The Successful Biological Control of the Water Fern

*Azolla filiculoides* in South Africa

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*Azolla filiculoides* Lamarck (Pteridophyta: Azollaceae) is a small, aquatic fern, first recorded in the Oorlogspoort River, Colesburg, South Africa in 1948. It is now found in at least 136 localities throughout South Africa. The weed reduces the quality of drinking water, increases siltation of rivers and dams, and reduces the water surface area for recreation and water transport. Clogging of water pumps and drowning of livestock are additional weed effects. The frond-feeding weevil, *Stenopelmus rufinasus* Gyllenhal (Coleoptera: Curculionidae), was released as a biocontrol agent of *A. filiculoides* in 1997. Here we report on the post release evaluation of this insect. Floating field cages were used to determine weevil population dynamics and their effect on plant growth. In the cages, the weevil populations increased rapidly and the *Azolla* material was cleared within a period of six weeks. Field surveys were conducted at more than 50 sites. Of these, approximately 48% were cleared within 12 months. Dispersal of the weevil up to 38 km in six months in the eastern Free State Province was recorded. The rapid rate of increase of the weevil and the corresponding decline in *A. filiculoides* populations at a number of sites throughout the country indicates that the likelihood of successful biological control of the weed in South Africa is excellent.

Factors Limiting Populations of the Native Milfoil Weevil, a Control Agent of Eurasian Watermilfoil

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The milfoil weevil (*Euhrychiopsis lecontei*) is a specialist watermilfoil herbivore, native to North America. During the summer, all life stages subsist on submersed watermilfoil and 3-5 generations can be produced. Adults move to shore in fall to overwinter in shoreline leaf litter. The weevil has been shown to control Eurasian watermilfoil (*Myriophyllum spicatum*) via stem mining in laboratory, tank, and mesocosm studies, as
well as at some field sites. At other sites the weevil has failed to persistently control
Eurasian watermilfoil, often because weevil densities remain low. Thus, it is important to
identify factors that limit weevil populations. Two sites, Lake Auburn and Smith’s Bay of
Lake Minnetonka, were surveyed for shoreline and in-lake densities in spring and fall
from 1993-1998. Fall (November) and spring (April) average shoreline densities (0.2m²
soil samples) ranged from 1 to 340 adults/m². Overwinter mortality appeared low and
rarely exceeded 50%. In-lake densities (larvae, pupae and adults) ranged from 1 to 40/m²
in spring (June) and 0 to 12/m² in fall (September). Shoreline densities at the two sites
were significantly correlated over time ($r = 0.9$), suggesting broader scale climatic control
of shoreline densities; however, in-lake densities were not correlated. Spring in-lake den-
sities may be related to shoreline densities, but fall densities were not. Given the relative-
ly low overwinter mortality and their high reproductive potential, failure to build high
summer populations seems more related to in-lake factors. At these sites, weevil densities
often decrease over the summer rather than increase. Adult weevils stocked into open
plots failed to establish in two lakes. Fish exclosure experiments at one lake suggest that
excluding sunfish enhanced the establishment of stocked weevils. Fish predation is likely
one important factor limiting weevil densities, although host-plant resistance also
deserves attention.

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**Biological Control of Purple Loosestrife -
Cooperative Implementation**

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Purple loosestrife (*Lythrum salicaria*, L.) is an invasive foreign weed that has taken
over many wetland habitats in the northeast and central states. It poises a serious threat to
wetland areas in many western states. A native to Europe, the plant was well established
by the 1830’s on the northeast coast. The plant suppresses and replaces native plants and
eventually alters and changes the structure of the wetland, further eroding the native habi-
tat. The large expanses of purple loosestrife threaten various endangered species, such as
the native bulrush (*Scirpus longii* Fern), dwarf spikerush (*Eleocharis parvula*) (Roemer
and J.A. Schultes) and the bog turtle (*Clemmys muhlenbergi* Schoepf). A leaf-feeding beetle (*Galerucella calmariensis* L.) that attacks purple loosestrife was reared on sleeved purple
loosestrife plants in the greenhouse at Mission. The harvested adults were released
into field insectary sites in 16 states: Connecticut, Delaware, Iowa, Indiana, Kansas,
Massachusetts, Maine, Missouri, Nebraska, New Hampshire, North Dakota,
Pennsylvania, Rhode Island, Virginia, Vermont, and West Virginia. The root boring wee-
vil (*Hylobius transversovittatus* Goeze) was received into quarantine from collections
made in Germany. The eggs from these weevils are being used to inoculate potted looses-