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Autor(en): **Zanetta, Andrea / Frey, David / Moretti, Marco**

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First records of *Edwardsiana sociabilis* (Ossiannilsson, 1936) and *Laburrus pellax* (Horváth, 1903) (Hemiptera, Auchenorrhyncha: Cicadellidae) in Switzerland

ANDREA ZANETTA[1,2], DAVID FREY[1,3], MARCO MORETTI[1] & VALERIA TRIVELLONE[1,4]

[1] Swiss Federal Research Institute WSL, Biodiversity and Conservation Biology, Zürcherstrasse 111, CH-8903 Birmensdorf, Switzerland
[2] University of Fribourg, Department of Biology, Ecology & Evolution, Chemin du Musée 10, CH-1700 Fribourg, Switzerland
[3] Institute for Terrestrial Ecosystems, Department of Environmental Systems Science, ETH Zurich, Universitätstrasse 16, CH-8092 Zürich, Switzerland
[4] University of Neuchâtel, Laboratory of Soil Biodiversity, Rue Emile Argand 11, CH-2000 Neuchâtel, Switzerland
Corresponding author: valeria.trivellone@gmail.com

The leafhopper species *Edwardsiana sociabilis* (Ossiannilsson, 1936) and *Laburrus pellax* (Horváth, 1903) were recorded in Switzerland for the first time in the frame of an extensive invertebrate survey of 85 urban gardens in the city of Zurich. Both species are native to Europe and feed on the frequently cultivated ornamental plant genera *Rosa* and *Aster*, respectively. No significantly negative impact on the vegetation is currently known. Based on these and previous findings, our study indicates that surveying the invertebrate fauna in urbanized environments is important for the early detection of new species in a given geographic area.

Keywords: Cicadellidae, distribution, early detection, first record, garden, phytophagous insects, urbanized area, city of Zurich.

INTRODUCTION

Urban areas are highly heterogeneous environments that support a high floral and faunal biodiversity and are characterized by warmer temperatures than their surroundings (Sattler *et al.* 2010). Gardens are important elements of the urban mosaic because they occupy large areas (Gaston *et al.* 2005) and provide habitats for numerous species of plants and animals (McDonnell & Hahs 2008; Goddard *et al.* 2010). Despite the importance, however, for example for early detecting new species or for surveying the biodiversity in urban environments, relatively few studies on urban garden biodiversity exist (Goddard *et al.* 2010).

Gardens are usually small artificial landscapes that are constructed and maintained by humans and which host a diversity of cultivated plants: many of which are exotics that are produced in nurseries and traded internationally (Smith *et al.* 2006; Quigly 2011). Such plants can host a multitude of native and non-native phytophagous insect species (Rabitsch 2010; Trivellone *et al.* 2015). Although arthropods have important roles in providing ecosystem services (e.g. pollination) and drawbacks (e.g. as pest), relatively few studies have been conducted on the arthro-

pod fauna present in cities when compared to the number of studies on plant and vertebrate taxa (McIntyre 2000; Sattler *et al.* 2010). To our knowledge, there have been particularly few studies on Hemiptera Auchenorrhyncha (hereafter referred to as leafhoppers) in urban habitats (e.g. Mühlethaler 2001; Turrini & Knop 2015). Leafhoppers are strictly associated to their host plants: feeding on plant sap or cell contents, and using them as breeding sites. Furthermore, leafhoppers can transmit plant pathogens.

A provisory checklist of leafhoppers found in Switzerland contains 422 species (Günthart & Mühlethaler 2002), although anecdotal evidence suggests that this number might be considerably higher with more than 500 species (Mühlethaler *et al.* 2009). In 2005, there were seven non-native species of leafhoppers that had been listed as present in Switzerland, of which two species of American origin are known to have serious negative impacts on crop production (Kenis 2005). At least 30 new leafhopper species have been recorded in Switzerland since 2005, which is largely due to a higher willingness by researchers to include leafhoppers and planthoppers in biodiversity studies (Trivellone *et al.* 2015).

