Gastrolobium spp. Poisoning in Sheep—A Case Report

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Abstract

This report describes the history and investigation of a suspected plant poisoning event in Western Australia where 15 sheep died. One of the poisoned sheep was necropsied, and gross and microscopic pathology of the poisoned sheep is described. Monofluoroacetate was detected in rumen contents from the necropsied sheep. The case history, pathological changes, and detection of monofluoroacetate in the rumen contents support a diagnosis of monofluoroacetate intoxication. A review of the literature suggests this is the first example of detection of monofluoroacetate in the rumen contents of an animal poisoned by a plant containing monofluoroacetate.

Keywords: *Gastrolobium* spp., monofluoroacetate, poisoning, sheep

Introduction

Many plants found primarily in the southern continents of Africa, Australia, and South America, belonging to the Fabaceae, Rubiaceae, Bignoniaceae, Malpighiaceae, and Dichapetalaceae families, contain monofluoroacetate and adversely affect livestock production on these continents (Lee et al. 2014). Australian species of *Gastrolobium* and *Acacia* produce monofluoroacetate and have had a significant impact in the settlement of Australia (McKenzie 2012). Early colonists of Western Australia (WA) experienced heavy livestock losses due to animal consumption of *Gastrolobium* spp., which resulted in the colloquial term for the plants as "poison peas" (Marchant 1994). There are over 100 *Gastrolobium* spp., primarily in WA, and many continue to affect modern-day farming (Chandler et al. 2002, 2003).

Aplin (1971) reported large variations in monofluoroacetate concentrations between different *Gastrolobium* spp. and between plants in the same species even at the same location.

Monofluoroacetate concentrations tend to be highest in reproductive tissues such as pods, flowers, and young leaves and much lower in mature leaves and wood (Aplin 1971, Hall 1972, Twigg et al. 1996b, Twigg et al. 1999). There are varying degrees of evidence for toxicity in 39 species of *Gastrolobium* (Bennetts 1935, Gardner and Bennetts 1956, Gardner 1964, Aplin 1971, Twigg et al. 1996a,b, Twigg et al. 1999, Chandler et al. 2002) and an additional 7 species are suspected or presumed to be toxic (Chandler et al. 2002).

This report describes the history and investigation of a suspected plant poisoning event in WA. The gross and microscopic pathology of one of the poisoned sheep is described. Analysis of the rumen contents suggested that the ingestion of a toxic monofluoroacetate-containing plant (*Gastrolobium* spp.) was the probable cause of the poisonings. This appears to be the first report of detection of monofluoroacetate in the rumen contents of a poisoned animal being used to support a diagnosis that they have consumed a *Gastrolobium* sp.

History

In February 2013, 1,200 young mated Merino ewes were introduced into a pasture near Merredin, WA. On or about April 18, 2013, there was a rainfall event. The next day, 10 ewes were found dead. The owner decided to remove the remaining ewes by walking them out of the pasture. Several animals walked slowly, kept stopping, and became recumbent. One of the ewes that became recumbent subsequently died, for a total of 11 dead sheep in this incident. The owner left about 20 sheep in the pasture. The following May, there was another rainfall event, and the owner revisited the pasture the next day to find four dead sheep. A total of 15 sheep died in the two episodes.

Gross Pathology

A sheep in good post-mortem condition from the second episode was necropsied. The ewe was in good body condition and not pregnant. Petechiae were in the myocardium, kidneys were soft, and rumen contents were green and fluid in consistency. Most of the rumen contents were accidentally discarded, with only a few plant pieces saved for identification and analysis.

Suspected Cause of Death

Findings at necropsy suggested enterotoxemia, but the sheep had received two vaccinations against this disease. Also, two episodes of synchronous deaths immediately after rainfall are inconsistent with enterotoxemia, being more consistent with fluoroacetate poisoning, since after a rainfall sheep nibble on toxin-containing bushes. The attending veterinarian suspected that *Gastrolobium stenophyllum* (narrow-leaved poison) was available to these sheep.

Histopathology

Tissues collected at necropsy were submitted to the Animal Health Laboratories of the Department and Agriculture and Food Western Australia for microscopic examination. In heart sections, rare myofibers were swollen, hypereosinophilic, fragmented, and had pyknotic nuclei (necrosis) (figure 1). There was also hypertrophy of interstitial cells, diffuse congestion, and multiple hemorrhages. Lung sections were congested, and proteinaceous fluid filled airways. A light lymphocytic and plasmacytic, periportal infiltrate was in liver sections. No significant findings were observed in sections of brain.

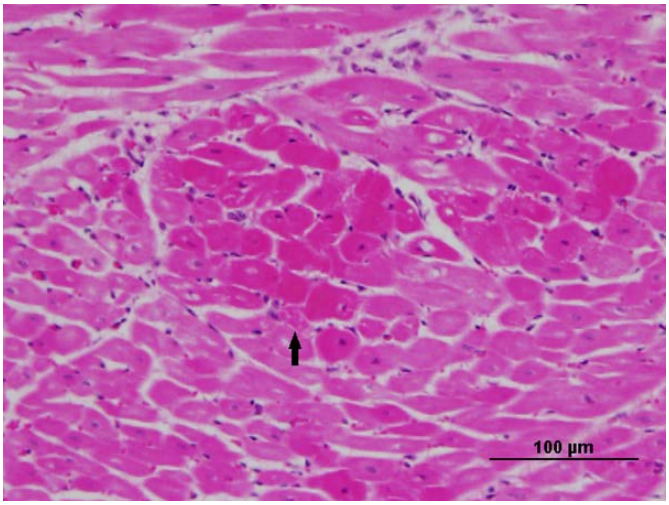

Figure 1. Heart (myocardium) with a focal area of necrosis. The necrotic myofibres are swollen, hypereosinophilic, and fragmented with pyknotic nuclei (arrow).

