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FLASHPOINT

Response to Bhattarai et al.: Trait differences between native and introduced genotypes results in subspecies level specificity in select *Phragmites* herbivores

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In weed biological control, as in any other invasive species management effort, we need to be concerned about population level effects, i.e. the ability to affect demographics of target species, as well as other species that should benefit, or not be harmed—not by occasional feeding (Blossey and Casagrande 2016). Current herbicide campaigns targeting introduced *Phragmites australis* are expensive, unsuccessful and with potentially widespread negative ecological consequences (Martin and Blossey 2013). Bhattarai et al. (2016) do not offer an alternative, apparently accepting that introduced *P. australis* will continue to spread resulting in documented disappearance of *P. australis americanus* (Saltonstall 2002; Lampert and Casagrande 2006). We can offer no assurance that implementation of biological control will guarantee control of introduced *P. australis*, but we believe that agents under investigation offer potential to reduce populations of invasive *P. australis* substantially with minimal or no adverse impacts on *P. australis americanus*.

We are concerned that Bhattarai et al. (2016) misrepresent techniques and outcomes of weed biocontrol programs, which may reflect an unfamiliarity with basic principles of contemporary weed biological control. For example we do not agree that absolute host-specificity is a necessity. Occasional feeding on native species (such as in spillover events) is of no concern as long as there are no negative demographic consequences (Blossey et al. 2001). While the herbivore literature may be replete with examples of incorporation of new hosts into insect diets, very few examples are drawn from weed biocontrol programs (Suckling and Sforza 2014). The claim that inclusion of native relatives is a "relatively common phenomenon" in biological control agents is not supported by the evidence (Pemberton 2000; Suckling and Sforza 2014). Weed biocontrol scientists use the term *fundamental* host-range to refer to plant species herbivores may attack in a petri dish or in a growth chamber when given no choice. What matters is the *realized* host range, i.e. the plant species attacked by foraging insects under field conditions, insights recognized in weed biocontrol programs decades ago (Cullen 1990). A number of insects attacking *Phragmites* in North America show actual subspecies

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specificity in the field clearly showing that subspecies level specificity in *Phragmites* is not as elusive as Bhattarai et al. (2016) claim. This holds even if *Lipara pullitarsis* will need to be removed from subspecies level specificity (we have a much larger stem collection of >10,000 stems from across much of North America, and in our surveys the species was not found on native *Phragmites*).

In regards to the herbivores we currently investigate, in our evaluation of 46 potential host plants under ideal conditions, both *Archanara neurica* and *A. geminipuncta* develop in introduced and native *P. australis*. Additionally we observed 2 % of *A. geminipuncta* larvae surviving for 10 days on *Spartina alterniflora* but unable to complete development. No larvae survived for 10 days on any other tested plant. Field observations and behavioral experiments in Europe indicate minimal risk to these non-targets, including *P. australis americanus*. We have no ability to forecast long-term eco-evolutionary dynamics, or evolution of host specificity. But we can say, with confidence, that this has not been a problem in over a century of weed biocontrol programs, and the one thing that we know for certain is that the native subspecies will continue to decline under current management.

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