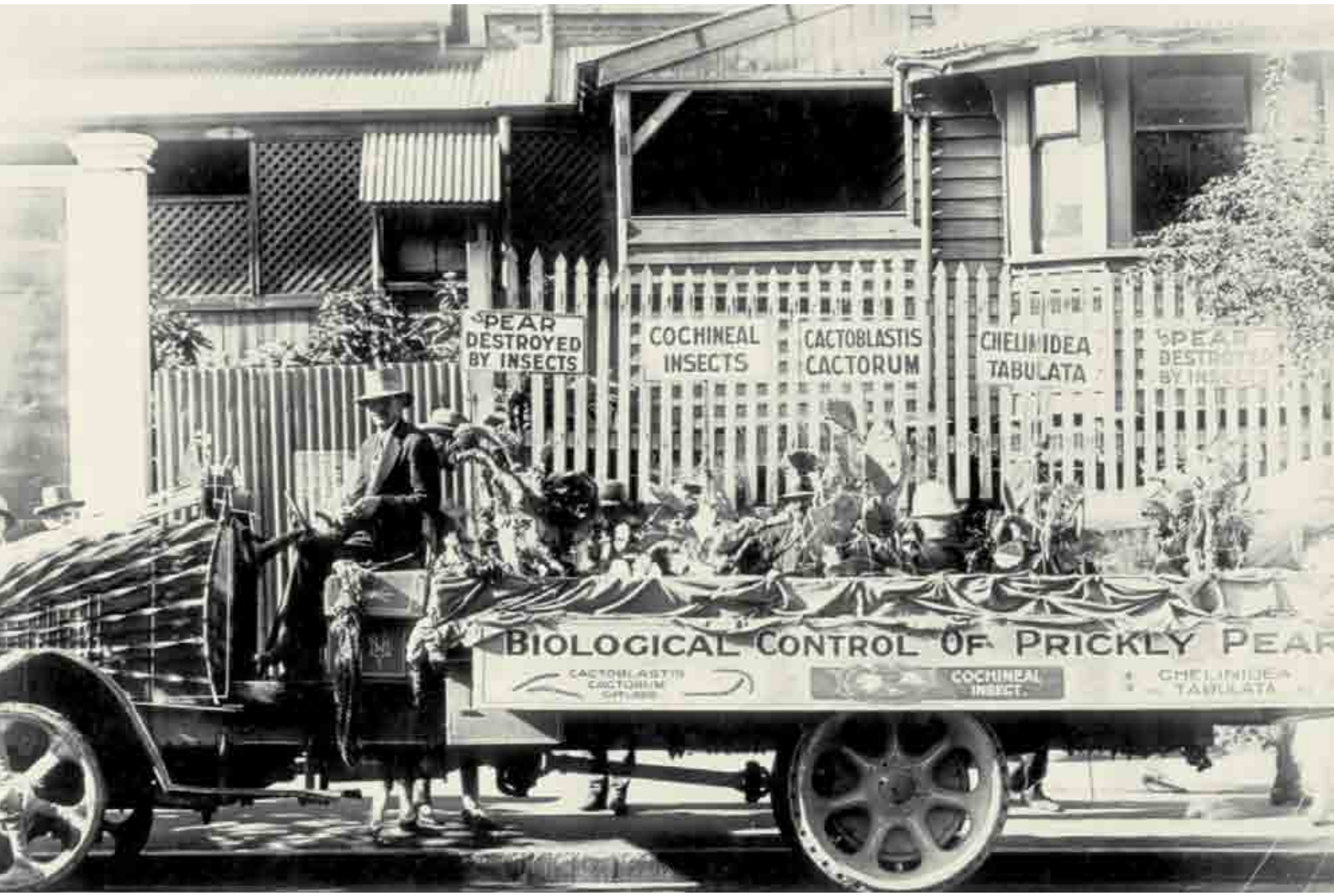
The prickly pear story



Acknowledged as one of the greatest biological invasions of modern times, the introduction and subsequent spread of prickly pear into Queensland and New South Wales had infested millions of hectares of rural land by the 1920s, rendering it useless for agriculture. Prickly pear proved so difficult and costly to control by chemical and mechanical means that enormous areas were simply abandoned by their owners.

The eventual control of this pest, mainly by one insect and in the space of a few short years, is an amazing story that has encouraged further successful developments in the field of biological pest control.

