86	29.9
18.0-20.9	85	36.5	9.5-10.9	60	33.9
≥21.0	54	40.9	≥11.0	53	48.0

Table 3. The number of galls formed as a result of *Tetraneura ulmi* (L.) feeding on leaves of *Ulmus minor* Mill. in 2006-2007

Number of galls per leaf	Leaves with a given number of galls in year of research [number]		Total	Percentage share of leaves with a given number of galls
	2006	2007		
1	164	177	341	74.1
2	37	48	85	18.5
3	13	6	19	4.1
4	4	7	11	2.4
5	1	1	2	0.4
6	0	0	0	0
7	1	0	1	0.2
8	1	0	1	0.2
Total	221	239	460	100

Conclusions

1. *Tetraneura ulmi* (L.) fed on the English elm trees in each year of the research.
2. In the spring only two generations of *T. ulmi* (fundatrix and winged migrants) were registered in galls. Their development lasted for 6 weeks.
3. Fecundity of fundatrices ranged from 15 to 85 larvae.

4. The size of galls significantly influenced the number of aphids which were developing inside it. The higher and the wider they were the more aphids were inside them.
5. In one gall fed only one fundatrix. On damaged leaves from 1 to 8 galls were recorded, leaves with one galas only constituted more than 70%.
6. The number of leaves with galls ranged from 26.5 to 36.8% depending on the year of research.
7. Most leaves with dried galls prematurely fell down from trees: right in the beginning of July.

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Występowanie *Tetraneura ulmi* (L.) (*Hemiptera*, *Eriosomatinae*) na wiązie jako żywicielu pierwotnym

Streszczenie

W pracy przedstawiono dwuletnie wyniki badań dotyczące wiosennego rozwoju *Tetraneura ulmi* (L.) (*Hemiptera*, *Eriosomatinae*) oraz skutków jej żerowania na wiązie polnym (*Ulmus minor* Mill.) w Lublinie. *T. ulmi* tworzyła na liściach wiązu polnego fasolowate wyrośla. W wyroślach obserwowano tylko dwa pokolenia tego gatunku (fundatrix i uskrzydłone migrantki), których rozwój trwał około 6 tygodni. Rozmiar galasów w istotny sposób wpływał na liczebność znajdujących się w nim mszyc. Na uszkodzonych liściach obserwowano od 1 do 8 wyrosli, ale większość stanowiły liście z jednym galasem.

