Primary photosensitisation in sheep in South Australia

SURVEY

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Introduction

An extensive outbreak of photosensitisation in sheep was observed across South Australia's Eyre Peninsula and Northern Adelaide Plains from late September through the month of October 2017. Large numbers of producers reported lambs and older sheep with swollen ears and faces, some with visibly sunburnt facial skin. These sheep had been grazing a variety of pasture types, but predominantly pastures with a high content of legumes such as medic and vetch species. Some flocks grazing cereals were also affected.

Affected producers contacted PIRSA, livestock agents, farm advisors and nutritionists for information and advice. Most producers moved affected sheep from the pasture and the syndrome rapidly resolved, although a small number of severely affected sheep died. Some testing was conducted on affected sheep, and this indicated some raised liver enzyme levels, and hepatopathy (liver damage) was noted in two severely affected animals.

In some areas producers observed heavy infestations of aphids on the pastures and the theory that aphid consumption was contributing to the condition gained some acceptance. Other producers observed black smut like fungal growth near and on some plant species and a suspicion of mycotoxin induced hepatopathy has also been discussed. However, some affected producers did not report either a heavy aphid infestation or fungal issues. The possibility of aphids being involved is not well understood.

Primary photosensitisation in livestock usually occurs sporadically in association with some *Brassica* species and sometimes on lucerne pasture. Occasionally the condition occurs in small numbers of sheep on other legumes, particularly in monocultures. On this occasion, an estimated 25,000 sheep on mostly legume pastures were affected over a short period. This condition has never been reported on this scale in South Australia. Disease investigations ruled out exotic diseases such as bluetongue and confirmed most cases as primary photosensitivity.

History

Cases of photosensitisation in sheep began to be reported to PIRSA in late September 2017. Reports and alarm escalated through October as more sheep and properties were reported.

PIRSA Animal Health collected data and blood and plant samples from eight properties on the Eyre Peninsula. Another 17 affected properties were reported via Landmark agents and anecdotally there were many more properties affected than this.

The syndrome was reported in ewes, lambs and wethers grazing rye grass, vetch, vetch and medic, and medic pastures. Six of nine producers interviewed reported aphids present, but with varying levels of infestation. One producer reported a black smut or mould growing underneath or near medic plants.

Lesions observed included swollen ears, swollen lips and face, scabby lips and ears, severe conjunctivitis and blindness in some sheep and deaths in a small number of sheep. Most affected sheep recovered quickly when removed from the affected pasture. Some affected sheep responded to injected corticosteroids and confinement in shearing sheds, away from sunlight. Some severe cases had crusty, thickened skin on the face, lips and ears and failed to grow well after being affected.

Some producers reported that they managed the problem by controlling aphids in pastures using insecticides such as LeMat 290 (Bayer) before reintroducing sheep. Aphids were identified as cow pea aphids, *Aphis craccivora*.

Test results

Four post mortem examinations were conducted by PIRSA, and a private Veterinary clinic conducted one investigation. Eleven blood samples were collected from nine properties.

Primary photosensitivity:

Most blood samples submitted showed only mildly elevated levels of the enzymes which indicate hepatic (liver) damage. This suggests that liver damage was not severe, and therefore primary photosensitivity is suspected in most cases.

Secondary photosensitivity:

Preserved liver samples in two cases of severely affected sheep did show evidence of hepatopathy with changes consistent with those observed with secondary photosensitisation. This suggests that in at least some of the severely affected sheep, liver damage was likely to have exacerbated the photosensitivity symptoms.

