



THE UNIVERSITY OF  
**SYDNEY**

McGarvie Smith  
INSTITUTE

# **Study of lower-virulent footrot in NSW**

**Final Report**

**Date: December, 2021**

**Prepared by: Associate Professor Om Dhungyel and Ms. Karen Smith.**

## **Project Background:**

Clinical forms of footrot in Australia range from highly virulent through to lower virulent and benign. Highly virulent footrot is easy to recognise clinically and easy to eliminate because infected sheep can be readily identified. In flocks infected with highly virulent strains of *D. nodosus*, many sheep may present with severe, underrun lesions. In contrast, lower virulent or benign footrot can be difficult to recognise clinically if the environmental conditions are not ideal and the disease has not expressed. Lower virulent footrot can cause significant economic losses and welfare issues in a flock where conditions are ideal for footrot expression.

Historically, research has focussed primarily on classically virulent footrot, and consequently, intermediate forms of the disease are poorly understood. Additionally, a knowledge gap is emerging in NSW with the loss of expertise through natural attrition, and the relative inexperience of younger vets who have had little direct experience with footrot. There is anecdotal evidence that despite the success of the NSW Footrot Strategic Plan in eliminating classically virulent footrot from much of the State, lower virulent footrot has persisted and has increased in prevalence, particularly in south-eastern NSW and the Central West. In many cases the presence of border-line virulent strains, coupled with good environmental conditions, can result in disease of a moderate severity, and the imposition of quarantine and control measures. However, in contrast to flocks with classically virulent footrot, eradication programmes are less likely to succeed in flocks infected with lower virulent prolonged quarantine.

In NSW in particular, lower virulent forms of footrot have been identified as a major challenge, both by the affected farmers, district veterinarians, and biosecurity officers. A lack of knowledge and understanding, and the absence of tools to deal with these forms of footrot, is seen as a major gap for further research in this field.

As part of a PhD program Ms. Karen Smith was supported by McGarvie Smith Institute fund for the study of these lower virulent forms of footrot. Following studies have been supported by this funding:

### **1. The severity of footrot lesions induced by aprV2-positive strains of *Dichelobacter nodosus* varies between strains**

#### **Abstract**

The severity of ovine footrot, caused by *Dichelobacter nodosus*, ranges from benign to the more severe virulent form. The primary virulence factors of *D. nodosus* are the extracellular proteases AprV2, AprV5 and BprV and the type IV fimbriae (encoded by the *aprV2*, *aprV5*, *bprV* and *fimA* genes respectively). Previous research has shown that the AprV2 protease is required for elastase activity and the development of underrun foot lesions, but correlations between the presence of *aprV2* (detected using PCR) and clinical disease have been inconsistent. In this study the virulence of three *aprV2*-positive field isolates of *D. nodosus* which had benign or intermediate phenotypes and an *aprV2*-positive virulent reference strain was evaluated in sheep using a pasture-based experimental infection model. Severe underrun (score 4) lesions developed in the sheep infected with the virulent reference strain but not in those infected with the field isolates in which lesions were mild (score 2 or 3). This suggests that the *aprV2* gene may not be a reliable indicator of virulence and that further investigation of the factors that determine virulence is required. A second objective of this study related to the elimination of *D. nodosus* because benign and intermediate strains of *D. nodosus* are reported to be difficult to eliminate. However, the three field isolates and the virulent reference

strain of *D. nodosus* were eliminated by intensive foot bathing and antibiotic therapy in combination with housing the animals in dry conditions post-treatment.

## **2. Efficacy of bi-valent fimbrial vaccines to control and eliminate intermediate forms of footrot in sheep**

### **Abstract**

The aim of this study was to determine the efficacy of serogroup-specific bi-valent fimbrial vaccines in the control and elimination of relatively mild (intermediate) forms of footrot in sheep flocks in NSW, there being some evidence that such forms are difficult to control.

Four flocks of sheep with history of footrot of intermediate virulence were selected based on clinical and bacteriological diagnoses. *D. nodosus* serogroups included in bi-valent vaccines at each farm were based on on-farm serogroup-prevalence data. Two doses of bi-valent vaccine were administered with a 4-week interval between doses. Repeated post-vaccination inspections of all feet of between 100 and 119 animals per mob were conducted and foot swabs were collected for bacteriological testing. Blood samples were collected from 10-24 individually identified animals per flock at each inspection to check for agglutinating antibody responses.

In the majority of animals, antibody levels for serogroups included in each vaccine were above the level believed to be required for protective immunity. Footrot disappeared on farm 1 prior to vaccination but did not reappear post-vaccination. Footrot was controlled but not eliminated on farms 2, 3 and 4, where the prevalence and severity of the disease and number of serogroups present were reduced.

Serogroup-specific bi-valent vaccines can be effective at controlling footrot caused by intermediate strains of *D. nodosus*.

### **Publications:**

1. *KJ Smith, MJ Rosser, AS McPherson, RJ Whittington, NK Dhand and OP Dhungyel\**. The severity of footrot lesions induced by aprV2-positive strains of *Dichelobacter nodosus* varies between strains. *Australian Veterinary Journal*, Vol 99, No.7, 279-287, 2021.
2. *KJ Smith, RJ Whittington, MA Corrigan, BI Edmonstone, N Cronin, NK Dhand, OP Dhungyel\**. Efficacy of bi-valent fimbrial vaccines to control and eliminate intermediate (lower virulent) forms of footrot in sheep. *Australian Veterinary Journal* 2021, doi: 10.1111/avj.13138.

### **Conference Presentations:**

1. *KJ Smith, RJ Whittington, NK Dhand and OP Dhungyel*. Study of the lower virulent footrot in NSW. Sydney School of Veterinary Science, Annual Post Graduate Conference, November 2020.
2. *KJ Smith, RJ Whittington, NK Dhand and OP Dhungyel*. Study of the lower virulent footrot in NSW. NSW District Veterinarians Annual Conference, Broken Hill, March 2021.

