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Commentary

Failure of *Diabole cubensis*, a promising classical biological control agent, to establish in Australia

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Abstract

The rust *Diabole cubensis* (Arthur & J.R. Johnston) Arthur was introduced into northern Australia as a classical biological control agent against the noxious wetland weed *Mimosa pigra* L. (*Mimosaceae*). Pre-release evaluation and observation in Mexico, Central America, and South America, the center of origin of *D. cubensis*, revealed a range of characteristics that suggested the rust had great potential to exert some control over *M. pigra* in Australia. This dry-season rust was cultured and field inoculations were carried out during the northern Australian dry season when ambient conditions were suitable for infection. Post-release assessments showed that *M. pigra* developed symptoms of rust infection in the field but that the rust failed to spread and therefore to establish in Australia. Analyses of the post-release assessments of *D. cubensis* in Australia pointed to gaps in the knowledge of the weed–pathogen ecology. The failure of the rust in light of performance of other biological control agents is reviewed.
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Keywords: *Diabole cubensis*; Fungal pathogen; Classical biological control; *Mimosa pigra*; Post-release assessment; Weeds; Australia

1. Introduction

The tropical shrub *Mimosa pigra* L. (Mimosaceae), native to the Neotropics, is an invasive woody shrub throughout the tropical wetlands of the world (Lonsdale, 1992; Lonsdale et al., 1989, 1995). In northern Australia, the plant covers more than 800 km^2 of wetland areas (Lonsdale, 1992), has substantially reduced plant and animal biodiversity in many areas, and poses a serious conservation problem (Braithwaite et al., 1989; Lonsdale et al., 1995). *M. pigra* is the target of an ongoing biological control program, which is believed to provide the only long-term control of this weed. To date, 14 insect herbivores and two fungal pathogens have been introduced (N. Ostermeyer, Weeds Branch, Darwin, Australia, personal communication), including the rust *Diabole cubensis* (Arthur & J.R. Johnston) Arthur in 1996 and the coelomycete pathogen *Phloeospora mimosae-pigrae* H.C. Evans & Carrión in 1994 (Table 1). The insect herbivores are two seed-feeding beetles (Bruchidae), two leaf beetles (Chryomelidae), four weevils (Curculionidae), two stem-boring moths (Gracillaridea and Sesiidae), and two loopers (Geometridae) (T.A. Heard, CSIRO Entomology, Canberra, Australia, personal communication).

Classical biological control of weeds involves the deliberate introduction of coevolved, highly specific pathogens, or other natural enemies, from the center of origin of the target weed species. The selection of *D. cubensis*, an autoecious, microcycle rust, as a classical biological control agent for *M. pigra* was based both on the severe leaf chlorosis and subsequent defoliation caused by the rust and its host-specificity to *M. pigra* observed on field surveys in the Neotropics (Evans et al., 1995). Detailed host-specificity studies of the rust that were carried out as pre-release evaluations confirmed the indications from field observations that *D. cubensis* is host specific to *M. pigra* (Seier, 1998). It was expected that *D. cubensis* would complement the action of other biological control agents of *M. pigra*,

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