Description and general information

Prickly pear is the general term used to describe over ten members of the Cactaceae family. Most of these cacti are of the *opuntia* species, which are indigenous to the Americas and are characterised by their fleshy, spine-covered growth. The term 'prickly pear' is derived from the plant's spiny and pear shaped fruit.

For most of its growth cycle prickly pear is a leafless shrub. The flat branches are commonly called leaves but the terms pad or joint are more accurate. The true leaves of the prickly pear plant are small, fleshy scales, usually pointed

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and commonly red or purplish in colour. These leaves are present on young shoots but fall off soon after they appear. Scattered over the pads and fruit are spots called areoles from which spines or bristles grow. Each areole is also a growing point from which a new pad, flower or root can develop.

The flowers are fairly large and usually yellow but on different species can be white, deep orange, red, pink or purple. The tough outer skin of the fruit is usually red when ripe but may be purple, orange or yellow.

Because of the lack of leaves and the tough outer skin of the pads, the plant is very drought-resistant. Some species grow bulbs under the ground and, should the plant above the ground be destroyed by bush fire or stock, the bulb will usually survive and give rise to new pads.

The cacti that have attained pest status in Queensland include:

Common pest pear	(*Opuntia stricta var. stricta*)
Spiny pest pear	(*Opuntia stricta var. dillenii*)
Tiger pear	(*Opuntia aurantiaca*)
Drooping tree pear	(*Opuntia monacantha*)
Velvety tree pear	(*Opuntia tomentosa*)
Westwood pear	(*Opuntia streptacantha*)
Devil's rope pear	(*Cylindropuntia imbricata*)
Coral cactus	(*Cylindropuntia fulgida var. mamillata*)
Snake cactus	(*Cylindropuntia spinosior*)
Harrisia cactus	(*Harrisia martinii, H.tortuosa and H.pomanensis*)

History of introduction

The first recorded introduction of prickly pear was attributed to Governor Phillip at Port Jackson in 1788. It is thought that the shipment comprised drooping tree pear (*Opuntia monacantha*) and possibly one or two other species. The reason for introducing the plant was to create a cochineal industry in the new colony. Cochineal is an insect that feeds on certain species of cactus and from which a scarlet dye is obtained. This dye was used to colour the distinctive red coats of the British soldiers at that time.

The fate of this first prickly pear plantation is not known; however, other introductions of different species followed and evidence suggests that plants were growing in cultivation at Parramatta prior to 1840 and spread to Chinchilla in Queensland by 1843.

Dispersal

Prickly pear is established from either seed (by germination) or plant segments (by vegetative reproduction).

The main dispersal method occurs via the tough, coated seeds that pass undamaged through the digestive system of animals and birds. The heavy crop of fruit produced by pear plants is particularly palatable to birds such as crows, emus and magpies. Many new infestations probably occurred through the germination of seed in bird droppings.

Plant segments are easily detached from the parent plant by animals, wind or flood waters, and take root where they lodge. It is believed that the flood of 1893 spread seed and plant parts to many new areas.

Prickly pear infestations covered 10 million acres (4 million ha) of land by 1900 and 58 million acres (24 million ha) by 1920. Despite every control effort, it was estimated that the plant's rate of advance was 2.4 million acres (1 million ha) per year.

Early control measures

Control methods, such as digging up and burning, and crushing with rollers drawn by horses and bullocks, all proved to be of limited use.

Early investigative work into chemical control of prickly pear established that best results were achieved by using arsenic pentoxide. This chemical although effective, was highly toxic, expensive and hazardous to operators and stock. A shortage of supply of the chemical during the years of World War I further reduced its usage. Demands for the chemical led to mining of the essential component, arsenic, in Queensland at Jibbenbar (near Stanthorpe) and the development of a new industry.

In 1901, the Crown offered a £5000 reward for the discovery of an effective control method. Despite an increase in reward to £10 000 in 1907, it was never collected.

Avenues for commercial use of prickly pear for purposes such as the production of paper, alcohol, dye, soap and oil were all investigated with little success.

A different concept

In 1912, the Prickly Pear Travelling Commission was formed. Members of this commission travelled to other countries where cacti occurred either as indigenous or naturalised species. The purpose of these visits was to identify natural enemies of the prickly pear and to investigate the possibility of their use as control agents in Queensland.

