Herbicide efficacy on the small floating weeds redroot floater and feathered mosquitofern[i]

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Florida's waters are routinely invaded by new exotic plants, with many arriving after escaping cultivation in water gardens and aquariums. Two new free-floating invaders are redroot floater (*Phyllanthus fluitans*) and feathered mosquitofern (*Azolla pinnata*). Redroot floater is a South American dicot in the Euphorbiaceae or the Phyllanthaceae and was first reported in a canal attached to the Peace River in 2010, where it is now established. It is an attractive ornamental plant with round, concave leaves that are up to 2 cm long and attached to the reddish stems. Feathered mosquitofern is an Australian fern in the Azollaceae. It was first collected in Florida in Palm Beach County in 2007 and is now in at least four Florida counties. Feathered mosquitofern has very small (ca. 1 mm) velvety leaves that are attached to the branch in an alternate manner and is roughly triangular in shape.

Despite their very different botanical classifications, these small floating species share a number of characteristics. Both form dense surface mats that block light and oxygen penetration into the water column and they also interfere with recreational activities. In addition, both species can survive "stranding" out of the water on damp soil along aquatic systems. Control efforts have not resulted in eradication, and both species continue to persist and form nascent populations in waters connected to invaded systems. Although the current distribution of both species is primarily southern Florida, future range expansion is likely. It is critical that we identify control methods to manage feathered mosquitofern and redroot floater, so the goal of these experiments was to evaluate the efficacy of aquatic herbicides on these small, weedy floating plants.

Materials and Methods

Plants were grown in a covered greenhouse in Davie FL in 68L mesocosms (one species per mesocosm) filled with well water until surface coverage was 80% or greater. Each mesocosm was treated once with one of 35 herbicide treatments (plus an untreated control); all products were labeled for aquatic use and were applied with surfactant as foliar applications with a handheld sprayer in a diluent volume equal to ca. 65 gallons per acre. Four replicates (mesocosms) were prepared for each herbicide treatment. Plants were monitored for 6 weeks after treatment (WAT), then scored for visual quality using a numerical scale of 0 through 10, where 0 = dead and 10 = excellent quality, perfect condition, healthy and robust. All live biomass was then subjected to a destructive harvest; plant material was rinsed and then placed in a forced-air oven at 65 °C for 2 weeks before weighing to obtain dry biomass. Visual quality and dry biomass data were subjected to analysis of variance and LSD separation of means to determine differences in biomass compared to untreated controls.

Results and Discussion

Mean dry biomass of redroot floater plants in untreated control treatment mesocosms was 6.16 g and visual quality was 6.75. Most (29 of 35) treatments reduced biomass and visual quality of redroot floater by at least 90% compared to untreated controls. Mean dry biomass of feathered mosquitofern plants in untreated control treatment mesocosms was 21.43 g and visual quality was 9.5. As with redroot floater, most (31 of 35) treatments reduced biomass and visual quality of feathered mosquitofern by at least 90% compared to untreated controls.

Based on these results, it seems clear that most aquatic herbicides provide effective control of redroot floater and feathered mosquitofern. These findings suggest that lackluster results after field management of these species are not due to herbicide tolerance, but are likely the result of other factors such as stranding. Stranded plants can "escape" herbicide treatments by persisting in wet soil along the banks of a treated area. Once floating populations have been killed as a result of herbicide treatment, stranded plants may flush back into the water, where they can quickly re-populate the treated area (which is now nutrient-enriched from the dying plants) with greatly reduced intraspecific competition. These experiments highlight the importance of ensuring that all plants targeted for treatment – including those stranded along shorelines – actually receive herbicide applications. Failure to do so will allow some plants to escape treatments and thus may facilitate quick recolonization of previously treated areas.

Acknowledgements

This research was supported by the Florida Agricultural Experiment Station, the US Department of Agriculture National Institute of Food and Agriculture (HATCH project FLA-FTL-005682), and the FWC Invasive Plant Management Section. Mention of a trademark, proprietary product or vendor does not constitute a guarantee or warranty of the product and does not imply its approval to the exclusion of other products or vendors that also may be suitable.

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[i] Note: This paper actually contains 804 words, not including this endnote