

**Allelopathic interference potential of the alien
invader plant *Parthenium hysterophorus***

by

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DECLARATION

DECLARATION

I, Michael van der Laan, hereby declare that this dissertation for the degree MSc (Agric) Agronomy at the University of Pretoria is my own work and has never been submitted by myself at any other University. The research work reported is the result of my own investigation, except where acknowledged.

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ABSTRACT

The alien invader plant *Parthenium hysterophorus* is a Category 1 weed in South Africa, where it poses a serious threat to indigenous vegetation in particular, and to biodiversity in general. In addition to its competitive ability, it is hypothesized that the successful invasiveness of *P. hysterophorus* is linked to the allelopathic potential of the plant. One compound in particular, parthenin, is alleged to play a major role in this allelopathic potential. Interference between *P. hysterophorus* and three indigenous grass species (*Eragrostis curvula*, *Panicum maximum*, *Digitaria eriantha*) was investigated on a site with a natural parthenium infestation at Skukuza, Kruger National Park. The trial was conducted over two growing seasons on enclosure plots which eliminated mammal herbivory. *P. maximum* displayed best overall performance and was eventually able to completely overwhelm *P. hysterophorus*. *Eragrostis curvula* and *D. eriantha* grew more favourably in the second season after becoming better established but were clearly not well adapted to the trial conditions. Although *P. maximum* was the supreme interferer, all grasses were able to significantly interfere with *P. hysterophorus* growth in the second season. The ability of *P. maximum* to interfere with *P. hysterophorus* growth so efficiently that it caused mortalities of the latter species, indicates that *P. maximum* exhibits high potential for use as an antagonistic species in an integrated control programme. An investigation on the production dynamics of parthenin in the leaves of *P. hysterophorus* indicated that

ABSTRACT

high levels of this compound are produced and maintained in the plant up until senescence. The high resource allocation priority of the plant towards this secondary metabolite even in the final growth stages may indicate the use of residual allelopathy to inhibit or impede the recruitment of other species. Studies on the persistence of parthenin in soil revealed that parthenin is readily degraded in soil and that microbial degradation appears to play a predominant role. Significant differences between parthenin disappearance-time half-life (DT_{50}) values were observed in soils incubated at different temperatures and in soils with different textures. Exposure of the three grass species to pure parthenin showed that, in terms of their early development, the order of sensitivity of the grasses was: *Panicum maximum* > *Digitaria eriantha* > *Eragrostis curvula*. It may therefore prove challenging to establish *P. maximum* from seed in *P. hysterophorus* stands during the execution of an integrated control programme due to the sensitivity of this grass species to parthenin. From the research findings it appears possible that *P. hysterophorus* can inhibit or impede the recruitment of indigenous vegetation under natural conditions. At least one mechanism through which this alien species can exert its negative influence on other plant species is the production and release of parthenin.