



Australian Government
Rural Industries Research and
Development Corporation

Plants Poisonous to Horses

An Australian Field Guide

RIRDC Shaping the future

Plants Poisonous to Horses

An Australian Field Guide

Mellisa Offord

RIRDC Shaping the future

Disclaimer by RIRDC

The information contained in this publication is intended for general use to assist public knowledge and discussion and to help improve the development of sustainable industries. The information should not be relied upon for the purpose of a particular matter. Specialist and/or appropriate legal advice should be obtained before any action or decision is taken on the basis of any material in this document. The Commonwealth of Australia, Rural Industries Research and Development Corporation, the authors or contributors do not assume liability of any kind whatsoever resulting from any person's use or reliance upon the content of this document.

This publication is copyright. However, RIRDC encourages wide dissemination of its research, providing the Corporation is clearly acknowledged. For any other enquiries concerning reproduction, contact the Publications Manager on phone 02 6272 3186.

In submitting this report the researcher has agreed to publishing this material in its edited form.

Disclaimer by author

The information presented in this publication are intended as a guide to the plants in Australia that are poisonous to horses. All care and diligence has been exercised in interpreting published information as the basis for the information presented in this book.

Specific circumstances and research findings after the date of publication may influence the accuracy of the information within this book. The author accepts no responsibility and disclaims any liability for any error, loss or unforeseen consequence that may arise from relying on, or adopting, any of the information in this publication.

RIRDC contact details

Level 2
15 National Circuit
BARTON ACT 2600

PO Box 4776
KINGSTON ACT 2604

Phone: 02 6272 4819
Fax: 02 6272 5877
Email: rirdc@rirdc.gov.au
Web: www.rirdc.gov.au

Published in June 2006.
Publication design and graphics by Mellisa Offord.
Cover design by RIRDC Publications.
Edited by Karen Drake. Sydney 02 9453 2420

Researcher's contact details

Mellisa Offord
PO Box 461
Forestville NSW 2087

Phone/Fax: 02 8901 0622

©2006 Rural Industries Research and Development Corporation
All rights reserved

ISBN 1440-6845
ISSN 1 74151 311 1

Plants Poisonous to Horses - An Australian Field Guide
Publication no. 06/048
Project no. OFF-1A

Front and back cover photograph: Mellisa Offord

Foreword

Many plants that grow in Australia are potentially poisonous to horses. Such plants can cause considerable economic and welfare problems for horse owners. Under most circumstances, horses will avoid consuming toxic amounts of poisonous plants. However, some poisonous plants are palatable to horses and some need only be consumed in very small amounts to cause poisoning. Horses may choose to eat poisonous plants when there is little alternative forage. Also, seasonal conditions may influence the toxicity levels of certain plants, making them more deadly at various times of the year.

An awareness of toxic plants growing in Australia and an understanding of the factors that influence the risk of poisoning will help horse owners keep their horses safe. Pasture management decisions and landscaping decisions should be made with consideration to plants that are potentially poisonous to horses.

This book is designed as a guide for horse owners to help them prevent plant poisoning in their horses. It clearly outlines the factors that influence the risk of plant poisoning and the ways to reduce this risk. The types of toxins that can be found in plants are discussed, along with the signs of poisoning that may be seen in horses that have ingested toxic plant material. A description of each plant is provided, including structure, growth habit and identifying features. Management notes suggest ways of dealing with poisonous plants on properties. The book includes a comprehensive list of ornamental plants that are known to be toxic to horses. The reference list is a useful resource for further reading and includes the journal articles, industry papers, books, CD Roms and Internet resources that were used to create this publication.

The production of this book was funded through industry revenue which was matched by funds provided by the Australian Government.

This book, an addition to RIRDC's diverse range of over 1500 publications, forms part of our Horse R&D program, which aims to assist in developing the Australian horse industry.

Most of our publications are available for viewing, downloading or purchasing online through our website:

- downloads at www.rirdc.gov.au/fullreports/index.html
- purchases at www.rirdc.gov.au/eshop

Peter O'Brien

Managing Director

Rural Industries Research and Development Corporation

Acknowledgments

I would like to acknowledge the following people and organisations for their support in the production of this book.

The Rural Industries Research and Development Corporation.

Jane Vincent and John Freestone for their continued support and encouragement in the production of this publication.

Ross McKenzie for supplying photos and for reviewing the publication and offering expert toxicology advice on many of the plants in the book.

My family for their support and encouragement. In particular I would like to thank my sister Cathy Offord and my mother Pat Offord for their expert botanic advice.

Susanne Hourigan for supplying photos and information on crotalarias.

Matthew Smyth for supplying photos and information on Paterson's Curse.

Many thanks go to the individuals who contributed photos. In particular I'd like to thank Ken Harris and Sheldon Navie for allowing me access to their extensive photo collections. I would also like to thank Paul McGreevy, Peter Windsor, Mary Alice Mitchell and Calder Chaffey for their contributions. Those that have no acknowledgement have either been supplied by myself or RIRDC.

Reuben Rose for his encouragement and feedback on the content of the book.

Barbara Wiecek for advice and information on plant identification.

Table of contents

The risk to horses from poisonous plants.....	1
Controlling poisonous plants.....	2
Naming plants	4
Identifying plants	5
Using this book.....	6
Alkaloids	
Pyrrolizidine alkaloids.....	7
Paterson's curse	8
Crotalaria.....	9
Senecios	12
Heliotropes.....	14
Amsinckias	16
Tryptamine alkaloids.....	17
Blue canary grass	17
Paradoxa grass	17
Indolizidine alkaloids	18
Swainsonas	18
Taxine alkaloids.....	20
English yew.....	20
Tropane alkaloids.....	21
Field bindweed	21
Thornapples	22
Angel's trumpet.....	23
Poison corkwood	23
Corkwood	24
Piperidine alkaloids.....	25
Hemlock	25
Quinolizidine alkaloids.....	26
Lupins	26
Golden chain tree	27
Brooms	27
Pyridine alkaloids	29
Tobaccos	29
Lobelias	29

Glycosides

Cyanogenic glycosides 30

Prunus	31
Sorghum.....	31
Other plants that can accumulate cyanogenic glycosides:	32

Cardiac glycosides..... 35

Oleander	35
Yellow oleander	36
Rubber vine	37
Purple rubber vine	37
Mother of millions	38
Cape tulips	39
Cotton bushes	40
Foxglove.....	41
Ornithogalums.....	42
Blue periwinkle	42
Pheasant's eye	43

Protoanemonin..... 44

Celery-leaf buttercup	44
-----------------------------	----

Steroidal saponins 45

Panicum spp	45
-------------------	----

Carboxyatractyloside..... 46

Noogoora burr	46
Bathurst burr	47
Green cestrum	48
Night scented jasmine	49

Calcinogenic glycosides..... 50

Day jasmine	50
-------------------	----

Alcohols and Acids

Soluble oxalates..... 51

Nutritional Secondary Hyperparathyroidism or 'big head'	51
---	----

Tannic acid 53

Oaks	53
------------	----

Quinones 54

St John's wort	54
----------------------	----

Proteins and Amino acids

Lectins..... 55

Castor oil plant	55
Crab's eye	56
Black locust	57
Jatropha.....	57
Beans.....	58

Propyl disulfide	60
Allium spp	60
Garlic supplements	60
Thiaminase	61
Bracken	61
Nardoo	62
Rock ferns	63
Horsetails	63
Terpenes	
Diterpene esters	64
Leafy spurge	64
Meliatoxins	66
White cedar	66
Other toxins	
Black bean	67
Crofton weed and Mistflower	68
Australian stringhalt	70
Nightshades	72
Chillagoe horse disease	75
Avocado	76
Senna	77
Red clover and alsike clover	79
Selenium poisoning	81
Privets	82
Chewing disease	83
Dune onion weed	85
Gomphrena weed	86
Small flowered mallow	87
Red maple	88
Birdsville horse disease	89
Irritants	
Stinging nettles	90
Gympie stinger	91

Plant associated mycotoxins	
Perennial ryegrass staggers	92
Paspalum staggers	93
Endophytes and pregnant mares	94
Aflatoxins	95
Equine leukoencephalomalacia	96
Lupinosis	96
Plant associated bacterial toxins	
Corynetoxins	97
Ornamental plants	99
Table of plant features and possible signs of poisoning	104
Glossary of terms	109
Glossary of botanic features	110
References	112
Index	117

The risk to horses from poisonous plants

Put simply, a poisonous plant is one that will have a detrimental effect on humans or animals if eaten. Plant toxins act as a chemical defence for the plant and most poisonous plants contain toxins that evolved to protect the plant against attack by insects. Some of these toxins are also poisonous to animals.

There are said to be around 1000 poisonous plants that grow in Australia. However, not all of these plants are considered a risk to horses. Some plants contain toxins that are not thought to affect horse health, some are very unlikely to be found in areas where horses are kept and some need to be eaten in such large quantities to induce poisoning, or so unpalatable to horses, that in practical

terms their risk to horses is virtually non-existent. The plants described in this book are either known to be poisonous to horses because poisoning cases have been well documented, or they are suspected to be poisonous to horses and are commonly found in areas where horses are kept.

Horses are grazing animals that have evolved to selectively browse on pastures that contain a wide variety of plants and grasses. Domestication has altered the diet of horses, their daily habits and the environment in which they live compared to their ancestors. The way that horses and horse properties are managed can play a major role in reducing the risk of plant poisoning.

Risk factors for plant poisoning

- **Type of toxin or toxins:** Different plant toxins have different effects on horses. Some plant toxins may have mild effects if ingested and some may be deadly. Plant toxins can affect body systems such as metabolism, the heart, brain, liver or the skin.
- **Stage of growth:** Some plants contain different amounts or types of toxins at different stages of growth.
- **Season:** Some plants are only poisonous at certain times of the year.
- **Environmental factors:** Environmental factors such as drought, flooding and fire can influence the growth of poisonous plants and the amount of toxins that they might contain.
- **Fertilisers:** The use of fertilisers can cause a flush in growth of potentially poisonous plants and it can increase the amount of toxins in some plants.
- **Herbicides:** The use of herbicides can make some poisonous plants more palatable to horses and these plants may be eaten when they would otherwise have been avoided. Wilted or dried poisonous plants are often just as toxic as fresh plants. Horses should ideally be removed from pastures that have been treated with herbicides until the toxic plants are no longer present.
- **Part of the plant eaten:** The different parts of some poisonous plants contain different amounts and/or types of toxins, for example the leaves, roots, bark, flowers and seeds of a plant may contain different levels of toxins and different types of toxins.
- **Availability of safe alternative feed:** Hungry horses are more likely to eat plants that they would otherwise avoid.
- **Boredom:** Horses that have low levels of activity or low levels of stimulation from their environment may indiscriminately graze on plants through boredom.

- **New environment:** Horses that have been moved to a new area may graze on unfamiliar plants. This factor should also be considered when horses are transported to events and are housed in unfamiliar surroundings, even if it's only overnight.



Pony club horse yards that have become overgrown with grass and a variety of weeds during the summer pony club break

- **Age and general health of the horse:** Young and old animals are often at an increased risk of poisoning if they eat toxic plant material. A healthy horse is better able to cope with the effects of a poisonous plant compared to a horse that is already unwell, is under- or overweight or has other health concerns.
- **Exposure to poisonous plants:** Most pastures contain some level of potentially poisonous plants. A few scattered poisonous plants in a healthy pasture are not generally a risk. Horses will either avoid these plants or they will not consume them in amounts that would cause poisoning. Some plants however can be toxic if only small amounts are ingested and others are palatable to horses and may be grazed preferentially – these plants should always be controlled in horse pastures. Poisonous plants should be controlled if a horse is kept on degraded or unhealthy pastures, in a very small paddock or in a yard. If a horse has little choice of alternative forage, the risk of poisoning is greatly increased.

Controlling poisonous plants

It is good practice to take periodic walks around your property to check for the presence of potentially poisonous plants. This will not only reduce the chance that your horses may be exposed to poisonous plants but will allow you to keep any potential weed or pasture problems in check.

Many poisonous plants are also considered weeds. In the following section the term 'weed' refers to all invasive plant species, including ornamental plants, that grow as weeds in areas where horses are kept.

Avoid the introduction of weeds

If your property does not have poisonous weed species growing in the pasture it is best to try and keep it that way. There are some simple management techniques that will help keep your property free of invasive or poisonous weeds.

- Make yourself aware of the weeds and plant species that can be invasive in pastures and/or poisonous to horses.
- Always be on the lookout for potentially invasive or poisonous weed species. It is much easier to deal with these weeds when only a few small plants are in the pasture, rather than deal with them when they have spread to become large infestations. Some invasive weeds can spread from a few isolated plants to become the dominant species in a pasture in just one season!
- Check hay that is to be fed on the ground does not contain the seeds of potentially invasive weeds.
- If you borrow or hire farm machinery such as mowers, slashers or cultivating equipment, ensure it is clean before it comes onto your property. The same applies to situations where you might lend your own machinery to be used on another property – ask that it be cleaned before it is returned. Weed seeds, root and stem fragments left on farm equipment is a major source of the spread of weeds.
- Weed seeds, root or stem fragments can also be introduced onto properties in the mud that is left on the wheels of vehicles. It is a good idea to remove mud from your vehicle before driving onto your property. This is especially important if you have been in an area where particular weeds that you don't have, or want, are commonly found.
- When introducing new stock to your property, whether it is a horse or other livestock species, try to confine the animals in a separate small paddock for the first 10 days to 2 weeks after arrival. Weed seeds can still be viable when passed through an animal's digestive tract. This is especially so for horses as most weed seeds are unchanged from one end to the other when they pass through a horse. During this quarantine period manure can be collected and disposed of and the paddock can be watched for the emergence of weeds. Quarantining new animals on a property is also good practice to minimise the chance of a new horse spreading disease to other horses on the property.
- Check newly arrived stock for weed seeds that might be present in their coats, manes, tails or in their hooves.

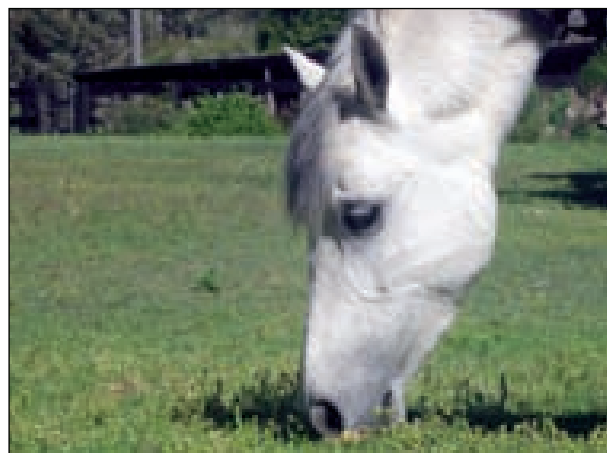
Controlling weeds

Integrated Weed Management refers to strategies that use the greater combined effect of mechanical, chemical and biological control methods to reduce weed populations. The best way to control weeds in pastures and around horse properties is through an integrated weed management approach.

Pasture management

The establishment of good pastures is one of the best ways to keep weeds and potentially poisonous plants to a minimum. Keeping down weeds and poisonous plants is of course only one benefit of maintaining good pastures. Good pastures will also supply the nutritional needs of most horses and will reduce the need for supplementary feeding.

There are many good books on pasture management available and one excellent resource for information on growing and maintaining pastures in Australia is the book



Pastures for horses – a winning resource (Avery 1996). Advice on pasture management can also be sought from your local agronomist.

Mechanical control of weeds

- Small isolated plants can be pulled out by hand and this is a cheap and simple method of dealing with weeds before they spread or become too large to remove manually. It is always best to use gloves when hand-removing plants and this is especially important when handling plants that are poisonous or have irritant sap, prickles, burrs or stinging hairs.
- Mowing or slashing pastures before weed species set seed can be an important management technique to control some particular weeds. It is important to get the timing and cutting height right to ensure the weed problem is reduced and not made worse! Sometimes mowing or slashing a paddock only serves to increase the spread of seed or stem fragments of weed species. It is always best to consult a local agronomist or weed management agency before devising a mowing or slashing program for your property.
- Cultivation of paddocks is sometimes the only option when pastures are degraded and are dominated by highly invasive weeds. If you decide to 'start over' with your pasture it is important to plan ahead and gather as much information and professional advice as possible before embarking on a complete pasture renovation.



Grazing management to control poisonous weed species

Sheep, cattle and goats are more tolerant of some poisonous weed species than to horses. In some circumstances it may be useful to intensely graze these animals on infested pastures to control the weeds. Advice

should be sought from a local agronomist or weed management agency before implementing this weed control strategy.

The use of herbicides

Herbicides are often an effective way to control individual weeds or infestations of weeds. It is advisable to contact a local agronomist or weed management agency before using herbicides as it is important to select the correct herbicide and spray program for the individual weed

species and the conditions on your property. It is also important to ensure that the use of herbicides on your property will not adversely affect desirable pasture species, native plants and animals, or the environment, as could occur when using herbicides along waterways.

Biological control of weeds

Biological control is the use of natural enemies to control weeds. Many invasive weeds in Australia have been introduced from other countries but their natural enemies do not exist here. Biological control of these weeds usually entails careful planning and research, culminating in the controlled release of a weed's natural enemy. Biological controls can be insects that specifically feed on the target weed species or they can be a fungus or other

organisms that cause disease in only the target weed. In some cases, landowners are able to participate in biological control programs for certain weeds. More information on the status of biological controls for particular weeds can be sought through your local agronomist, weed management agency or your state Department of Agriculture.

Disposing of weeds and poisonous plant materials

- Individual plants that are pulled from the ground can be composted if they do not have seeds present or nodes from which they may shoot new roots.
- Individual plants that do have seeds or nodes capable of shooting new roots should be placed in plastic bags before disposal.
- Large amounts of weed material can be burnt, composted or taken to council green waste locations.
- Ensure that potentially poisonous weeds and the prunings of ornamental species are not dumped or composted in horse paddocks. Wilted plant material is often more palatable to horses than fresh plant material and the dumping of poisonous plants in horse paddocks is a significant risk for poisoning.

Naming plants

People usually refer to plants by their common name and most of the time the use of common names for plants is appropriate. However the use of common names can sometimes lead to confusion over plant identity because some plants share common names, some plants have multiple common names and some plants have common names that are only used in particular geographic areas. Fortunately there is a system of plant naming that may look confusing at first but it greatly reduces confusion over plant identification. This system is called Binomial Nomenclature and it was first developed in the 1750s

Plants are grouped according to shared characteristics and all plants are assigned a botanical name (scientific name) that consists of two latin words. The first word indicates the genus to which a plant belongs and the second word indicates the species of a plant.

Plants that are in the same genus are closely related and they have similar characteristics. The species name indicates a grouping of plants within a genus that have identical features or close to identical features. Genera that possess similar characteristics are grouped into families.

You will notice in this book that some plants have been given multiple botanical names. This is because taxonomists are constantly refining the relationships

between plants, and the recent development of DNA techniques has been particularly helpful in establishing the similarities and differences between groups of plants. As new information has been discovered, plants may have been allocated to a different genus or to an entirely new genus in some cases. Some species have been split into two or more new species and some groups of species have been combined. The old or alternative names have been included in this book in cases where plants have been recently renamed or in cases where there may still be confusion over a plant's botanical name.

Each plant described in this book is given the following naming information:

Common name
(other common names)

Botanical name (other botanical names or older names if applicable) [family]

Example –

Crofton weed
(catweed, sticky eupatorium, Mexican devil, sticky snakeroot)

Ageratina adenophora (also known as *Eupatorium adenophorum*, *Eupatorium glandulosum* or *Eupatorium pasdadense*)
[Asteraceae]

Some notes about plant names

The plural of the word genus is “genera”. The word “species” applies to both the singular and the plural but their abbreviations are different. The singular abbreviation for species is ‘*sp*’ and the plural abbreviation for species is ‘*spp*’, so *Crotalaria sp* is used when referring to a particular unspecified species of *Crotalaria* and *Crotalaria spp* is used when referring to several unspecified *Crotalaria* species or all species of *Crotalaria*.

It is a plant naming convention to express both the genera and the species names in italics. In this book italics are used for

genera and species, except when referring to plants using their genera as a common name. For example: it is appropriate to write both ‘there are several species of *Crotalaria* in the pasture’ and ‘there are several crotalarias in the pasture’. In the second phrase ‘crotalarias’ is used as a common name for the plants and italics are not used. This use of genera as a common name without italics is in line with the plant naming conventions of many horticultural societies but not all taxonomists agree with this convention.

Identifying plants

Poisonous plants do not, unfortunately, have any particular characteristics that indicate their potential toxicity.

The identification notes in this book are designed to assist in the identification of potentially poisonous plants. Some of these plants can be easily identified from the notes and from the photos. Other plants are more difficult to identify and further research may be needed before undertaking any action to either remove or keep particular plants in horse areas.

It is important to correctly identify plants that are potentially poisonous for reasons that include:

- Mistakes in identification can be dangerous to horses if poisonous plants are mistakenly identified as safe plants.
- Mistakes in identification can result in wasted money, time and effort if safe plants are removed from horse areas on the mistaken belief that they are poisonous.
- Some genera contain both poisonous species and Australian native species that are not poisonous but are vulnerable or endangered. In particular, the genera *Indigofera*, *Swainsona* and *Crotalaria* contain toxic species and non-toxic species that are vulnerable or endangered. All of the plants in some genera are considered toxic to horses, for example *Solanum* and *Senecio*, however these genera also include Australian native species that are vulnerable or endangered. A positive identification of a suspect plant will ensure that the correct management technique is undertaken that will keep horses safe from poisoning and will preserve plants that are vulnerable or endangered.

The avenues through which you can seek help in confirming the identity of a plant include:

- A reputable gardening or botanical book.
- A reputable website that has information on plant identification, for example Australia's Virtual Herbarium <<http://www.chah.gov.au/avh/>>.
- Knowledgeable staff at nurseries or garden centres.
- A local agronomist.
- Your state Department of Agriculture.
- Your state Herbarium.

Some of these agencies provide plant identification services and a fee may or may not be charged. It is usually free to use the public reference collections that

some of these agencies provide. You can find out more information on plant identification services by contacting the appropriate agency by phone or via the Internet.

The more information that you can gather about a plant, the better your chances of identifying it quickly and accurately. Always collect a sample of a plant to assist in identification and samples can be sent by mail to some agencies.

Plant sample preparation:

- The sample should consist of a small branch or a portion of stem that is around 30 cm long and has leaves, flowers and/or fruit still attached.
- Collect the whole plant if it is small. This is particularly important for grasses.
- Where appropriate, collect tubers or bulbs with all or part of the plant attached. Collect a sample of the roots and the fronds when seeking the identity of a fern.
- Collect a sample of the buds, fruit, young leaves and adult leaves when seeking the identity of a tree. Make a note of information such as the bark type, the size and growth characteristics of the tree and the habitat in which the tree is growing.
- If you are mailing a sample to an agency that offers a plant identification service they will usually want you to provide information that includes the date and location of collection of your specimen as well as details of the habitat in which the plant was growing.
- Samples should be pressed and dried before mailing to ensure that they are not destroyed by mould and that mould does not pose a health risk to the person who opens the package containing your sample. Samples can be pressed between sheets of newspaper. Loose seeds or fruits can be put into separate paper bags or envelopes.
- The pressed and dried plant sample should be packed with cardboard to prevent damage. Samples should not be stuck onto paper.

