Broomrapes (*Orobanche* spp.) are Excellent Candidates for Imposing Biological Weed Control Methods

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Attempts to impose biological control on weeds were successful when current control measures were inadequate, when the weed had a native habitat, and when no closely related crops or plants of economic/ecological importance are present within the region of weed infestation. Around the Mediterranean region, at least seven broomrape species attack economically important crops. Estimated crop yield losses due to such infestations range between 10 to 100%. Beneficial utilization of broomrapes or any closely related species were not reported. Broomrape control options continue to be scarce, although reports of successful control by Imidazolinone herbicides are accumulating. Accordingly, we believe that broomrapes should receive greater research efforts to explore possible biological control alternatives. The aggressiveness of these parasites and their parasitic nature allocate broomrape species as ideal targets for biological control approaches. Previously, research efforts focused on utilizing some fungi of the genus *Fusarium* as a potential mycoherbicide. In this review, we will provide a thorough and updated revision for the attempts and constraints that face biological control of broomrapes.

The Response of Purple Loosestrife (*Lythrum salicaria*) to Herbivory by Leaf-Feeding Beetles: Can Gas Exchange Measurements Be Used to Predict Herbivore Impact?

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Negative impacts of herbivores on plant biomass allocation and resource acquisition are well documented and a pre-requisite for successful biological weed control. In contrast, the influence of herbivory on plant physiology (such as net photosynthesis and stomatal conductance) has not been well investigated. Knowledge of how leaf carbon fixation rates are altered in response to herbivory may offer important information regarding the impact of different herbivore species on overall plant performance. This study investigated the influence of the leaf feeding biological control agent *Galerucella calmariensis* (Coleoptera: Chrysomelidae) on gas-exchange in purple loosestrife (*Lythrum salicaria*). Net photosynthetic rate (A), stomatal conductance (g), and internal CO₂ concentration
(Ci) of purple loosestrife were measured at two herbivory levels. Stomatal conductance was reduced when herbivory was low but increased at high herbivory levels. When percentage leaf area removed in damaged leaves was used as continuous variable in regression analysis, we found significant positive increases of A, g and Ci with increasing loss of leaf area. This suggests that purple loosestrife attempts to compensate for increased loss of leaf area by increasing rates of carbon fixation. Compensation was not sufficient to completely tolerate damage, however, since total carbon fixation per leaf was much less in damaged leaves. These results indicate that *G. calmariensis* as a biocontrol agent is likely to have a significant impact on purple loosestrife performance. Thus, measurements of gas exchange provide a more complete picture of plant response to herbivory and may enhance our ability to better predict success or failure of weed control programs.

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**Epidemic Spread of a Rust Fungus in a Weed Population**

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The system management approach was proposed as an alternative for the classical and inundative approach. The approach is based on the reduction of competitiveness of a target weed by stimulating epidemics of a pathogen. Mass release of inoculum (inundative approach) or introduction of exotic organisms (classical approach) are excluded. A small amount of inoculum is artificially introduced at one or more points in the field. The epidemic expands from these points with a predictable constant velocity. The velocity of epidemic spread can be calculated using an analytical model which is based on a gross reproduction factor, a latent period, and a contact distribution. The aim of the research presented was to calculate the velocity of epidemic spread of the rust fungus *Puccinia lagenophorae* on the annual weed *Senecio vulgaris* at various temperatures. To calculate the velocity of epidemic spread at various temperatures, the effect of temperature on latent period and aeciospore production was determined in a laboratory experiment. Latent period decreased and aeciospore production increased by increasing temperature in a range from 10 to 22°C. Equations describing the effect of temperature on both parameters were incorporated in an analytical model to estimate the influence of temperature on velocity of epidemic spread. Velocity of epidemic spread increased by increasing temperature. Temperatures tested in the experiment were realistic for conditions during spring in Switzerland, when populations of *S. vulgaris* start to develop. Natural epidemics of *P. lagenophorae* are seldom observed in populations of *S. vulgaris* before the end of summer, probably caused by a lack of inoculum in spring. The results of the research presented indicate that an artificially induced epidemic could develop under spring conditions. The velocity of epidemic spread could then be predicted using the model presented.