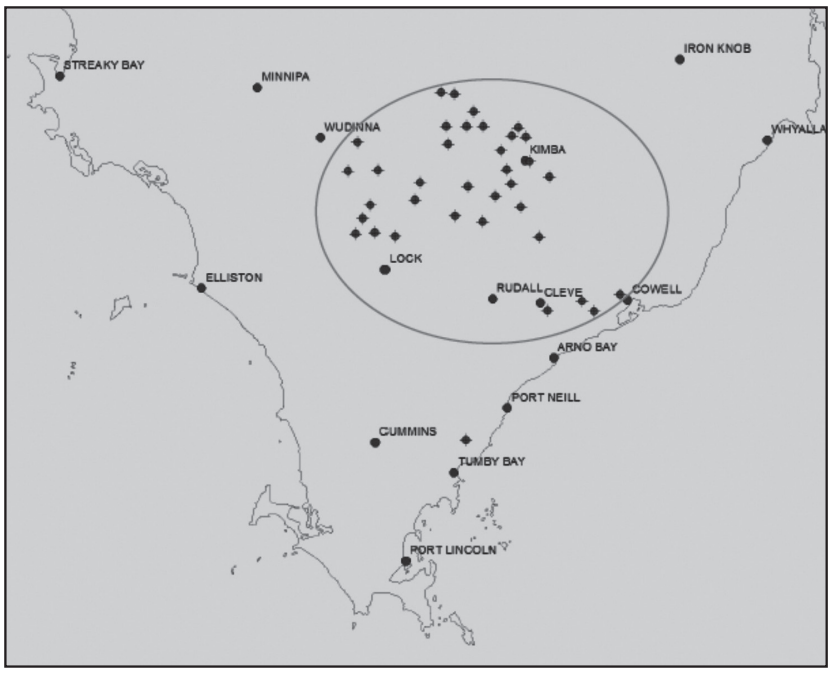

Figure 1. Some of the Eyre Peninsula properties with reported photosensitivity cases in 2017.

Discussion

Sporadic primary photosensitisation in sheep is well documented and known to be associated with particular plants and crops at specific stages of development. The condition normally affects small numbers of animals within a group, some more severely than others, and is often associated with very good growing conditions (Salmon *et al*. 2015). Growing conditions across most of the Eyre Peninsula had generally been poor prior to spring, with well below average biomass production across the region. Above average rainfall in August with a warm spring produced good fodder growth on some of the affected properties, particularly in the Kimba area. Not all affected properties experienced this above average fodder growth.

Sporadic, individual cases of primary photosensitization associated with fast growing, high protein pastures are reported in this area from time to time. The scale of this outbreak and the concurrent severe aphid infestations have not been reported previously in SA.

In this event an estimated 20,000-30,000 sheep were affected across a wide area, with face and ear lesions in young and adult sheep the predominant characteristics. In contrast, the Salmon *et al*. report noted feet lesions as well. Understandably there was some confusion about the co-involvement of parapox virus infection (scabby mouth), and in one case this virus was confirmed. Some exotic diseases involving face lesions (vesicular diseases and bluetongue) were excluded on six properties using serology. Only sheep were reported to be involved in this event, and mainly merino or merino cross-bred sheep.

Primary and secondary photosensitisation have been described from a wide variety of green leafy plants: *Brassicas*, millets, medic species, lucerne and grasses (Radostits *et al*. 2000). Primary photosensitisation is described as "…ingestion of plants containing light sensitive substances" (Robson, 2007). These substances are ingested in amounts that exceed the animal's ability to detoxify through liver activity, and metabolites accumulate in the skin and are transformed into phylloerythrin by sunlight, and this damages the skin. Livestock are generally affected 4-5 days after going on to pastures and new cases cease when removed from the pasture affected. All grazing species may be affected, but there can be individual and species susceptibilities.

In some of these cases, some sheep appeared to respond to injected corticosteroids and/or being confined out of sunlight in shearing sheds to reduce symptoms. Some lambs appeared to be severely affected (possibly some secondary liver damage) and lost considerable condition and value when sold one month later (pers. comm.).

