

## The Biological Control of *Acacia nilotica indica* in Australia

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### Abstract

*Acacia nilotica indica*, originally introduced as a beneficial shade tree, has become a serious weed in northern Queensland, particularly in the arid sheep- and cattle-grazing regions. It forms dense prickly thickets which interfere with stock mustering. A biological control programme was commenced in 1981 and to date, four insect species have been imported into Queensland. The seed-feeding bruchid, *Bruchidius sahlbergi*, has become established and the present status of this insect and the recently released green-shoot-boring graciariid, *Cuphodes profluens*, is discussed.

### De Lutte Biologique Contre *Acacia nilotica indica* en Australie

*Acacia nilotica indica* qui, à l'origine, a été introduite comme essence d'ombre bénéfique, est actuellement une plante nuisible qui cause de graves problèmes dans le nord de la zone tropicale de Queensland, particulièrement dans les régions semi-arides de pâturages des moutons et du bétail où cette espèce forme de denses fourrés épineux qui nuisent au rassemblement du bétail. Un programme de lutte biologique a été mis en oeuvre en 1981 et, jusqu'à présent, deux espèces d'insectes ont été mises en liberté à Queensland. Un bruche granivore *Bruchidius sahlbergi* s'est établi dans ces régions, et le rôle actuel de cet insecte ainsi que celui du graciariidé perceur de pousses vertes *Cuphodes profluens* qui a récemment été introduit font l'objet du présent document.

### Introduction

*Origin and Distribution of Acacia nilotica (L.) Delile spp. indica (Benth.) Brenan (Mimosaceae)*

*A. nilotica indica* is a prickly shrub or spreading tree which grows to about 7.5 m high and can grow into dense thickets (Kleinschmidt and Johnson 1977). It is one of about nine subspecies of the *A. nilotica* complex formerly known as *A. arabica* (Lam.) Willd. This complex is native to Africa and the Indian sub-continent (Brenan 1957; Ali and Faruqi 1969). *A. nilotica indica* is native to India and Pakistan (Ali and Faruqi 1969). It probably occurs in Iraq (Townsend 1968); it occurs in Tanzania but was probably introduced there (Brenan 1959). It was introduced into Australia early this century and is restricted to the State of Queensland where it is known as prickly acacia. A few trees have been recorded in the Northern Territory adjacent to the Queensland border (I.L. Miller, pers. comm.).

#### *A. nilotica indica* in Queensland

*A. nilotica indica* has been used as a shade tree in tropical areas of Queensland since its introduction. Pollock (1926) noted it growing extensively in two coastal areas —

Bowen and Rockhampton (Fig. 1). He recommended the tree to sheep graziers as filling a need for a shade tree in western Queensland. He warned however, that when consumed by cattle 'the seeds are not masticated and pass whole through the digestive track thus causing numbers of young trees to appear where they are not wanted'. The weed potential of this plant was thus forecast before its use on the plains of western Queensland.

