J. Aquat. Plant Manage. 34: 74-76

The Potential for Biological Control of Water Primrose (*Ludwigia grandiflora*) by the Water Primrose Flea Beetle (*Lysathia ludoviciana*) in the Southeastern United States

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INTRODUCTION

Water primrose, *Ludwigia grandiflora* (Michaux) Zardini, Gu, and Raven, comb. nov., formerly in the *Ludwigia uruguayensis* (Camb.) Hara Complex, is a member of the evening primrose family Onagraceae. Water primrose is native to North and South America ranging from the southern and eastern United States to the Rio La Plata in Argentina. In the United States, its range is mostly the Atlantic and Gulf Coastal Plain, from southeastern New York to Florida and westward to Texas (Chester and Holt 1990). In the southeastern United States, water primrose has been considered a nuisance plant in most of its range (Balsbaugh and Hays 1972, Aurand 1982, Chester and Holt 1990). Herbicides suggested for chemical control of water primrose have been limited to 2,4-D, glyphosate, and fluridone (Aurand 1982, Thayer et al. 1987, and Everest et al. 1992).

The water primrose flea beetle *Lysathia* (*Altica*) *ludoviciana* (Fall) (Coleoptera:Chrysomelidae:Alticinae) is easily distinguished from other Chrysomelidae by the greatly enlarged hind femora. It is typically phytophagous and host specific. Adults of water primrose flea beetles are dark brown with a bluish-black appearance, have a shiny and finely punc-

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tate pronotum, are about 4-5 mm in length and can be distinguished from other beetles by their enlarged yellowish-brown legs (Habeck and Wilkerson 1980).

The natural hosts of the water primrose flea beetle include parrotfeather *Myriophyllum aquaticum* (Velloso) Verde, (Habeck and Wilkerson 1980), creeping water primrose *Ludwigia peploides* (H.B.K.) Raven, and water primrose *Ludwigia grandiflora* (first reported here). Other *Ludwigia* spp. act as hosts for closely related Alticinae (Sankaran et al. 1967, Cordo and DeLoach 1982, Jhala et al. 1987). This paper describes a study of an infestation of water primrose in Alabama and suggests that this beetle may serve as a biological control agent for water primrose in southeastern waters.

MATERIALS AND METHODS

During an ongoing study at the Auburn University Fisheries Research Field Station, Auburn, Alabama, a population of water primrose in a 1.0 ha pond was colonized by the water primrose flea beetle. Specimens of the flea beetle were brought into the laboratory where they were identified and placed into a 10 gallon aquarium to confirm feeding habits and life history information.

Changes in aquatic macrophyte communities and insect abundance in six littoral enclosures (5 by 10 m) were examined throughout the summer of 1994. On four occasions (6 July, 4 August, 30 August and 28 September) macrophyte coverage and biomass were estimated using quadrat (25 by 25 cm) samplers. A visual estimate of species coverage was made by examining each enclosure and estimating coverage of each species in that enclosure. Results were averaged for the six enclosures. In the laboratory, macrophytes were separated by species and weighed (dry weight after oven drying for 24-48 hours at 105C). Photographs were taken biweekly to document the nature and extent of damage to the water-primrose.

Insects were sampled with floating emergent traps ($0.18m^2$) patterned after the design by LeSage and Harrison (1979). In each enclosure insects were collected for a one week period. Nine dates were sampled between July and October.

RESULTS AND DISCUSSION

Water primrose dry weight biomass declined from 61 g/m^2 on 6 July to a low of 7 g/m^2 on 28 September. Conversely, biomass of pickerel weed *Pontederia cordata* L., a second common species present in the enclosures, increased from a low of 1 g/m^2 to a high of 36 g/m^2 (Figure 1a). Mean percent composition of water primrose within the enclosures changed during the study from a high of 63% composition on 6 July, to 40%, 39% and 48% on 4 August, 30 August and 28 September, respectively. Pickerel weed percent composition increased in virtually all enclosures.

