

INTRODUCTION OF THE CROWN WEEVIL (*TRICHOSIROCALUS HORRIDUS*) AS AN ADDITIONAL BIOCONTROL AGENT AGAINST NODDING THISTLE

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SUMMARY

The crown weevil (*Trichosirocalus horridus*) was released against nodding thistle in Mid-Canterbury in 1985. Weevils collected from this site have since been released at a further 28 sites throughout New Zealand. Preliminary assessment has shown that the crown weevil will complete development on the rosettes of nodding, winged, slender-winged, Scotch and marsh thistles but not on cotton, variegated or Californian thistles. The crowns of infested nodding and Scotch thistles were severely damaged. Subsequent lateral regrowth produced significantly fewer flowers than uninfested plants.

INTRODUCTION

Nodding thistle (*Carduus nutans* L.), plumeless thistle (*C. acanthoides* L.), winged thistle (*C. tenuiflorus* Curtis) and slender-winged thistle (*C. pycnocephalus* L.) are the four representatives of the genus *Carduus* present in New Zealand. All can be serious weeds of pasture, but the large-flowered nodding thistle is the most important. Moore and Mulligan (1956) detailed evidence of hybridization between nodding and plumeless thistles in Canada. New Zealand specimens are also suspected to be of such hybrid origin (Webb *et al* 1988).

During the last 40 years nodding thistle has spread to become a serious agricultural weed infesting thousands of hectares of both the North and South Islands, particularly summer-dry areas. Seasonal outbreaks usually follow extensive pasture depletion caused by over-grazing, drought or severe infestation of pasture pests.

A biocontrol programme for nodding thistle in New Zealand commenced with the successful introduction of the receptacle weevil (*Rhinocyllus conicus* (Froelich)) in 1972 (Jessep 1975). This species is now well established throughout the range of nodding thistle.

Recently, *Trichosirocalus horridus* (Panzer), a winter-active weevil which can destroy the crown of thistle plants, was introduced. Progeny of weevils obtained from the Regina Station of Agriculture Canada (but originally from Germany) were first released near Ashburton in April 1985.

The small grey-brown crown weevils, 3-4 mm in length, emerge from aestivation in late-summer to lay eggs, in groups of 1-4, in cavities along the leaf ribs of thistle rosettes. Newly hatched larvae crawl down to the crown where their feeding damages the central growing point, as well as the bases of older leaves. Feeding often destroys the crown and developing larvae also attack lateral regrowth. Fully developed larvae leave the plant to pupate in the surrounding soil. Adults emerge and feed extensively for several weeks before entering a mid-summer aestivation.

This paper describes a preliminary assessment of the impact of crown weevil on thistles and recent progress in its distribution around New Zealand.

METHODS

Two hundred crown weevil adults were placed in a field cage over naturally growing rosettes at a site near Ashburton in April 1984. The cage was removed 1 year later leaving the weevils to establish and multiply. In succeeding years part of the site was regularly cultivated to maintain a population of developing rosettes. The purpose was to provide optimum conditions for natural multiplication so that maximum numbers of weevils could be collected for release to other areas.

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In April 1988, 300 adults were collected and released onto nodding thistles at two sites, in the Strathallan and Whakatane counties. In December 1988, approximately 7000 newly-emerged weevils were individually collected from thistle plants at the Ashburton site. Weevils were placed on thistle rosettes under three 1 m x 1 m x 1 m cages at the Ashburton site to complete aestivation. In March 1989, 5000 weevils were recovered from the cages and released onto thistle rosettes at 26 further sites.

In 1987-88, the possible impact of the crown weevil on nodding and Scotch thistles was examined at Ashburton. During April 1987, 10 nodding thistle rosettes and 10 Scotch thistle rosettes were randomly selected from within the original release area. In December 1987 and January 1988 the degree of attack on these rosettes, the number of lateral stems developing from destroyed crowns, the height of stems and the number of inflorescences per plant were measured. Ten uninfested nodding thistle and 10 uninfested Scotch thistle rosettes growing approximately 50 m from this area were randomly selected and the same parameters measured. Conditions for thistle growth here appeared identical to those in the infested area. Other nodding thistle rosettes were dissected at regular intervals to monitor the reproductive activity of the weevils.

Ten rosettes of each of five other thistle species which do not occur naturally at the Ashburton site were planted amongst the nodding thistle. The rosettes were monitored throughout the year.