Here we report the first records of two leafhopper species in Switzerland: *Edwardsiana sociabilis* (Ossiannilsson, 1936) and *Laburrus pellax* (Horváth, 1903).

MATERIALS AND METHODS

An invertebrate survey was conducted as part of the Sinergia SNF (Swiss National Foundation) project Bettergardens (www.bettergardens.ch), which is led by the Research Institute of Organic Agriculture (FiBL) in collaboration with the Swiss Federal Research Institute for Forest Snow and Landscape (WSL). The survey was carried out in 85 urban gardens distributed across the city of Zurich (Switzerland), which consisted of 43 private gardens, 41 allotment gardens and one school garden. Garden lots were chosen according to two criteria: 1) a management intensity and structural complexity gradient, ranging from extensive and structurally rich to intensive and structurally poor; and 2) an urbanization gradient, ranging from the city centre to the urban fringe. Within each garden, surface dwelling arthropods and terrestrial gastropods were caught using six 70-mm diameter pitfall traps covered with transparent roofs as rain protection. Pitfall traps were placed in two of the common garden habitats, such as lawn, flowerbeds, vegetable-beds and berry cultivations. Within each garden habitat, pitfall traps were arranged in two equilateral triangles with a side length of 1 m. In cases in which the arrangement in triangles was not possible the pitfall traps were arranged in rows of 1 m length. In addition, flying arthropods were sampled with three 1-litre bowl traps fixed on a 1.5-m tall triangular wooden pole (Buri *et al.* 2014), which was placed in a central and unshaded position in each garden. Each bowl was sprayed with either UV-bright blue, white or yellow paint (Sparvar Leuchtfarbe, Spray-Color GmbH, Merzenich, Germany, details in Westphal *et al.* 2008). Both pitfall and bowl traps were three quarters filled with 0.2 % Rocima solution (bactericide and fungicide from Acima, Buchs, Switzerland). The traps were continuously open between 18 May 2015 and 19 August 2015 and emptied on a weekly basis. Trapped invertebrates were sorted in the laboratory into specific taxa and sent to specialists for species identification. All leafhopper adults were identified by the last author. The reference specimens of *Edwardsiana sociabilis* and *Laburrus pellax* are conserved in her collection.

