Argentine stem weevil
(Listronotus bonariensis)

Sustainable Land Management Programme 9

TARANAKI REGIONAL COUNCIL

“The biological control of Argentine stem weevil *(Listronotus bonariensis)* by the Parasitoid Wasp *(Miroctonus hyperodae)* in Taranaki.”

Introduction
Argentine stem weevil (ASW) first arrived in New Zealand around 1900. Without any natural enemies, it has established throughout New Zealand and affects all seven million hectares of improved pasture. Most damage is caused by larval feeding and stem mining. It is estimated to cost individual farmers several thousands of dollars annually through pasture damage and animal health problems

Female Argentine stem weevil and eggs

Close up of ASW eggs deposited under the epidermis of ryegrass stem

Until now, there has been no effective control of ASW although weevil resistant species of ryegrass have been developed. Unfortunately, these species also contain toxins that can lead to animal health problems. Alternatively, high producing - but non-resistant - pasture is susceptible to ASW attack and may only last for 12 months.

In its native homeland of South America, the parasitoid wasp Microctonus hyperodae is an important natural enemy of ASW. Consequently, it was selected by NZ scientists as the best option for ASW control in NZ. The wasp was introduced to NZ in 1989 to biologically control the ASW.

The Taranaki Regional Council (TRC) is funding (1996-98) the equitable introduction of the parasitoid throughout Taranaki as part of an initiative between Federated Farmers and the TRC. With financial assistance from the government administered Technology for Business Growth, the project is managed by Agriculture NZ, with research input from AgResearch. AgResearch was contracted to release the parasitoid at 40 sites throughout the region. This was completed in July 1997 and ongoing research will monitor the establishment at these sites and dispersal from five selected sites.

Argentine stem weevil (ASW)
ASW attacks many economically important grass species including: cereals (wheat, barley, maize, etc.). Adults (3-4mm long) cause some damage by feeding on the foliage but it is the larvae that cause the most significant losses.
In the Taranaki region, ASW is capable of producing three generations per year. Eggs (1mm) are laid near the base of the stem - just under the epidermis. Eggs develop into larvae when the temperature is above 10°c. After emerging, larvae burrow into and mine the central stem, which eventually kills the tiller. ASW has 4 larval stages of life and a single larva can destroy 3-8 tillers. This can result in significant pasture damage, for example, an 18% reduction in annual pasture production has been recorded in the Waikato.
Until now, there has been no effective control of ASW. High-endophyte ryegrass species resistant to ASW have been developed. However, the toxins produced by the endophyte that protect the plant against ASW, also cause animal health problems.

Summary
Argentine stem weevil damage to pasture results in:

- lower stocking rates
- more frequent need to resow pasture
- reduced cultivar suitability (some high-performing low endophyte types are susceptible to ASW)

Animal health problems due to high endophyte include:

- lower weight gains
- lower milk production
- high incidence of dags and fly-strike

Biological control with the parasitoid wasp will in time reduce ASW numbers. The expected outcome from reduced ASW populations are:

- increased persistence of high producing (low endophyte) ryegrass species.
- a projected increase in drymatter production.
- a projected increase in milk production by up to 54 kg / ha milksolids per year.

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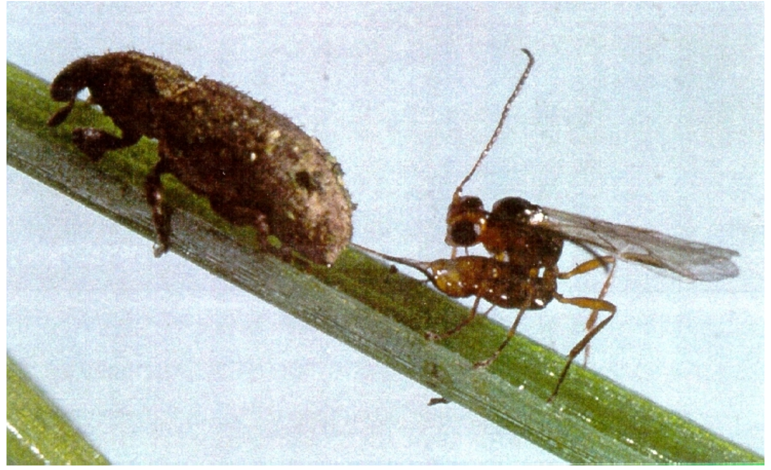


