Articoli

Development and impact of *Ophraella communa* in Europe

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Abstract – The ragweed leaf beetle *Ophraella communa*, a potential biocontrol agent of invasive common ragweed *Ambrosia artemisiifolia*, that recently was discovered to have established in southern Switzerland and northern Italy. Combining field experiments with demographic modelling. we here provide the first evidence that this beetle has the potential to build up multiple generations with high densities on the Po plain, and to strongly reduce pollen and seed release of common ragweed in both the short and the long term in this European climate.

Key words: demographic model, field experiments, spatio-temporal variation, population growth

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Background

We present studies assessing the potential impact of the ragweed leaf beetle *Ophraella communa* on the invasive common ragweed, *Ambrosia artemisiifolia*, in Europe. The beetle is a potential biocontrol agent that was recently discovered to have established in southern Switzerland and northern Italy (Müller-Schärer et al., 2014). Although this beetle has good success in controlling ragweed in China (Huang et al., 2011, Zhou et al. 2014), prospective evaluation of its potential impact in Europe are lacking. Such studies are essential to decide upon the suitability of the candidate biocontrol agent for the target area (Morin et al., 2009). This accidental introduction provided the opportunity to test the beetle's development under European conditions in the field and its impacts on common ragweed.

Preliminary results

A cage experiment set up along an altitudinal gradient in northern Italy indicated that the multivoltine beetle can develop up to four generations in the growing season on the Po Plain, but less at higher altitudes with colder temperatures. At 1250 meters only a single new generation was completed. When monitoring 4 sites with natural ragweed and beetle populations on the Po Plain in 2016, we discovered that the leaf damage caused by the beetles at all sites dramatically increased within a few weeks in August, after 3-4 generations of the beetle have been produced. In this period, when the male flowers of common ragweed normally produce pollen, the beetle also inflicted damage to these structures, likely resulting in less pollen being released. Although the leaf damage was high at all sites, the mortality of the plants at seed set (before seed dispersal) varied a lot between sites. By killing plants at this stage, the beetle reduces the numbers of *Ambrosia* seeds being released. In the best case, *Ophraella* caused a 4-fold mortality rate compared to plants that had been kept free from the beetle. The maximum mortality rate found was over 95%. To assess the long-term impact of *Ophraella,* we constructed a deterministic demographic model of common ragweed and parameterised this with observations from 4 field sites in Ticino, Switzerland, and the Italian regions Piemonte and Lombardia. In two of these sites the beetle was experimentally excluded by applying insecticides on half of the study area. Data from 3 different years indicate strong year-to-year variation of the common ragweed dynamics and the impact of the beetle, resulting in highly different estimates of population growth rates. When projecting data from the most favourable year into the future, ragweed populations exposed to the beetle all showed a strong reduction of the population size. In the same year, in each of the two manipulated sites the beetle achieved a more than 10-fold decrease in population growth compared to the insecticide-treated parts (where populations were projected to grow). Altogether, this indicates that the beetle has varying success, but has the potential to build up multiple generations with high densities on the Po plain, and to strongly reduce pollen and seed release of common ragweed in both the short and the long term.

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