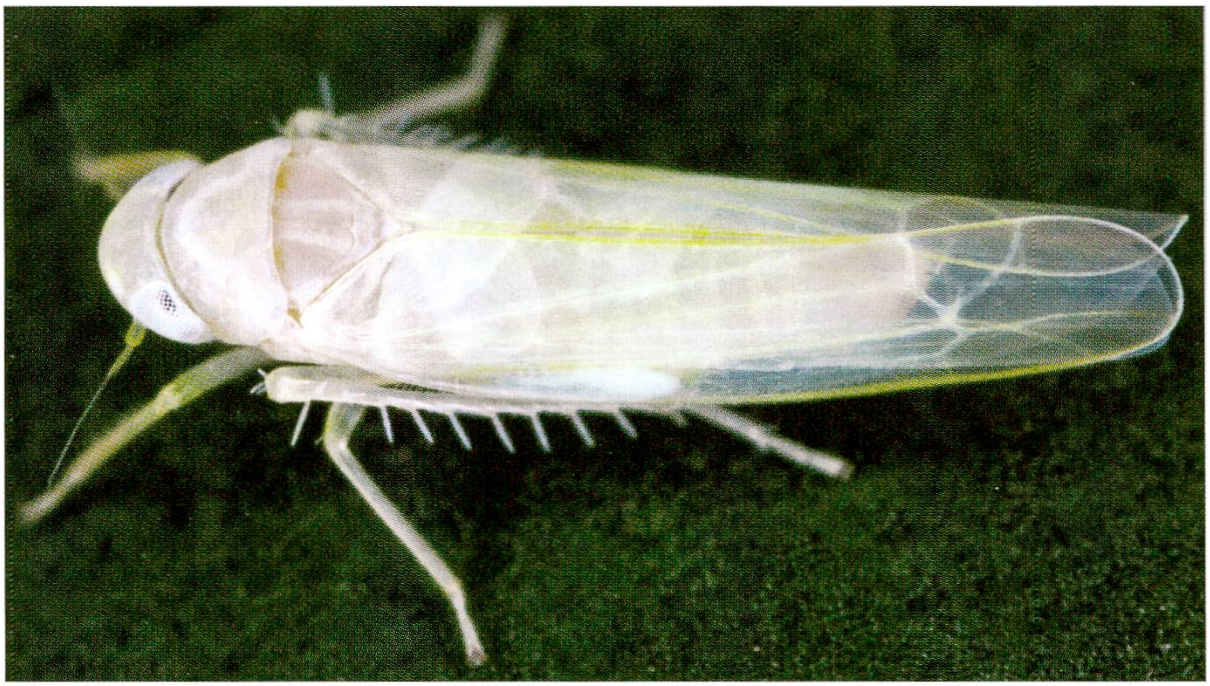

Fig. 1. *Edwardsiana sociabilis* (Ossiannilsson, 1936). Photograph by Gernot Kunz.

In the following section, for each individual of the new species recorded, we inform about the garden type, geographical coordinates, altitude, date of collection, number of individuals, sex, trap type and, for pitfall traps, the habitat type.

RESULTS AND DISCUSSION

CICADELLIDAE

Edwardsiana sociabilis (Ossiannilsson, 1936)

(Fig. 1)

Material. 1. allotment «Käferberg»; N 47° 24' 3.132", E 8° 31' 25.932" (Fig. 2); 520 m; 8 June 2015; 1 ♂; bowl trap.

This Palearctic species is widespread in central-northern Europe. Its distribution area ranges from Germany to Sweden, and from The Netherlands to Russia (European part) with the most southern record from Georgia. *Edwardsiana sociabilis* represents one of the rare documented cases in which specialized native leafhoppers have shifted to exotic shrubs, such as *Rosa rugosa*, but in natural habitats it is confined to the tall herb *Filipendula ulmaria* (Nickel 2008). This species frequently occurs in urban areas on *Rosa* spp., which is one of the most frequently cultivated genera among garden plants. The presence of this leafhopper in gardens was expected in Switzerland as the species occurs in Germany and Austria (Nickel 2003). Considering that leafhoppers in gardens have hardly been investigated in Switzerland, it is not surprising that *E. sociabilis* has not previously been found.