Plant sample preparation information supplied by the Botanical Information Service, National Herbarium of NSW, Botanic Gardens Trust, Mrs Macquaries Road Sydney 2000 Fax 02-9251 1952 <http://www.rbgsyd.nsw.gov.au/information_about_plants/botanical_info/plant_identification>

Using this book

Toxicity information on poisonous plants

The information on plant toxins presented in this book is intended to give the reader some background information on how toxins cause poisoning in horses and the signs that might be seen in horses that have ingested plant toxins. This information may also help the reader when it is necessary to undertake a paddock inspection to locate

a plant that may have caused poisoning symptoms in a horse. The information on the toxicity of plant toxins and the signs that might be seen in poisoned horses should not be used to diagnose or treat a horse that may have been poisoned by the ingestion of toxic plants.

ALWAYS CONSULT YOUR VETERINARIAN IF PLANT POISONING IS SUSPECTED IN A HORSE.

How to find plants in this book

The index containing plant names at the back of this book will make finding a plant of interest easy – if you know its name. If you need to identify a plant that is growing

in your paddock the tables on pages 104-108 show plant characteristics that should guide you towards the correct identity of the plant.

Distribution maps

The distribution map alongside each plant description is meant to serve as a general guide to the areas within Australia in which the plant might be found.

Underneath most of the distribution maps is a brief note on the type of habitat in which the plant is usually found growing.

Management notes

The management notes presented in this book are intended to serve as a guide to some simple management techniques that can be used to control poisonous plants or to protect horses from exposure to poisonous plants. Some of the practices included in the management notes for particular plants in this book may not represent

suitable practice for all horse farms or for all situations. It is important to seek local expert advice before implementing farm management tasks, particularly when intending to use herbicides or when employing practices that may be detrimental to pastures, the environment or animal health.

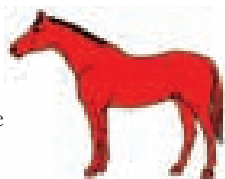
Danger icons

The coloured horse icons are meant to serve as a basic guide to the degree of danger that particular plants pose to horses.

horse areas. Plants that do not cause serious poisoning in horses but are commonly found in pastures may also have a blue icon.

Highly dangerous

Plants with a red icon are those known to be highly toxic to horses, are commonly found in areas where horses are kept and/or they are palatable to horses. Plants that are so toxic that only small amounts of the plant will cause severe poisoning if ingested may also have a red icon.

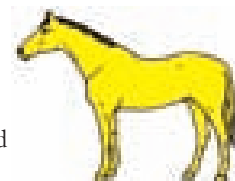


These plants should always be removed from horse areas or they should be fenced off to restrict horses' access to the plants. When fencing off highly toxic plants, ensure that horses can't reach the plant through the fence and that leaves or fallen branches can not end up where a horse might access them. Prunings or clippings of highly toxic plants must never be placed in horse paddocks.

These plants should be controlled or completely removed from horse areas. Management practices should be implemented to ensure that these plants do not become the dominant species in pastures.

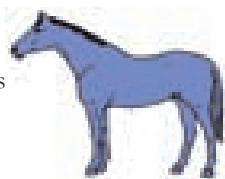
Mildly dangerous

Plants with a yellow icon are those that only cause mild and transient poisoning in horses. A yellow icon might also be assigned to those plants that rarely cause poisoning in horses and are not commonly found in horse areas, or to plants that must be ingested in very large quantities before poisoning occurs.



Moderately dangerous

Plants with a blue icon are those that are known to be toxic to horses but are not commonly eaten, are only toxic under certain conditions, or are not commonly found in



These plants should be controlled where practical and horses should be watched for potential signs of poisoning if the plant grows in horse areas.

Check the glossary!

If you see a term in this book that you are unfamiliar with, check to see if it is included in the glossary on page 109.

Alkaloids

Pyrrolizidine alkaloids

Many plants throughout the world contain toxic pyrrolizidine alkaloids and they are among the most common poisonous plants that affect horses and other livestock. Most plant species that contain these toxins are bitter and are generally avoided by horses. The ingestion of hay or other feedstuffs that have been contaminated with these plants is said to be the most common source of pyrrolizidine alkaloid poisoning. During periods of drought horses may consume pyrrolizidine alkaloid plants if little other forage is available. Toxic seeds of some pyrrolizidine alkaloid-containing plants may contaminate feed grains in some seasons.

The toxicity of pyrrolizidine alkaloid plants varies markedly and some plants may be more toxic in certain seasons or at certain stages of growth.

The pyrrolizidine alkaloids themselves are not toxic. They are absorbed through the gut and are transported

via the bloodstream to the liver. The alkaloids react with substances in the liver and both toxic and non-toxic forms of the alkaloids are produced. The non-toxic chemicals are excreted and the toxic chemicals either remain in the liver where they interfere with vital cell functions leading to the death of liver cells, or they are transported to other parts of the body, for example the lungs and kidneys. The extent of damage to the liver or to other organs depends upon the particular type of pyrrolizidine alkaloid ingested and the amount of toxin ingested. Most of the pyrrolizidine alkaloid plants that cause illness in horses primarily affect the liver, and affected animals show signs of progressive liver disease.

Pyrrolizidine alkaloid poisoning can be acute or chronic, with the acute form being much less common. Acute poisoning can occur through the accidental ingestion of significant amounts of toxic plants in

contaminated hay or feed, or a horse may suffer acute poisoning when environmental conditions have allowed pyrrolizidine alkaloid plants to become the dominant species in pasture. Chronic poisoning occurs when the horse ingests small amounts of the plants over time.

The onset of signs of chronic pyrrolizidine alkaloid poisoning can be delayed, occurring at a time when the animal no longer has access to the hazardous plants. This can make it difficult to determine when and how a horse was exposed to the toxins. It is thought that the toxic effects of pyrrolizidine alkaloids are cumulative and that the toxins may stay in the liver and continue to cause damage even when access to the plants has been removed.

A comprehensive liver function test can assist in the diagnosis of pyrrolizidine alkaloid poisoning in a horse showing signs.

Signs of pyrrolizidine alkaloid poisoning

Acute poisoning – Affected horses have rapid, progressive liver failure and may die within days or weeks of ingestion of pyrrolizidine alkaloid plants.

Signs of acute poisoning may include:

- Food refusal
- Depression
- Jaundice (characterised by a yellow colouring of the mucous membranes)
- Abdominal swelling
- Signs of colic
- Behavioural changes that may include nervousness or excitability
- Death can occur in severe cases

Horses showing advanced signs of acute pyrrolizidine alkaloid poisoning rarely recover. Veterinary attention should be immediately sought if poisoning is suspected in a horse. Treatment and supportive care may increase the chance of survival and help with the subsequent recovery.

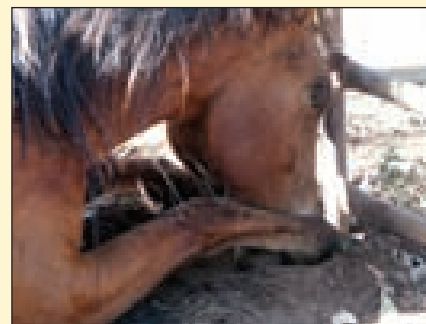
Chronic poisoning – Signs may not appear for months or even years after the ingestion of pyrrolizidine alkaloid plants. As loss of liver function gradually progresses, there is a corresponding progression in the severity of symptoms. When the liver is damaged to a critical point, liver failure progresses rapidly and death can occur soon after.

Signs of chronic poisoning may include:

- Food refusal
- Depression
- Increasing signs of jaundice
- Loss of condition
- Secondary photosensitisation – redness and swelling of the skin in unpigmented areas. The nose, lips and around the eyes are areas commonly affected. The skin may crack and weep fluid.
- Yawning
- Head pressing - the horse may push its head against a wall or other surface
- Incoordination

- Aimless wandering
- Death can occur in severe cases

There is no specific treatment for chronic pyrrolizidine alkaloid poisoning. Removal of the plants from the diet can slow the progression of symptoms. Horses with photosensitisation should be kept out of the sun to help the skin heal. Veterinary attention should be sought if chronic poisoning is suspected in a horse. Horses showing signs of advanced liver disease have little chance of survival.



*This horse is suffering crotalaria poisoning and is displaying head pressing behaviour.
Photo: Susanne Hourigan*

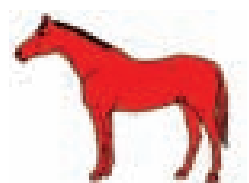
Paterson's curse

(salvation Jane, Lady Campbell weed, purple bugloss, Riverina bluebell)

Echium plantagineum [Boraginaceae]



Weed of pastures, grasslands, open woodlands, roadsides, parklands and gardens.



Paterson's curse is native to the Mediterranean region. It is a major weed of Australia pastures and it is a declared noxious weed in all states except Queensland and the Australian Capital Territory.

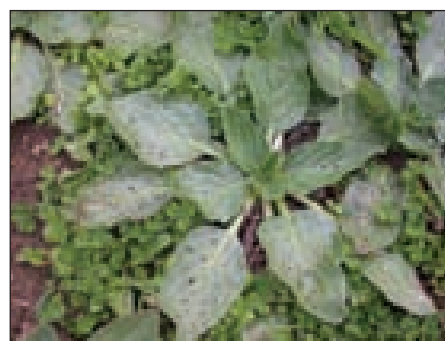
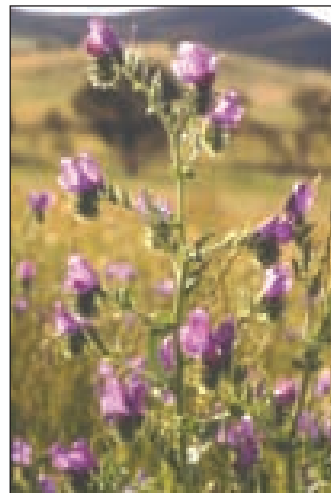
In recent times Paterson's curse has been a particular problem for horse owners in some parts of Australia. The plant is usually unpalatable but horses will eat it if there is little other available forage. Paterson's curse can dominate pastures and this is especially so in degraded pastures, such as those affected by drought, fire or overgrazing. Paterson's curse contains up to ten types of toxic pyrrolizidine alkaloids and the weed has been associated with many horse deaths in recent years. All parts of the plant are toxic and the toxicity is not lost in dried plants.

Growth and identification

Paterson's curse is a short-lived winter annual or biennial that grows to 90 cm in height. The plant produces numerous seeds that can accumulate in the soil and remain dormant for many years. Seeds can be easily spread to new areas through water run-off, as contaminants of transported hay and grain or through animal and vehicle movements. The seeds usually germinate following rain in summer or autumn.

During winter Paterson's curse grows as rosettes. The leaves of the rosettes are hairy and oval or oblong in shape. The leaves can grow to 30 cm in length and they have distinct branched veins.

Flowering occurs in early spring with the appearance of several upright flowering stems that grow from the middle of the rosette. The branched stems are covered in stiff hairs. The leaves on the stems are hairy and are smaller and narrower than the leaves of the rosette. The leaves



Photos: Matthew Smyth

are arranged alternately along the stem and they decrease in size towards the flower. The leaves are held close to the stem and they do not have stalks.

The flowers are tube-shaped and are usually purple or blue, but white and pink flowers are occasionally seen. Each flower has 5 fused petals and is 2 – 3 cm long. The flowers have 5 stamens and 2 of these extend beyond the flower tube.

Paterson's curse seeds are around 3 mm long and are brown, grey or black. They are three-angled and have a wrinkled and pitted surface.

Management notes

- Avoid grazing horses on pastures infested with Paterson's curse.
- Check hay for Paterson's curse contamination.
- Individual plants can be pulled out by hand or spot sprayed with herbicide. Remove plants at rosette stage for the best results. Ensure all parts of the plant are removed from the ground.
- The use of herbicides for larger infestations is most effective when the plant is in the rosette stage. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- The establishment of competitive pastures can control Paterson's curse.
- Minimise summer and autumn grazing pressure on lightly infested pastures as this will maintain a good ground cover and will prevent Paterson's curse from establishing in bare patches.
- Check for Paterson's curse seed in seed batches bought for sowing crops and pasture.
- Graze adult non-pregnant goats or sheep on heavily infested pastures as they are more tolerant of pyrrolizidine alkaloids and will readily eat the weed. Heavy grazing by these species in spring and early summer can suppress seed set in Paterson's curse. Do not leave these animals on the infested pasture continuously as toxicity problems can occur.

Crotalarias

Plants in the *Crotalaria* genus are known as the ‘rattlepods’ because the seeds rattle inside the dried inflated seedpod when shaken.

Some crotalarias are known to contain pyrrolizidine alkaloids and several species have caused cases of poisoning in Australian horses. A horse poisoned by the pyrrolizidine alkaloids in crotalarias is said to be suffering ‘crotalism’, ‘walkabout disease’ or ‘Kimberly horse disease’. Two species of crotalaria contain an unknown toxin that causes a disease known as ‘Chillagoe horse disease’ and this is discussed on page 75.

The incidence of horse poisoning cases caused by the ingestion of crotalarias has decreased over the past 50 years. This is due to an increased awareness of the potential toxicity of the plants and the subsequent implementation of horse management techniques that reduce horses’ exposure to crotalarias. Poisoning cases are still occasionally reported and crotalaria poisoning can be a significant problem for horse owners in northern regions of Australia where crotalarias are common, particularly when those areas are affected by drought.

Crotalarias that contain pyrrolizidine alkaloids are usually unpalatable but horses will eat the plants if other forage is scarce. Some crotalarias can become the dominant species in pastures that are degraded by drought, fire or overgrazing. Crotalarias may also be found as contaminants

of hay. The seeds of some crotalaria can contaminate feed grains, particularly sorghum.

Not all species of *Crotalaria* contain toxic pyrrolizidine alkaloids and the amount of toxins in crotalarias varies between species. More than forty species of crotalaria grow in Australia and around eighteen of these are native Australian species. Not all crotalarias have been tested for alkaloid content and although all species should be regarded as potentially toxic to horses, it is advisable to seek a positive identification of the species before removing crotalarias from pastures.

The crotalarias most commonly associated with poisoning in horses is *C. crispata* and *C. ramosissima*, both commonly called Kimberly horse poison. Other species that have been associated with horse poisoning cases, or are known to contain toxic alkaloids are listed below.

Growth and identification

Identification note: distinguishing between the different species of *Crotalaria* can be extremely difficult and only a very basic description is given here. See page 5 for more information on obtaining a precise identification of a plant species.

Two general characteristics of plants in the genus *Crotalaria* are their pea-shaped flowers that are yellow in all but one species and their seedpods that are usually inflated when dried.



This map shows the general distribution of crotalarias. Individual species may not occur in all of the areas shown on the map.

Crotalarias can be found in pastures, crops, grasslands, open woodlands, roadsides, parklands and gardens.

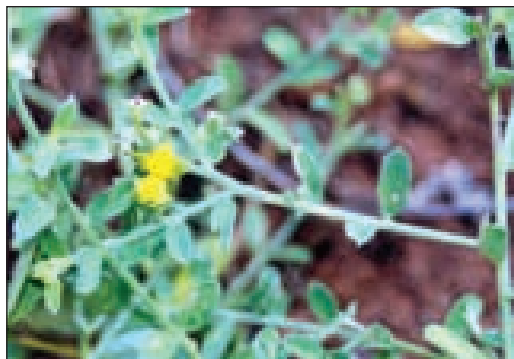


Identification note: *Crotalaria crispata* and *Crotalaria ramosissima* are very difficult to tell apart, with *Crotalaria crispata* having the larger calyx lobes (the bracts that hold the flower).



Above and right, *Crotalaria crispata*
Photos: Susanne Hourigan

Annual or short-lived perennials that grow to 50 cm. The stems lie on the ground and grow upwards at the tips (decumbent). The oval to wedge-shaped, grey-green leaves can be up to 2.5 cm long. Flower spikes appear at the tips of branches from spring to late summer. Numerous yellow pea-shaped flowers. Produces hairy pods. Native Australian species.



Grey rattlepod

C. dissitiflora [Fabaceae]

Mostly upright annual that grows 30 - 40 cm. Hairy stems. The leaves have 3 oval leaflets up to 3.5 cm long. Flower spikes appear at the tips of

branches in summer to early winter. Numerous yellow pea-shaped flowers. Produces hairy pods. Native Australian species.

Narrowleaf rattlepod*Crotalaria linifolia* [Fabaceae]

Erect annual that grows 50 cm –1 m. **Hairy** stems and leaves. The leaves are narrow and grow 2 – 3 cm long by 3 mm wide. Flower spikes

appear at the tips of the branches. Numerous yellow pea-shaped flowers. Produces egg-shaped black pods. Native Australian species.

Yellow rattlepod*Crotalaria mitchellii* [Fabaceae]

Upright perennial shrub that grows to 1 m. The oval leaves are hairy on the lower surface and can grow to 8.5 cm long by 4 cm wide. Flower spikes

appear at the tips of the branches. Numerous yellow pea-shaped flowers. Produces hairless greenish-grey pods. Native Australian species.

Showy rattlepod*Crotalaria spectabilis* [Fabaceae]

Upright annual that grows 1 – 2 m. **Stems and** leaves are hairless. The lower surface of the leaves is sometimes hairy. The leaves are oval and are up to 10 cm long by 4 cm wide. Flower

spikes appear at the tips of the branches in summer and autumn. Numerous yellow pea-shaped flowers. Produces a black pod that can be up to 6.5 cm long. Introduced species.

Purple-flowered rattlepod*Crotalaria verrucosa* [Fabaceae]

Annual that grows to 80 cm in height. The leaves are broadly oval and are up to 7 cm long by 2 cm wide. Flower spikes appear at the tips of the

branches. Numerous blue or purple pea-shaped flowers. Produces oblong-shaped pods that have brownish hairs. Native species.

Streaked rattlepod*Crotalaria pallida* [Fabaceae]

Upright annual or short-lived perennial that grows to 3 m. Leaves have 3 egg-shaped leaflets up to 7.5 cm long. Flower spikes appear at the tips of the branches from autumn to spring.

Numerous yellow pea-shaped flowers with reddish-brown streaks. Produces hairy pods that are brown or mottled yellow and dark green. Introduced species.

Sunhemp*Crotalaria juncea* [Fabaceae]

Upright annual that grows to 2 m. Leaves are long and narrow and grow to 6.5 cm long by 0.5 cm wide. Flower spikes appear at the tips of

the branches in autumn and winter. Numerous yellow pea-shaped flowers that have a faint purplish blush. Produces black pods. Introduced species.

Wedge-leaf rattlepod*Crotalaria retusa* [Fabaceae]

Upright annual that grows to 1 m. Leaves can be up to 8 cm long and they are dark green on top and paler below. The leaves are wedge-shaped.

Flower spikes appear at the tips of the branches. Numerous yellow pea-shaped flowers. Produces purple-black pods. Native Australian species.

Crotalaria montana [Fabaceae]

This variable species can be annual or perennial and prostrate (creeping) or upright. Grows to 1 m when upright. Leaves can be oblong to elliptical and can be up to 4.5 cm long by 0.8 cm

wide. Flower spikes appear at the tips of the branches from late summer to winter. Numerous pale yellow pea-shaped flowers. Produces dark grey to blackish pods. Native Australian species.

New Holland rattlepod*Crotalaria novae-hollandiae* [Fabaceae]

Upright or spreading perennial that grows to 1.5 m. Stems covered in long silky hairs. Oval or triangular hairy leaves up to 12 cm long and 4.5 cm wide. Flower spikes appear at the tips of

the branches for most of the year but mainly in autumn to spring. The numerous pea-shaped flowers are yellow with darker streaks. Produces hairy pods up to 4.5 cm.

Crotalaria brevis

[Fabaceae]

Annual stems and perennial rootstock. Prostrate (creeping), growing to 30 cm in height. The stems and leaves have long white-reddish coloured hairs. The leaves are lance-shaped and can be up to 2.5 cm long by 0.5 cm wide. Flower

spikes appear at the tips of the branches from summer to winter. Numerous crowded yellow pea flowers that have darker yellow markings. Produces brown hairless pods. Native Australian species.

Bluebush pea

Crotalaria eremaea

Upright perennial that grows to 2 m. The leaves have 1 – 3 oblong leaflets that can be up to 4 cm long. Flower spikes appear at the tips of

the branches in summer and autumn. Numerous yellow pea flowers. Produces yellow pods. Native Australian species.

Management notes

- Avoid grazing horses on pastures infested with crotalaria.
- Improve pastures to increase desirable grasses.
- Isolated small plants can be pulled out by hand or spot sprayed with herbicide.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.



Crotalaria spectabilis (showy rattlepod)
Photo: Ken Harris



Crotalaria pallida (streaked rattlepod)
Photo: Ken Harris

Senecios

There are several thousand species of *Senecio* worldwide, of which around fifty are native to Australia. Many introduced senecios have become important agricultural weeds in Australia and others have been cultivated as garden plants.

Senecios contain pyrrolizidine alkaloids and their ingestion poses a potential risk to horses. The plants are usually unpalatable and are unlikely

to be consumed in amounts that would cause poisoning. Horses may eat senecios if other fodder is scarce and the plants may contribute to pyrrolizidine alkaloid poisoning when consumed along with other toxic plants in horse grazing areas. The contamination of hay or other feedstuffs with senecios can pose a risk for poisoning.

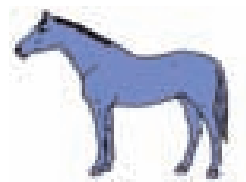
Ragwort

(tansy ragwort, common ragwort, stagger wort, stinking willy, St James wort)

Senecio jacobaea [Asteraceae]



Weed of pastures, open woodlands, waterways and occasionally crops.



Ragwort is native to Europe and western Asia. Ragwort is commonly found as a weed in pastures and it can become the dominant species in degraded pastures. It is a declared noxious weed in Victoria, Tasmania, New South Wales, South Australia and Western Australia.

Growth and identification

Ragwort is a long-lived perennial that grows to 1.2 m. The plant produces numerous seeds that can be spread by wind, water run-off, as contaminants of transported hay and grain or through animal and vehicle movements. The plant can also spread when root and crown segments are broken off and dispersed by cultivation or other practices that move soil.

Young plants form a rosette of leaves. One or more upright stems grow from the centre of the rosette as the plant matures. The ribbed stems are branched towards the top of the plant and they are covered in cottony hairs when young. The stems are often red or purple towards the base of the plant.

The leaves are dark green and hairless on the upper surface and lighter green and hairy underneath. The stem leaves can be up to 15 cm long and most do not have a stalk. The leaves of



Photo: Paul McGreevy. Courtesy University of Sydney

the rosette can be up to 35 cm long and they are attached to the plant by a stalk that can be 1 – 3 cm long. The edges of the leaves are distinctly 'ruffled' and convoluted. The plant gives off an unpleasant smell when damaged.

Ragwort usually flowers in summer. The flowers are bright yellow and are arranged in dense clusters at the tops of the branches. The flowers are around 2 cm in width and they have 12 – 15 petals that can be up to 1 cm long. Green bracts that are tipped with black or brown surround the flowers and each flower has many small 'florets' in the centre. Small brown seeds are formed as flowering finishes. Some seeds have a ring of fine white hairs at the top and some seeds are hairless.