M. hyperodae (right) ovipositing in adult ASW

M. hyperodae larva emerging from weevil. Weevil dies soon after

ASW and Endophyte

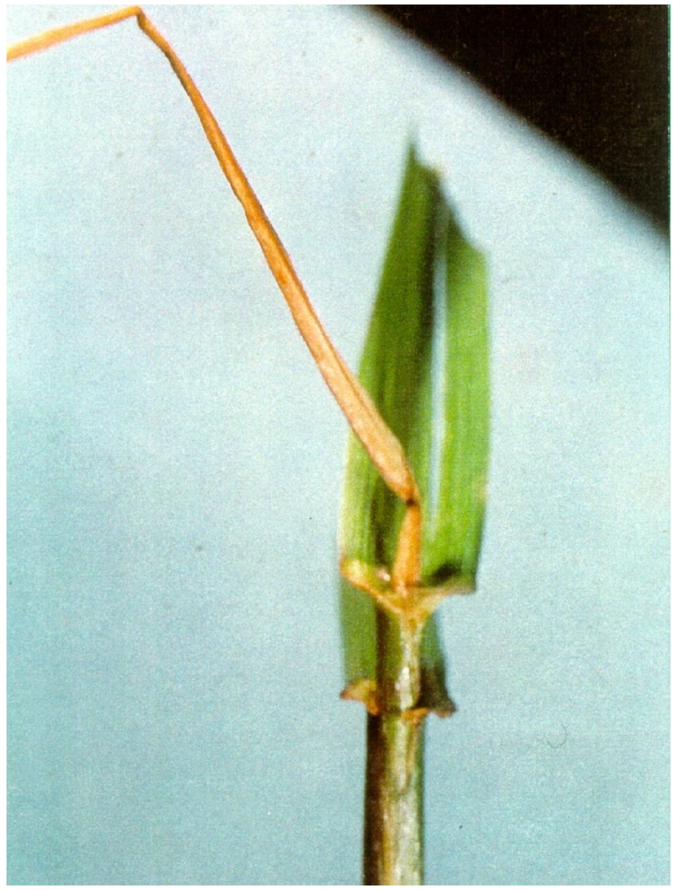
Endophyte is a living fungus inside a plant, which produces toxins (alkaloids) that protect it from grazing by insects and herbivores

Until the early 1980's, plant breeders were unaware of the effects of the endophyte / grass association other than the positive effect of improved plant persistence. For this reason, grass cultivars were bred with more and more toxic endophyte strains for greater plant performance while ignoring animal health performance.

Alkaloids produced from the grass / fungus association are responsible for ryegrass staggers and animal body temperature fluctuations, which can result in lower animal performance. For example, heat stress can result in reduced milk synthesis and / or meat and fibre production (growth rate).

Most cultivars of perennial ryegrass are now available with or without endophyte, although there is a trade-off between plant persistence and animal performance. For example, high producing (low endophyte) pasture is susceptible to ASW damage.

New research is looking at developing endophytes that are 'animal friendly'. AgResearch researchers have selected

