

## First record of *Corythucha arcuata* in Slovakia – Short Communication

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**Abstract:** In June 2018, the presence of one adult specimen and one egg cluster of the North-American oak lace bug *Corythucha arcuata* were recorded near the village of Mužla, close to the Danube River, in southern Slovakia. They were found on leaves of *Quercus cerris* growing in a mixed stand. In August 2018, other specimens (nymphs and adults) were observed on *Quercus robur* leaves, near Čičarovce, in eastern Slovakia. This is the first record of *C. arcuata* in our country. The oak lace bug probably reached us while invading from Hungary, where heavy infestation is reported from several parts of the country.

**Keywords:** oak lace bug; *Quercus* spp.; invasive species

The oak lace bug, *Corythucha arcuata* (Say, 1832) (Heteroptera: Tingidae) is 3 mm long, bizarrely shaped insect (Figure 1), overwintering in bark crevices or in leaf litter. The females lay black eggs during spring in clusters of 15–100 pieces, on the underside of leaves. Upon hatching, the blackish-spined larvae (nymphs) begin sucking the structures they are on. There are 2–4 generations per year (ZÚBRIK *et al.* 2013).

*C. arcuata* is considered a native species to North America. Until 2000, it was only known in the Nearctic region, with a particular distribution in the United States and southern Canada (DRAKE & RUHOFF 1965). This species was recently introduced to Europe, where it was found for the first time in 2000, in Lombardy and Piedmont regions of northern Italy. The pest was already spread over a wide area, suggesting an introduction of some years earlier (BERNARDINELLI & ZANDIGIACOMO 2000). The species was spreading fast in Europe. First, through the north-western regions of



Figure 1. *C. arcuata* nymphs and adults on the leaves of pedunculate oak (*Q. robur*)

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Italy (BERNARDINELLI 2000) and it reached Switzerland (FORSTER *et al.* 2005) and Turkey (MUTUN 2003) in 2002. Between April and July 2002, two specimens of OLB were caught in a flight interception trap in Southern Switzerland (FORSTER *et al.* 2005). The oak lace bug arrived in Bulgaria (DOBREVA *et al.* 2013) in 2012. And the following year, it was also found in Croatia (HRAŠOVEC *et al.* 2013), Hungary (CSÓKA *et al.* 2013), and Serbia (GLAVENDEKIC *et al.* 2017; PAP *et al.* 2015; POLJAKOVIĆ-PAJNIK *et al.* 2015). It was introduced to Russia in 2015 (SHCHUROV *et al.* 2016). In 2016 it was detected for the first time in Romania (DON *et al.* 2016; CHIRECEANU *et al.* 2017) and Slovenia (JURC & JURC 2017). *C. arcuata* main host plants are oaks, belonging to the white oak group (DRAKE & RUHOFF 1965; DREW & ARNOLD 1977). In Europe, its main hosts are *Quercus petraea*, *Q. robur*, *Q. pubescens* and *Q. cerris* (BERNARDINELLI & ZANDIGIACOMO 2000; FORSTER *et al.* 2005; DIOLI *et al.* 2007; MUTUN *et al.* 2009; DOBREVA *et al.* 2013; JURC & JURC 2017). In addition to these major species, *Castanea sativa*, *Rosa canina*, *Rubus idaeus*, *R. ulmifolius*, *Malus sylvestris*, and *Ulmus minor* are also mentioned as host plants (BERNARDINELLI 2006; HRAŠOVEC *et al.* 2013).

In this paper, we present data related to the first record in Slovakia of oak lace bug *C. arcuata*.

## MATERIAL AND METHODS

In August 2017, as well as in June and in August 2018, we searched for *C. arcuata* on oak and other trees. In total, 24 plots were selected and visited during that period (Table 1). For each one, the geographical coordinates were taken and data related to the altitude was gathered. Leaf damage characteristic symptoms, occurrence of eggs, nymphs or adults (*C. arcuata*) were also recorded for each.

Leaves showing symptoms or presence of *C. arcuata* eggs, nymphs or adults were placed in plastic bags and brought to the laboratory for further study. Field-collected eggs and nymphs were reared on oak foliage in 2 l plastic rearing boxes. Leaves were then replaced every second day, together with the absorbent paper lining on the bottom of the box. They were kept in a small plastic test tubes filled with water to keep them fresh as long as possible. Regarding the nymphs, they were placed in the laboratory, under room conditions until developing into adults. These were then identified using the key by FORSTER *et al.* (2005).