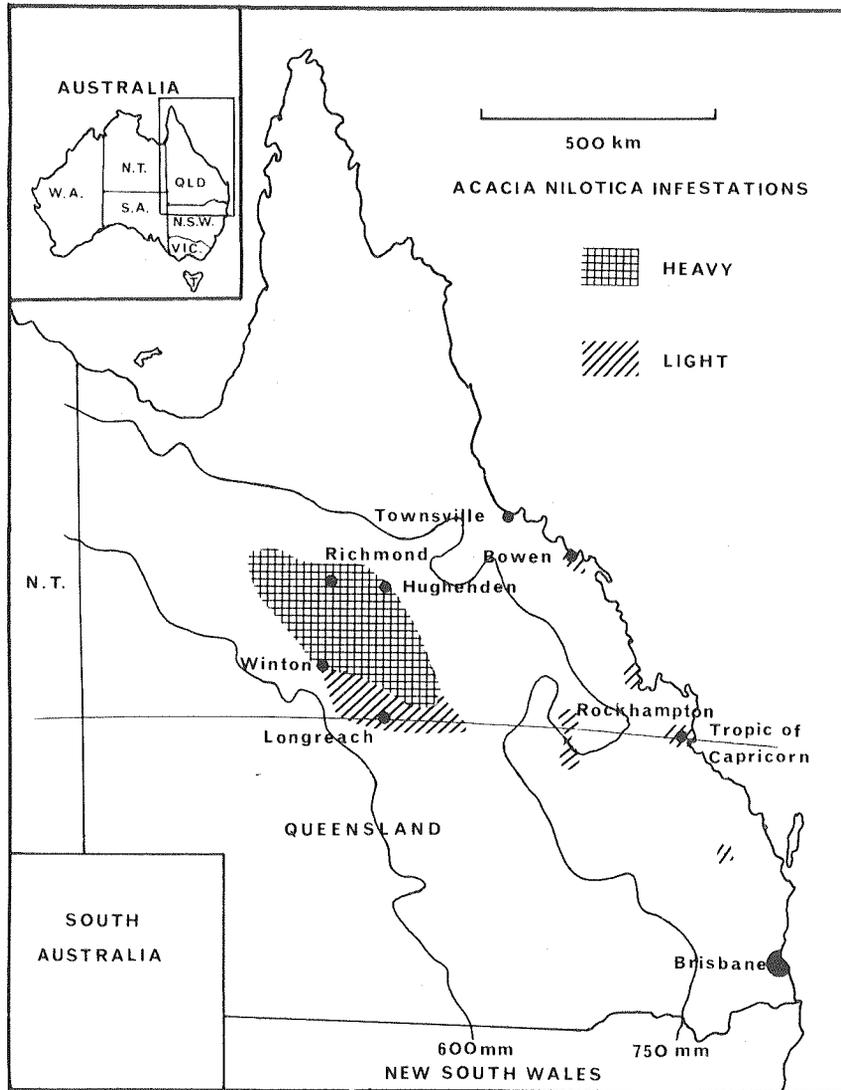


Fig. 1. Areas of infestation of *Acacia nilotica* (L.) *Delile indica* (Benth.) Brenan in Australia.

During the 1930s, '40s and '50s the plant was grown extensively around homesteads, artesian bore tanks and drains in arid areas of tropical northern Queensland where its shade was claimed to be extremely beneficial in improving lambing rates and fleece quality. No other tree species will grow on the brown, self-mulching, cracking clay soil plains and it is not surprising that *A. nilotica indica* has been grown so enthusiastically not only for its shade, but also for the high nutritive value of its leaves and pods which are relished by sheep. Brunnich (1926) reported these pods to have a

protein content of 12.5% and many graziers claim that pods helped their flocks survive recurrent drought conditions.

It was not until a decline in the wool industry in the late 1950s when many sheep-grazing properties converted either wholly or partly to cattle-grazing that the tree's potential for weediness became fact. In favourable seasons, the seeds spread over large areas by cattle germinated and grew into impenetrable prickly thickets. Harvey (1981) has shown by feeding trials with sheep and cattle that the greatly increased survival of seed ingested by cattle would at least partly explain the upsurge in growth of prickly acacia.

*A. nilotica* was declared a noxious plant in 1959. Its declaration was mooted in 1951, but this was shelved as many graziers were still convinced that they could manage it successfully. Even now it is generally agreed by landholders that maintenance of large shade trees around properties would be very desirable if control over its spread could be achieved.

An accurate assessment of the total area infested with prickly acacia is difficult to obtain. An attempt using questionnaires was made in 1979 by P. James (pers. comm.). Information obtained by James indicated that 5000–6000 km<sup>2</sup> of prime grazing land was infested to some degree by prickly acacia. Up to 20% of that infestation was regarded as impenetrable. One property of 20,000 ha near Richmond was estimated to contain 6000 ha of impenetrable thickets, 8000 ha of heavy infestation and 4000 ha of scattered prickly acacia. This property had four prickly acacia trees in 1960. Another property of 20,000 ha near Richmond was 100% infested with 8000 ha of impenetrable thickets, 4000 ha heavy infestation and 8000 ha scattered plants.

Since 1979, the situation has continued to worsen at an alarming rate with much of the scattered and heavy infestations becoming impenetrable. If this plant is not controlled, the arid grasslands of northern Queensland will be lost to the pastoral industry. Areas of infestation are shown in Fig. 1.

#### *Biological Control of A. nilotica indica*

The weed has now become too widespread to be cheaply controlled either mechanically or by the use of herbicides, and biological control is being attempted.