Mild, multifocal, acute, myocardial necrosis, together with moderate, diffuse pulmonary edema, are suggestive of cardiac toxicosis. In WA, the ingestion of plants containing either monofluoroacetate or cardiac glycosides is usually suspected as the cause of such changes in ruminants that have died unexpectedly.

Plant Identification

Plant fragments recovered during necropsy were examined and could not be positively identified as from a *Gastrolobium* spp.

Chemistry

Using a HPLC-APCI-MS method developed by Lee et al. (2012), monofluoroacetate was detected in the plant material collected from the rumen during necropsy at a concentration of 63mg/kg (figure 2). The identification of monofluoroacetate-containing plant material in the rumen at the time of death supported a diagnosis of monofluoroacetate poisoning, and the veterinarian's suspicion that the

plant fragments collected were from a *Gastrolobium* spp.

Summary

In conclusion, the case history, pathological changes, and detection of monofluoroacetate in rumen contents supported a diagnosis of monofluoroacetate intoxication. A review of the literature suggests that this is the first example of detection of monofluoroacetate in rumen contents of an animal poisoned by a plant containing monofluoroacetate. Methods have been developed to detect monofluoroacetate in rumen contents and liver samples. Monofluoroacetate was spiked into the liver or gastric contents, and it was determined how much could be recovered (Minnaar et al. 2000). In addition, monofluoroacetate has been detected in the kidneys of a lamb and a ewe diagnosed with 1080 (monofluoroacetate) poisoning (Giannitti et al. 2013), and monofluoroacetate has been detected in the blood, heart, skeletal muscle, and liver of sheep that died due to experimental poisoning with 1080 (monofluoroacetate). Significantly, in the last situation, monofluoroacetate was not detected in any of the organs of animals that survived (Gooneratne et al. 2008). In none of these examples was plant material containing monofluoroacetate consumed by the animals. This case demonstrates the diagnostic value of using modern chemical instrumentation to detect toxins in gastrointestinal contents from animals intoxicated by poisonous plants.

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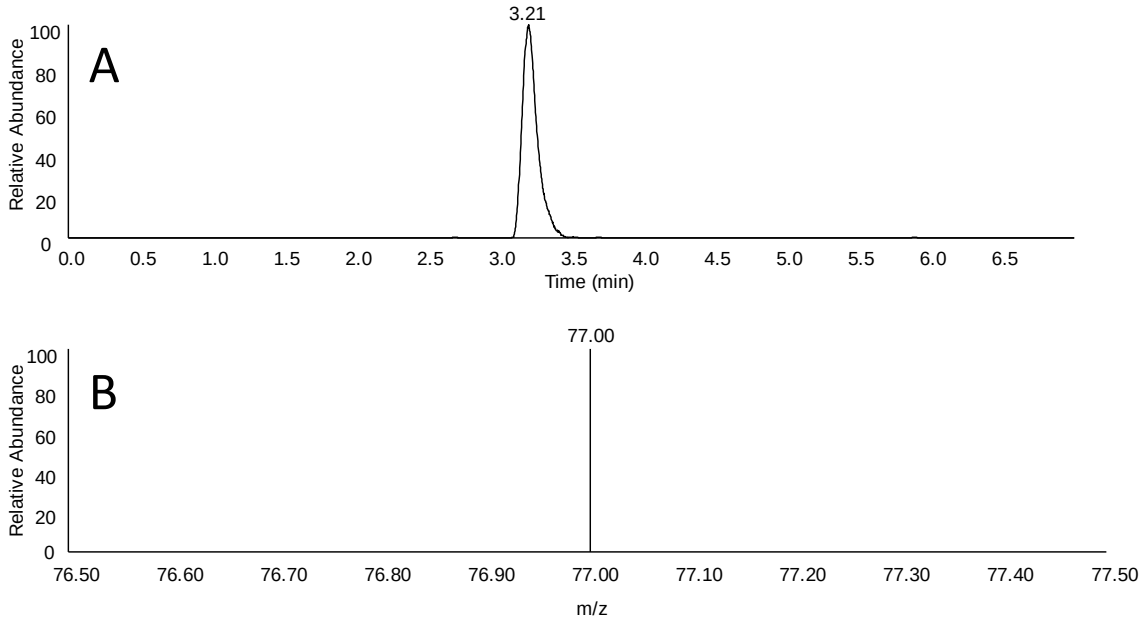

Figure 2. Selected negative ion monitoring HPLC chromatogram at *m/z* 77; of (A) water extract of sheep rumen plant material and (B) the mass spectrum of the peak. *m/z*, mass to charge ratio.

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