## RESULTS AND DISCUSSION

On June 20, 2018, *C. arcuata* was observed in the vicinity of Mužla, a village near the Danube River, in a mixed oak forest stand (Figure 2) dominated by *Quercus robur* and *Fraxinus excelsior*, with *Ulmus* spp., *Populus* spp., and *Salix caprea* as minor tree species located in the underground level or at the border of the stand. It was mainly a composition of hardwood trees growing on moist habitats. One single adult specimen and one single egg cluster of *C. arcuata* were found on a *Q. cerris* tree growing at the border of this site. No chlorotic spots on the leaves were noticed on infested trees, as a result of the sucking of *C. arcuata* adults and nymphs. Intensive searching for symptoms frequent in this area related to this species, on *Q. robur* leaves, did not confirm further presence of the pest. We can conclude that this one was extremely rare in this locality.

Then, on August 10, 2018, a second plot attacked by *C. arcuata* was observed in the eastern part of the country. In the forest area near the village of Čičarovce, several trees of *Q. robur* were found to be infested by *C. arcuata*. The tree composition was similar to the one in Mužla, with the prevalence of *Q. robur* along with *Fraxinus excelsior*, *Populus tremula*, *Populus alba*, and some other trees as accompanying species. We have noticed the presence of many adults and nymphs on the leaves of host plants. In addition, chlorotic spots on the leaves as a result of sucking of adults and nymphs of *C. arcuata* have also been found. Numerous black spots of bug



Figure 2. Mixed oak forest stand near Mužla, south Slovakia, with presence of *C. arcuata*

Table 1. List of field plots and their geographical location where oak lace bug was monitored in 2017 and 2018

District	Geographical location	Tree species inspected	m a.s.l.	08/2017	06/2018	08/2018	No. of eggs, nymphs, and adults
Bajtava	47°51'16.1"N 18°45'30.2"E	<i>Q. petraea</i> , <i>Q. cerris</i>	253	x		x	free of <i>C. arcuata</i>
Častá	48°22'44.8"N 17°21'12.5"E	<i>Q. petraea</i> , <i>Q. cerris</i>	234	x		x	free of <i>C. arcuata</i>
Chlaba	47°49'46.3"N 18°48'46.7"E	<i>Q. robur</i> , <i>Q. cerris</i>	130	x		x	free of <i>C. arcuata</i>
Čičarovce	48°30'39.2"N 22°03'03.8"E	<i>Q. robur</i>	102			x	lots of adults and nymphs found on <i>Q. robur</i>
Čifáre	48°15'10.7"N 18°23'34.9"E	<i>Q. petraea</i> , <i>Q. cerris</i> , <i>Rosa canina</i> ,	234	x	x	x	free of <i>C. arcuata</i>
Filakovské Kováče	48°10'48.9"N 19°49'10.0"E	<i>Q. cerris</i>	218		x		free of <i>C. arcuata</i>
Homok	48°03'27.0"N 18°57'53.7"E	<i>Q. robur</i> , <i>Q. cerris</i> , <i>Rubus idaeus</i>	134	x			free of <i>C. arcuata</i>
Kurinec	48°20'54.0"N 20°00'53.6"E	<i>Q. petraea</i> , <i>Q. cerris</i> , <i>Q. robur</i>	235	x			free of <i>C. arcuata</i>
Malacky 1	48°26'20.5"N 17°01'50.3"E	<i>Q. petraea</i> , <i>Q. robur</i>	184	x		x	free of <i>C. arcuata</i>
Malacky 2	48°24'49.7"N 17°03'59.9"E	<i>Q. robur</i>	192	x		x	free of <i>C. arcuata</i>
Medovarce	48°14'15.0"N 18°59'19.4"E	<i>Q. pubescens</i> , <i>Q. robur</i> , <i>Q. cerris</i> , <i>Rosa canina</i>	259	x		x	free of <i>C. arcuata</i>
Mužla	47°46'40.5"N 18°34'20.3"E	<i>Q. robur</i> , <i>Q. cerris</i>	106	x		x	1 adult and 47 eggs found on <i>Q. cerris</i>
Ortov	48°35'11.7"N 22°05'38.3"E	<i>Q. robur</i>	115	x			free of <i>C. arcuata</i>
Párovské Háje	48°17'04.1"N 17°59'17.0"E	<i>Q. petraea</i> , <i>Q. cerris</i>	225	x		x	free of <i>C. arcuata</i>
Plášťovce	48°09'53.8"N 18°59'46.9"E	<i>Q. pubescens</i> , <i>Q. robur</i> , <i>Q. cerris</i> , <i>Rosa canina</i>	260	x	x		free of <i>C. arcuata</i>
Plešivec	48°33'27.1"N 20°24'39.6"E	<i>Q. petraea</i> , <i>Rosa canina</i> , <i>Ulmus minor</i>	268	x	x		free of <i>C. arcuata</i>
Šahy	48°04'11.4"N 18°56'54.1"E	<i>Q. rubra</i>	130	x		x	free of <i>C. arcuata</i>
Šiatorská Bukovinka	48°10'48.9"N 19°49'10.0"E	<i>Q. petraea</i> , <i>Q. cerris</i>	306		x		free of <i>C. arcuata</i>
Tehla	48°10'43.3"N 18°23'23.2"E	<i>Q. petraea</i> , <i>Q. cerris</i>	196	x		x	free of <i>C. arcuata</i>
Tesárske Mlyňany	48°20'14.6"N 18°23'12.2"E	<i>Q. petraea</i> , <i>Q. cerris</i>	228	x	x		free of <i>C. arcuata</i>
Tomášovce	48°23'28.2"N 20°06'19.0"E	<i>Q. robur</i> , <i>Q. cerris</i>	233	x		x	free of <i>C. arcuata</i>
Topoľčianky	48°25'20.3"N 18°24'50.1"E	<i>Q. robur</i>	215	x		x	free of <i>C. arcuata</i>
Veľké Lovce	48°04'51.6"N 18°22'28.2"E	<i>Q. petraea</i> , <i>Q. cerris</i>	242	x	x		free of <i>C. arcuata</i>
Veľké Zálužie	48°19'26.8"N 17°56'38.5"E	<i>Q. robur</i> , <i>Q. cerris</i>	189	x		x	free of <i>C. arcuata</i>