By 1914, the board had imported specimens of several promising insect species. These included two species of the cochineal insect (*Dactylopius ceylonicus and D. confuses*) and the cactoblastis moth (*cactoblastis* sp). Although the cactoblastis larvae failed to reach maturity, encouraging investigative work with the cochineal insects led to a determination to pursue the concept of biological control. The first field releases of the cochineal insect were

made in May 1914. Within three years of release, most stands of drooping prickly pear, found primarily in the Charters Towers, Townsville and Bowen regions were destroyed.

An untimely suspension of research occurred as a result of World War I when all available resources were directed to the war effort.

Further development did not eventuate until after the war when, in 1919, the Commonwealth Prickly Pear Board recommenced research into biological control agents. Several organisms were imported from the Americas in 1921 and a laboratory, breeding and quarantine station was established at Sherwood in Brisbane. This complex, now known as the Alan Fletcher Research Station, continues to develop control methods for pest plants. Twelve insects were successfully released to control the major prickly pear species. These insects included the moth borer (*Olycella*), two species of plant suckers (*Chelinidea* spp.), the prickly pear red spider mite (*Tetranychus opuntiae*) and various cochineal species (*Dactylopius* spp.). The success of these insects was variable due mainly to their specificity to certain types of the prickly pears.

During the early part of the 1900s when air travel was still in its infancy, the insects had to endure an 8 to 10 week voyage to Australia by ship. On such voyages insects were confined within gauze-covered wooden boxes in which their food source, prickly pear segments, was sustained in damp sphagnum moss.

In a series of tests in 1914, cactoblastis larvae failed to reach maturity, however, the moth was again investigated in 1924. Specimens arrived at Sherwood in May 1925 and rearing of the moths proved successful. Following mass rearing of cactoblastis, 10 million eggs were distributed in 61 localities throughout affected areas during 1926 and 1927 and a further 2.2 billion eggs were released between 1927 and 1931. Eggs were wrapped in paper quills together with pins to attach the quills to the pear plants. They were packed in boxes; each box contained 100 000 quilled eggs and printed instructions to guide landholders in the correct method of release. A fleet of seven trucks and 100 men distributed packed eggs across the state.

This insect proved to be spectacularly successful in destroying the weed. By 1932, the stem-boring cactoblastis larvae had caused the general collapse and destruction of most of the original, thick stands of prickly pear. By 1932, almost 7 million ha of previously infested land was made available to 1165 settlers. Townships that had been stagnant in the 1920s were revitalised; public buildings, offices, shops and residences were built.

Cactoblastis larvae

The conquest of the prickly pear was a black and white movie produced to record the success of the biological control program, making cactoblastis a star of the big screen. The most lasting memorial to the success of the program was built in Boonarga, a small settlement west of Dalby, after the removal of the prickly pear. Its residents built a district hall and, in gratitude to their entomological benefactor, they named it the Cactoblastis Memorial Hall.

The control of prickly pear by the cactoblastis moth is still regarded as the world's most monumental example of successful pest plant repression by biological means. The insect was also utilised in other countries and was again successful in controlling prickly pear. Unfortunately, after its deliberate release to control prickly pear in the Caribbean, it is now threatening the native prickly pear species of North America.

This control is not without its limitations. Cactoblastis larvae do not thrive in dry conditions or on plants growing in poor soils and they are not effective against all species of prickly pear. Their main host is the common pest pear, which was the dominant prickly pear species present in Queensland at the height of the weed's infestation. Other insects, such as a mite, a beetle and mealy bugs, were introduced to control velvety tree pear, devil's rope pear and drooping tree pear.

What cactoblastis achieved was a spectacular reduction of susceptible prickly pear species to a point where other insects and conventional methods of control could successfully continue to manage the prickly pear pest.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

Property infestation before the release of cactoblastis

The same property following cactoblastis release

Front image: Early display vehicle promoting the success of prickly pear biological control

Fact sheets are available from Department of Employment, Economic Development and Innovation (DEEDI) service centres and our Customer Service Centre (telephone 13 25 23). Check our website at www.biosecurity.qld.gov.au to ensure you have the latest version of this fact sheet. The control methods referred to in this fact sheet should be used in accordance with the restrictions (federal and state legislation, and local government laws) directly or indirectly related to each control method. These restrictions may prevent the use of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, DEEDI does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.