Fireweed

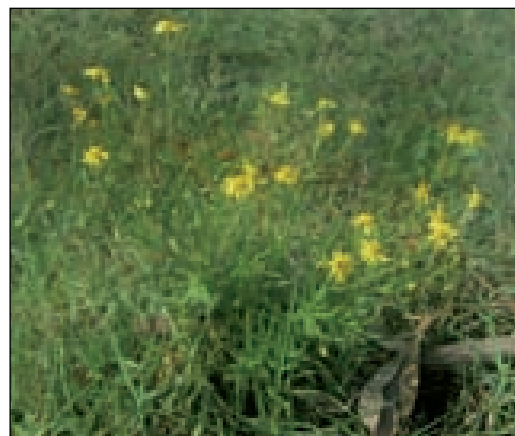
(Madagascar ragwort, senecio amarillo)

Senecio madagascariensis [Asteraceae]

Fireweed is native to southern Africa and Madagascar. The plant has spread rapidly in Australia, particularly in the past 30 years, and it is a significant problem for farmers. Fireweed is a declared noxious weed in Queensland, New South Wales, the Australian Capital Territory and Western Australia.

Growth and identification

Fireweed is a short-lived annual that grows 10 – 50 cm tall. In good seasons the plant can behave as a short-lived perennial. Fireweed produces numerous seeds and most of these are



Fireweed

spread by wind. Seed can also be spread by water run-off, as contaminants of transported hay and grain or through animal and vehicle movements. The plant can occasionally spread when root and crown segments are broken off and dispersed by cultivation or other practices that move soil.

Fireweed can have one main stem or several stems and each stem has many branches towards the top of the plant. The leaves are alternately arranged along the stem and both the leaves and stem are hairless, or have a sparse covering of hairs. The leaves are 2 – 12 cm long and up to 2.5 cm wide. Their broad base wraps around the stem and the edges of the leaves are usually serrated but can sometimes be smooth.

Flowering can occur 6 – 10 weeks after germination in favourable conditions and several generations of the plant can be produced over one season. Flowering usually occurs from late autumn through to early summer but some plants may flower in late summer. The flowers are yellow and are loosely clustered at the tops of the branches. The flowers are up to 2 cm in width and they have 12 – 15 petals that can be up to 1.4 cm long. Green bracts surround the flowers and each flower has many small 'florets' in the centre. As flowering finishes small brown seeds are formed. The seeds are covered in tiny hairs and are topped with a silky tuft of hairs.

Management notes

- Avoid grazing horses on pastures infested with senecio.
- Check batches of hay and chaff for senecio contamination.
- Individual plants can be pulled out by hand or spot sprayed with herbicide. Remove plants in the early growing stages for best results. Ensure all parts of the plant are removed from the ground.
- The use of herbicides on larger infestations is most effective when the plant is in the small seedling to early flowering stages. Seek advice from local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Minimise grazing pressure on infested pastures to maintain a good ground cover year-round and prevent fireweed from establishing in bare patches.
- Graze adult non-pregnant goats or sheep on heavily infested paddocks as they are more tolerant to pyrrolizidine alkaloids and will readily eat the weeds. Do not leave these animals on the infested pasture continuously as toxicity problems can occur.
- Improve pastures to increase desirable grasses.



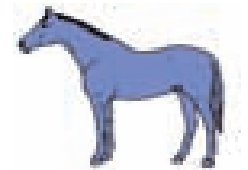
Fireweed



Fireweed



Weed of pastures, open woodlands, parklands and roadsides.



Heliotropes

Heliotrope poisoning in horses is not commonly seen in Australia. Many heliotrope species are known to contain pyrrolizidine alkaloids and they are potentially toxic to horses. The plants are usually unpalatable and are unlikely to be consumed in amounts that would cause poisoning. Horses may eat heliotropes if other

fodder is scarce and the plants may contribute to pyrrolizidine alkaloid poisoning when consumed along with other toxic plants in horse grazing areas. The contamination of hay or other feedstuffs with heliotropes can pose a risk for poisoning.

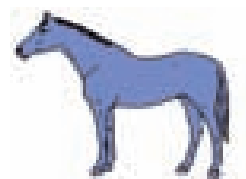
Blue heliotrope

(wild verbena, clasping heliotrope, purpletop, turnsole, wild heliotrope, creeping heliotrope)

Heliotropium amplexicaule [Boraginaceae]



Weed of pastures, crops, roadsides, parklands and gardens.



Blue heliotrope is native to South America. The plant is drought tolerant and it can quickly become the dominant pasture species when it rains after a prolonged dry period. Blue heliotrope is a declared noxious weed in New South Wales and Western Australia.

Growth and identification

Blue heliotrope is a summer-growing perennial that grows to 30 cm in height. The plant produces a large number of seeds that can be easily spread through water run-off, as contaminants of transported hay and grain or through animal and vehicle movements. The plant can also spread when root and crown segments are broken off and dispersed by cultivation or other practices that move soil.

Blue heliotrope has prostrate (creeping), branched stems that can grow up to 1 m long. The stems are green and are covered in hairs.

The leaves are hairy and are a dull green colour on the upper surface and lighter green on the lower surface. They are elongated and can grow

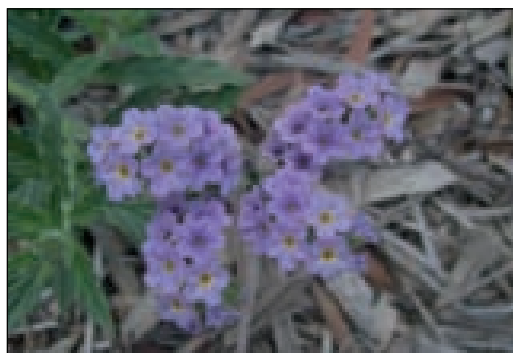


Photo: Sheldon Navie

to 8 cm long and 2 cm wide. They are alternately arranged along the stems and are attached without stalks. The leaves have prominent veins and are wavy along the edges.

The plant produces a flush of growth from autumn to spring and flowering usually occurs from November through summer into early autumn. In some areas the plant can flower at any time of year. The tube-shaped flowers can be purple, lilac, blue or pink in colour and each has a distinctive yellow throat. The flowers are 4–6 mm long and are arranged in 2 rows along one side of a curved flower spike.

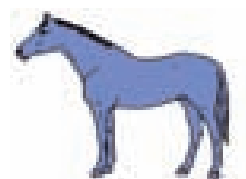
Common heliotrope

(potato weed, European heliotrope, Barooga weed, Wanderie curse, bishop's beard, caterpillar weed)

Heliotropium europaeum [Boraginaceae]



Weed that favours bare, disturbed ground such as fallow areas. Also found in crops, pastures and on roadsides.



Common heliotrope is native to Europe, western Asia and northern Africa. Common heliotrope is drought tolerant and once established it can flourish during dry hot summers when other desirable crop and pasture species fail to thrive. It is a declared noxious weed in Western Australia and Tasmania.

Growth and identification

Common heliotrope is a short-lived annual that grows to 30 cm in height. The plant produces numerous seeds that can be spread by animals, water run-off or as contaminants of hay or grain.

The plant has upright or semi-upright branched stems. The leaves are greyish-green and are arranged alternately along the stems. The stems and leaves are covered in coarse hairs. The oval or egg-shaped leaves can grow to 9 cm long and

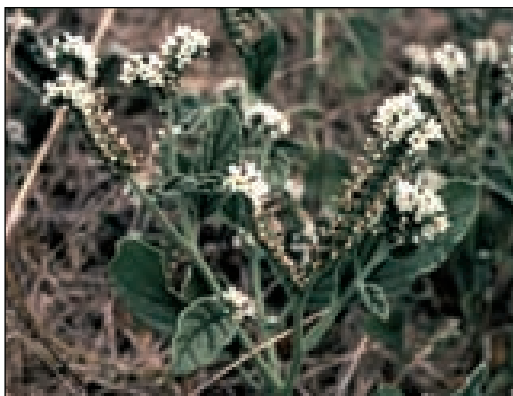


Photo: Ken Harris

3 cm wide. The leaves are attached to the stems by stalks that are up to 4 cm long.

The flowers are tube-shaped and are white with a distinctive yellow throat. Each flower is 2–3 mm long and the flowers are arranged in 2 rows along one side of a curved flower spike.

Heliotropium ovalifolium

(Also known as *Heliotropium coromandelianum* var. *ovalifolium* or *Heliotropium gracile*)

[Boraginaceae]

This native heliotrope grows throughout northern Australia, Asia and Africa. In the late 1990s the plant was implicated as the source of pyrrolizidine alkaloids that caused the death of a number of horses on a property in the Kimberly region of Western Australia.

Growth and identification

Heliotropium ovalifolium is a perennial that can grow 15 – 80 cm in height.

The plant has a branched, semi-upright to spreading growth habit. The smaller branches are covered in curled hairs. The leaves are grey-green in colour and are covered in fine hairs that may be curled. The leaves grow to 7 cm long and 2 cm wide.

The flowers are tube-shaped and are white to pale yellow. Each flower is up to 5 mm long and flowers are arranged along one side of a curved flower spike.

Management notes

- Avoid grazing horses on pastures infested with heliotropes.
- Check batches of hay and chaff for heliotrope contamination.
- Improve pastures to increase desirable grasses.
- Minimise grazing pressure on infested pastures to maintain a good ground cover year-round and prevent heliotropes establishing in bare patches.
- Graze adult non-pregnant goats or sheep on heavily infested paddocks as they are more tolerant to pyrrolizidine alkaloids and will readily eat the weed. Do not leave these animals on the infested pasture continuously as toxicity problems can occur.
- Individual plants can be pulled out by hand or spot sprayed with herbicide. Remove plants in the early growing stages for best results. Ensure all parts of the plant are removed from the ground.
- The use of herbicides on larger infestations is most effective when the plant is in the small seedling to early flowering stages. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.



Found on coastal plains and dunes, seasonally wet areas, pastures, grasslands and waterways.



Amsinckias

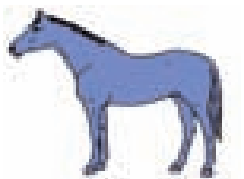
(Amsinckia, yellow burrweeds, fiddlenecks)

Amsinckia calycina, *Amsinckia lycopsoides*, *Amsinckia intermedia* and *Amsinckia menziesii* [Boraginaceae]



Some species of *Amsinckia* are found in isolated pockets of Western Australia, Tasmania and the Northern Territory. *A. menziesii* is the only amsinckia that grows in Victoria.

Weeds of cereal crops, pastures and roadsides.



There are 4 species of *Amsinckia* in Australia. It is currently thought that these plants may not be separate species but different forms of one species. For the purposes of this book they will be discussed as one species.

Amsinckias are native to North America and South America. Amsinckias are important weeds of crops and pastures. They are declared noxious weeds in Victoria, South Australia and Western Australia.

Amsinckias are usually unpalatable to horses and are unlikely to be consumed in amounts that would cause poisoning. Horses may eat amsinckias if other fodder is scarce and the plants may contribute to pyrrolizidine alkaloid poisoning when consumed along with other toxic plants in horse grazing areas. The main risk for horse

poisoning by amsinckias is through their potential to contaminate grain. They are an important cause of poisonings in horses in other countries but there have been no confirmed reports of horse deaths from amsinckias in Australia.

Growth and identification

Amsinckias are short-lived perennials that grow 20 – 70 cm tall. The plants germinate in autumn giving them a competitive advantage over other desirable species that germinate later in the year. The seeds are contained in a burr that can become attached to animals and can be dispersed to new areas. Seed can also be spread by vehicles and clothing and as contaminants of cereal crops.

The young plants form rosettes from which flowering stems are produced as the plant matures.

The plants have upright or semi-upright stems that are branched or unbranched. The stems are covered in long stiff hairs and short soft hairs.

The green leaves can grow to 20 cm long and 2 cm wide and they are covered in stiff hairs. The rosette leaves are generally the largest and they have short stalks. The stem leaves have no stalks and they are alternately arranged along the stem. The leaves are lance-shaped and have a pointed tip.

Flowering occurs from late winter to spring. The flowers are tube-shaped and are yellow or orange. Each flower is up to 1.5 cm long and the flowers are arranged along one side of a 5 – 15cm long curved flower spike.



Photo: Ken Harris

Management notes

- Avoid grazing horses on pastures infested with amsinckia.
- Check feed grains for amsinckia seeds. Amsinckia seeds are contained in a group of 4 ‘nutlets’ that each contain a seed and are around 2 – 3.5 mm long. The nutlets are brown or black and have a rough surface. The nutlets are surrounded by spiny bracts to form a burr. Grain can contain the burr or the released nutlets.
- Individual plants can be pulled out by hand or spot sprayed with herbicide.
- The use of herbicides on larger infestations can be an effective control measure. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Graze adult non-pregnant goats or sheep on heavily infested paddocks as they are more tolerant to pyrrolizidine alkaloids and will readily eat the weed. Do not leave these animals on the infested pasture continuously as toxicity problems can occur.
- Mow or slash pastures before flowering to reduce seed production. If done repeatedly this practice will deplete the soil seed bank.
- Cropping areas: repeated harrowing before crops are sown can destroy amsinckia seedlings. Planting pasture legumes on land used for cereal crops can suppress amsinckia establishment in between crops.

Tryptamine alkaloids

Phalaris grasses contain tryptamine alkaloids. Most phalaris species are harmless to horses and phalaris grasses are valuable grazing species for all livestock in Australia. However two closely-related phalaris species, blue canary grass and paradoxa grass, have been implicated in the death of a small number of horses in Australia. All commercially available phalaris grass seed is the species *Phalaris aquatica* and this grass does not contain toxins.

Since the early 1980s there have been sporadic reports of horse deaths in Australia that have been attributed to blue canary grass, with cases occurring in New South Wales, Victoria and South Australia. In 1999, three horses died suddenly on a farm in Narrabri, New South Wales and their deaths were linked to paradoxa grass. Other horse deaths related to paradoxa grass have been occasionally reported in Australia.

Blue canary grass and paradoxa grass are thought to contain alkaloids closely related to tryptamine alkaloids. Rapid growth after rainfall is thought to increase the amount of tryptamine-type alkaloids in these grasses.

The action of the toxins found in these grasses is unknown, as post-mortems of affected horses have not shown conclusive findings. It is thought that the cause of death might have been sudden heart failure.

Signs of tryptamine alkaloid poisoning

In most reported poisoning cases the horse has been found dead in the paddock after no apparent ill health. In a few cases an owner has been present at the time that their horse

died. These owners have reported that there was nothing to indicate their animal was unwell before a sudden onset of symptoms. One horse became suddenly unsteady, collapsed

and died. Another horse apparently reared before collapsing and dying. A third horse became excited while being moved from a paddock, galloped for about 400 m, collapsed and died.

Blue canary grass is native to the Mediterranean countries Madeira and the Canary Islands. It is a major weed in winter crops and pastures.

Growth and identification

Blue canary grass is a short-lived perennial, surviving for 3 – 4 years. It grows vigorously in autumn and spring, especially after rain. The grass continues its growth through winter and it has a summer dormancy period. In cool, high rainfall areas the grass maintains growth through summer.

Blue canary grass can grow to 1.5 m tall. The green stems grow from a crown that is mostly

above ground. Many buds develop at the crown during spring growth and these buds are the source of new growth in the following autumn.

The numerous leaves of blue canary grass are greenish blue in colour and they are mostly upright.

Flowering occurs in late spring. The flowering seed heads of blue canary grass are upright, cylindrical in shape and are up to 14 cm long and 1 – 2 cm wide.

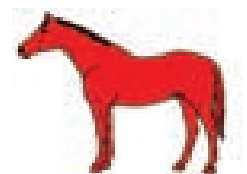
The seed heads are green, with blue or purple coloured tips.

Blue canary grass

Phalaris coerulea [Poaceae]



Weed of crops, pastures, waterways and roadsides.



Paradoxa grass is native to the Mediterranean region. It is a major weed in winter crops and pastures.

Growth and identification

Paradoxa grass is an annual. It grows mainly in winter and spring, and can grow vigorously after rain. The seeds germinate in autumn to early winter.

Paradoxa grass can grow up to 1 m tall. The green stems grow from a crown that is mostly below the ground. The numerous leaves of

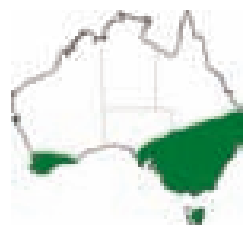
paradoxa grass are greenish blue in colour and are mostly upright.

Flowering occurs in late spring. The flowering seed heads of paradoxa grass are cylindrical in shape and are 18 cm long and 1.5 - 2.5 cm wide. The seed heads are green, with blue or purple coloured tips.

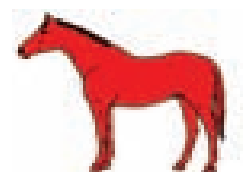
Identification note: Distinguishing between different grasses can be extremely difficult and only a very basic description is given here. See page 5 for more information on obtaining a precise identification of a plant species.

Paradoxa grass

Phalaris paradoxa [Poaceae]



Weed of crops pastures, waterways and roadsides.



Management notes

- Avoid grazing horses on pastures infested with blue canary grass or paradoxa grass, especially when these grasses are rapidly growing.
- Improve pastures to increase desirable grasses.

Indolizidine alkaloids

Many plants worldwide contain indolizidine alkaloids. The most significant indolizidine alkaloid plants that are potentially toxic to horses in Australia are in the *Swainsona* genus of plants. These plants contain several indolizidine alkaloids but the most important in regard to toxic effects is called swainsonine.

Swainsona species are related to other swainsonine-containing genera such as

Astragalus and *Oxytropis*. These plants cause livestock poisonings in many countries and they are known as 'loco weeds' in North America.

The species of *Astragalus* found in Australia do not produce toxic amounts of swainsonine and there are no species of *Oxytropis* that grow in Australia.

Swainsonine is readily absorbed from the digestive tract and is rapidly

distributed throughout the body. Swainsonine induces a condition known as lysosomal storage disease.

The toxin inhibits the action of two important enzymes and this causes the accumulation of a particular protein-carbohydrate molecule in cells of the brain and other organs. This leads to nerve cell damage that is largely irreversible.

Signs of indolizidine alkaloid poisoning

Signs of poisoning do not usually occur until after the horse has consumed plants containing swainsonine for at least 3 – 4 weeks.

- Depression
- Circling
- Incoordination
- Unpredictable behaviour – some horses may fall down or rear while being ridden or otherwise handled
- As the disease progresses horses become increasingly depressed

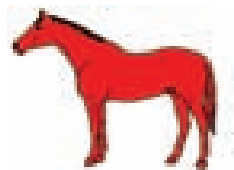
and some horses may be so depressed that they appear to be asleep.

- The horse may become too weak to stand.
- In severe cases the horse may suffer convulsions followed by coma and death.

There are no current treatment options that have proven to be effective for swainsonine poisoning.

If access to swainsonine-containing plants is restricted when symptoms first appear there is a good chance the horse could make a full recovery. However, if the symptoms are not recognised and the horse continues consuming swainsonine plants the damage to the brain may be too extensive for the horse to fully recover. Such horses are dangerous to ride or handle because of their ongoing unpredictable behaviour.

Swainsonas



There are around eighty-five native species of *Swainsona* in Australia. Some of these are considered valuable as fodder for stock in arid areas and some have been cultivated as garden plants. The group contains the iconic Australian flowering plant, the Sturt's desert pea, *Swainsona formosa*.

Most swainsonas are considered safe as they contain low levels of swainsonine. The swainsonas that have been implicated in the poisoning of horses and other livestock in Australia are *Swainsona galegifolia*, *S. canescens*, *S. luteola*, *S. greyana* and *S. procumbens*.

Swainsonas are palatable and horses may eat the plants when growth is abundant. Some horses may selectively graze swainsona, even when other

pasture is available. Swainsonas can be found in pastures, crops, grasslands, open woodlands and roadsides.

Growth and identification

Identification note: distinguishing between the different species of *Swainsona* can be extremely difficult and only a very basic description is given here. See page 5 for more information on obtaining a precise identification of a plant species.

Swainsonas are perennial or sometimes annual plants that develop quickly after spring or autumn rains and can dominate pastures during these times. They have colourful pea flowers and they produce seedpods.

Smooth darling pea

Swainsona galegifolia (also known as *Swainsona queenslandica*) [Fabaceae]



Smooth darling pea is a perennial that grows to 1 m in height. The plant has arching stems. The leaves are around 10 cm long and are made up of 20 – 25 leaflets that are arranged along the leaf stem in pairs. The stems are usually hairless.

The plant flowers in spring. The pea-shaped flowers appear in clusters of about 20 and flower colour varies from white to deep red. Pink and mauve flowers are the most common colours. The plant produces leathery pods that can be up to 4 cm long.



Hairy darling pea
Photo: Ken Harris

Hairy darling pea

Swainsona greycana

Hairy darling pea is a perennial that grows to 1.5 m in height. The leaves are approximately 15 cm long and are made up of 17 – 21 leaflets that are arranged along the leaf stem in pairs. The stems are covered in hairs.

The plant flowers in spring. The pea-shaped flowers appear in clusters of about 20 and they can be white, pink or purple. Some parts of the flowers are covered in hairs. The plant produces hairless seedpods that can be up to 5 cm long.



Grey swainsona is a perennial that grows to 60 cm or taller in favourable conditions. Grey swainsona has upright or prostrate (creeping) stems.

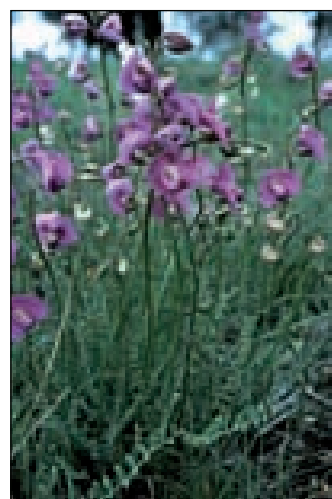
The leaves are up to 12 cm long and are made up of around 10 oblong-shaped leaflets that are arranged along the stem in pairs. The leaves and

leaf stems are covered in white or cream coloured hairs.

The plant flowers from May through to December. The pea-shaped flowers appear in clusters of 20 – 35 and are mostly purple, pink, yellow or green. The plant produces hairy seedpods that can be up to 1.5 cm long.

Grey swainsona

Swainsona canescens



Broughton pea
Photo: Ken Harris

Broughton pea

Swainsona procumbens

Broughton pea is a low, spreading perennial that grows 30 – 50 cm in height. The stems can be hairless or covered in tiny hairs. The leaves are up to 15 cm long and have up to 25 leaflets arranged on opposite sides of the leaf stems. The leaflets are up to 2.5 cm long.

The plant flowers in spring. The pea-shaped flowers appear in clusters of 2 – 12 and are mostly purple, mauve or pink. The plant produces seedpods that can be hairless or sparsely covered in hairs. The seedpods can be up to 4 cm long.



This perennial plant grows to 50 cm high. The stems are prostrate (creeping) or semi-erect and they are sparsely covered in hairs. The leaves are up to 10 cm long and have up to 17 leaflets arranged on opposite sides of the leaf stem. The leaflets are around 2 cm long and 1 cm wide.

The plant flowers in spring. The pea-shaped flowers appear in clusters of 5 – 15 and are mostly purple or occasionally yellow. The plant produces a seedpod that is oblong in shape and is up to 3.5 cm long. The seedpod is hairless or has a sparse covering of hairs.

Dwarf darling pea

Swainsona luteola



Management notes

- Avoid grazing horses on pasture infested with swainsona.
- Improve pastures to increase desirable grasses.
- Isolated small plants can be pulled out by hand or spot sprayed with herbicide.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Closely monitor horses for behavioural changes if consumption of swainsona plants is suspected.

Taxine alkaloids

Taxine alkaloids are found in the evergreen trees or shrubs of the *Taxus* genus. These are known as 'yews' and the species grown most commonly in Australia is the English yew. All *Taxus* species should be considered poisonous to horses.

