Rapid expansion of the Oak lace bug *Corythucha arcuata* (Say, 1832) (Hemiptera: Tingidae) in Bulgaria

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**Abstract:** New records, host associations, damages on oaks and the potential threat of alien oak lace bug (*Corythucha arcuata*) to native forests in Bulgaria are reported and briefly discussed.

**Key words:** *Corythucha arcuata*, host plants, new localities, spreading

**Introduction**

The oak lace bug, *Corythucha arcuata* (Say, 1832) (Heteroptera: Tingidae), is of North American origin and is widely distributed in the United States of America and the southern part of Canada. It is an invasive species in Europe and has been firstly recorded in Italy (Bernardinelli & Zandigiacomo, 2000) and Switzerland (Forster et al., 2005). *Corythucha arcuata* has spread to a large part of Turkey (Mutun et al., 2009) and it was expected the alien species to reach Bulgaria in a short time (Simov et al., 2012). In 2012, the oak lace bug was found for the first time on the Balkan Peninsula in Plovdiv City and Zlati dol Vill. near the town of Simeonovgrad (Dobreva et al., 2013). In the next few years, the species penetrated in many regions of the country (Georgiev et al., 2017).

The present paper is a continuation of a previous study of alien true bugs in Bulgaria and summaries data on the rapid expansion of *C. arcuata* in the country.

**Materials and Methods**

The field studies were conducted in the period 2015-2017. Many visual observations of infested oak trees were performed within the ESENIASTOOLS and TUNESinURB project activities. The biological material was collected using an entomological beating sheet and by hand – after searching leaves of infested host trees or hibernating places in bark crevices or under tree bark. Damages, adult insects, nymphs and eggs were photographed with a Panasonic Lumix DMC-FZ200 and Olympus E-30 cameras.

**Results and Discussion**

During the study period, *C. arcuata* was observed in many new localities in Bulgaria.

**Material examined:** Burgas District: Primorsko Town, 26 m a.s.l., 42.24620°N, 027.75087°E, host *Quercus frainetto* Ten., *Q. hartwissiana* Steven, *Q. cerris* L., 08.10.2016, G.
### Table 1. Host plants of *Corythucha arcuata* in Bulgaria

<table>
<thead>
<tr>
<th>Common hosts with massively found symptoms</th>
<th>Hosts with restricted distribution in Bulgaria</th>
<th>Occasional hosts</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Quercus robur</em> L.</td>
<td><em>Castanea sativa</em> Mill.</td>
<td><em>Lysimachia punctata</em> L.</td>
</tr>
<tr>
<td><em>Quercus petraea</em> (Matt.) Liebl.</td>
<td></td>
<td><em>Rosa canina</em> L.</td>
</tr>
<tr>
<td><em>Quercus pubescens</em> Willd.</td>
<td></td>
<td><em>Rubus caesius</em> L.</td>
</tr>
<tr>
<td><em>Quercus cerris</em> L.</td>
<td></td>
<td><em>Rubus sp.</em></td>
</tr>
<tr>
<td><em>Quercus frainetto</em> Ten.</td>
<td></td>
<td><em>Acer platanoides</em> L.</td>
</tr>
<tr>
<td><em>Quercus hartwissiana</em> Steven</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Quercus pedunculiflora</em> K.Koch</td>
<td></td>
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<tr>
<td><em>Quercus polycarpa</em> Schur</td>
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</tbody>
</table>
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Fig. 1. Recorded localities of *Corythucha arcuata* in Bulgaria. Semicircles – first records in 2012, black circles – new records 2015-2017.

The localities of the oak lace bug in Bulgaria (Fig. 1) are situated in the lowland and hill zone of the country, in the belt of xerothermic oak forests up to 600-700 m a.s.l.

In this study, 14 tree, shrub and herbaceous species were detected as common or occasional hosts of *C. arcuata* in Bulgaria (Table 1). Besides eight *Quercus* species (Fig. 2A), the oak lace bug was also established to develop on sweet chestnut, *Castanea sativa* (Fig. 2B). During hibernation, the species was found under bark and in bark crevices of *Q. robur* and *Pinus sylvestris* L. Among the occasional hosts of the species in Bulgaria, *Lysimachia punctata*, *Rosa canina*, *Acer platanoides* and *Rubus caesius* (Fig. 2C) were recorded. In Slovenia, *C. arcuata* was also found on other host plants: *Malus sylvestris* and *Ulmus* spp. (Jurc & Jurc, 2017).

Five years after the first record on the Balkan Peninsula, the oak lace bug has invaded most of Bulgaria. The species has spread rapidly, occupying urban areas and oak forests in the country. In the case of heavy infestation, the oak trees turn yellow in the middle of the summer and lose their leaves earlier than usual (Fig. 2D). In heavy attacked trees in mid-July about all of the leaves suffer damage due to *C. arcuata* feeding activity. About 85% of the leaves display discoloration, that can be spread over half of the leaf surface (Fig. 2E). The high population density of the oak lace bug appears to be the major threat to the native sucking insects in oak forests, such as honeydew producers, especially in the Strandzha Mt. (Georgiev et al., 2008). *Corythucha arcuata* causes...
Fig. 2. Host plants of Corythucha arcuata in Bulgaria and impact on them: A – *C. arcuata* on *Quercus robur*; B – *C. arcuata* on *Castanea sativa*; C – *C. arcuata* on *Rubus caesius*; D – Strongly damaged *Q. pedunculiflora* stand in the beginning of July; E – heavy leaf discoloration due to *C. arcuata* feeding activity; F – strongly attacked solitary *Q. robur* trees; G – strongly attacked solitary *Q. fainetto* trees; I, J – strongly attacked one-year-old oak seedlings.
strong damages to oak trees in urban green infrastructure, as well (Fig. 2F). In forest stands, the highly attacked young oak seedlings are particularly threatened (Fig. 2I, J). Castanea sativa in the Belasitsa Mt. has not yet been attacked by the pest. However, the chestnut stands in the region are in poor health condition due to the negative impact of Cryphonectria parasitica (Murrill.) Barr. (Georgieva et al., 2013) and, therefore, are potentially threatened during future calamities of C. arcuata.

The expansion of the oak lace bug is already registered in Turkey (Mutun, 2003; Mutun et al., 2009; Küçükbasmaci, 2014; Croatia (Hrašovec et al., 2013; Nikl, 2017), Serbia (Pap et al., 2015), Romania (Chireceanu et al., 2017), Slovenia (Jurc & Jurc, 2017), Hungary (Csepelényi et al., 2017a, b) and Russia (Neimorovats et al., 2017). Almost all of our records are close to the main European roads E-80, E-79, E-85, E-87, and this fact supports our hypothesis of human mediated dispersal mechanism of oak and sycamore lace bugs in Bulgaria as stowaways (Simov et al., 2012; Dobreva et al., 2013).

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