Secondary photosensitisation occurs following liver damage, often due to fungal or plant toxins such as those occurring in lupinosis or in *Heliotrope* (potato weed) poisoning. These toxins damage the liver and allow metabolites to circulate that are activated by sunlight, like they do in primary photosensitivity. Typically, severe cases of secondary photosensitivity do not respond well to treatment, they involve liver damage detectable on blood tests (significant elevation of GGT and AST) and are often fatal. Livestock disease investigations on the Eyre Peninsula sometimes confirm cases of secondary photosensitisation, usually associated with lupinosis or *Heliotrope* poisoning (pyrrolizidine alkaloid toxicity). The history of such cases occurring in the region and the occasional reports of jaundice or cirrhosis from abattoirs suggest that flocks sometimes include sheep with underlying or chronic liver damage. In cases of predominantly primary photosensitisation, individual sheep or even individual mobs may present with more severe symptoms of secondary photosensitivity, possibly due to underlying chronic liver pathology from their earlier grazing history.

While there is no peer reviewed literature describing any causative association between aphid consumption and photosensitivity in sheep, there are some papers that do propose it as a possibility. Ferrer *et al*. (2007) actually investigated whether photosensitivity in sheep grazing lucerne was due to *Aphis craccivora* and/or seven-spot ladybirds (*Coccinella septempunctata)* larvae. These authors concluded that the aphids were not implicated in the photosensitisation cases, while the ladybird larvae were. McClymont and Wynne (1955) proposed the possibility of aphids causing photosensitisation in sheep in NSW, but no research was conducted to establish this.

Other theories of fungal or mycotoxin involvement associated with aphid excretions were circulating during this event, but were not investigated. Not all photosensitivity events were reported and while some cases reported an associated aphid infestation, others did not.

The biochemical and other defence mechanisms that plants have evolved to protect themselves from insect and mammalian herbivores are well reported (War *et al*. 2012; Launchbaugh *et al.* 2001). These anti-grazing attributes in plants reduce their palatability, reduce their digestibility, or induce toxic effects when consumed. Some of these attributes are induced by particular seasonal conditions or by grazing pressure (including herbivorous insects), or by an interaction between these factors and growth stage. Launchbaugh *et al*. (2012) describe how grazing animals have developed mechanisms to contend with the anti-grazing attributes of plants. They discuss how grazing animals manage potentially harmful plant compounds by:

1. Grazing selectively. Diet selection skills involve cautious sampling, consuming a varied diet and consuming plants in a cyclic, intermittent or carefully regulated pattern.
2. Possessing internal systems to detoxify or tolerate ingested plant toxins.

The ecological interactions which may have contributed to this animal health event are not well understood. In contrast, the ability of sheep and other grazing animals to protect themselves from the harmful aspects of plants has been studied at length (Launchbaugh *et al*. 2001). These protective grazing strategies tend to be less available to animals grazing pastures with less species diversity. The mix of plant species available to grazing livestock varies with seasonal conditions, agronomy, ecology, soil nutrition or interactions between any of these.

In cases where animals have chronic liver damage (possibly by longer term exposure to toxins) their ability to detoxify recently ingested material will be compromised, and toxicity symptoms will be more pronounced and slower to resolve. Cereal hay without green matter is suggested as the safest feed for any photosensitivity affected animals (Robson, 2007). To safeguard against photosensitivity risk situations, one option may be to background livestock onto cereal hay prior to grazing risky fodder, and to continue feeding palatable hay throughout the risk situation.

In this event affected producers contacted a range of industry sources for advice and assistance, although there were many producers who did not. If this had been an exotic or new disease incursion, it is pleasing that producers could refer to informed sources. Stock agents quickly contacted PIRSA and producers were able to access funding to assist with investigations and testing. PIRSA Animal Health liaised with producers and collected samples for subsidised veterinary pathology testing and diagnosis. SA Sheep Connect (an industry/government partnership) organised a helpful webinar at short notice with a presentation from Dr Colin Trengrove, and this benefitted regional producers across South Australia.

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