Horses will not intentionally eat the unpalatable leaves or seeds from yew

trees. Most horse poisoning cases have occurred when clippings from yew trees have been placed in horse areas. Yew leaves mixed with the clippings of other plants or grass are a particular risk to horses.

The taxine alkaloids found in yews are cardiotoxins, which means that they act upon the heart. All parts of the plant

are toxic and mature leaves in winter are reported to be the most toxic.

Horses are highly susceptible to poisoning by taxine alkaloids and only small amounts need be ingested for death to occur. One report in the literature describes the death of a pony within 1¼ hours of ingesting only 160 g of Japanese yew leaves.

Signs of taxine alkaloid poisoning

In many reported poisoning cases the horse has been found dead in the paddock. The first signs of poisoning may appear within an hour of ingesting material from a yew tree and the progression of symptoms is rapid.

- Decreased tone in the lips and tail
- Decreased blood flow - difficult to find an arterial pulse
- Incoordination, staggering and trembling
- The horse may appear paralysed.
- Breathing becomes difficult and noisy

- In the final stages the horse will collapse and die, either from heart failure or respiratory failure

There is no specific treatment for yew poisoning in horses and in most cases death is likely to occur within 12 hours. Veterinary attention should be immediately sought if it is suspected that a horse has suffered yew tree poisoning and supportive care may help with survival and subsequent recovery. The horse should be confined to a quiet area and handling should be

minimised, as stress can precipitate heart failure. The administration of activated charcoal may stop further absorption of toxins from the gut. The placement of a stomach tube would likely be too stressful for the affected horse, so the activated charcoal should be added to feed and the horse should be gently encouraged to eat.

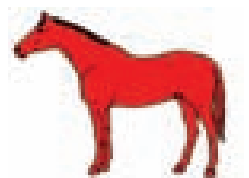
If the animal survives beyond 12 hours and symptoms improve there is a chance of full recovery.

English yew

Taxus baccata [Taxaceae]



Yew trees and shrubs are commonly grown in cool temperate areas of Australia as hedges, garden ornamentals, park trees and street trees.



English yew is native to Europe

Growth and identification

English yew is an evergreen tree that can grow to 20 m in height. The tree has a dark trunk that is quite thick in mature plants. The needle-like leaves are dark green and are glossy on the upper surface and paler green on the lower surface.

English yew flowers in spring. Male and female flowers are borne on separate plants. The male flowers appear as clusters of small scaly cones that turn yellow on maturity. The female flowers are very small solitary green cones. The female trees produce berries that are up to 1.2 cm in diameter. The berries are cup-shaped, fleshy and red in colour.

Management notes

- Yew trees are not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.
- Do not dispose of yew tree clippings in areas where horses could access them.



Photo: Ken Harris

Tropane alkaloids

Tropane alkaloids are found in several plants that commonly grow in Australia. Some of these plants grow as weeds and some are grown as garden ornamentals.

Cases of horse poisonings by tropane alkaloid plants are uncommon because horses will not usually eat the

unpalatable plants. Most reported cases occur through the ingestion of contaminated hay or other feedstuffs. Horses may eat the plants if no other forage is available.

Tropane alkaloids are anticholinergic, which means that they reduce the metabolic effects of an important

compound called acetylcholine. This compound stimulates muscles to contract and it is important for brain activity and normal nerve function.

The properties of the tropane alkaloids in some plants have made them useful in human medicine.

Signs of tropane alkaloid poisoning

The signs and severity of tropane alkaloid poisoning varies between cases because of the variability in the type and amount of tropane alkaloids in particular plants. The signs that may be seen in a case of poisoning include:

- Loss of appetite
- Depression
- Colic
- Rapid pulse and respiratory rate
- Dilated pupils
- Excessive thirst
- In severe cases death may occur within minutes, hours or days of ingesting the toxic plant material. Death can be due to respiratory paralysis, heart failure or rupture of the stomach.

A full recovery is the usual outcome in mild cases. Veterinary attention should be sought if tropane alkaloid poisoning is suspected in a horse. The treatment options may include the administration of activated charcoal to stop further absorption of toxins and the administration of drugs and supportive therapy.

Field bindweed

(common bindweed, morning glory, field morning glory)

Convolvulus arvensis [Convolvulaceae]

Field bindweed is native to Europe, Asia and northern Africa. Field bindweed is a declared noxious weed in Victoria, South Australia and Western Australia.

No cases of field bindweed poisoning have been reported in Australia. The plant is suspected of causing tropane alkaloid poisoning in a group of thirteen horses in the United States and has been shown to be toxic to mice when fed in high doses in toxicity studies.

Growth and identification

Field bindweed is a creeping vine that can grow along the ground or on support. The ribbed climbing stems are usually 1 – 3 m long but can be up to 7 m long. The vine produces seeds that can be spread by animal and vehicle movements and as contaminants of hay or grains.

Root segments can spread by cultivation or other practices that move soil.

The leaves are alternately arranged along the stem and they can be up to 6 cm long by 3 cm wide. The leaves are triangular or shaped like an arrowhead.

The vine flowers in spring to early autumn with most flowers appearing in summer. The flowers are tubular and they grow where the leaves meet the stem. They have 5 fused petals and are on

stalks that are up to 6 cm long. The flowers are white to pale pink and they can sometimes have a streaked appearance. Each flower is only open for one day.

The plants produce fruit that is a smooth, egg-shaped capsule with a slightly pointed tip. The capsule is up to 8 mm across and it turns brown as it matures.

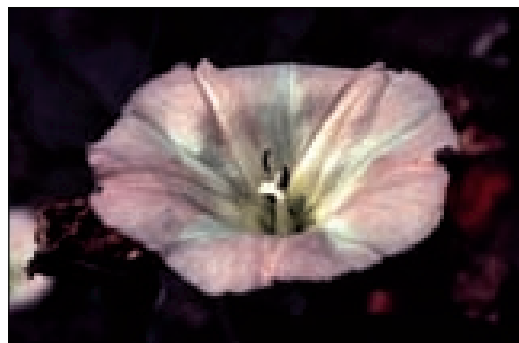
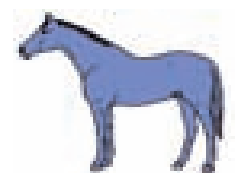


Photo: Ken Harris



Weed of pastures, grasslands, crops, gardens and roadsides.



Identification note: Vines in the genus *Ipomoea* are, like field bindweed, known by the common name 'morning glory'. These plants should not be confused with *Convolvulus arvensis*. See page 5 for more information on obtaining a precise identification of a plant species.

Management notes

- Avoid grazing horses on pastures infested with field bindweed.
- Check hay for field bindweed contamination.
- Individual plants can be pulled by hand or spot sprayed with herbicide. Ensure all plant material is removed as the vine can regrow from root fragments.
- The use of herbicides can be an effective control measure for larger infestations. For best results the plant should be treated when actively growing. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Improve pastures to increase desirable grasses.

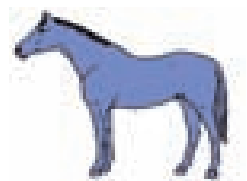
Thornapples

Datura spp [Solanaceae]



This map shows the general distribution of the thornapples that are commonly found as pasture weeds. Individual *Datura* species may not occur in all of the areas shown on the map.

Thornapples can be found in pastures, crops, grasslands, roadsides and waterways. Some thornapples are grown as garden ornamentals.



The plants in the *Datura* genus are commonly known as thornapples. There are several native thornapples but most of the species that grow in Australia were introduced as garden ornamentals. Some are still cultivated for gardens but many species have escaped to become important weeds of pastures and crops. The following thornapples are declared noxious weeds in several states: fierce thornapple (*Datura ferox*), downy thornapple (*Datura innoxia*), native thornapple (*Datura leichhardtii*), hindu thornapple (*Datura metel*), common thornapple (*Datura stramonium*) and hairy thornapple (*Datura wrightii*).

Thornapples are unpalatable to horses but they may be eaten if other forage is scarce. The plants can sometimes be found as contaminants of hay.

Growth and identification

Thornapples are summer growing annuals. They range in height from 50 cm to 2 m but most grow to around 1 m.

The stems and leaves can be hairless or hairy, depending on the species. The leaves are alternately arranged along the stem. The edges of the leaves are usually smooth or they are lobed in some species. The leaves of most species are egg-shaped or triangular and the leaves have an unpleasant odour when damaged.

The characteristic features of thornapples are the showy 'trumpet' flowers and the large seed capsules that appear after flowering. The tubular



flowers appear singly in the forks of the branches. The flowers of most species have 5 lobes, although the number of lobes can range from 3 to 9. The flowers can be a range of colours depending on the species. Most of the thornapples that grow as weeds have white flowers but some species have purple or lilac flowers.

Thornapples produce seed capsules that are usually rounded or egg-shaped and they can be up to 5 cm across. The capsules are usually covered in spines.

Management notes

- Ornamental thornapples are not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.
- Avoid grazing horses on pastures infested with thornapples.
- Check hay for thornapple contamination.
- Isolated small plants can be pulled out by hand or spot sprayed with herbicide, preferably before the plant has set seed.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.

Angel's trumpet

Brugmansia spp [Solanaceae]

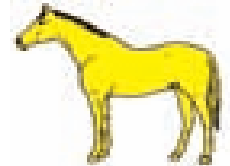
Brugmansias are natives to South America and most are known by the common name angel's trumpet. They are grown in Australia as garden ornamentals and some species have naturalised in some areas of Australia.

Growth and identification

Angel's trumpets are perennial shrubs or small trees that can grow to 5 m but most are around 3 m in height. They have a spread of up to 4 m, depending on the species.



Garden ornamentals.



The leaves are large and may be up to 30 cm long in some species. The leaves are oval or oblong in shape and they usually have toothed or wavy edges.

The flowers usually appear in spring or summer and they are distinctly trumpet shaped. The flowers can be up to 30 cm long and the colours include white, red, purple, orange, pink or yellow.

Management notes

- Angel's trumpets are not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.

Poison corkwood

(corkwood, eye opening tree, yellow basswood)

Duboisia myoporoides [Solanaceae]

Poison corkwood is native to Australia.

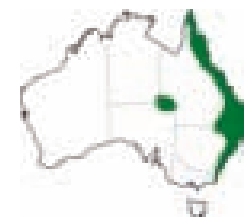
Growth and identification

Poison corkwood is a shrub or tree that can grow to 9 m in height.

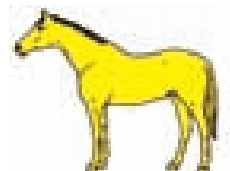
The leaves are elliptical in shape and they are 4 – 15 cm long by 1 – 4 cm wide. The leaves are arranged alternately along the stem.

The bark of the tree is thick and 'corky' and is yellowish-brown to pale grey in colour.

Poison corkwood flowers in winter and spring. The clustered flowers usually form a broad pyramid shape at the ends of the branches. The numerous small flowers are white with mauve streaking on the inside surface. The flowers have



Grows in native bushland and on the edges of rainforests. It is sometimes cultivated in gardens.



5 petals. The plant produces a rounded berry that is dark purple-black.

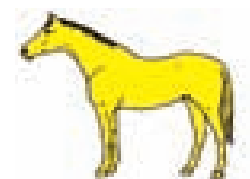
Corkwood

(poisonous corkwood, Queensland Duboisia, yellow basswood)

Duboisia leichhardtii [Solanaceae]



Grows in native bushland and on the edges of rainforests. It is sometimes cultivated in gardens.



Corkwood is native to Australia.

Growth and identification

Corkwood is a shrub or tree that can grow to 7.5 m in height.

The leaves are elliptical in shape and they are 3 – 8.5 cm long by 0.5 – 2 cm wide. The leaves are arranged alternately along the stem. The bark of the tree is thick and ‘corky’.

Corkwood flowers mainly in winter. The flowers appear in open clusters at the ends of the branches. The numerous small flowers are creamy white. The flowers have 5 petals that are longer and more slender than the petals of poison corkwood.

The plant produces a rounded berry that is dark purple-black.

Management notes

- Corkwoods are not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.
- Corkwoods should be removed from horse paddocks if present.

Piperidine alkaloids

Piperidine alkaloids occur in plants of the genera *Nicotiana* and *Lupinus* and in the plant *Conium maculatum* (hemlock). Only hemlock will be discussed in this section. *Nicotiana* plants contain mostly pyridine alkaloids and these plants are discussed on page 29. Lupins contain

mostly quinolizidine alkaloids and these plants are discussed on page 26.

Hemlock contains several piperidine alkaloids and the plant is highly poisonous to all species, including humans. The plant is unpalatable and

cases of hemlock poisoning in horses are uncommon.

Ingested piperidine alkaloids in hemlock are rapidly absorbed from the gut into the bloodstream. The alkaloid initially has a stimulating effect, followed by a longer-lasting depression of nerve function.

Signs of piperidine alkaloid poisoning

- Muscle weakness
- Incoordination – ‘staggers’
- Slobbering
- Rapid pulse
- Dilated pupils
- Frequent urination and defecation
- A distinctive ‘mousey’ odour on the breath

- In severe cases the horse may die from respiratory failure

There is no specific treatment available for hemlock poisoning in horses but supportive veterinary care can assist with survival and subsequent recovery. An affected animal should be kept calm and should be contained in a safe area

to avoid injury brought about by its incoordination. Veterinary attention should be immediately sought if it is suspected that a horse has suffered hemlock poisoning. If the symptoms improve and respiratory failure does not occur there is a good chance that the horse will make a full recovery.

Hemlock

(fool’s parsley, poison root, carrot fern, winter fern, California fern, wild carrot, wild parsnip, wode whistle)

Conium maculatum [Apiaceae]

Hemlock is native to Europe, Asia and Africa. Hemlock is a declared noxious weed in Victoria, New South Wales and Western Australia.

Hemlock is rarely grazed and the main danger to horses is through contamination of hay, chaff or other feedstuffs. Horses may consume hemlock if other forage is scarce.

Growth and identification

Hemlock is a short-lived biennial or annual plant that grows 1 – 2 m tall. The plant produces seed that can be spread by vehicle movements, water run-off, wind, or as contaminants of transported hay and grain. The seeds germinate in autumn and can grow rapidly after autumn rains, crowding out other species.

The upright, branched stems of hemlock are hollow and are pale green with distinct purple blotches. The hairless leaves are carrot-like and are alternately arranged along the stem. The leaves can grow up to 50 cm long by 40 cm wide and they have long, hollow leaf stalks. The upper surfaces of the leaves are dark green and the undersides are light green or greyish-green.

Management notes

- Avoid grazing horses on pastures infested with hemlock.
- Check hay and other feedstuffs for hemlock contamination.
- Individual plants can be pulled by hand or spot sprayed with herbicides. Use heavy rubber gloves to prevent contamination from plant toxins.
- Improve pastures to increase desirable grasses.
- Hemlock does not persist in cultivated ground. Disk plough heavily infested paddocks before the weed has flowered and topdress to encourage new growth of desirable pasture species.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.

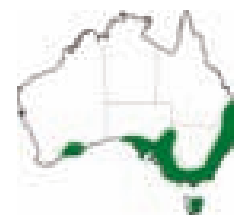
The stems and leaves of hemlock give off a strong odour when damaged. Some describe it as a ‘mousey’ smell.

Flowering occurs in spring and summer. The flowers are white or greenish-white and are 2 – 4 mm across. The flowers are arranged at the ends of stalks in clusters that form an umbrella shape. Individual flowers have 5 petals.

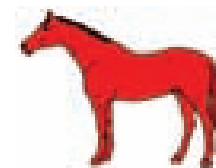
Identification note: Hemlock is often confused with Bishop’s weed (*Ammi majus*). The main differences are that Bishop’s weed has solid stems that do not have purple blotches and the plant does not have a ‘mousey’ smell when damaged.



Above: Hemlock flowers
Right: Bishop’s weed flowers



Weed of floodplains, marshes, moist gullies, forest edges, crops, pastures, roadsides and waterways.



Quinolizidine alkaloids

Quinolizidine alkaloids occur in many plants in the legume family. The quinolizidine-containing plants that can be found in Australia are from the genera *Lupinus* (excluding those grown for food), *Laburnum*, *Cytisus* and *Genista* (the plants in the latter two closely-related genera are generally known as brooms).

The seeds and seedpods contain the highest concentration of toxic quinolizidines but the leaves are also

toxic. Some of these plants also contain piperidine alkaloids, see page 25.

Plants containing quinolizidine alkaloids are usually unpalatable to horses and poisoning cases are uncommon. There have been no reported cases of quinolizidine alkaloid poisoning of horses in Australia. The toxins most commonly affect sheep and major losses in this species can occur though quinolizidine alkaloid poisoning, especially in the northern hemisphere.

Lupins and brooms that grow as weeds in pasture can sometimes be found as contaminants of hay and this can pose a risk to horses as the toxicity of quinolizidine alkaloids is not lost in dried plants.

Quinolizidine poisoning in horses is not fully understood but the toxins are thought to affect the normal function of the nervous system and possibly the gastrointestinal system.

Signs of quinolizidine alkaloid poisoning

Poisoning of horses by quinolizidine alkaloids has not been well described in the literature and this probably reflects the infrequency of its occurrence. The signs that may be seen in horses include:

- Muscle tremors
- Loss of appetite
- Incoordination
- Diarrhoea
- Severely affected animals may die from respiratory failure

Veterinary attention should be sought if quinolizidine poisoning is suspected in a horse. Treatment and supportive care will help with recovery.

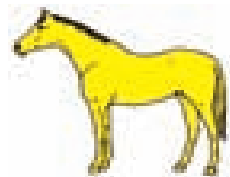
Lupins

Lupinus spp [Fabaceae]

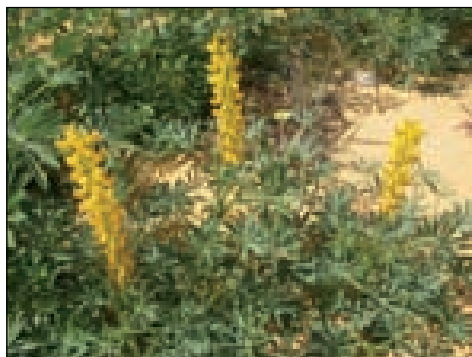


Lupins that contain quinolizidine alkaloids can be found growing as weeds in pastures, crops, roadsides and waterways. Lupins are also commonly grown in gardens as ornamental species.

Lupins are adaptable plants that can be found growing in most areas of Australia.



Lupins are native to North and South America and the Mediterranean region. Several species of lupins grow in Australia, some as ornamental garden plants and some introduced lupins have naturalised to become weeds. The lupins grown for human or livestock feed are low-alkaloid varieties and they do not cause quinolizidine poisoning.



Lupinus luteus, a low-alkaloid species of lupin.
Photo: Sheldon Navie



Lupinus arboreus. Photo: Sheldon Navie

Growth and identification

Lupins can be annual or perennial and can grow to 1 m in height. The leaves are alternately arranged along the stem on long stalks. The leaves are fan-shaped and have 5 – 13 leaflets.

Lupins flower in summer. The colourful pea-shaped flowers are arranged along a centre stem that can be up to 40 cm long. The plant forms pods that are flat and oblong in shape.

Management notes

- Ornamental lupin species should not be grown in areas where horses are kept.
- Avoid grazing horses on pastures infested with lupins.
- Check hay for lupin contamination.
- Individual plants can be pulled out by hand or spot sprayed with herbicide.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.

Lupinus cosentinii. Photo: Sheldon Navie



Golden chain tree

Laburnum anagyroides [Fabaceae]

Golden chain tree is native to Europe and it is grown in Australia as an ornamental garden tree.

Growth and identification

Golden chain tree is deciduous and it usually grows to around 7 m in height.

The leaves are alternately arranged along the stem and they can be up to 8 cm long. The leaves consist of 3 oval-shaped leaflets.

Management notes

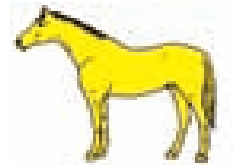
- Golden chain tree is not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.
- Do not dispose of golden chain tree clippings in areas where horses could access them.

Golden chain tree flowers from spring to early summer. The tree is known for its distinctive showy yellow flowers. The pea-shaped flowers grow in drooping clusters that can be up to 30 cm long.

The tree produces seedpods that can be up to 6 cm long.



Most common in cool, humid areas in the southern states of Australia. Grown as a garden ornamental and street tree.



Brooms

Plants in the genera *Cytisus* and *Genista* are generally known as 'brooms' and they are similar in appearance. Some plants in these genera are cultivated as garden ornamentals and some are important weeds of pastures.

The plants are usually unpalatable and are generally thought to be low in toxins. The main

risk for horse poisoning is through their potential to contaminate hay.

All plants in these genera should be considered unsuitable to be grown in areas where horses are kept. Described below are two species of broom that are commonly found as pasture weeds in Australia.

English broom

(Scotch broom, broom)

Cytisus scoparius [Fabaceae]

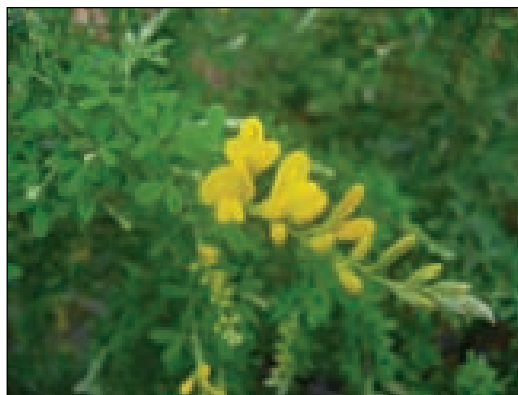
English broom is native to Europe, Asia and Russia. The plant is invasive and is an important weed in pastures. It is a threat to Australian native bushland areas and it has been declared a noxious weed in all states except the Northern Territory and Queensland.

Growth and identification

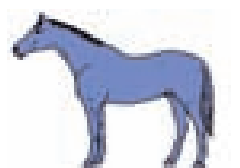
English broom is an upright perennial shrub that usually grows 1 - 2 m in height but can be up to 4 m. The plant produces seedpods that burst open to spread the seed. Seed can also be spread by water run-off, as dumped garden waste, as contaminants of transported hay and grain or through animal and vehicle movements.

The stems are numerous, woody and green to brownish in colour. The stems are ridged and angular.

The leaves appear singly or in clusters and are attached to the stem by short stalks. The leaves are covered in soft hairs underneath and have scattered hairs on the top surface. The leaves are bright green and are composed of 3 leaflets, with the centre leaflet being the largest. Where new growth occurs the leaves appear singly. The leaflets are oval to lance-shaped and the largest leaflets are up to 2 cm in length.



Weed of pastures, open woodlands, bushland, waterways and roadsides. Despite its declared weed status the plant is often grown in gardens as an ornamental species and a hedge plant.



Flowering usually occurs from spring to early summer but flowers may appear at any time throughout the year. The plant has bright yellow pea-shaped flowers and some flowers may have red markings in the centre. Flowers occur singly or in pairs and grow from the angle between the leaf stalks and the stem. The plant produces seedpods that are hairy on the edges. The seedpods are flat and green, turning to black or brown as they mature. The seedpods ripen in summer and burst open to release the seed. Some seedpods curl once the seed has been released.

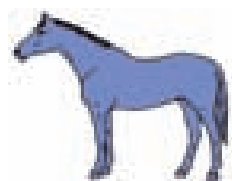
Montpellier broom

(cape broom, canary broom, French broom, Madeira broom, broom)

Genista monspessulana (also known as *Cytisus monspellulanus*, *Teline monspessulana*) [Fabaceae]



Weed of pastures, open woodlands, waterways and roadsides.