RESULTS

Weevils have now established at Ashburton and at the sites in Strathallan and Whakatane counties. Fig. 1 shows all of the sites at which crown weevil has been released, but it is too early to tell whether it has established at 26 of these 29 release sites.

Regular dissection of plants from the Ashburton site has shown a long oviposition period occurs from March until November. This results in autumn rosettes, regrowth from damaged rosettes, as well as rosettes from later germination all being exposed to larval attack. Table 1 shows that uninfested nodding thistle plants produced a mean of 49 inflorescences and no lateral stems. By contrast the crowns of all infested plants were destroyed and the weak lateral regrowth produced a mean of only 7.7 inflorescences.

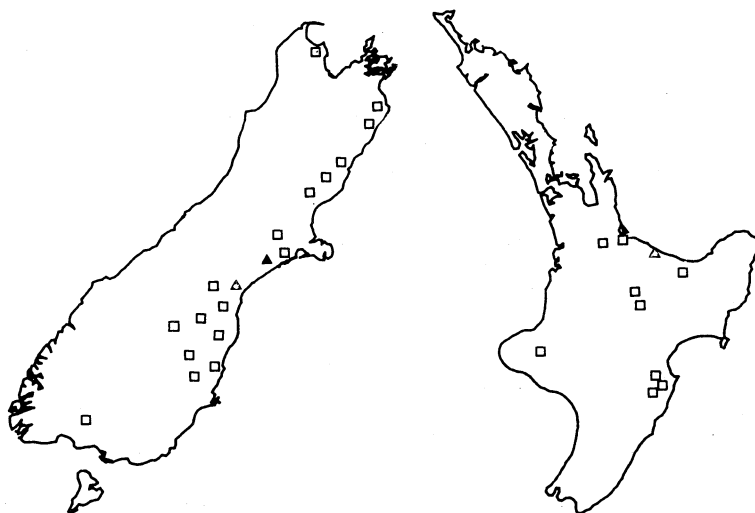


Fig. 1: Crown weevil release sites.
 Released April 1985. ▲
 Released April 1988. △
 Released March 1989. □

TABLE 1: Effects of crown weevil larvae on 10 nodding thistle and 10 Scotch thistle plants compared with a similar number of plants without larvae (means and s.e.). Following crown destruction, infested plants only produced laterals.

	Nodding thistle		Scotch thistle	
	uninfested	infested	uninfested	infested
% crowns destroyed	0	100	0	100
stems/plant	1	1.14 (0.36)	1	1.3 (0.15)
mean stem height	128.9 (10.14)	67.9 (10.15)	94.5 (2.62)	70.6 (4.52)
mean flowers/plant	49 (6.49)	7.7 (3.14)	83.5 (2.09)	6.4 (1.14)

Similarly, uninfested Scotch thistle plants produced a mean of 83.5 inflorescences while infested plants yielded only 6.4 inflorescences.

Rosettes of nodding, winged, slender-winged, Scotch (*Cirsium vulgare* (Savi) Ten.), and marsh (*C. palustre* (L.) Scop.) thistle are acceptable hosts for the crown weevil, but there were no larvae in cotton (*Onopordum acanthium* L.), variegated (*Silybum marianum* (L.) Gaertn.) or Californian (*Cirsium arvense* (L.) Scop.) thistles.

During this trial it was noted that damaged crowns and lateral regrowths were soft rather than prickly. Sheep have been observed grazing this affected growth.

DISCUSSION

The crown weevil has so far established at three sites and has been released at 26 more throughout New Zealand. A similar number of releases is planned for March 1990.

Because winged, slender-winged and marsh thistles do not naturally occur at the Ashburton site it was not possible to compare the performance of infested and uninfested plants of these species, but 100% of the winged, slender-winged and marsh thistle rosettes planted became infested with crown weevil larvae. These will almost certainly be alternative hosts for this weevil in New Zealand.

All nodding and Scotch thistles marked for this trial became infested and severely damaged by the crown weevil. Cartwright and Kok (1985) reported that, in Virginia, small and medium rosettes were damaged more than large rosettes. Larval density will be important in determining this. The Ashburton site was managed to increase the weevil population. It has yet to be determined just how much damage will be caused by the crown weevil under more natural conditions.

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