Indigofera toxicity in the Northern Territory

The plant

Indigofera linnaei (Birdsville Indigo) is an Australian native plant with widespread distribution across northern and central Australia. There are at least 29 species of *Indigofera* that have been identified in the Northern Territory, many of which are toxic.

Figure 1: Distribution of *Indigofera linnaei*

Image: Atlas of Living Australia

The plant grows in a variety of soil types but is more prevalent in disturbed and overgrazed areas. In desert regions and places with intermittent rainfall, it is a low-spreading, weedy looking plant, with a thick taproot that enables it to withstand drought conditions and respond rapidly to rainfall. It has numerous thin woody stems that form a mat up to 1.5m in diameter. In higher rainfall areas, the plant grows upright, sometimes to a height of 30 to 45cm.

The leaves are fern-like, and consist of 7 to 9 wedge-shaped leaflets, 3 to 6mm long, that tend to fold upwards along the midrib. Flowers are very small and occur in dense clusters in the forks of the leaves. They are red in colour, turning blue as the leaves dry out. Seedpods are grey, very narrow, sharply pointed at the tip and contain 2 cube-shaped seeds separated by a partition. The pods are about 6mm long.

Figure 2: Low-spreading *Indigofera linnaei* in central Australia, showing red flowers

Image: Atlas of Living Australia

For more information, and to view additional images of Birdsville indigo that may assist with plant identification in pastures, go to the NT Herbarium website.

Toxins

Reports of toxicity associated with *I. Linnaei* are most commonly received from central Australia. *I. linnaei* contains 2 toxins - the liver toxin indospicine and the neurological toxin 3-nitropropionic acid (3-NPA). The nervous system signs in horses associated with Birdsville disease are caused by 3-NPA, which is released during the digestion of *I. linnaei* and rapidly absorbed from the large intestine. When ruminant animals, such as cattle or sheep, consume *Indigofera*, 3-NPA is metabolised and detoxified in the rumen (the forestomach where fermentation occurs), these animals do not absorb it.

Ruminants have the ability to detoxify some of the indospicine they ingest and horses have been shown to be relatively resistant to the effect of indospicine on the liver. However, indospicine is a cumulative toxin, reaching high levels in the skeletal muscles, blood and liver following continuous intake. Levels of indospicine will deplete over time (weeks to months depending on the levels and the species of animals) once access to the plant is withdrawn.

Both toxins are present in the leaves and seeds of the plant at all times (green or dry), but disease outbreaks most commonly occur after rain. At these times, the plant responds more quickly to moisture than other plant species. In this situation, horses are highly likely to consume a large amount of the green plant in a short time, while other edible plants are growing on pasture at a slower rate. On rare occasions at Northern Territory properties, 100% of susceptible horses have died from Birdsville disease within an 8-week period. More commonly however, only 10% of horses are affected during an outbreak.

Under normal grazing conditions, the toxins do not appear to cause clinical disease in cattle in Australia. However, there is some suspicion that grazing of *Indigofera* by pregnant female cattle may cause indospicine-related developmental abnormalities, such as cleft palette in the foetus. The causes of early calf loss on extensively managed properties in central Australia are difficult to quantify, but it is possible that maternal consumption of *Indigofera* is a contributing factor.

Other *Indigofera* species, including *Indigofera australis*, contain toxic compounds, including cyanide, which may lead to staggering, spinal cord damage and sudden death in a range of grazing animal species.

Symptoms of Birdsville disease in horses

Affected horses may show general weakness and nervousness, depression, incoordination, shivering, twitching and swaying.

Incoordination and weakness are more evident when the animal is under physical stress, which may be hazardous to the rider. The toxic effects are often permanent, so a degree of incoordination will remain even after preventing further access to the plant.

The first signs of toxicity observed in horses at rest are loss of appetite and depression, which may develop after 10 days of grazing *Indigofera*. Some affected horses will have bad breath. Cases may progress with evidence of weight loss and toe dragging. This results in a characteristic wear of the front of the hoof. Continual ingestion of the plant will result in death. In some cases, the disease is diagnosed without seeing the horses but by observing their tracks. Toe-drag marks are distinctive and may be continuous.

Symptoms of indospicine toxicity in dogs

Raw and cooked meat from affected camels, horses, donkeys and mules is poisonous to dogs due to the presence of indospicine. Even horses that appear clinically normal may have consumed small amounts of *Indigofera* without developing clinical signs of Birdsville disease. Meat from clinically normal camels, horses or donkeys may cause severe liver damage and death if eaten by dogs and must not be fed to pets. As a precaution, avoid feeding pet meat harvested from horses, donkeys or camels if it originates from an area where Birdsville disease can occur.

There is no information available on the potential toxicity of pet meat obtained from kangaroos or wallabies.

Management and treatment of toxin-affected horses

Awareness of this disease and the monitoring of horses during critical periods of the year is important. Horses should have limited access to *Indigofera*. If this is difficult, supplementary feeding is required during critical periods, such as after spring or summer storms if other feed is not plentiful.

While there is no evidence that indospicine causes the neurological signs seen in Birdsville disease in horses, a neurological study suggests that “indospicine-induced arginine deficiency could exacerbate the neurological effects of 3-NPA”. In simple terms, this means that feeding a large amount of arginine to vulnerable horses may prevent Birdsville disease, because indospicine indirectly enables the activity of 3-NPA on the nervous system.

A clinical feeding trial conducted in Alice Springs in the late 1960s reflects this belief. Horses fed supplements containing elevated levels of arginine showed excellent protection from disease while still consuming *Indigofera*. Feeding lucerne hay (5kg/day – about half a small bale), peanut meal (0.5kg/day) or linseed meal (0.75kg/day) is the recommended preventative measure, based on the results of this study. Horse lick blocks containing a high level of arginine are also commercially available. These provide ad lib access to the supplement in high-risk paddocks.

Horses with advanced disease, especially those with severe incoordination, should be euthanised on humane grounds. Less severely affected horses may be drenched with 400g gelatine every day and fed an arginine-rich feed as described above. Recovered horses will suffer residual effects of toxicity and may behave unpredictably and be unsuitable for further work.

Prevention of indospicine poisoning

The *Meat Industries Act 1996* bans the slaughter of horses, donkeys, mules or hinnies for human consumption if the animals are exhibiting signs of Birdsville horse disease. Slaughter for pet food is also banned if these animals originate from an area in which *Indigofera* poisoning occurs within the Territory.

I. linnaei is reportedly a favoured food of feral camels in the Territory. Consumption of the plant does not affect camel health, but deaths have been reported in dogs that have eaten camel meat containing high levels of indospicine.

Birdsville indigo can be managed through use of Dicamba and Metsulfuron, both available under various trade names. Chemical control would only be practical over small areas.

Although legislation controls use within the Territory of central Australian horses, donkeys, mules, hinnies and camels for pet food, movement of affected animals interstate may still occur.

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