Montpellier broom is native to the Mediterranean and Middle Eastern regions. It is invasive and is an important weed in pastures. It has been declared a noxious weed in all states except the Northern Territory and Queensland.

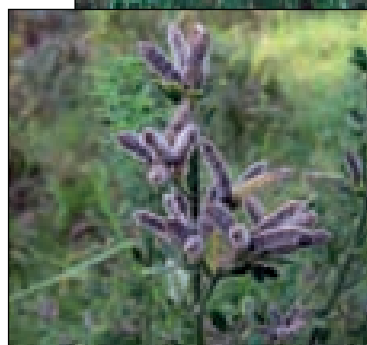
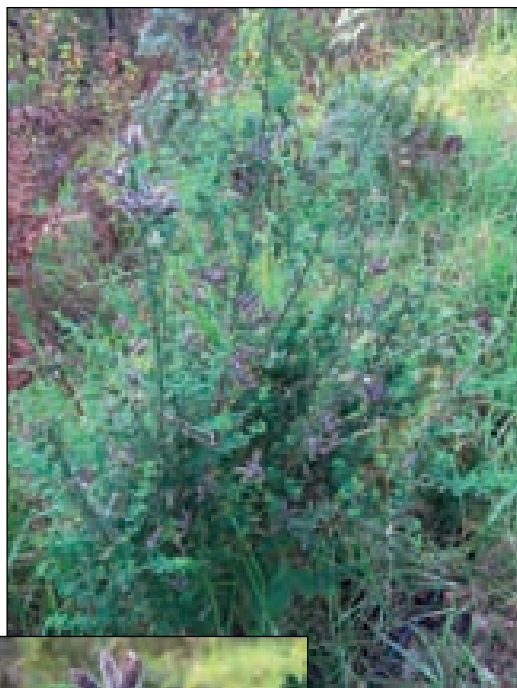
Growth and identification

Montpellier broom is an upright and spreading shrub that usually grows 1 – 2 m in height but can be up to 3 m. The plant produces seedpods that burst open to spread the seed. The seeds can be ejected to a distance of up to 3 m from the plant. Seed can also be spread by water run-off, as dumped garden waste, as contaminants of transported hay and grain or through animal and vehicle movements

Montpellier broom usually has one main woody stem that has many branches. The young stems have ridges along their length and are covered in soft hairs.

The leaves are alternately arranged along the stems on short stalks. The leaves are covered in soft hairs underneath and have scattered hairs on the top surface or may have a hairless surface. The leaves are composed of 3 leaflets and the centre leaflet is usually the largest. The leaflets are oval to egg-shaped and the largest leaflets are up to 3 cm in length.

Flowering usually occurs in late winter and spring. The plant has bright yellow pea-shaped flowers that occur singly or in small clusters. The flowers occur at the tips of the stems and along the branches of the main stem. The plant



produces brown or black seedpods that are covered in soft hairs. The seedpods contain 5 – 8 seeds and the pods become distinctly coiled after they burst to release the seeds.

Management notes

- Avoid grazing horses on pastures infested with broom.
- Check hay for broom contamination.
- Broom should not be grown as an ornamental plant in areas where horses are kept.
- Isolated small plants can be pulled out by hand or spot sprayed with herbicide, preferably before the plant has flowered. Mature plants can be cut to the base and the stump painted with herbicide.
- The use of herbicides can be an effective control measure for larger infestations. The plants should be sprayed while actively growing. Seek advice from local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Some success can be achieved with controlled burning followed by herbicide treatment of new seedlings. Seek advice from the local council regarding regulations and from a local agronomist or weed management agency regarding the best method and timing for this technique.
- Slashing pastures when broom seedlings are between 5 and 10 cm high can provide some degree of control of the weed.

Pyridine alkaloids

Pyridine alkaloids occur in many plants in the genera *Nicotiana* and *Lobelia*. Some *Nicotiana* species (tobaccos) also contain piperidine alkaloids, see page 25.

Poisoning of horses by pyridine alkaloid plants is very rare and the only documented case occurred in the United States when horses were housed in barns containing harvested tobacco

plants (*Nicotiana tabacum*). Cattle and sheep have reportedly been poisoned after the ingestion of native tobacco plants in Australia. There have been no reports of lobelia poisoning in horses.

Although poisoning of horses by pyridine alkaloids is rare, all plants containing these toxins should be considered poisonous. The plants are unpalatable but may be consumed by

hungry horses if no other forage is available.

The main pyridine alkaloid in tobaccos is nicotine. Lobelias contain similar toxins to those in tobaccos but they are considered to be less toxic.

A high dose of pyridine alkaloids mainly affects the central nervous system but the heart and gastrointestinal tract are also affected.

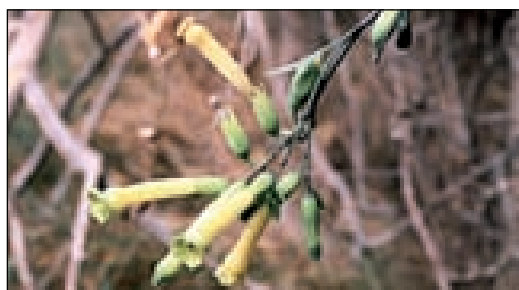
Signs of pyridine alkaloid poisoning

- Muscle tremors and weakness
- Excitement
- Increased breathing rate
- Incoordination

- Coma, paralysis and death in severe cases

Mildly to moderately affected animals usually make a complete recovery.

Affected animals should be kept in a quiet, safe area and veterinary attention should be sought.



Nicotiana glauca (tree tobacco). Photo: Ken Harris

Around seventeen species of tobacco grow in Australia.

Growth and identification

Tobaccos are annuals or short-lived perennials. The plants can be low growing herbs or spindly

Around twenty species of native lobelia grow in Australia. Some of these are cultivated as garden ornamentals and some are considered weeds in some areas.

Growth and identification

Plants in the *Lobelia* genus can be annual or perennial herbs. Lobelias are usually hairless and the stems are upright or they can be prostrate.

The leaves are alternately arranged along the stem and the edges of the leaves are usually toothed.

The flowers appear at the ends of the stems and they can appear in a group of flowers or they can

Management notes

- Do not graze horses on pastures infested with tobaccos or lobelias.
- Individual plants can be pulled out by hand or spot sprayed with herbicide.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Tobaccos and lobelias should not be grown as ornamental plants in areas where horses are kept.

Tobacco

Nicotiana spp [Solanaceae]

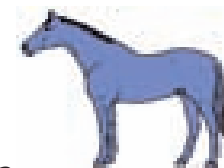
shrubs. The leaves of tobacco are variable in size and shape depending on the species but they are usually dull green in colour.

The flowers occur singly in the fork of the leaves or they may be borne on a flower spike. The flowers are enclosed at the base by a tubular fused bract that has 5 lobes. The flowers are tubular and they have 5 lobes. The flowers can be pale green, white, cream or yellow in colour.

The plants produce fruit capsules in the flower bracts as flowering finishes.



Tobaccos can be found in all states. Cultivated tobacco (N. tabacum) are grown in subtropical and warm temperate regions.



Lobelia

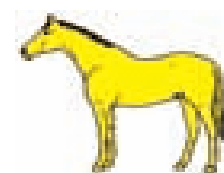
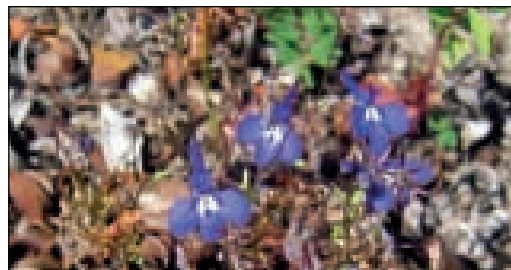
Lobelia spp [Lobeliaceae]

be solitary. The flowers have a short tube that spreads into lobes. The tube is split almost to the base on the upper side to form 2 'lips'. The upper lip is erect or it bends back towards the stem. The lower lip has 3 spreading lobes.

The plants produce a fruit capsule that contains many seeds.



Garden ornamentals, weeds and native bushland plants. Lobelias can be found in all states.



Glycosides

Cyanogenic glycosides

Cyanogenic glycosides are responsible for plant-related cyanide poisoning. The toxins are present in varying amounts in many plants and under certain conditions some plants can accumulate the toxins.

Plants containing cyanogenic glycosides are usually unpalatable but cases of poisoning in horses have been reported in Australia. Cyanogenic glycosides can convert to the deadly toxin cyanide (also known as prussic acid). This conversion takes place under the influence of certain plant enzymes. The enzymes and cyanogenic glycosides are both present in the plant material but they are found in separate cell compartments. Chewing, crushing,

trampling or grinding the plant material exposes the cyanogenic glycosides to the enzymes, leading to the production of cyanide.

Cyanide is quickly absorbed from the gastrointestinal tract into the bloodstream. Once in the blood it travels all over the body and inhibits blood cells from delivering oxygen to tissue cells. The blood becomes supersaturated with oxygen and appears bright red. However tissue cells are simultaneously starved of this oxygen.

Factors that affect the toxicity of plants containing cyanogenic glycosides:

- A high nitrogen to phosphorus ratio in the soil favours cyanogenic

glycoside formation in plants.

- Plant species containing cyanogenic glycosides have different levels of the toxins depending on the stage of growth. In general the highest toxin levels are present when the plant is young and/or rapidly growing.
- Wet leaves, such as from dew or rain, are considered more toxic than dry leaves.
- Some herbicides can increase both the toxicity and the palatability of cyanogenic glycoside plants.
- Environmental stresses such as drought or frost can promote the formation of cyanogenic glycosides.

Signs of cyanogenic glycoside poisoning

Acute poisoning - signs develop rapidly after ingestion of the toxic plant material, with the first signs appearing within 10 minutes to an hour. Cases of acute cyanogenic glycoside poisoning are more commonly seen in cattle than in horses.

The signs that may be seen with acute cyanide poisoning in horses include:

- Rapid breathing (hyperventilation)
- Low blood pressure
- Mucous membranes are characteristically bright red
- Convulsions
- Coma, respiratory failure and death

In the most severe cases it may only be a matter of minutes between the onset of symptoms and death and in other cases there may be 1-2 hours before

death occurs. In many reported cases of acute cyanogenic glycoside poisoning the horse has been found dead in the paddock.

If a veterinarian attends the horse in the early stage of acute poisoning there are steps that can be taken that may save the horse. Among the treatment options is the administration of either sodium nitrate or methylene blue.

These compounds can remove cyanide from the blood to allow the delivery of oxygen to the tissues. If either of these compounds is rapidly administered there is a chance the horse will recover. Once the horse shows signs of severe breathing difficulties it is unlikely to survive.

Chronic poisoning - chronic cyanide poisoning can occur if a horse consumes small amounts of cyanogenic glycoside plants over time. It is thought

that low levels of cyanide damage parts of the spinal cord and long nerves.

The signs that may be seen with chronic cyanide poisoning include:

- Hindlimb incoordination that is more noticeable when the horse is backed or turned
- Urinary incontinence
- Constipation
- Weight loss
- The horse may develop urinary tract infections that can be severe

Animals affected by chronic cyanide poisoning usually make a slow recovery once access to cyanogenic glycoside plants has been removed. The prognosis may not be so good if hindlimb incoordination is advanced and/or serious urinary tract/kidney problems have developed.

Prunus

(includes plums, peaches, apricots, cherries, nectarines and almonds)

Prunus spp [Amygdalaceae]

Many species of *Prunus* are grown in Australia, either as orchard fruits or as garden ornamentals. The ingestion of only small quantities of prunus leaves can be enough to cause poisoning in horses. Estimates on exactly how much is too much varies but the consensus in the literature is that horses should be restricted from ingesting any amount of prunus leaves. Cyanogenic glycoside levels are highest in prunus leaves when they are damaged or stressed from frost, storms, drought or seasonal wilting.

Growth and identification

The *Prunus* genus contains trees or shrubs that are mostly deciduous. The plants produce blossoms that are usually pink or white. The blossoms appear in spring before the appearance of new leaves. The plants produce fleshy fruit that is usually indented on one side and many of these fruits are edible.

Management notes

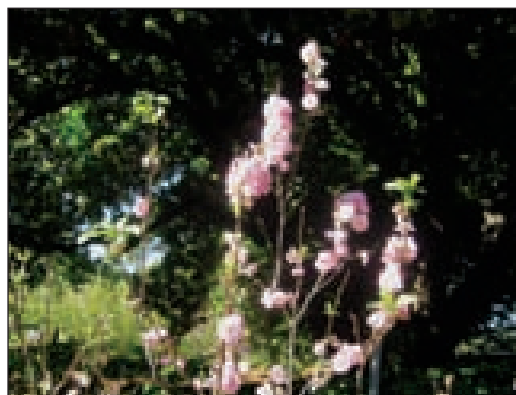
- Prunus trees or shrubs are not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.
- Do not put fallen leaves or clippings of prunus in areas where horses could access them.

All sorghums contain cyanogenic glycosides but there is much variation between species and varieties. Sorghums that have been associated with poisoning in horses either in Australia or overseas include the forage or weed sorghums (Johnson grass, Sudan grass, Columbus grass) and grain sorghum. There is some confusion over sorghum names and for the purposes of this book we will refer to sorghums by their common names and note the species name by which they are usually known. A taxonomic review of sorghums in 2003 showed that there are many hybrids and types of sorghum that are difficult

Johnson grass is native to the Mediterranean region, Europe, Asia and Africa. It is a major weed in pastures and crops and it is declared noxious weed in New South Wales, the Northern Territory and Western Australia.

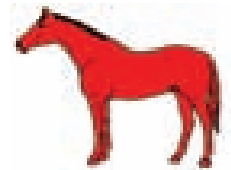
Growth and identification

Johnson grass is a long-lived perennial grass that competes vigorously with crop and pasture species. It reproduces by seed and by creeping underground stems. The seeds can spread by wind, water run-off, as contaminants of hay and grain or through animal and vehicle movements.



Orchard trees, garden ornamentals, summer shade trees.

Most suited to temperate climates. Varieties of fruiting Prunus have been developed for subtropical and tropical climates. Prunus spp can be found growing in most parts of Australia.

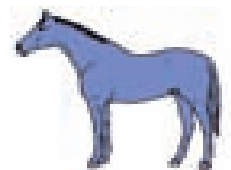


Sorghums

to classify. There may be further changes to the naming of these plants in the future.

Horses may be at risk of chronic cyanide poisoning if they are grazed on sorghum-dominant pastures or if they are fed hay containing sorghum species. Sorghum grain has very low levels of cyanide and is considered safe.

Identification note: distinguishing between different grasses can be extremely difficult and only a very basic description is given here. See page 5 for more information on obtaining a precise identification of a plant species.



Sorghums are usually a low-moderate risk to horses. Young sorghum-dominant pastures affected by frost or storms, and sorghum hay that has not been cured can pose a very high risk to horses.

Johnson grass

Usually known as *Sorghum halepense* [Poaceae]

The grass can grow to 1.5 m. It has stout upright stems with alternately arranged leaves that are glossy in appearance. The leaves have a prominent midrib that is almost white and the edges of the leaves are rough. The flowering stems have joints that may have tufts of downy hairs.

The flowering seed heads can be pale green, red or purple in colour and they appear at the top of a flowering stem. The seeds are borne on many slender branches that divide into finer branches. The seed heads can be up to 30 cm long and 30 cm wide.



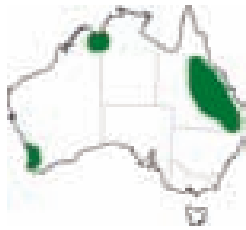
Weed of crops, pastures, roadsides and waterways.

Johnson grass has underground stems (rhizomes) that are white or reddish-purple in colour and are covered in brown scaly sheaths. These stems have nodes from which new growth can occur.

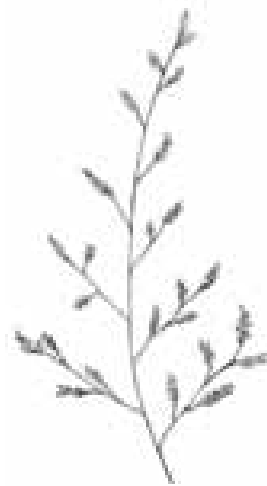
Sudan grass

Known as *Sorghum sudanense* or *Sorghum drummondii* [Poaceae]

Sudan grass is very similar to Johnson grass. The main differences are that Sudan grass does not produce underground shoots (rhizomes), it is an annual and the seed head is longer.



Pasture grass.



The seedheads of Johnson grass, Sudan grass and Columbus grass are very similar.

Columbus grass

May be a hybrid of *Sorghum halepense* x *almum* [Poaceae]

Columbus grass is very similar to Johnson grass. The main difference is that the sections between the nodes of the underground stems (rhizomes) are thicker and shorter in Columbus grass.

Declared a noxious weed in New South Wales and Western Australia.



Pasture grass.

Grain sorghum

Sorghum bicolor [Poaceae]

Grain sorghum is similar to Johnson grass but it does not have underground stems. The flower head of grain sorghum is denser than that of Johnson grass. It can be an annual or a short-lived perennial.



Grain sorghum is mainly cultivated in the eastern states. Its hybrids can be found growing as weeds in all states.



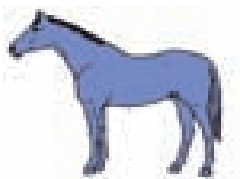
Grain sorghum

Management notes

- Young sorghum pastures are not safe for grazing, especially if damaged by frosts, drought or storms. Pasture over 50 cm high is usually considered safe for grazing.
- If feeding sorghum hay to horses, ensure that it is properly cured. Fresh or green sorghum hay has the potential to contain high levels of cyanogenic glycosides.
- Select low-risk cultivars if planting sorghums as pasture grasses.

Other plants that can accumulate cyanogenic glycosides:

The following plants may, under certain conditions, contain high levels of cyanogenic glycosides.



Spotted fuchsia

(native fuchsia, spotted emu bush)

Eremophila maculata [Myoporaceae]

Densely branched perennial shrub growing to 2 m. Alternately arranged, narrow leaves that can be up 5 cm long by 1 cm wide. The leaves are dark green and glossy. Flowers in winter and spring. The tubular flowers appear in the forks of the leaves on S-shaped stalks. Flowers can be shades of yellow or red. The inside surface of the flowers is spotted.



Birdsfoot trefoil

Lotus corniculatus [Fabaceae]



Annual or perennial plant growing to 40 cm. The stems lie along the ground and grow upwards at the tips (decumbent). The alternately arranged leaves have 5 egg-shaped leaflets that are each up to 1.5 cm long. The 2 lower leaflets are sometimes very small. The pea-shaped flowers appear in a group of 2 – 8 and the flower stalks of each group arise from a single point on the stem. The spring - summer flowers are usually yellow with red veins. Produces brown pods.



Pasture legume.

Wattles

Acacia spp [Fabaceae]



Acacia is the largest genus of flowering plants in Australia with 960 species. Acacias can be trees or shrubs. Young leaves are bi-pinnate, which means that the main leaf stem has opposite pairs of stems and these smaller stems have opposite pairs of leaflets. Older leaves might retain this form, be cylindrical or be a flattened, leaf-like stem. Acacia flowers are small and round, oval or cylindrical. The flowers are usually yellow. Pods are usually leathery or woody.



Occurs naturally in most environments in Australia. Grown as garden plants, street trees and park trees.

Couch grasses

Cynodon spp [Poaceae]

Particularly African star grass (Coondai couch) *Cynodon nlemfuensis* and *Cynodon plectostachyus*



African star grass

Cynodons are perennials. They produce underground (rhizomes) and aboveground (stolons), root-like stems that can take root and produce new growth. The leaves are sheathed. The inner junction of the leaf sheath and leaf blade is thin and translucent. The flowers have 2 – 6 narrow spikes spreading from the top of the flowering stem and all of the spikes arise from the same point. The small spikelets appear in 2 rows on the underside of the flower stems.

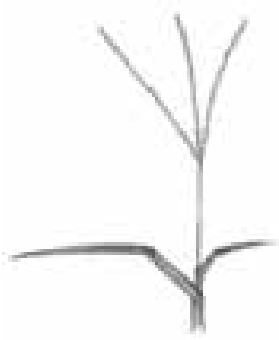


Pasture grasses. African star grass is found in the areas shown in dark green on the above map. Other couch grasses are widely distributed throughout Australia.

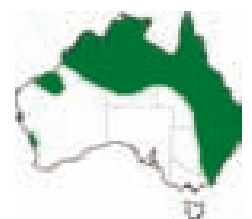
Native couch

(*spider grass*)

Brachyachne convergens (also known as *Cynodon convergens*) [Poaceae]



Upright or semi-upright annual that grows to 50 cm. The branched stems are bent (like a knee or elbow joint) at the base. The leaves have a loose overlapping sheath. The flower has 3 – 5 narrow spikes spreading from the top of the flowering stem. All of the spikes arise from the same point and they can be 3 – 5 cm long.



Native pasture grass.

Linseed (flax)

Linum usitatissimum [Linaceae]

Linseed meal was once a common protein supplement for horses but it is not as commonly used today. Heat pressed linseed meal does not contain cyanogenic glycosides and is not a risk to horses. Cold pressed linseed meal that has not been treated with heat contains cyanogenic glycosides and poses some risk to horses. Whole linseed seed is sometimes fed to horses as a coat conditioner and laxative. Whole linseed seed is safe to feed dry and untreated if using small amounts in the ration (less than half a cup, or 75 g). Larger amounts of whole linseed seed should be heat treated to remove cyanogenic glycosides before being fed to horses. Method: add the seeds to boiling water and continue boiling for at least 5 minutes. Do not soak linseed seeds in cold water as this will increase the amount of cyanide in the seeds, making them more toxic.



Management factors

- Some of the plants on the above list are important pasture species and are safe under most circumstances. An observance of the risk factors listed at the start of this chapter will reduce the risk of poisoning by pasture species that can accumulate cyanogenic glycosides.
- The ornamental plant species on the above list are usually unpalatable but horses may eat them if other forage is scarce. In some circumstances these ornamentals may accumulate large amounts of cyanogenic glycosides and the ingestion of only small amounts may be enough to cause poisoning. These plants should be considered unsuitable for planting in paddocks, along paddock fences or in areas where horses are kept.

Cardiac glycosides

Cardiac glycosides are found in several plant families. Cardiac glycosides are extremely toxic but poisoning is relatively uncommon in horses because the plants are generally unpalatable.

Cardiac glycosides disrupt normal heart function by inhibiting an important enzyme called Na⁺/K⁺ATPase. The enzyme regulates the levels of sodium ions (Na⁺) and Potassium ions (K⁺) in the cells of the body. Inhibition

of the enzyme controlling sodium and potassium levels in cells leads to a build-up of potassium outside cells and a build-up of sodium inside cells. This triggers a release of calcium into the cells. High levels of calcium in the cells of the heart can cause problems with normal function and can lead to heart failure. The action of cyanogenic glycosides also has effects on the gastrointestinal system and the nervous

system. The properties of some cardiac glycosides have made them useful in human medicine.

Note: Care should be taken if the plants in this group are removed from paddocks or otherwise handled. They are very toxic to humans if ingested and the sap of these plants causes skin irritation. The ingestion of one leaf or flower from the oleander tree can be enough to cause death in a human.

Signs of cardiac glycoside poisoning

The ingestion of plant material containing cardiac glycosides can rapidly cause death in horses. In many reported cases of acute cardiac glycoside poisoning the horse has been found dead in the paddock. Signs of poisoning appear soon after ingestion of toxic plant material and the symptoms progress rapidly.