x – plot was monitored

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excrements were located on the underside surface of oak leaves.

We have observed *C. arcuata* on leaves of *Q. cerris* and *Q. robur* (Table 1). Other authors (BERNARDINELLI & ZANDIGIACOMO 2000; BERNARDINELLI 2006; JURC & JURC 2017) mentioned both tree species also as main hosts for *C. arcuata*.

We assume that *C. arcuata* reached Slovakia spreading from Hungary. In this country, it was found for the first time in 2013 (CsÓKA *et al.* 2013). In the last five years, particularly in 2016 and 2017, the species showed a rapid area expansion. Pest outbreaks were recorded in several pedunculate oak stands, covering ca. 5 000 ha of forest area in total, situated in the south-eastern part of the country (CSEPELÉNYI *et al.* 2017b). The plot including Mužla is located about 30 km north (47°25'24.0"N 18°35'31.0"E) and the one that includes Čičarovce about 150 km north-east from the closest place (47°41'23.0"N 20°18'49.0"E) where *C. arcuata* occurs in Hungary (CSEPELÉNYI *et al.* 2017b; CsÓka, personal communication). Čičarovce is currently the northernmost place of pest occurrence in Europe.

The feeding of nymphs and adults results in discoloured, pale, mottled leaves (Figure 3). If the attack is heavy, these drop down prematurely (CSEPELÉNYI *et al.* 2017b; NEIMOROVETS *et al.* 2017). These symptoms are very similar to those caused by a close relative species, namely *C. ciliata* (Figure 4) attacking plane trees (*Platanus* spp.) (MACELJSKI 1986). Long-term consequences of this effect on oak health status, especially in dry seasons, have not been investigated yet.

In 2000, oak lace bug has been distributed on an area of about 700 000 hectares located in Italy, Lombardy



Figure 3. Chlorotic spots on the leaves of pedunculate oak (*Q. robur*) as a result of the sucking of *C. arcuata* adults and nymphs



Figure 4. Chlorotic spots on the leaves of the plane tree (*Platanus* spp.) as a result of the sucking of adults and nymphs of close relative species *C. ciliata*

and Piedmont regions (BERNARDINELLI 2000). Within just five years, the species spread to a large part of Turkey (MUTUN *et al.* 2009). The fast-spreading of the pest is also reported in Russia. Oak lace bug was able to overcome 250–270 km within less than two years. Presently, in Krasnodar Territory and the Republic of Adygea, *C. arcuata* has spread over an area comprising more than 1 900 000 ha of broad-leaved forests. More than 300 000 ha of these showed intense symptoms of pest presence; chlorotic discoloration and desiccation of leaves (NEIMOROVETS *et al.* 2017). The species recently showed rapid area expansion in Hungary (CSEPELÉNYI *et al.* 2017b). Further spread of *C. arcuata* in Slovakia is expected in the next years.

It seems that cold winter are not likely to limit further expansion of the oak lace bug in Central Europe (CSEPELÉNYI *et al.* 2017a). As adult oak lace bugs are not good fliers, they are carried by wind to spread over medium-range distances. Anthropogenic factors, such as passive transport via transportation vehicles, played very probably an important role by spreading this pest within Turkey (MUTUN *et al.* 2009). Also in Slovakia, humans may act significantly as a vector of *C. arcuata*. Nowadays, there is very strong traffic between Slovakia and Hungary with an increasing tendency. In the future, new places of occurrence can be therefore found along main roads as well as near large petrol or rest stations in areas close to the Hungarian borders.

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