Estimating Density Dependent Impacts of the Arundo Scale, Biological Control Agent for the Invasive Giant Reed

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Abstract

The sap-feeding armored arundo scale (*Rhizaspidiotus donacis* (Leonardi)) has been permitted for use as a biological control agent for giant reed (*Arundo donax* L.), a non-native, highly invasive woody grass that infests waterways and riparian areas of the southwestern US and Mexico. We used a nested factorial design within a controlled greenhouse setting to (1) test the hypothesis that pressure from natural enemies can interrupt the net primary production of giant reed by disrupting water and nutrient transport and detrimentally affecting the photosynthetic ability of the plant and (2) build a predictive model of the density dependant impacts of the arundo scale on plant growth to inform a biological control program. Different densities of the immature stages of two distinct genotypes of the arundo scale were administered to individually-potted ramets of the same genotype of the target weed. Growth parameters of plant such as shoot height and number of nodes, number of shoots, number and length of side shoots were measured monthly for six months, or after one generation of the scale. Insect-induced plant physiological stress was estimated with monthly measurements of light reflectance using a spectroradiometer, and by analyzing differences in leaf gas exchange among the different treatments at the end of the experiment. At six months, all plants were destructively sampled to count the density of mature scale adults and to extrapolate biomass accumulation and allocation of the test plants. Initial results suggest a scale density-dependent effect on both total plant biomass and water use efficiency. *Arundo* plants with severe infestations of scale insect exhibit reduced photosynthesis and tend to have a slower rate of growth than control plants with no insects or plants with low levels of scale density. If this trend continues, this biological control agent may prove to be an effective tool to curb the negative ecological and social impacts of this weed, especially if present in high densities. These results may help inform an inundative approach to weed biological control.