- Colic
- Lethargy and weakness

- Diarrhoea
- Abnormal heart beat and weak pulse
- Cold extremities
- Sweating
- Shortness of breath
- Death from heart failure usually occurs from 12 - 48 hours after ingestion of the toxic plant

There is no specific treatment available for cardiac glycoside poisoning.

Supportive care and treatments such as activated charcoal administered directly to the stomach, fluids and heart medications have been useful in a small number of cases. Immediate veterinary attention is critical for there to be any chance of survival.

Horses that survive cardiac glycoside poisoning may be left with permanent damage to the heart.

Oleander

Nerium oleander [Apocynaceae]

Oleander is native to the Mediterranean region and it is widely grown in Australia as a garden ornamental and street tree.

The plant is extremely toxic to all species, including humans. A study on the toxicity of oleander showed that the ingestion of only 7 leaves could be fatally toxic to an average sized horse. All parts of oleander trees are toxic and this toxicity is retained in dried leaves, flowers and branches. Oleander contains several cardiac glycosides but the most toxic of these is called oleandrin.

Horses will not usually eat oleander leaves because they have a bitter taste. Cases of oleander poisoning in horses have been reported in Australia and overseas. Some cases involved

the ingestion of fresh oleander leaves from the tree but most documented cases of poisoning have involved the ingestion of plant clippings or fallen and dried leaves. Dried leaves have not lost their toxicity but they are more palatable than fresh leaves.

Growth and identification

There are many cultivars of oleander grown in Australia and there is much variation between them.

Oleander is an evergreen shrub or tree that can grow from 2 – 5m tall. Some newer dwarf varieties grow to 1.5 m tall.

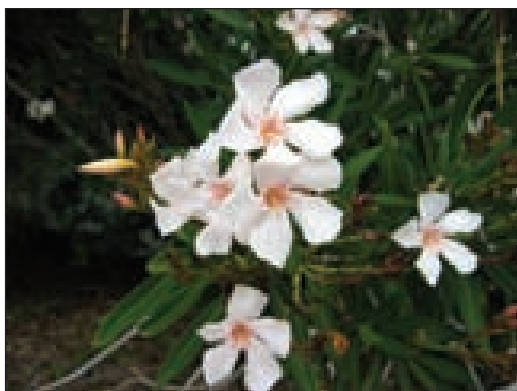
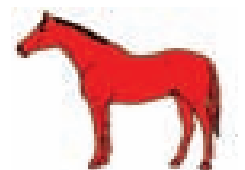
The plant is upright and has many stems that may start to branch near ground level. The stem and branches exude a thick white sap if damaged.

The leaves are narrow and are elliptical or lance-shaped. They are positioned on opposite sides of the stem or in whorls of 3 to 4. The leaves can be from 6 – 20 cm long and up to 3 cm wide. The tips of the leaves are pointed and the edges are smooth. The leaves have a leathery feel and have a prominent midrib, with side veins that are parallel. The leaves are usually green but can sometimes have a variegated pattern of white or yellow. The lower surface of the leaves is usually paler than the upper surface.



Drought resistant and adaptable plant that can be found in most parts of Australia.

Grown as garden ornamentals, street trees, park trees and hedges.

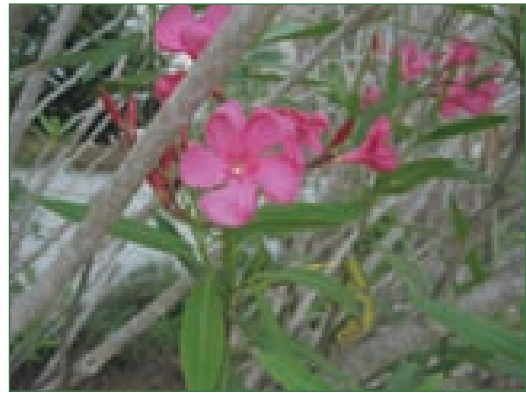


The plant flowers mainly in summer but many cultivars can also flower in spring and autumn. The flowers are usually 3 - 4 cm in diameter. The flowers can have a single or double layer of petals and are most commonly pink but can be white, red, or yellow.

The plant produces a pair of narrow brown pods that can be up to 20 cm long. The pods droop downwards and they contain many silky seeds.

Management notes

- Oleander is not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.
- Do not put fallen leaves or clippings of oleander in areas where horses could access them.



Yellow oleander

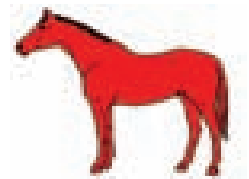
(Captain Cook tree, Cook tree, lucky nut, Mexican oleander, dicky plant)

Cascabela thevetia (also known as *Thevetia nereifolia* or *Thevetia peruviana*) [Apocynaceae]



Drought resistant and adaptable plant that can be found in most parts of Australia.

Grown as garden ornamentals, street trees and park trees. It grows as a weed in some areas.



Yellow oleander is native to South America. The plant contains several cardiac glycosides with the major ones being thevetin A and B and peruvoside.

Yellow oleander is widely grown as a garden ornamental. However, the plant has spread beyond gardens and naturalised populations that are considered weeds occur mostly on the east coast, especially in Queensland and northern New South Wales. Some populations of naturalised yellow oleander are recorded in the Northern Territory and Western Australia. It is a declared noxious weed in Queensland.

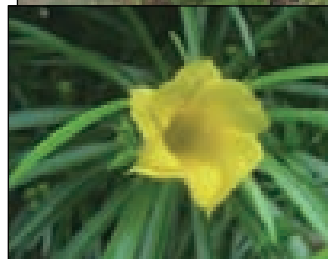
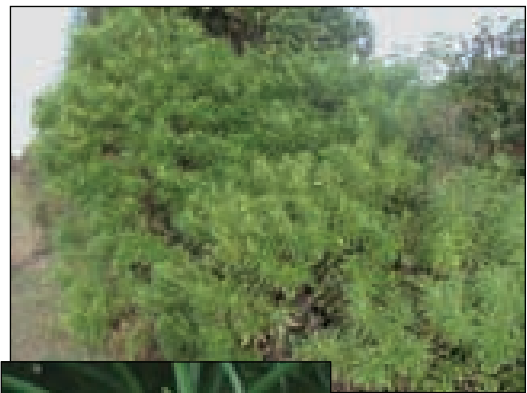
Growth and identification

Yellow oleander is an evergreen shrub or tree that can grow from 2.5 – 3 m tall. Occasionally the plant can grow as high as 10 m.

The plant is upright and has many stems that may start to branch near ground level. The stem and branches exude a thick white sap if damaged.

The leaves are lance-shaped and are arranged along the stems in a spiral pattern, often in dense clusters. The leaves can be from 5 – 15 cm long and up to 1.5 cm wide. The tips of the leaves are pointed and the edges are smooth and may curve downwards. The leaves have a prominent midrib. The leaves are glossy and green on the upper surface and dull and paler green on the lower surface.

The plant flowers mostly in summer and autumn but can flower at any time of the year. The



Photos: Sheldon Navie

flowers are tubular in shape and are 5 – 7 cm long. The flowers are usually bright yellow or occasionally orange. The plant produces a slightly fleshy fruit that is up to 5.5 cm across. The fruit is roughly triangular and it droops from the branch. The fruit is glossy green turning to black with maturity.

Management notes

- Yellow oleander is not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.
- Do not put fallen leaves or clippings of yellow oleander in areas where horses can access them.
- Individual plants found as weeds in paddocks should be removed. Small seedling can be removed by hand. Wear thick gloves and take extreme caution to avoid the sap of this plant.
- Larger plants may need to be cut at the base and the stump painted with herbicides. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide.



Photo: Sheldon Navie

Rubber vine is native to Madagascar. The plant is a notorious invader and it thrives in Australian conditions, particularly in northern Australia. The plant creates dense thickets and chokes out native species. It is considered one of Australia's worst weeds and it is on the list of the *Weeds of National Significance*. It is declared noxious in Queensland, Western Australia, the Northern Territory and South Australia.

Rubber vine contains cardiac glycosides and is very toxic. Reports of poisonings are uncommon but rubber vine was implicated as the cause of poisoning in several horses in Australia in 1990.

Growth and identification

Rubber vine is a woody shrub or climber. It can grow to 1 – 3 m high without support but it can reach up to 30 m high when growing on vegetation.

The plant produces seeds that are spread by wind, water run-off or through animal and vehicle movements.

The stems of the plant are grey-brown and are covered in raised spots. The stems exude a thick white sap if damaged. Young stems are green and are of two types: leafy and branched or leafless and unbranched 'whips'. The 'whip' stems can grow up to 8 m and may find support for climbing.

The leaves are thick and leathery and are arranged on opposite sides of the stem. The leaves are glossy dark green on the upper surface and they are pale and dull on the lower surface. The leaves are oblong in shape and can be up to 10 cm long by 6 cm wide. The leaves have smooth or slightly wavy edges and they have green or red-purple stalks that can be up to 1.5 cm in length.

Rubber vine flowers mainly in summer. The flowers are white or shades of purple or pink. The usual colour is pale pink with a darker centre. The flowers are tube-shaped and are 4 – 6 cm long and 5 – 9 cm wide. The plant produces fruit that can be green or brown in colour. The fruit is produced in pairs and resemble pods. The seeds inside the fruit are brown and flat and are topped with a tuft of white hairs that are up to 4 cm long.

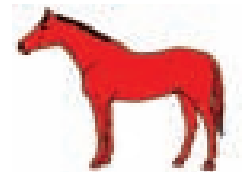
Rubber vine

(Indian rubber vine)

Cryptostegia grandiflora [Asclepiadaceae]



Weed of waterways, open woodlands, grasslands, pastures, forests and roadsides.



Purple rubber vine

(rubber vine, Madagascar rubber vine)

Cryptostegia madagascariensis [Asclepiadaceae]

Purple rubber vine is native to Madagascar. It is a declared noxious weed in Western Australia, the Northern Territory and Queensland.

Growth and identification

Purple rubber vine is very similar to rubber vine. The flowers of purple rubber vine are slightly

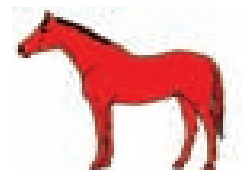
smaller and are a deeper pink colour than those of rubber vine.

Identification note: There are several cultivated plants available in nurseries that go by the name rubber vine. These are unrelated plants and should not be confused with *Cryptostegia grandiflora* or *Cryptostegia madagascariensis*.



Weed of waterways, open woodlands, grasslands, pastures, forests and roadsides.

Grown as an ornamental garden plant in some areas of Australia.



Management notes

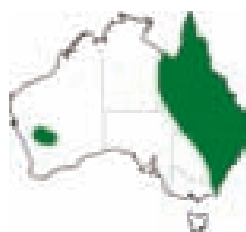
- Avoid grazing horses in areas where rubber vine grows.

Control of these plants, especially large infestations of rubber vine, requires an integrated weed management approach.

- Isolated small plants can be pulled out by hand. Wear thick gloves and take extreme caution to avoid the sap of these plants.
- The strategic use of herbicides is effective in controlling individual plants or small infestations. If the stems are greater than 90 mm across, cut the plants at the ground and apply herbicide to the stumps. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Fire is often used as a control method for large infestations of rubber vine. Follow-up burns and removal of seedlings will be required. Seek advice from the local council regarding regulations and also seek advice from a local agronomist or weed management agency regarding the best method and timing for this technique.

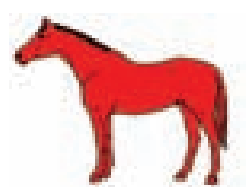
Mother of millions

Bryophyllum spp [Crassulaceae]



Weed of pastures, grasslands, open woodlands, roadsides and forests.

Mother of millions hybrids are commonly grown as garden ornamentals.



Most species of *Bryophyllum* are known as mother of millions.

Mother of millions and hybrid mother of millions are native to Africa and Madagascar. The plants are drought tolerant and can quickly dominate pastures that have been affected by dry conditions. Several species of *Bryophyllum* have been declared noxious weeds in Queensland, New South Wales and Western Australia.

All species of *Bryophyllum* contain highly toxic cardiac glycosides. There are no confirmed reports of horse poisonings by this plant in Australia. The plants are usually unpalatable but they can heavily invade pastures and they should be considered a risk to horses. It has been reported that the flowers are the most palatable part of the plant and they may be eaten when other fodder is scarce. Mother of millions can sometimes be found as a contaminant of hay.

All parts of mother of millions plants are toxic but the flowers contain the highest levels of toxins.

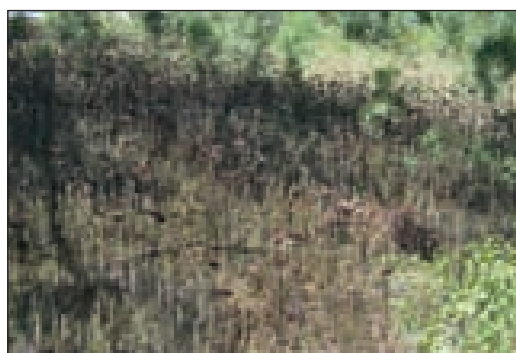
Growth and identification

Mother of millions and its hybrid species are very similar in their growth habit and appearance.

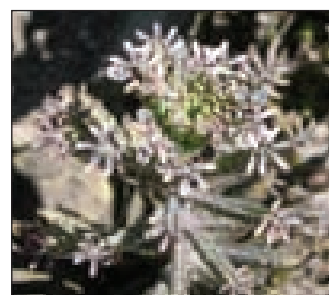
The plants are erect perennial succulents that can grow up to 1.8 m but are usually around 1 m in height. Mother of millions produce numerous seeds that can be dispersed by water run-off, as contaminants of hay and grain or through animal and vehicle movements. The plant also produces numerous tiny plantlets at the edges or tips of the leaves. Each of these plantlets can grow if dislodged from the leaves or dumped as garden waste. This feature of the plant gives it the common name 'mother of millions'

Management notes

- Avoid grazing horses on pastures infested with mother of millions. This is especially important when the plant is flowering and when other fodder is scarce, for example during drought conditions.
- Check hay for mother of millions contamination.
- Mother of millions should not be grown as an ornamental plant in areas where horses are kept.
- Do not put clippings of the plant in areas where horses could access them.
- Improve pastures to increase desirable grasses.
- Individual plants can be removed from the paddock by hand. Ensure all plant material is removed and dispose of plants by burning or place them in bags. Wear thick gloves and take care to avoid the sap of these plants.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.



A pasture infested with mother of millions.



Mother of millions seedling showing plantlets.

The leaves are arranged on opposite sides of the stem and can be single or compound, with up to 5 leaflets. The leaves vary between species in shape and colour.

The flowers grow in drooping clusters at the top of the upright stems. The flowers are contained within a tube that can be coloured and mottled and can be up to 4 cm long. The petals extend from the tube and are fused for more than half their length. There are 4 petal lobes near the tip of the flower. The flowers can be red, orange-red, pink or greenish-yellow. Flowering occurs in winter to early spring.

Cape tulips

Cape tulips are native to Africa. There are two species of cape tulip and both are declared noxious weeds in all states except Queensland, the Northern Territory and the Australian Capital Territory.

Cape tulips contain highly toxic cardiac glycosides but there are no confirmed reports of horse

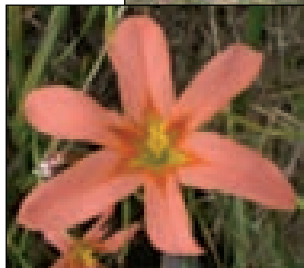
poisonings caused by the plant in Australia. There are reports of cape tulip poisoning in other livestock species in Australia. The plants are usually unpalatable but they can invade pastures and they should be considered a risk to horses. Cape tulips are a common contaminant of hay that has been cut in areas where the weed grows.

Growth and identification

One leaf cape tulip is an upright plant that usually grows to 60 cm tall but can occasionally grow to 75 cm. The plant produces perennial underground 'bulbs' (called corms). The leaves and stems die back annually. The plant spreads mostly by seed. It can also spread in its immediate area by the production of the underground corms. These corms can be spread to other areas by cultivation or other practices that move soil.

The rounded stems may appear to grow in a zigzag manner and the stems may branch near the top of the plant. Each plant has 1 leaf that sheaths the lower part of the plant. This leaf is folded when young and matures to be strap-like and slightly ribbed.

The plant flowers in late winter to early spring. The flowers are usually pink or orange with a yellow centre. The

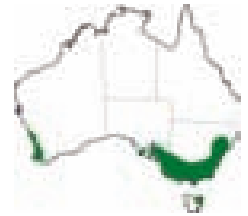


Photos: Sheldon Navie

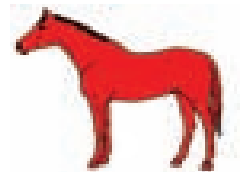
One leaf cape tulip

Moraea flaccida [Iridaceae]

flowers appear at the end of the branches and each flower has 6 elongated petals that can be up to 4 cm long. The plant produces a green fruit capsule that turns brown as it matures. The fruit capsule is elongated and is around 5.5 cm long, with a short 'beak' at its tip. Each fruit capsule contains up to 150 small seeds.



Weed of pastures, open woodlands, roadsides and crops.



Growth and identification

Two leaf cape tulip is an upright plant that usually grows to 60 cm tall. The plant produces numerous perennial underground 'bulbs' (called corms). The leaves and stems die back annually. The plant spreads through the distribution of a large number of bulb-like structures that form in the forks of the leaves after flowering has finished (called cormils). Mature 'cormils' have a hard black covering and can be spread by machinery, contaminated crops and feedstuffs or by cultivation and other practices that move soil. It has been estimated that up to 20,000 cormils can accumulate per square metre of land in heavily infested areas. The plant also spreads in its immediate area by the production of underground corms and these corms can be spread to other areas by cultivation or other practices that move soil.

The rounded stems may appear to grow in a zigzag manner and the stems may branch near

the top of the plant. Each plant has 2, or less commonly 3, large alternately arranged leaves. The leaves are folded when young and mature to be strap-like and slightly ribbed.

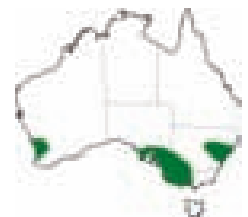
The plant flowers in late winter to early spring. The flowers are usually pink or orange with a yellow centre. Flowers appear at the end of the branches and each flower has 6 broad petals that can be up to 2.5 cm long. The plant produces a small green fruit capsule that turns brown as it matures. The fruit capsule does not produce seeds.



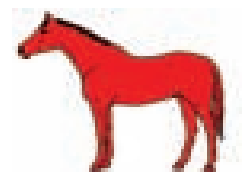
Photo: Sheldon Navie

Two leaf cape tulip

Moraea miniata (previously known as *Homeria flaccida* and *Homeria miniata*) [Iridaceae]



Weed of pastures, open woodlands, roadsides and crops.



Management notes

- Avoid grazing horses on pastures infested with cape tulips.
- Check hay for cape tulip contamination.

Reducing the chance of introducing cape tulips to a property is important because, once established, the weeds are very hard to control.

- Check hay that is to be fed on the ground for cape tulip contamination.
- Seed can be carried onto a property in mud on vehicles. Clean vehicles after visiting cape tulip infested areas.

Control of established infestations is a difficult and ongoing process because of the high dormancy rate of underground corms of both species and the cormils of two leaf cape tulip.

- Individual plants found growing as weeds can be removed by hand or spot sprayed with herbicide. Dig around the base of the plants to ensure that all of the underground corms are removed.
- The use of herbicides is the main control technique for managing cape tulip infestations. The timing and type of herbicide used are critical to the success of a control program. Seek advice from a local agronomist or weed management agency on the best method and timing for herbicide control of cape tulip.

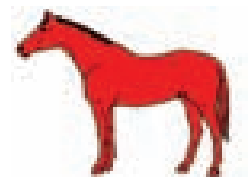
Cotton bushes

Gomphocarpus spp and *Asclepias spp* [Apocynaceae]



Weeds of waterways, roadsides, pastures and open woodlands.

Grown as garden ornamentals in some areas.



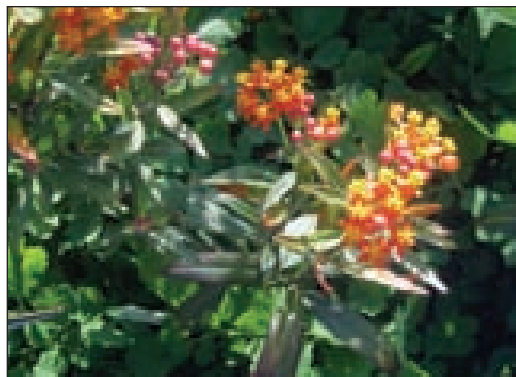
Cotton bushes are those plants in the genera *Gomphocarpus* and *Asclepias*. Cotton bushes are also known as milkweeds and some are known as swan plants. They were introduced to Australia as garden plants. Some are still grown in gardens today and some have become important agricultural weeds. Narrow leaf cotton bush (*Gomphocarpus fruticosus*) is a declared noxious weed in Western Australia.

Cotton bushes contain highly toxic cardiac glycosides but there are no confirmed reports of horse poisoning cases caused by the plants in Australia. The plants are usually unpalatable to horses but they may be ingested if other forage is scarce. Cotton bushes are sometimes found as contaminants of hay. There are reports from other countries of horse deaths caused by the ingestion of cotton bushes.

Growth and identification

Cotton bushes are perennial upright plants that are usually 1 – 2 m tall. The stems are usually thin, stiff and woody.

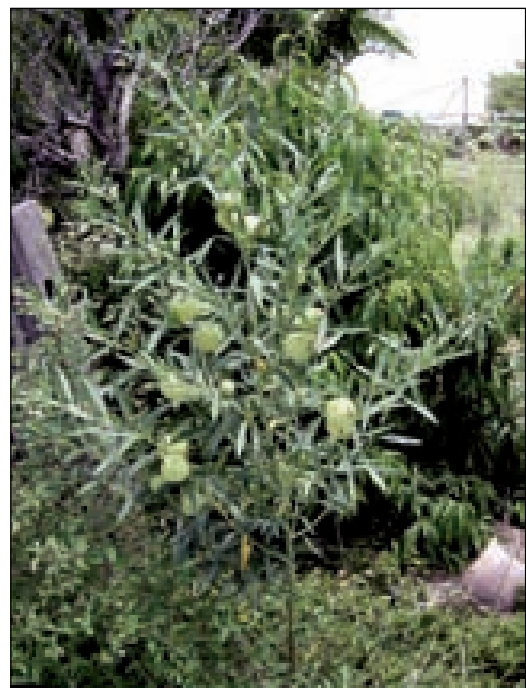
The leaves are usually lance-shaped and they are arranged on opposite sides of the stem. All parts of the plant release a milky sap when damaged.



The flowers of red headed cotton bush (*Asclepias curassavica*).



Above and right: balloon cotton bush (*Gomphocarpus physocarpus*, also known as *Asclepias physocarpus*).



The flowers are white in most species and they are produced in clusters of 3 – 10. Red headed cotton bush has red and orange flowers. The flower clusters droop on a stalk from the forks of the leaves. Flowering can occur from spring to autumn.

The plants produce distinctive balloon-like green fruit that has thin walls. The fruits are covered in soft bristles and they are usually rounded or slightly oval. The fruits of some species may taper to a short curved projection at one end. The seeds inside the fruit are brown or black and are topped with numerous white silky hairs.