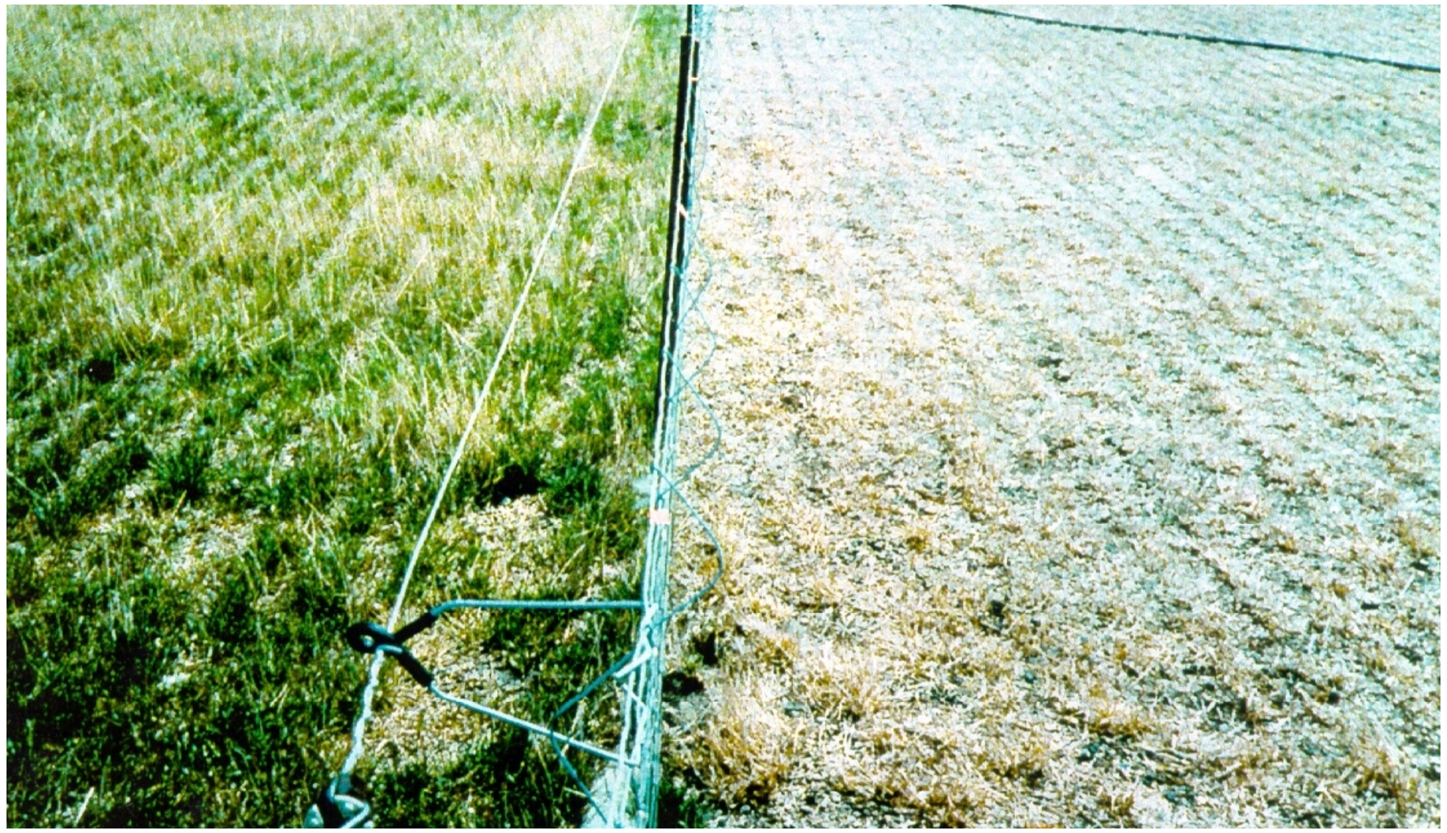


Die-back in ryegrass tiller caused by mining of the stem by ASW larva

ASW larva (2-4 cm long) mining the stem of ryegrass

endophytes which have been inoculated into several ryegrass cultivars which protect against ASW but do not produce the toxins that cause animal health problems. These new associations are being evaluated in grazing trials at Lincoln and the results to date are very encouraging. These endophytes are likely to be the first available to farmers in commercial ryegrass cultivars in 3-5 years time.

Exit hole made by ASW larva emerging from ryegrass stem



Comparison of pastures. - High endophyte pasture (left) and nil endophyte pasture (right) destroyed by ASW larval feeding

Biological Control of ASW by Parasitoid Wasp

Understanding the ecology and population dynamics of pests makes it possible to exploit weak links in their life cycle. In its native homeland of South America, ASW is naturally controlled by several natural enemies but arrived in NZ free of these predators. The parasitoid wasp Microtonus hyperodae is the most important of the several enemies of ASW.

Eight different strains (ecotypes) of the wasp were collected from South America and brought to NZ. All eight strains have been released at each site in Taranaki to ensure that the full genetic range of parasitoid is present. Time will determine whether one strain will work better than the others.

The adult parasitoid is capable of laying up to 60 eggs in its two week life cycle. The wasp uses its sharp ovipositor to penetrate the soft parts of the weevil and deposit a single egg inside. Female weevils are sterilised once parasitised. The parasitoid can also distinguish between already parasitised and unparasitised ASW which means that every egg leads to a dead weevil.

The parasitoid release sites need to be managed for the first 2-3 years to facilitate successful establishment and buildup. Pastures should be kept between 3-15 cm for at least 18 months. Mob-stocking, pugging and insecticide use on the release sites should be avoided.

Integrated Pest Management (IPM)

The parasitoid will never totally eradicate ASW in Taranaki, but in time will reduce the overall ASW population density to a lower equilibrium. However, as biological control is a dynamic system, there will be occasions where ASW numbers temporarily 'escape' from the parasitoid. For this reason, long term control of ASW will rely on the integration of several pest management practices. The parasitoid will form a significant component of this IPM but 'animal friendly' or high-tillering pasture cultivars and farm management practices such as sowing time, grazing, and irrigation management will be essential components to successfully managing ASW.

Benefits of Biological Control

It is expected to take 5-10 years for the parasitoid to build up and disperse from the 40 release sites to cover the whole Taranaki region. Assuming that 50% parasitism of the ASW is achieved, a 6% increase in pasture drymatter (DM) production could be expected. An independent economic evaluation for a dairy farm predicted that the increase in DM would equate to approximately 54kg milksolids / ha per year in some cases.