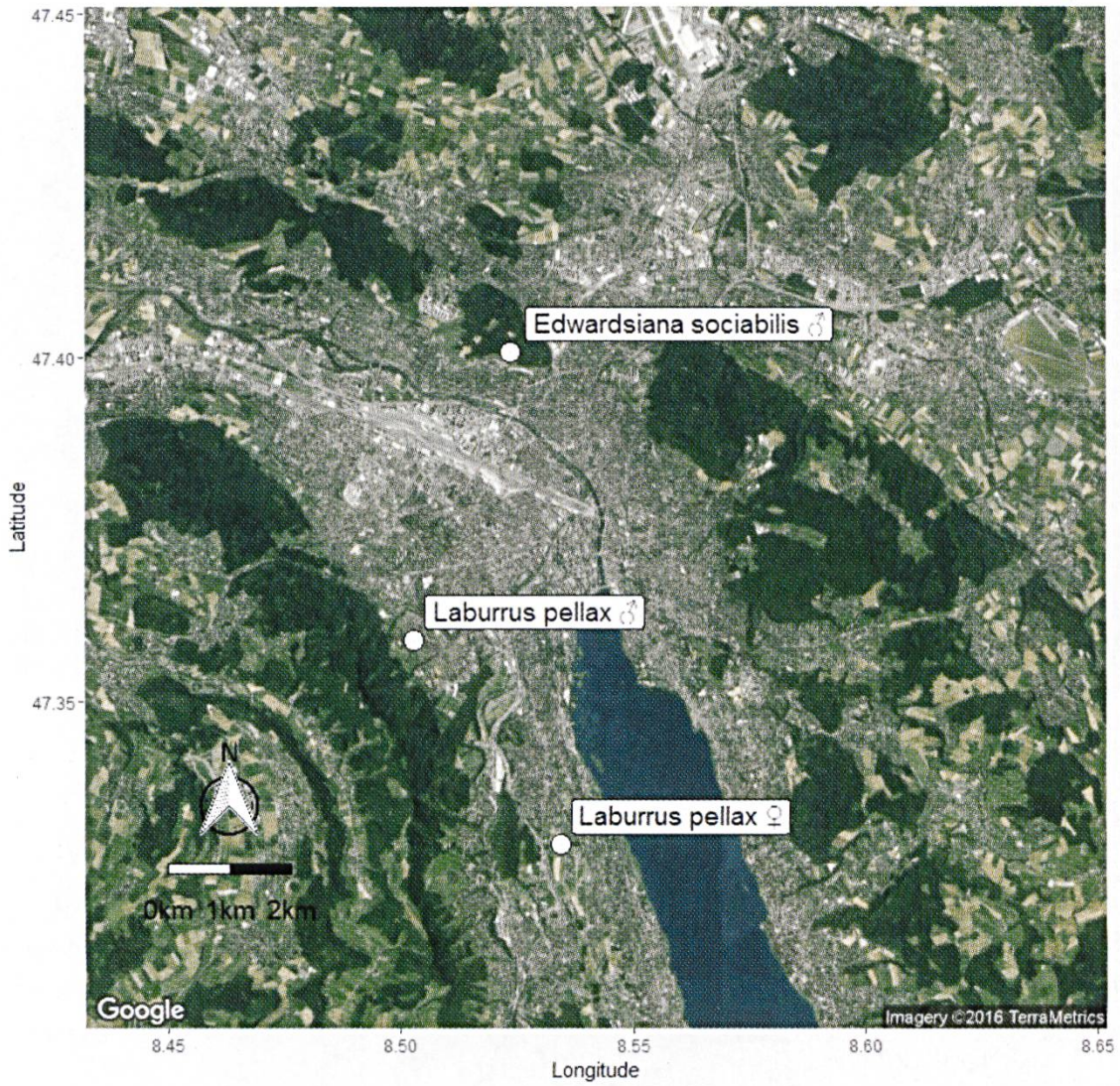

Fig. 2. Geographic locations of the gardens in the city of Zurich where the leafhopper species new to Switzerland were sampled with bowl and pitfall traps during the BetterGardens invertebrate survey between May 18th and August 19th 2015. Each individual reported in the text is assigned to its respective sampling site.

Laburrus pellax (Horváth, 1903)

(Fig. 3)

Material. 1. allotment «Moos»; N 47° 19' 45.156", E 8° 32' 3.804" (Fig. 2); 474 m; 20 July 2015; 1 ♀; pitfall trap in lawn. 2. allotment «Bachtobel 2»; N 47° 21' 32.292", E 8° 30' 10.512" (Fig. 2), 502 m; 3 August 2015; 1 ♂; pitfall trap in vegetable bed.

Laburrus pellax has been recorded in central Europe, from Southern Russia to France. It is reported to be a monophagous species on *Aster linosyris* (Asteraceae) in Germany (Nickel & Remane 2002) and in the South Moravian Region, Czech Republic (Malenovský *et al.* 2011). The presence of *L. pellax* in an urban setting raises questions about its monophagy. Its host plant *A. linosyris* is rare in Switzerland and restricted to semiarid continental grassland or in dry meadows on the southern slopes of the Swiss Alps. Moreover, this plant species is only rarely