The hairy seeds of narrow leaf cotton bush (*Gomphocarpus fruticosus*)

Management notes

- Avoid grazing horses on pastures infested with cotton bushes.
- Cotton bush species should not be grown as ornamental plants in areas where horses are kept.
- Do not put clippings from ornamental cotton bush species in areas where horses could access them.
- Check hay for cotton bush contamination.
- Individual plants can be easily removed from the paddock by hand as they have shallow root systems. Ensure all root material is removed from the ground. Wear thick gloves and take care to avoid the sap of this plant.
- The use of herbicides can be an effective control measure for larger infestations. The plant should be sprayed while actively growing. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.

Foxglove

Digitalis purpurea [Scrophulariaceae]

Foxglove is native to Europe and is widely grown in Australian gardens. In some areas of Australia the plant grows as a weed in pastures and it has the potential to contaminate hay and other feedstuffs.



glycosides and it has been reported to cause poisoning in horses in some countries, although there has been no confirmed horse poisoning cases in Australia.

Growth and identification

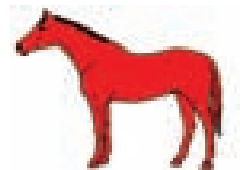
Foxglove is an erect perennial or biennial plant that grows to around 1.5 m. The plant produces a large number of seeds that can be spread by wind or water run-off.

The stem and leaves of the plant are covered in dense hairs. The leaves are egg-shaped and form a rosette. A showy flower spike grows from the centre of the rosette in spring to early summer. The flowers are produced at the top of the spike and flowers hang from all sides. The flowers are tubular and bell shaped and can be white, purple or pink with mottled patterns.



Weed of pastures, grasslands and roadsides in eastern New South Wales, eastern Victoria and Tasmania.

Foxgloves are grown throughout Australia as garden ornamentals.



Management notes

- Avoid grazing horses on pastures infested with foxgloves.
- Foxgloves should not be grown as an ornamental plant in areas where horses are kept.
- Do not put clippings from foxgloves in areas where horses could access them.
- Individual plants found growing as weeds can be removed by hand. Wear thick gloves and take care to avoid the sap of this plant.
- The use of herbicides can be an effective control measure for larger infestations. The plant should be sprayed while actively growing. Seek advice from local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.

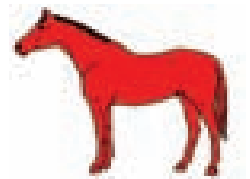
Ornithogalums

Ornithogalum spp [Hyacinthaceae]



Weeds of crops and pastures in southern New South Wales, southeastern South Australia, Victoria and southwestern Western Australia.

Grown throughout Australia as garden ornamentals.



Some species of *Ornithogalum* are considered weeds in some areas of Australia where they invade crops and pastures, for example *Ornithogalum umbellatum* (star of Bethlehem), *Ornithogalum longibracteatum* (pregnant onion) and *Ornithogalum thyrsoides* (Chinkerichiee). Ornithogalums are cultivated as garden plants throughout most of Australia. The plants are usually unpalatable to horses but they can sometimes be found as contaminants of hay.

Growth and identification

Ornithogalums are erect annual plants. The plants grow from bulbs, around which smaller bulbs are produced. These bulbs can be spread though machinery movements or cultivation and other practices that move soil. The plant can also reproduce by seed.

The leaves are usually dark green and shiny and some species have leaves with a distinctive white midrib. The leaves are strap-like.

The flowers grow on a long stem that is hollow. There can be many flowers on the branches of



Ornithogalum umbellatum
(star of Bethlehem)
Photos: Ken Harris

each stem. Each white flower has 6 'petals' (not all are true petals) and there is usually a green midvein on the outer surface of the petals. Flowering occurs mostly in spring but can occur at other times of the year.

Management notes

- Avoid grazing horses on pastures infested with ornithogalums.
- Ornithogalums should not be grown as ornamental plants in areas where horses are kept.
- Do not put clippings from ornithogalums in areas where horses could access them.
- Individual plants found growing as weeds can be removed by hand or spot sprayed with herbicide. Dig around the base of the plants to ensure that all of the bulbs are removed. Wear thick gloves and take care to avoid the sap of this plant.
- The use of herbicides can be an effective control measure for larger infestations. The plant should be sprayed while actively growing. Seek advice from local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.

Blue periwinkle

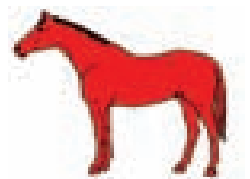
(greater periwinkle)

Vinca major [Apocynaceae]



Weed of pastures, particularly pastures that are adjacent to urban areas.

Grown as a garden ornamental.



Blue periwinkle is native to Europe and North Africa. It grows as a weed in many parts of Australia, particularly adjacent to urban developments. Blue periwinkle grows vigorously to form a mat that can choke out pastures.

The plant is usually unpalatable to horses but it is commonly found in horse paddocks, especially in semi-rural areas. It can occasionally be found as a contaminant of hay.

Growth and identification

Blue periwinkle is a spreading perennial that grows to a height of 50 cm.

The plant produces seeds but under Australian environmental conditions the seeds produced are not usually viable. The plant can grow from

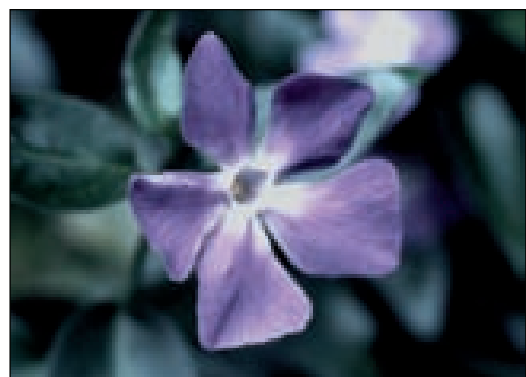


Photo: Ken Harris

nodes that occur along the stem and roots. Dispersal of plant material is usually via stem fragments that are discarded as garden waste.

Stem fragments can also be spread by water run-off or through cultivation and other practices that move soil.

The plant has broad oval leaves that are glossy dark green and are arranged on opposite sides of the stem. The leaves can be up to 5 cm in length.

The flowers are mauve or purple and the petals have a distinctive 'twist'. The flowers are usually 3 – 6 cm wide and are tubular, with 5 spreading petals that can be up to 2.5 cm long. Cylindrical paired fruit after flowering has finished. Flowering occurs in spring and summer.

Management notes

- Avoid grazing horses on pastures infested with blue periwinkle.
- Blue periwinkle should not be grown as an ornamental plant in areas where horses are kept.
- Do not put clippings from blue periwinkle in areas where horses could access them.
- Individual plants found growing as weeds can be removed by hand. All parts of the plant must be removed to ensure the weed does not regrow from stem or root fragments. Wear thick gloves and take care to avoid the sap of this plant.
- The use of herbicides can be an effective control measure for larger infestations. The plant should be sprayed while actively growing. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.

Pheasant's eye

(small fruited pheasant's eye, red chamomile, adonis, autumn pheasant's eye)

Adonis microcarpa [Ranunculaceae]

Pheasant's eye is native to central Europe and the Mediterranean region. It is a major weed of crops and pastures in Australia. Pheasant's eye is a declared noxious weed in South Australia and Western Australia.

The plant is unpalatable and cases of poisoning caused by pheasant's eye or its close relatives are rare. All reported cases of poisoning in horses by plants in the *Adonis* genus have involved the ingestion of contaminated hay.

Growth and identification

Pheasant's eye is an upright annual that usually grows 20 – 40 cm but can occasionally grow to 60 cm in height. The plant produces seeds in a small fruit that can attach to clothing and

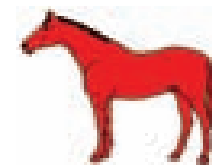
animals. The seeds can also be spread through contaminated hay or grains.

The slender stems have many branches and they are covered in soft hairs near the base of the plant. The leaves are alternately arranged along the stem and they usually have stalks up to 7 cm in length but some leaves do not have stalks. The leaves are up to 6 cm long. They are deeply divided and look somewhat like carrot leaves.

The plant flowers in late winter to early summer. The flowers are bright red or occasionally yellow and they appear at the tips of the stems. The flower has 5 – 10 petals and the centre of the flower appears black. The plant produces a small fruit that can be up to 4 mm across. The fruit is wrinkled and has a beak at the top that is around 1 mm long.



Weed of pastures, crops and roadsides.



Management notes

- Check hay for pheasant's eye contamination.
- Avoid grazing horses on pastures infested with pheasant's eye.
- Individual plants found growing as weeds can be removed by hand.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Establish competitive pastures.

Protoanemonin

Protoanemonin is a toxin formed from glycosides that are found in several plant genera including *Ranunculus*, *Helleborus*, *Clematis* and *Caltha*. These plants are usually unpalatable to horses. Most of the plants in these genera that grow in Australia are cultivated as garden species and they pose very little

risk to horses. Celery-leaf buttercup is of some risk to horses because it is considered to be the most toxic of the buttercups and it grows as a weed in pastures. Reports of celery-leaf buttercup poisoning are uncommon.

The primary effect of protoanemonins is irritation of the digestive tract.

Protoanemonins are only poisonous in fresh plants because the toxins have converted to the non-toxic form, anemonin, in dried plants. The level of toxins is highest in flowering plants and the irritant effects of toxic protoanemonins start soon after ingestion of fresh plant material.

Signs of protoanemonin poisoning

- Blistering and swelling of the skin in and around the mouth
 - Diarrhoea
 - Colic
- In mild cases of protoanemonin poisoning the affected horse will usually recover within a few days.
- In more severe cases veterinary attention should be sought and treatment will aid recovery.

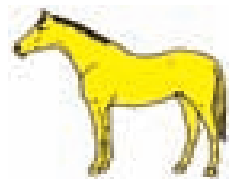
Celery-leaf buttercup

(poison buttercup, cursed crowsfoot)

Ranunculus sceleratus [Ranunculaceae]



A weed that grows mainly in damp areas, such as the edges of dams, drainage channels and moist areas of pastures.



Celery-leaf buttercup is native to Europe. The plant is a declared noxious weed in South Australia and Western Australia.

Growth and identification

Celery-leaf buttercup is an upright annual that usually grows to 60 cm in height. The branched stems of the plant are thick and hollow.

The plant forms a rosette of leaves and each leaf can be up to 6 cm long by 8 cm wide. The leaves have stalks that can be up to 15 cm long. The leaves are kidney-shaped or egg-shaped and they have 3 or 5 lobes that have toothed edges. The leaves on the stem do not have stalks and they are alternately arranged along the stem. The stem leaves are smaller than the rosette leaves.

Flowering occurs in spring. The centre of the flower contains numerous 'fruitlets' that develop as the flower matures. The flower has 5 yellow petals and 5 hairy bracts that are bent downwards.



Management notes

- Avoid grazing horses on pastures infested with celery-leaf buttercup.
- Individual plants can be pulled out by hand or spot sprayed with herbicide.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Establish competitive pastures.



Steroidal saponins

A number of plants that contain steroidal saponins grow in Australia and some of these plants have been reported to cause poisoning in some livestock species, most commonly in sheep.

Steroidal saponins in grasses of the *Panicum* species may be toxic to horses, although reports of poisoning cases are rare. A small number of cases have

been reported in the United States but there have been no confirmed cases in Australia.

The ingestion of large amounts of steroidal saponins can disrupt normal liver function and in horses this may lead to liver disease with secondary photosensitisation.

There may be other interacting factors involved in the development

of poisoning after ingestion of steroidal saponin-containing plants. Some researchers suggest that these factors may be environmental, or that mycotoxins may contribute to the condition.

Signs of steroidal saponin poisoning would usually only occur after a horse has been grazing panic grasses for several weeks or longer.

Signs of steroidal saponin poisoning

The signs of steroidal saponin poisoning in horses are not well described in the literature and this probably reflects the infrequency of its occurrence. The toxins reportedly cause liver disease with secondary photosensitisation in horses. The signs that may be seen include:

- Weight loss
- Feed refusal

- Photosensitisation - redness and swelling of the skin in unpigmented areas. The nose, lips and around the eyes are areas commonly affected. The skin may crack and weep fluid
- Lameness associated with photosensitisation of the skin near the coronary band has been reported to occur in some cases

- Incoordination may develop in severe cases and death could occur in rare cases where liver damage is severe

Affected animals should be removed from the pasture that contains panic grasses and veterinary advice should be sought. The horse should be kept in an area that is out of direct sunlight to allow the skin to heal.

Panicum spp

[Poaceae]

There are as many as 500 species of *Panicum* found worldwide and 33 are known to occur in Australia. Five species of *Panicum* have been associated with steroidal saponin poisoning in livestock and these are giant panic grass (*Panicum*

antidotale), coolah grass (*Panicum coloratum*), guinea grass (*Panicum maximum*), millet panic (*Panicum miliaceum*) and red switch grass (*Panicum virgatum*).

Growth and identification

Identification note: distinguishing between the different panic grasses can be extremely difficult and only a very basic description of the genus is given here. See page 5 for more information on obtaining a precise identification of a plant species.

Panicum species are grasses that can be annual or perennial.

The long narrow leaf blades often have hairs at the junction between the leaf sheaf and blade and the leaf blades are rolled when immature.

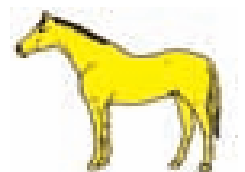
Panics usually have an open, branched seed head but some species have a compact seed head.

Management notes

- Avoid grazing horses for long periods on panic grasses. Rotate between pastures containing panic grasses and those not containing panic grasses every few weeks if possible.
- Observe horses grazing on panic grasses for signs of photosensitivity.



Common pasture species in all states of Australia.



Carboxyatractyloside

Carboxyatractyloside is a diterpenoid glycoside that can be found in plants of the *Xanthium* genus. Two species of the *Cestrum* genus contain toxins that are very similar to carboxyatractyloside in their structure and their potential toxicity to animals. These toxins are called carboxyparquin and parquin and they are found in green cestrum and night cestrum.

The toxins in xanthiums, green cestrum and night cestrum are

absorbed from the digestive tract and they disrupt normal cell metabolism, causing cells to die. Cells of the liver are particularly affected.

Cases of poisoning by xanthiums, green cestrum and night cestrum in horses are uncommon and no confirmed cases have been reported in Australia.

The seeds and first seedling leaves of xanthiums are the only parts of the plants that are toxic. The seeds are encased in a hard burr and horses

will not eat the burr. The risk for poisoning in horses is through seed contamination of processed feeds or processed supplements, contamination of hay (although horses will usually selectively leave the burrs) or through the ingestion of xanthium seedlings.

Green cestrum and night cestrum are usually unpalatable to horses, however they may be eaten if other forage is scarce. Green cestrum is a common weed in many parts of Australia.

Signs of carboxyatractyloside poisoning

Poisoning of horses through the ingestion of carboxyatractylosides has not been well described in the literature and this probably reflects the infrequency of its occurrence. Ingestion of these toxins causes severe liver damage in other species and most likely has the same effect in horses if the plants are eaten in large enough quantities to cause poisoning.

The signs that may be seen in horses include:

- Depression
- Increased respiratory rate
- Incoordination
- Rigidity of limbs
- Neck and limb muscle contractions
- Convulsions, coma and death may occur in severe cases

There is no known treatment for carboxyatractyloside poisoning in horses. Veterinary care should be sought if poisoning is suspected.

In mild cases, the horse may make a full recovery with supportive veterinary care. In cases of severe liver disease there is very little chance of survival.

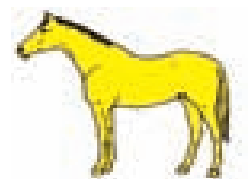
Noogoora burr

(cockle burr, hedgehog burweed, sheep's burr, ditchbur, Italian cocklebur, hunter burr, Californian burr, European cocklebur, large cocklebur, rough cocklebur)

Xanthium strumarium [Asteraceae]



Weed of crops, pastures, waterways and roadsides.



The naming of some xanthium species is rather complicated and several species have been grouped under the name "Noogoora burr complex". The Noogoora burr complex goes by the scientific name *Xanthium strumarium* and it includes *Xanthium cavanillesii*, *Xanthium italicum*, *Xanthium orientale* and *Xanthium occidentale*. For the purposes of this book we will refer to all of these species as Noogoora burr.

Noogoora burr is most likely native to America but it is found all over the world. It is a declared noxious weed in all states except Queensland.

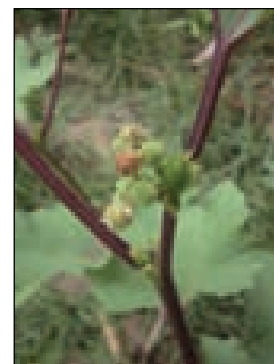
Growth and identification

Noogoora burr is an upright or spreading annual that usually grows to around 1 m in height, but can occasionally grow to 2.5 m. The plant is dispersed via seed that is contained in a burr. The burrs are covered in hooked spines and they can attach to clothing or animal coats. Seeds can also be spread by water run-off or as contaminants of hay and other feedstuffs.

The thick, hairy stems have many branches and they are green with purple blotches or streaks. The lower leaves are arranged opposite each other



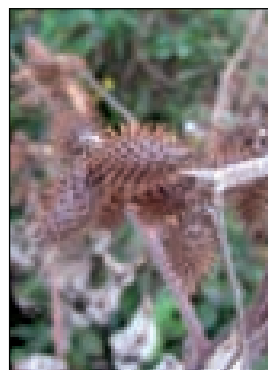
Photo: Sheldon Navie



Developing burr
Photo: Sheldon Navie

on the stem and the upper leaves are alternately arranged. The triangular or egg-shaped leaves can be up to 20 cm long and 18 cm wide. The leaves have deeply toothed edges and may be divided into 3 or 5 lobes. The leaves grow on stalks that can be up to 20 cm long.

The plants produce two types of flowers in late summer and autumn. Male flowers appear in clusters at the tips of the branches and some female flowers appear below these clusters. Most of the female flowers grow where the leaf stalk meets the stem of the plant. As flowers finish a green burr develops and it turns brown as it matures. The burr can be up to 3 cm long and it is covered in hooked spines with 2 larger spines or 'beaks' at the end.



Mature burr
Photo: Sheldon Navie

Bathurst burr

(common cocklebur, spiny cocklebur, daggerweed, Spanish thistle, burrweed, prickly burrweed, thorny burweed, spiny burweed, clotbur)

Xanthium spinosum [Asteraceae]

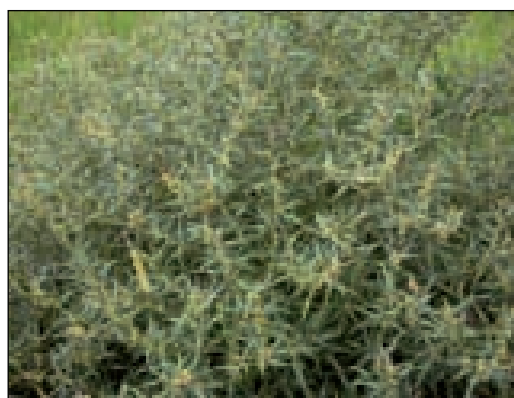
Bathurst burr is native to South America. It is a declared noxious weed in all states except Queensland and the Australian Capital Territory.

Growth and identification

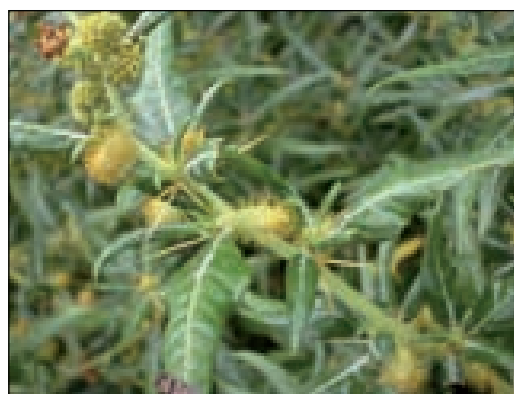
Bathurst burr is an upright annual growing to 60 cm in height but it can occasionally grow to 1.2 m. The plant is dispersed via seed that is contained in a burr. The burrs are covered in hooked spines and can attach to clothing or animal coats. Seeds can also be spread by water run-off or as contaminants of hay and other feedstuffs.

The stems are greenish-yellow and are covered in fine hairs. Three-pronged spines occur at the base of the leaf stalks and these spines can be up to 5 cm long. The leaves are arranged alternately along the stems. The leaves have 3 or sometimes 5 lobes, with the centre lobe being the largest. The leaves can be up to 10 cm long and 3 cm wide and are dark green and shiny with prominent white veins. The lower surface of the leaves is paler than the top and is densely covered in hairs.

The plants produce two types of flowers in late spring through to early autumn. Male flowers appear in dense clusters at the tips of the branches. Female flowers grow where the leaf stalk meets the stem. As flowers finish a green burr develops and it turns brown as it matures. The burr can be up to 1.5 cm long and it is covered in hooked spines.



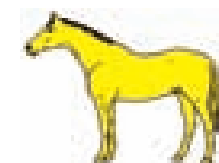
Growing plant. Photo: Sheldon Navie



Male flowers at the tip of the branch and immature burrs along stem.
Photo: Sheldon Navie



Weed of crops, pastures, waterways and roadsides.



Management notes

- Avoid grazing horses on pastures infested with xanthiums.
- Establish competitive pastures.
- Individual plants can be pulled out by hand or spot sprayed with herbicide. Wear gloves to avoid the burrs of all plants and the spines of Bathurst burr.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Graze sheep on xanthium infested pastures to help suppress the weeds. Extreme care must be taken to ensure the sheep only graze the plants between the stages of early growth and flowering. Newly germinated seedlings and seeds formed on the plant are toxic to all livestock species.

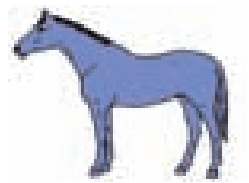
Green cestrum

(green poisonberry, willow jasmine, willow leaved jessamine)

Cestrum parqui [Solanaceae]



Weed of pastures, parklands, gardens and roadsides.



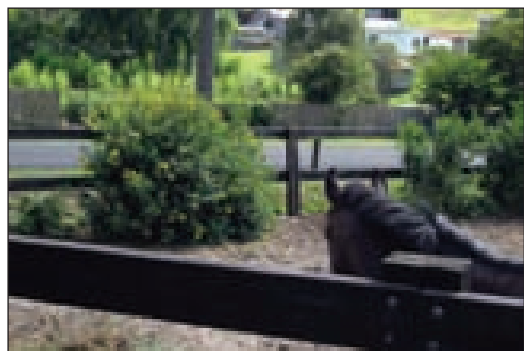
Green cestrum is native to South America. The leaves and ripe berries of the plant may also contain tropane alkaloids, see page 21. The green berries may contain solanine, see page 72. Green cestrum is a weed that competes vigorously with pasture species and it can become the dominant species if not controlled. Green cestrum is a declared noxious weed in New South Wales, Victoria and Western Australia.

Growth and identification

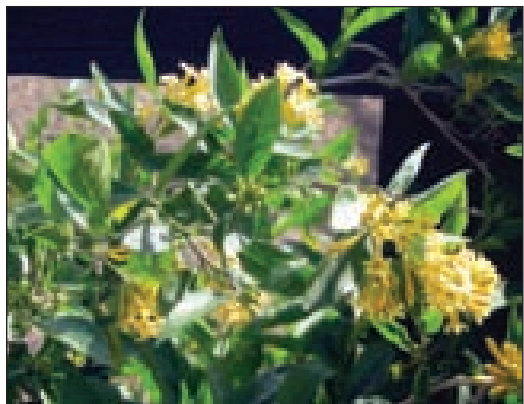
Green cestrum is an evergreen shrub that grows to 3 m in height. The leaves are alternately arranged along the stem and can grow to 14 cm long by 4 cm wide. The leaves are shiny, green and are lance-shaped. Green cestrum produces seeds that can be spread by birds and water run-off. The plant also produces underground root suckers.

