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Comparison of herbivore communities on the native Field Maple *Acer campestre* (L.) and the invasive neophyte Box Elder *Acer negundo* (L.) in the NP Donau-Auen, Lower Austria

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Abstract

Neobiota are one of the main reasons of biodiversity decline in the world (e.g. KOWARIK 2003; HULME 2007). They cause high financial costs for monitoring, management and control measures and thereby also represent a significant socioeconomic challenge (COLAUTTI et al. 2006; OLSON 2006). In Austria there occur at least 225 well established alien plants (ESSL & RABITSCH 2002), of which 112 species (76 neophytes and 26 archeophytes) have thus far been found in the National Park "Donau-Auen" (DRESCHER & MAGNES 2002). Hence, alien plants nowadays comprise about 13% of vascular plant biodiversity in this nature reserve (DRESCHER & MAGNES 2002). One of these non-native plant species is the North American box elder tree *Acer negundo*. Since the beginning of the 19th century this tree species has spread mainly in anthropogenically disturbed areas, including softwood floodplain forests along rivers. Box elder were rated in Austria as an invasive species first in 2002 (DRESCHER & MAGNES 2002; ESSL & RABITSCH 2002; WALTER et al. 2005). The Danube east of Vienna is one of the last near-natural, extensive and free-flowing rivers in the middle of Europe (LAZOWSKI 1997). Its associated floodplain forest is characterized by dynamic processes triggered through the annual high water 4 in summer, caused by alpine snow-melt (LAZOWSKI 1997). Such disturbance regimes support the formation and persistence of open gravel and sand banks, where specialized flooding-tolerant pioneer plant communities can establish (LAZOWSKI 1997; GEPP 1986). In these dynamic open habitats box elder *Acer negundo* can establish highly efficiently. In its native range this very fast growing pioneer tree utilizes a broad range of habitat types (MĘDRZYCKI 2011). The fast spread of an alien plant frequently has a negative impact on autochthonous ecosystems, i.e. biodiversity decline or loss (via hybridization), competitive displacement of native species, changes in (abiotic and biotic) habitat conditions, including the deprivation of the nutrition basis for a certain specialist fraction of the native fauna (SCHULDES & KÜBLER 1991; KOWARIK 1995, 1996), and other ecosystem functions (e.g. PYŠEK et al. 2009; VILÀ et al. 2000, 2009, 2011). In the case of the Danube floodplain forests, *Acer negundo* has a negative influence on the silver willow floodplain in open and disturbed habitats (DRESCHER et al. 2005). Due to its fast germination and growth rate (MĘDRZYCKI 2011; PORTÉ et al. 2011) it can rapidly build a second lower tree layer which is increasing canopy cover and consequently reduces the growth and establishment of light-demanding young willows and other pioneer plants (ESSL & Rabitsch 2002; PORTÉ et al. 2011). In the present study we examined the invertebrate herbivore communities (ectophages and endophages) of two syntopic maple tree species, the invasive *Acer negundo* and the native *A. campestre*, in a floodplain forest in eastern Austria. The associated invertebrate fauna of *A. negundo* remains largely unknown in the European range. We assessed whether *A. negundo* (1) experiences a lower herbivore load; (2) has a different herbivore community, (3) dominated by generalist feeders; and (4) may be overall less damaged by herbivores than the co-occurring native *A. campestre*. Field work started in April 2011 with the selection of 21 trees of *Acer campestre* and *A. negundo*, in a floodplain forest near Orth an der Donau. We collected herbivorous insects, snails and slugs (4,342 individuals; 100 species) and also recorded the leaf area loss on 630 leaves (15 leaves per tree) over the vegetation period. Furthermore we measured various micro-habitat descriptors like tree height, trunk diameter, distance to nearest forest edge, and distance to nearest water body. Rarefied herbivore species richness and diversity on *A. negundo* and *A. campestre* was almost identical, whereas nearly twice as many herbivore individuals were found on the native tree species. Nevertheless, *A. negundo* experienced similar proportional leaf damage (36.6%) as *A. campestre* (44.9%). The proportion of specialized herbivores was six times higher on *A. campestre* (19 species, 281 individuals) than on *A. negundo* (7 species, 40 individuals). Leaf miners and plant gulls did not infest the invasive *Acer* species. Hence, insect assemblages on *A. negundo* were more strongly dominated by generalist feeders. For species composition of host specialists, tree species identity was the most influential factor, whereas communities of polyphagous herbivores were affected more strongly by structural tree and site characters. Many studies detected that herbivore richness may strongly depend on the time of introduction of an invasive alien plant species because the formation of assemblages of insects on these plants needs considerable time (time hypothesis: SOUTHWOOD 1961; BRÄNDLE et al. 2008). In our study the less homogeneous communities on *Acer negundo* could be explained by the not yet completed co-evolutionary process. Our study show that, in line with expectations, (1) the native field maple harbors a herbivore community comprising many specialists, which is relatively predictable and compact; (2) herbivore communities on the invasive alien box elder are dominated by opportunists and less predictable; (3) faunal differentiation between the native and neophyte tree depends on whether in a focal herbivore taxon specialists or generalists

prevail; (4) these patterns are rather similar with regard to herbivore species composition and abundance, whereas herbivore species richness and diversity do not show noticeable differences. Accordingly, *Acer negundo* is colonized from the meta-community of regionally available herbivorous invertebrates by basically the same rules as every other tree, but turns out to be rather unattractive (or impossible to colonize) for most of the *Acer campestre* host specialists. My study from the Danube floodplain showed that the invasive alien tree species *Acer negundo* and its native congener *A. campestre* are affected by a similar herbivore pressure, which indicates that the invasive tree species is already integrated into the food web of the Danube floodplain forest (with regard to the herbivore feeding damage and to the species composition of the local fauna). Herbivorous invertebrates are an important component of terrestrial food webs. Many other taxa (i.e. zoophagous predators) depend on them for food (TALLAMY 2004). Should *Acer negundo* be able to replace native pioneer trees (especially the silver willow floodplain) in the National Park "Donau-Auen", the consequences for the associated food web, however, cannot yet be predicted. Herbivore communities of *Salix* do hardly overlap with those of *Acer* species, because they do not share similar secondary plant metabolites phytochemical substances. Hence, specialist *Salix* herbivores are not expected to switch on the neophyte and would therefore lose their host if this would be completely outcompeted. The specialist herbivore community of *Salix alba* would likely be replaced by an insect assemblage dominated by generalists recruited from other deciduous broad-leaved trees occurring in the region. This could have unpredictable effects on interactions at higher trophic levels (GRATTON & DENNO 2005). Two major question will be (1) whether herbivore damage can contribute to constrain the fitness of *A. negundo* to such an extent that this may affect the future distribution and abundance of this tree species in the Danube floodplain forest and (2) to what extent the different herbivores that occur in the area (whether specialist or generalist) will be able to include the invasive box elder more strongly into their host range.

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