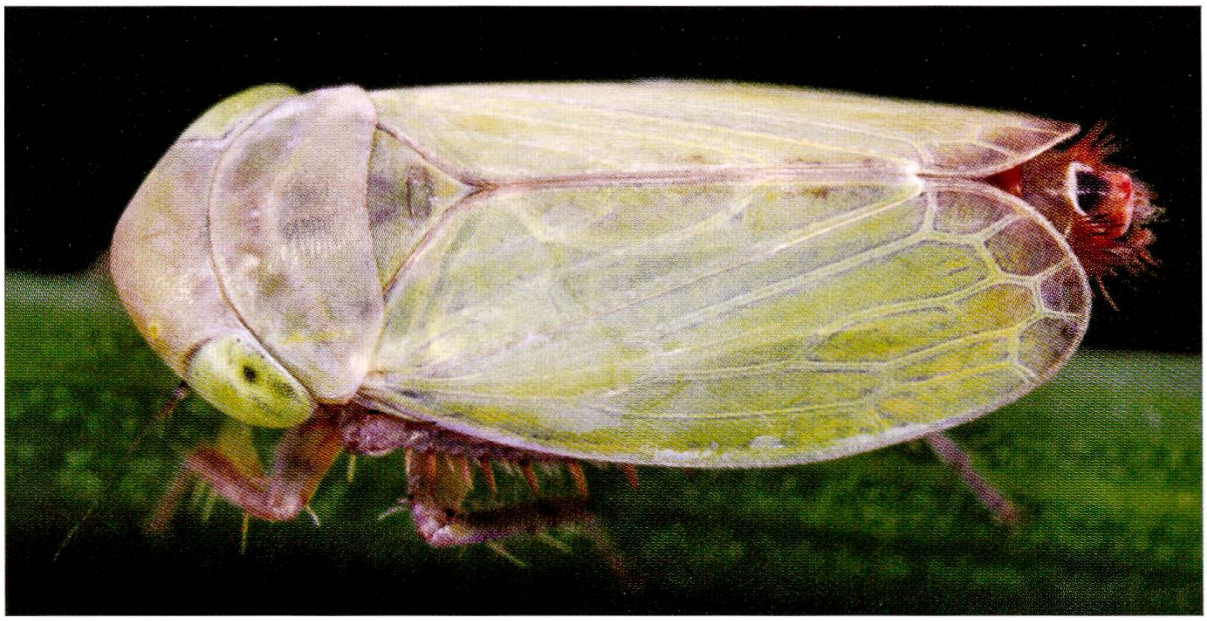

Fig. 3. *Laburrus pellax* (Horváth, 1903). Photograph by Gernot Kunz.

cultivated in gardens. *A. linosyris* does not occur within the city of Zurich or in adjacent areas (Info Flora 2016) and was absent from all of the 85 gardens investigated (D. Frey, unpublished results). However, *Aster* spp. are very common garden plants, and were found in many of the 85 gardens in this study. This suggests that *L. pellax* may also feed on other species belonging to the genus *Aster*. For instance, in the botanical survey of the 85 study gardens, *A. dumosus*, *A. novae-angliae*, *A. novi-belgii* were frequently cultivated (D. Frey, unpublished results). Furthermore, the urban heat island effect (Pickett *et al.* 2011) may favor *L. pellax*, which naturally occurs in xerothermic habitats.

CONCLUSION

During the invertebrate survey conducted in the city of Zurich, we sampled two leafhopper species that had not previously been found in Switzerland. The reason they have not been found previously might be due to a lack of extensive investigations of leafhoppers in urban areas. One species: *Laburrus pellax* is believed to be monophagous, but was found in a location in which its host plant was not present, which raises questions about its monophagy. So far, no impact on vegetation by these two new species has been reported: in particular with regards to *E. sociabilis* on *Rosa* spp. Similar findings have been published within the BetterGardens invertebrate survey for one weevil species, *Euophryum confine* (Broun, 1881) (Germann *et al.* 2015), two species of true bugs, *Chlamydatus saltitans* (Fallén, 1807) and *Tupiocoris rhododendri* (Dolling, 1972) (Frey *et al.* 2016), and one species of crabronid wasps, *Psenulus fulvicornis* (Schenk, 1857) (Frey *et al.* in preparation). This indicates that biodiversity surveys in cities, and particularly in gardens, have a great potential to unveil arthropod species whose presence was not previously known.

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