





A decade of biological control of *Parthenium hysterophorus* L. (Asteraceae) in South Africa reviewed: introduction of insect agents and their status

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The annual herb, *Parthenium hysterophorus* L. (Asteraceae: Heliantheae) is a severe terrestrial invader globally. Infestations reduce crop yield, limit available grazing, hinder conservation efforts, and affect human and animal health in Africa, Asia and Australia, and on associated islands. Due to the impact and threat of further invasion of *P. hysterophorus*, a biological control (biocontrol) programme was initiated in 2003 in South Africa. This review discusses the research and implementation activities undertaken on the insect agents from 2011 to 2020. During this period, the stem-boring weevil *Listronotus setosipennis* Hustache (Coleoptera: Curculionidae), leaf-feeding beetle *Zygogramma bicolorata* Pallister (Coleoptera: Chrysomelidae) and seed-feeding weevil *Smicronyx lutulentus* Dietz (Coleoptera: Curculionidae), were found to be host specific and approved for release. Releases of mass-reared insect agents have been concentrated particularly in north-eastern South Africa, where *P. hysterophorus* infestations are most prolific. Post-release monitoring studies indicated localised establishment and impact of *L. setosipennis* and *S. lutulentus*. *Listronotus setosipennis* persisted through severe drought conditions, and although it disperses slowly larval feeding is structurally damaging. Establishment of *S. lutulentus* is improving, reducing seed production where it is established. *Zygogramma bicolorata* resulted in defoliation at a few sites, but establishment has been poor and the beetle has been absent since 2019. Although a combination of fungal and insect agents were demonstrated to reduce *P. hysterophorus*, additional natural enemies could improve control. Consequently, the stem-galling moth *Epiblema strenuana* Walker (Lepidoptera: Tortricidae) and root-crown boring moth *Carmentis* sp. nr. *ithacae* (Beutenmüller) (Lepidoptera: Sesiiidae) remain under evaluation. The management of *P. hysterophorus* in South Africa has been guided by the development of a national strategy, which incorporates multiple management methods, including biocontrol. International collaborations have intensified as a growing number of countries begin to utilize biocontrol to manage *P. hysterophorus*. Despite the progress towards biocontrol of *P. hysterophorus* during this period, increased utilisation of approved agents and the introduction of additional agents are necessary to achieve greater control.

Key words: host specificity, implementation, integrated management, parthenium weed, post-release evaluation



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