Flea beetle population abundance was variable during the study with at least three peaks in abundance. Mean adult densities ranged from a low of $1/m^2$ to a high of $12/m^2$ (Figure 1b). Maximum densities ranged from $6/m^2$ to $81/m^2$. Mean larval densities were highest on 15 July, 5 August and 30 September with $24/m^2$, $36/m^2$ and $21/m^2$, respectively. Maximum larval densities peaked on three dates, 15 July ($181/m^2$), 5 August ($200/m^2$) and 30 September ($169/m^2$).

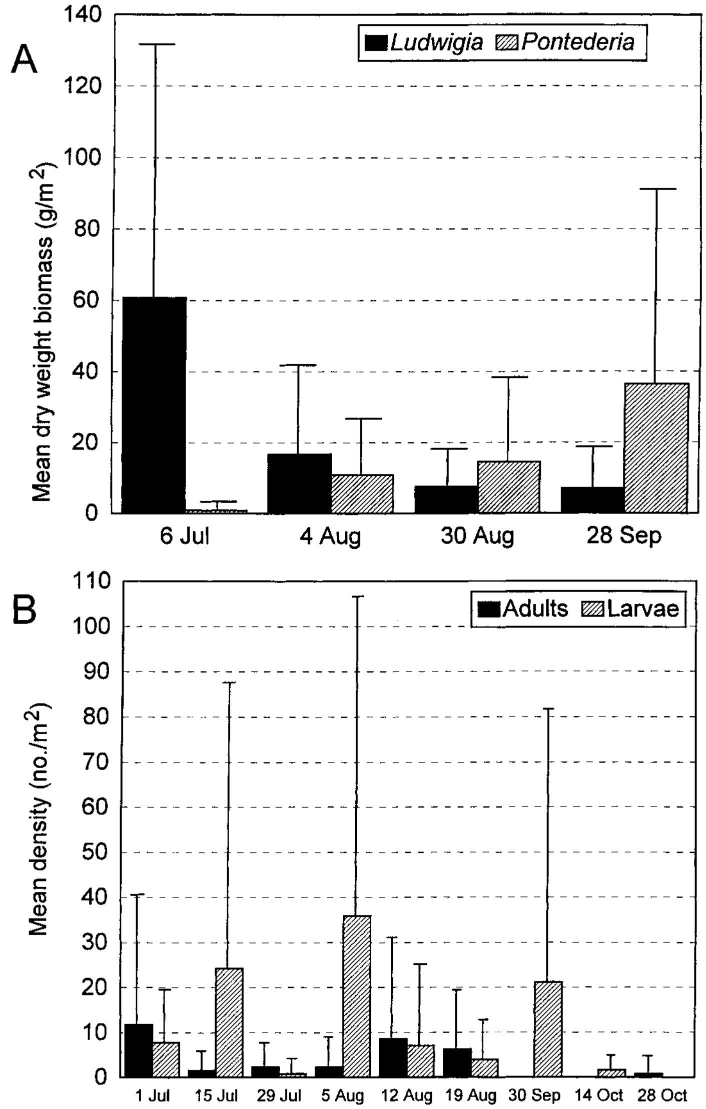

Figure 1. Estimates across all six enclosures for a) average biomass (g/m^2) of *Ludwigia grandiflora* and *Pontederia cordata* and b) average densities ($no./m^2$) of adults and larvae of *Lysathia ludoviciana*. The bars indicate one standard error.

Laboratory studies in petri dishes and aquariums confirmed life cycle information similar to that reported by Habeck and Wilkerson (1980). Larvae and adults fed upon leafy shoots of water primrose when presented to them. No noticeable damage was done to the stems. No larvae or adults fed on pickerel weed when presented either alone or with water primrose.

In the spring of 1995, areas within the enclosures where pickerel weed had become established during 1994 were still dominated by pickerel weed. Although water primrose was present, no beetles were found during the spring of 1995. The water primrose flea beetle inflicted severe damage to stands of water primrose both inside and outside of littoral enclosures located within a 1.0 ha earthen pond. Further study may reveal that this insect has potential as a biological control agent for certain noxious species of *Ludwigia* in the southeastern United States.

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