Leptoglossus occidentalis (Heteroptera: Coreidae) and Harmonia axyridis (Coleoptera: Coccinellidae), two new invasive alien species for insect fauna of Macedonia

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The dispersal of organisms is an important natural process for the distribution of life on Earth and represents one of the drivers of evolution. Natural dispersal is limited by multiple barriers, among which biogeographical ones are the most evident. Growing mobility of people and their goods helped species to overcome these barriers. Globalization connected all parts of the world and as a consequence, intentionally and unintentionally, humans distributed thousands of species worldwide (McNeely et al. 2001; Nentwig 2007). Generally, most of alien species are not able to adapt to new environment, but there is a small number of successful ones that when introduced to new habitats establish large populations and become threat to native biodiversity and natural ecosystems (Nentwig 2007; Rabitsch 2008). Two of very successful invasive insect species introduced in Europe are Leptoglossus occidentalis Heidemann, 1910 and Harmonia axyridis (Pallas, 1773).

The western conifer seed bug, (Leptoglossus occidentalis), is native to the western areas of North America, from British Columbia to Mexico (McPherson et al. 1990). The first European record dates from 1999 when the species was discovered near Vicenza in northern Italy (Taylor et al. 2001). This record was followed by a rapid spread and within a decade the species was reported as far as Portugal, England, Norway and Turkey (Frent & Kment 2008). In 2010 and 2011 it was found even further east, in Ukraine and Russia (Gapon 2013). L. occidentalis feeds on the young seeds or flowers of different conifer species, with a preference for Pinaceae, feeding can cause reduction of seed fertility (Frent & Kment 2008).

The harlequin ladybird (Harmonia axyridis), is an invasive coccinellid native to East and Central Asia (Dobzhansky 1933; Brown et al. 2011). It was deliberately introduced to many countries as biological control agent for aphids and coccids. The species soon adapted to new environments and spread to large areas of the world, where it became predator to native arthropods, household invader and pest in fruit production (e.g. Brown et al. 2011; Majerus et al. 2006). In 1990's and especially after 2002 harlequin ladybird spread rapidly throughout Europe and by 2011 was already reported from 26 countries.

The knowledge of invertebrate fauna of Macedonia is scarce and very little attention is given to invasive species (Denux & Zagatti 2010; Hristovski et al. 2015). Hristovski et al. (2015) summarized the current knowledge on the invasive invertebrate species in the country, but did not mention presence of L. occidentalis or H. axyridis. The occurrence of both species in Macedonia was expected, particularly after they were already known for some time in several neighboring countries (Bulgaria, Greece and Serbia) (e.g. Brown et al. 2011; Petrakis 2011; Protić 2008; Simov 2008; Thalji & Stojanović 2008; Tomov et al. 2009).

The records presented here (Fig. 1.) were collected during dragonfly field research conducted in a scope of the Fifth Balkan Odonatological Meeting that was held in Macedonia from 7th to 15th August 2015. All specimens were collected by hand or using entomological hand net. The voucher specimens of H.
}_axyridis_ from the Monastery St. Gjorgji (4 specimen of f. succinea) and fishpond near Oreovec village (1 specimen of f. spectabilis) (Prilep Municipality) are deposited in the collections of the National Museum of Bosnia and Herzegovina in Sarajevo.

In the countries with low research intensity, as is the case of Macedonia, the possibility that alien species remain undiscovered for long time is significant. This results with the species being discovered at the time when they are already well-established and widespread. At that point it is usually very hard to determine their origin and the time or direction of invasion. As both species already have established populations in neighboring countries, the way of their introduction to Macedonia is probably natural.
expansion of these populations. The fact that they were easily found during odonatological field study suggests that both species could be widespread and present for some time in Macedonia, particularly *H. axyridis* that was found at seven locations across the country.

**Figure 2.** The western conifer seed bug, *Leptoglossus occidentalis* Heidemann found on *Pinus nigra* at Prilep Lake.

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**References**