Following field surveys in Pakistan by Mohyuddin (1981), the Commonwealth Institute of Biological Control was contracted by the Queensland Government through the Stock Routes and Rural Lands Protection Board to conduct a programme of exploration and evaluation of likely biological control agents. Particular attention was paid to those agents likely to interfere with the plant's reproduction either by the prevention of flowering or by flower or seed destruction.

As the host-specificity testing involved many plant species not readily available in Pakistan, the testing of all candidates was finalized under quarantine in Australia.

Four insect species have been received in Australia to date; of these, *Bruchidius sahlbergi* (Schilsky) (Coleoptera: Bruchidae) and *Cuphodes profluens* Meyrick (Lepidoptera: Gracillariidae) have been field-released; *Tephрина disputaria* Gn. (Lepidoptera: Geometridae) was rejected because of host-specificity doubts; and *Ascalenia callynella* Kasy (Lepidoptera: Momphidae) is undergoing final host testing.

#### Results and Discussion

##### *Bruchidius sahlbergi*

This seed-boring beetle is widespread in Pakistan (Mohyuddin 1981). It oviposits into the crevice of partially dehisced pods and on hatching, the larva moves from one

seed chamber to another to find an unattacked seed. One larva will effectively destroy one seed and multiple larval feeding within a seed is rare. The larva enters the seed using the pod wall for leverage and it is doubtful if larvae can attack seed once it has fallen from the pod.

Approximately 1000 beetles were imported into Queensland in four shipments in the period from November 1981 to January 1982. Field liberations were commenced in Bowen in August 1982 after additional testing under quarantine confirmed their specificity to prickly acacia. In the following 18 months, approximately 309,000 beetles were released at 96 sites. Eighty-one of these sites were located in the arid region of Queensland with an annual rainfall of < 750 mm; the remainder were located in higher-rainfall coastal regions. All prickly acacia growing in the arid region had been under severe drought stress from before the previous flowering period, with the consequence that only trees growing around permanent water such as artesian bore drains produced a seed crop in November–December 1982. These areas offering both shade and water were stock camps and as pods fell, they were eagerly consumed.

To ensure availability of seed in the 1983/84 season, all liberations in this region were made near permanent water. Beetles were released into unstocked areas wherever possible; alternatively, pods were raked into heaps and protected from stock with fallen timber.

*B. sahlbergi* has readily established at 80% of the release sites. Those sites where the beetles have failed have been either destroyed by floods in May and December 1983 or eaten by stock. At many sites, their continued survival is threatened by a shortage of suitable seed, but wherever stock has been excluded, establishment appears assured. Fifty-two percent of seed from the 1983/84 crop was attacked by *B. sahlbergi* at one Winton site four months after its fall. A further 30% was destroyed at this site by the cosmopolitan *Caryedon serratus* (Oliver) (Coleoptera: Bruchidae).

#### *Cuphodes profluens*

Larvae of this small moth tunnel in young, green shoots of prickly acacia. Following initial host-specificity testing by Siddique *et al.* (1982), five shipments totalling 1299 pupae were sent to Australia in 1983. From these, 739 live moths were obtained. On successful completion of host testing under quarantine in Australia, field liberation was commenced in November 1983. To date, 3395 moths have been released at 14 sites. Insufficient time has elapsed to determine establishment.

It is hoped that this insect will attack sufficient young tips to make a significant reduction in number of inflorescences produced.

#### *Tephрина disputaria*

This small moth is the most abundant and widespread defoliator of *A. nilotica indica* occurring throughout Pakistan (Mohyuddin 1981). Initial testing in Pakistan indicated that it was probably host-specific. Subsequent testing showed that its larvae could complete their development on *A. deanei* (R.T. Baker) Welch in Australia and on *A. hydaspica* J.R. Drumm. *ex* R. Parker in Pakistan. The adult oviposits indiscriminately when caged and as it was impossible to prove host-specificity, this insect was not accepted as a control agent for release in Australia.

#### *Ascalenia callynella*

This green-shoot-borer has only recently been received into quarantine in Australia and as yet, final host-specificity testing has not concluded. As with *C. profluens*, the

aim of this introduction is to reduce flowering of prickly acacia by destruction of flower-bearing tips. Siddiqui and Mohyuddin (1984) reported that in Pakistan unattacked shoots had a significantly higher number of inflorescences than those attacked by *A. callynella*.

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