

Biological control of Cactaceae in South Africa

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Cactaceae are among the most problematic invasive alien plants in South Africa, posing serious negative consequences to agriculture and natural ecosystems. Fortunately, South Africa has a long and successful history of controlling cactus weeds using biological control (biocontrol). This paper reviews all the biocontrol programmes against invasive alien Cactaceae in South Africa, focusing on the decade since the last review published in 2011, up to, and including 2020. Biocontrol programmes against 16 target weeds are summarised, all of which rely on either the galling mealybug, *Hypogeococcus* sp. (Pseudococcidae), or various species or intraspecific lineages of cochineal insects (*Dactylopius* spp., Dactylopiidae) as agents. New agents are being considered for the three target weed species, *Opuntia elata* Salm-Dyck, *Opuntia megapotamica* Arechav. and *Tribocereus spachianus* (Lem.) Riccob., while permission to release a new agent against *Sclerocarpus pallida* (Rose) F.M. Knuth has recently been granted. The biocontrol agent, *Dactylopius opuntiae* (Cockrell) 'stricta', which has been utilised for the successful control of *Opuntia stricta* Haw., has shown some promise as an agent against one of the worst cactus weeds in the country, the North Cape/Free State variety of *Opuntia engelmannii* Salm-Dyck. Post-release monitoring and recent observations of the status of control for the 11 other cactus weeds, all of which have well-established agents, are provided. Taxonomic uncertainties and misidentifications of both target weeds and agents has been a constraint to biocontrol efforts, but this has been partially overcome through the use of genetic techniques. Biocontrol is particularly successful in controlling cactus weeds compared to most other taxonomic groups, and it is likely that past successes can be repeated with new target weeds. Mass-rearing and redistribution of agents are essential to gain the maximum possible benefit from cactus biocontrol agents, and recent increases in mass-rearing outputs have been beneficial.

Key words: Biocontrol success, cochineal, *Hypogeococcus*, mass-rearing, post-release evaluation.

INTRODUCTION

Invasive cacti (family Cactaceae) have been targeted for biological control (biocontrol) in South Africa since 1913, when the cochineal *Dactylopius ceylonicus* (Green) (Hemiptera: Dactylopiidae) was introduced against *Opuntia monacantha* Haw. (Lounsbury 1915). This was the first release of a biocontrol agent against an invasive plant in South Africa and the first successful release of an agent against Cactaceae globally. During the next 98 years, until the last review on cactus biocontrol in South Africa in 2011 (Paterson *et al.*

2011), 15 biocontrol agent entities (species and intraspecific lineages often referred to as biotypes) became established on 15 cactaceous species in South Africa (Klein 2011). In most instances, these biocontrol agents achieved substantial success (Zimmermann *et al.* 2009; Paterson *et al.* 2011). In this paper, we review the progress that has been made with the biocontrol of cactaceous weeds in South Africa during the decade since the last review on cactus biocontrol in South Africa (Paterson *et al.* 2011), up to, and including, 2020.



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