The plant flowers throughout the year but most flowers appear in spring. The tubular flowers are yellow. The flowers grow in clusters and each flower is around 2.5 cm long.

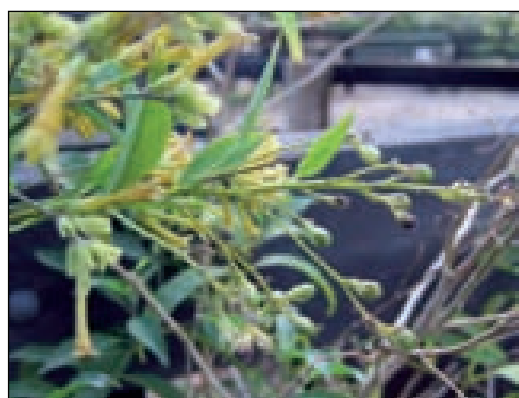
The plant produces fleshy berries that are small and green when young. The berries are black or purplish-black when ripe. The egg-shaped or oval berries are around 1.5 cm across.



Green cestrum growing in a horse yard



Green cestrum flowers



Green cestrum unripe berries

Management notes

- Individual plants can be pulled out by hand or spot sprayed with herbicide. Ensure all parts of the plant are removed from the ground as green cestrum can regrow from root fragments.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Establish competitive pastures.

Night scented jasmine

(lady of the night, night jessamine)

Cestrum nocturnum [Solanaceae]

Night scented jasmine is native to South America. The leaves and ripe berries of the plant may also contain tropane alkaloids, see page 21. The green berries may contain solanine, see page 72.

Growth and identification

Night scented jasmine is an evergreen shrub that grows to 2.5 m in height. The leaves of the plant can grow to 15 cm long by 7 cm wide. The leaves are shiny, green and are lance-shaped.

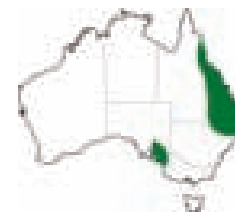
The plant flowers in summer and autumn. The tubular flowers are greenish-white to yellow and they are fragrant during the night. The flowers grow in clusters and each flower is around 2.5 cm long.

Management notes

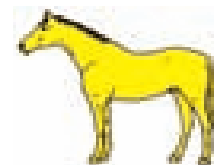
- Night scented jasmine is not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.



Unopened flowers of night scented jasmine
Photo: Pat Offord



Garden ornamental.



The plant produces fleshy berries that are small and white, or occasionally black, red or purple. The oval berries are around 1 cm across.

Calcingenic glycosides

A small number of plants contain a glycoside that is very similar to calcitriol, which is the active form of vitamin D. Calcitriol acts to increase calcium absorption from the gastrointestinal tract, increase the mobilisation of calcium from bones and decrease the excretion of calcium. The ingestion of calcitriol-

like compounds in plant matter can cause an excess of calcium in the bloodstream. If calcium levels are elevated for a prolonged period the calcium can mineralise in muscles and organs such as the heart, lungs, kidneys and gastrointestinal tract.

The calcingenic glycoside plant present in Australia that may pose a

risk to horses is the day jasmine. There are no confirmed reports of this plant causing poisoning in Australian horses but it has caused poisoning in horses in the United States and several other countries. The effects of ingested calcingenic plants are cumulative and signs of poisoning may occur after a horse has been grazing the plant for several weeks or longer.

Signs of calcingenic glycoside poisoning

The early signs of poisoning are subtle and may go unnoticed. As the condition progresses the signs that may be seen in horses include:

- Depression
- Weakness
- Weight loss
- Loss of appetite

- Irregular and rapid heartbeat
- Stilted gait progressing to lameness
- A horse may lie down for prolonged periods
- In severe cases death can occur from heart and lung complications

Mildly affected horses usually recover once the source of calcingenic

glycosides has been removed from the diet. Severely affected horses rarely recover to their previous level of performance and lameness problems may be permanent. Veterinary care should be sought if calcingenic glycoside poisoning is suspected in a horse.

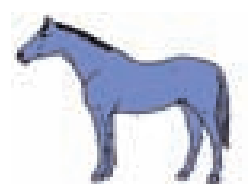
Day jasmine

(day blooming cestrum, day jessamine, white cestrum)

Cestrum diurnum [Solanaceae]



Garden ornamental.



Day jasmine is native to tropical America and the West Indies. Its relatives, night jasmine and green cestrum, contain tropane alkaloids and glycoalkaloids and although poisonous, they do not cause calcinosis in horses. Day jasmine contains several other toxins besides calcingenic glycosides. The green berries of the plant contain glycoalkaloids (see page 72) and the leaves and ripe berries contain tropane alkaloids (see page 21).

Growth and identification

Day jasmine is an evergreen shrub that grows to 2.5 m in height. The leaves of the plant can grow

to 10 cm long by 4 cm wide. The leaves are shiny, green and oval or oblong-shaped.

The plant flowers throughout the year. The tubular flowers are white or occasionally greenish-white and they are fragrant during the day. The flowers grow in clusters and each flower is around 2 cm long.

The plant produces small greenish-white fleshy berries that turn purple and then black with maturity. The oval berries are around 0.5 cm across.

Management notes

- Day jasmine is not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.

Alcohols and Acids

Soluble oxalates

Nutritional Secondary Hyperparathyroidism or 'big head'

Introduced tropical grasses that contain soluble oxalates are associated with a condition in Australian horses known as nutritional secondary hyperparathyroidism or 'big head'. This



Horses showing signs of 'big head'
Photo: Veterinary Pathology, University of Sydney

condition is primarily a problem in the northern areas of Australia where introduced tropical grasses are most common. Horses are most at risk of developing big head if the tropical grasses are the dominant species in the pasture. Native grasses and many introduced temperate grasses are not associated with big head and are safe to use as pasture species for horses.

The soluble oxalates in introduced tropical grasses combine with calcium to form insoluble calcium oxalate crystals. The formation of these crystals reduces the absorption of calcium from ingested fodder and it

alters the calcium to phosphorus ratio in the diet. In effect, the horse suffers a calcium deficiency. This deficiency causes mobilisation of bone calcium to compensate for low blood calcium levels. Over time the bones lose so much calcium that they become soft and misshapen.

Some or all horses grazing the same pasture may be affected. Mares and foals have been reported to be more susceptible than stallions or geldings but all horses can be affected. The soluble oxalate content of tropical grasses is highest in periods of rapid pasture growth.

Signs of 'big head'

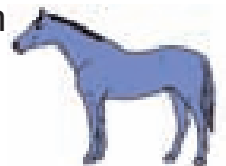
Signs of the condition usually develop after 6 - 8 months of grazing soluble oxalate pastures. Some cases have been reported to occur after only 2 months.

- Stiff and shortened gait
- Joint tenderness
- Loss in condition even when plenty of pasture is available
- Swollen jawbones - the upper, lower or both jawbones can be affected

Removal of the horse from the soluble oxalate pasture should see the resolution of lameness problems and the horse should regain condition. Facial swelling should also resolve, unless it is severe.

Grasses associated with nutritional secondary hyperparathyroidism

Identification note: distinguishing between the different grasses that grow in pastures can be extremely difficult and only a basic description is given here. See page 5 for more information on obtaining a precise identification of a plant species.



Buffel grass

Cenchrus ciliaris [Poaceae]

Upright perennial that grows to 1 m. Tough rootstock. Fringe of hairs at inner junction of leaf sheath and leaf blade. Bristled, branched

flower spike up to 15 cm long. 1 – 3 spikelets per cluster.

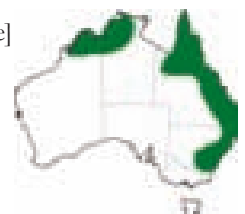


Setaria (South Africa pigeon grass)

Setaria sphacelata [Poaceae]

Compact tufted perennial that grows to 2 m. Fringe of dense hairs at inner junction of leaf sheath and leaf blade. Cylindrical flower spike up

to 30 cm long. Fine, rigid bristles on flower spike. Spikelets in groups of 1 – 4. Under each spikelet group there are 6 – 10 rough hairs.

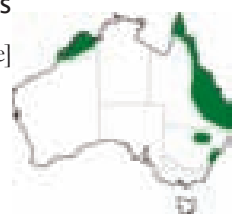


Pangola grass

Digitaria eriantha ssp. pentzii (formerly known as *Digitaria decumbens*) [Poaceae]

Semi-erect perennial grass that grows to 1 m. Produces underground shoots. Fringe of short hairs at inner junction of leaf sheath and leaf

blade. The plant produces a group of 3 – 10 flower spikes up to 20 cm long.



Guinea grass

Panicum maximum [Poaceae]

Densely tufted perennial that grows to 3 m. Produces short, stout underground shoots. The inner junction of leaf sheath and leaf blade is thin and translucent. Branched flower spike up to 50 cm long.



Kikuyu

Pennisetum clandestinum [Poaceae]

Perennial that grows to almost 1 m. Many underground (rhizomes) and aboveground (stolons), root-like stems that can take root and produce new growth. Fringe of dense hairs at inner junction of leaf sheath and leaf. Flower heads on short shoots. Spikelets in cluster of 2-4. Spikelets enclosed in a sheath.



Para grass

Brachiaria mutica (also known as *Urochloa mutica* and *Panicum muticum*) [Poaceae]

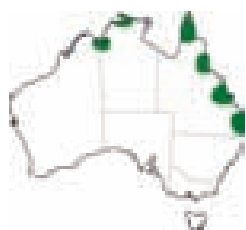
Perennial that has long stems (stolons) that can take root and produce new growth. The stolons can be up to 4 m long. Fringe of dense hairs at inner junction of leaf sheath and leaf. Produces numerous branched flower spikes up to 8 cm long.



Signal grass

Brachiaria decumbens (also known as *Urochloa decumbens*) [Poaceae]

Perennial that has long stems (stolons) that can take root and produce new growth. The stolons can be up to 1.5 m long. Fringe of dense hairs at inner junction of leaf sheath and leaf. Produces 2 – 3 flower spikes up to 8 cm long.



Purple pigeon grass

Setaria incrassata [Poaceae]

Perennial that grows to 2 m. Produces underground shoots. The base of the inner junction of leaf sheath and leaf blade is thin, translucent and topped by hairs. Cylindrical, flower spike up to 18 cm long.



Management notes

- Avoid grazing horses on pastures dominated by soluble oxalate grasses for periods longer than 1 month. This is particularly important when the grasses are rapidly growing.
- Use a mix of pasture grasses and legumes in horse paddocks. Some of the grasses NOT associated with 'big head' include: all native grasses, Rhodes grass, paspalums, couches, creeping blue grass, ryegrass and sorghums.

When there is no option but to graze horses on hazardous tropical grass pastures:

- Encourage the growth of the legume component of the pasture.
- Feed a calcium and phosphorus supplement. Seek veterinary advice to ensure that this is the right management technique for your horse. A supplement mix should be made available to each horse once a week for ad lib consumption, or the supplement could be split into portions and fed daily. The supplement mix can consist of:
 - 1 kg rock phosphate mixed with 1.5 kg molasses or,
 - 1 kg mix consisting of 1/3 ground limestone and 2/3 dicalcium phosphate (DCP) mixed with 1.5 kg molasses.
- Use double these amounts under veterinary supervision as part of the management of horses showing signs of nutritional secondary hyperparathyroidism.

Tannic acid

Tannic acid is the main toxin found in oak trees and shrubs. Tannic acid can cause damage to the gastrointestinal tract and can cause liver disease when large amounts have been ingested.

Oak poisoning in horses is rare and there are no confirmed reports of oak poisoning in Australian horses. The leaves are usually unpalatable and the main risk to horses is from the

ingestion of acorns that have fallen to the ground. Young oak leaves and buds may be more palatable to horses than older leaves.

Signs of oak poisoning

The symptoms of oak poisoning can progress rapidly and the horse may die within days of the onset of symptoms. The signs of oak poisoning that may be seen in horses include:

- Depression
- Weakness, incoordination
- Dehydration
- Head pressing - the horse may push its head against a wall or other surface
- Sweating
- Diarrhoea
- Red or brown urine
- Convulsions
- Coma followed by death

Veterinary attention should be sought if oak poisoning is suspected in a horse. Treatment and supportive care may help with survival and subsequent recovery. In mild cases the horse may make a full recovery with supportive veterinary care.

Oaks

Quercus spp [Fagaceae]

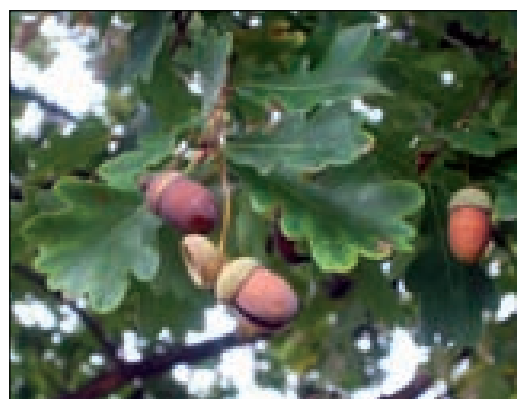
Growth and identification

There are many different species of oak grown in Australia. The trees are deciduous or evergreen and can range in height from 1 m to 35 m. The leaves of oak trees are usually leathery and toothed, lobed or heart-shaped. The leaves of deciduous oaks can turn shades of yellow, red, orange and other colours before they fall in the cooler months.

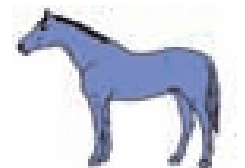
The female flowers of oak trees are green and very small. The male flowers appear as long, thin drooping clusters known as 'catkins'. Flowering occurs in spring. In autumn the trees produce acorns that are round or oval.



English oak (*Quercus robur*) - mature tree (above), bark (top right) and 'catkins' (centre right). Acorns of *Quercus sp* (bottom right)



Shade trees, garden ornamentals and street trees.



Management notes

- Oak trees are not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.
- Do not dispose of oak clippings or acorns where horses could access them.

Quinones

The consumption of plants containing quinones can cause photosensitisation in horses and cases of St John's wort poisoning have been reported in Australian horses. The toxin is a quinone called hypericin. After ingestion of the plant, hypericin is absorbed from

the gut, enters the bloodstream and is transported to all tissues. When hypericin present in the skin is activated by sunlight it interacts with cell components leading to tissue damage. The areas of skin most at risk are those with minimal pigmentation and areas exposed to direct

sunlight. The toxin in St John's wort is highest in the plant during rapid growth in spring through to the end of flowering. Horses grazing pastures heavily infested with St John's wort can develop photosensitisation within days of initial exposure.

Signs of quinone poisoning

- Redness and swelling of the skin - the nose, lips, lower legs and the areas around the eyes are most commonly affected. The skin may blister, crack and weep fluid.
- The horse may appear to be sensitive to light
- Lameness may occur in severe cases where skin damage occurs on the coronet and around joints
- Some horses may appear restless and may develop diarrhoea

The skin usually heals when access to St John's wort is restricted. The horse should be kept out of direct sunlight while the skin heals. Veterinary attention should be sought.

St John's wort

Hypericum perforatum [Clusiaceae]

St John's wort is native to Europe, Asia and North Africa. St John's wort is a declared noxious weed in Victoria, New South Wales, Tasmania and Western Australia.

Growth and identification

Upright perennial that usually grows 30 – 70 cm in height. The plant produces numerous seeds that are contained in a sticky capsule. The seeds can be spread by wind, as contaminants of transported hay and grain or through animal and vehicle movements. The plant can also spread by the growth of underground stems.

The hairless stems are upright and grow from a woody base. The stems branch in opposite pairs at an angle of 45° to the main stem. Most branching occurs in the upper sections of the main stems. The stems can be reddish in colour and they have 2 ridges that run along their length.

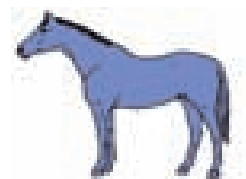
The stalkless leaves are arranged on opposite sides of the stem and are around 3 cm long by 1 cm wide. The leaves are dotted with many oil glands containing the hypericin toxin. The oil glands can be seen by holding the leaves up to the light.

Management notes

- Avoid grazing horses on pastures infested with St John's wort, particularly when the plant is rapidly growing and flowering.
- Provide plenty of shade for horses if pasture contains any amount of St John's wort.
- Individual plants can be pulled out by hand or spot sprayed with herbicide. Ensure all parts of the plant are removed from the ground as St John's wort can regrow from root fragments or from underground stems.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Establish competitive pastures.
- Graze adult sheep or cattle on heavily infested paddocks. Do not use freshly shorn sheep as they have no protection from sunlight and may suffer photosensitivity problems. Heavy grazing by these species in winter and early spring, when hypericin levels are low in the plant, can help suppress the weed. Do not leave these animals on the infested pasture continuously as toxicity problems can occur.



Weed of pastures, open woodlands, grasslands, roadsides, waterways and forests.



Flowering occurs during late spring and summer. The flowers are 1 – 3 cm across and have 5 elongated bright yellow petals. The flowers have numerous prominent stamens. The plant produces a reddish-brown sticky fruit capsule containing many seeds. St John's wort seeds are cylindrical, small (1 mm by 0.5mm) and dark brown or blackish in colour.

Proteins and Amino acids

Lectins

Lectins are proteins that can attach to sugar molecules. The most toxic lectins are called ricin and abrin and these are two of the most poisonous substances known. Although highly toxic, ricin and abrin do not often cause poisoning in horses because the leaves and seeds of plants containing the toxins are unpalatable. Ricin is present in castor oil plant and abrin is in the Australian native vine crab's eye. Other lectins can be found in most beans, black locust tree and *Jatropha spp.*

Lectins contained in leaves and seeds do not cause poisoning unless the toxins are released from the plant material. This only occurs if the leaves are well chewed or if the seed coat has been pierced. Released toxins from ingested plants that contain lectins are absorbed from the gut into the surrounding tissues. The lectins ricin and abrin bind to proteins on the surface of cells and this allows the toxin access to the inside of the cells. Through a complicated process, ricin and abrin disrupt the ability of

cells to produce new proteins and the cells die. Ricin also disrupts the balance of calcium in the blood. The lectins present in beans and other lectin-containing plants can interfere with nutrient absorption and can cause gastrointestinal problems.

All parts of plants containing lectins are poisonous but most cases of poisoning are associated with the ingestion of seeds, as this part of the plant contains the highest levels of toxins. Poisoning is often the result of seed contamination of grain.

Signs of lectin poisoning

The signs of poisoning can appear within hours or days after ingestion of the toxic plant material. The signs that may be seen include:

- Loss of appetite
- Colic
- Diarrhoea – in severe cases the diarrhoea contains blood
- Weight loss
- Dehydration
- In cases of black locust poisoning the horse may have dilated pupils and develop heart irregularities

- In severe cases of lectin poisoning where the horse has not received prompt treatment, death may occur through hypovolemic shock (a condition where the heart is unable to supply blood to the body because blood loss or fluid loss has caused low blood volume)

There is no specific treatment for lectin poisoning. Veterinary attention should be sought and the administration of activated charcoal may prevent further absorption of further toxins from

the gut. Supportive care and the administration of fluids and other medications will help with recovery.

Horses do not often die from the ingestion of lectin-containing plants. Although some lectins are extremely toxic, the seeds must be thoroughly chewed or crushed for the toxins to be absorbed and in most cases very few ingested seeds will be chewed sufficiently to release toxins.

Castor oil plant

Ricinus communis [Euphorbiaceae]

Castor oil plant is native to Asia and Africa. Castor oil plant is a declared noxious weed in New South Wales, the Northern Territory and Western Australia.

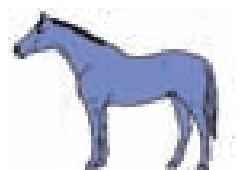
Growth and identification

Castor oil plant is a perennial shrub that usually grows to 3 m tall but can occasionally grow to 4 m. The plant produces seeds that are explosively released from the seed capsule when mature. The seed can be spread by water run-off, dumped as garden waste, transported as contaminants of hay and grain, or spread through animal and vehicle movements.

The thick, branched stems are greyish-green and sometimes have a reddish tinge. The stems are hollow and hairless. The leaves can be up to 10 cm by 70 cm and they have 7 – 9 triangular or



Weed of pastures, gardens, roadsides and waterways.



elongated lobes with finely toothed edges. Each lobe has a prominent vein along the centre. The leaves are glossy and are often dark red when

young and green or bluish-green when mature. Leaf stalks can be up to 30 cm long.

Flowering occurs in summer. The flowers are elongated and grow in clusters near the tips of the branches. The male flowers grow at the bottom of the flower cluster and are cream or yellow in colour with a 'fluffy' appearance. The female flowers are produced at the top of the flower cluster and they have a large seed capsule with 3 red feathery styles at the top. The seed capsules are green, greenish-red or bright red when young and are covered in spines. They are brown when mature and they open to release mottled grey and brown seeds that are around 1 cm by 1.5 cm.



Above: Castor oil plant flower spike showing the red feathery styles of the female flowers and the cream coloured male flowers.



Left: Maturing seed pods. Remnants of the red styles can still be seen on the pods.

Management notes

- Avoid grazing horses on pastures infested with castor oil plant.
- Check grain for castor oil plant seed contamination. The seeds are mottled grey and brown and are around 1 cm by 1.5 cm.
- Individual plants can be pulled out by hand or spot sprayed with herbicide.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.

Crab's eye

(jequirity bean, rosary bean, Gidee Gidee)

Abrus precatorius [Fabaceae]

Crab's eye is native to Australia.

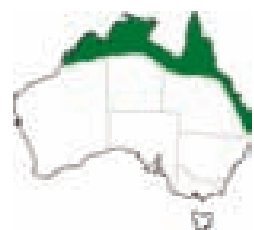
Growth and identification

Crab's eye is a deciduous climber that grows to 3.5 m in height. The plant has a slender twining stem. The leaves can be up to 12 cm long and they are fern-like. The elliptical leaflets are up to 2 cm long and they grow in pairs along the leaf stalk.

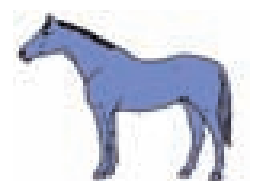
The flowers are white to lilac-pink and are up to 1 cm wide. The flowers appear in sprays up to 10 cm long. The flat brown seedpods are around 5 cm long and they open to release red and black seeds. Flowering occurs in summer.



Photo: Ken Harris



Found in open forests and coastal bushland. It is grown as a garden ornamental in some areas.



Management notes

- Poisoning of horses through ingestion of the seeds of crab's eye is unlikely. The plant is unpalatable and the seed coat is very hard and if ingested it will usually pass through the gut intact. However, the plant does contain a powerful toxin and it should not be used as an ornamental species in horse areas. The plant should be removed from paddocks if present.

Black locust

(false acacia, locust tree, yellow locust, robinia)

Robinia pseudoacacia [Fabaceae]

Growth and identification

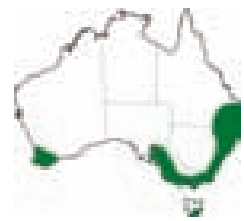
Black locust is a deciduous tree that can grow 10 – 20 m in height. The branches have paired spines at the point where the leaves attach. The leaves are 8 – 15 cm long and have numerous leaflets that are 2 – 5 cm long and 1 – 2 cm wide. The bark of the tree is thick and deeply furrowed.

Flowering occurs in spring. The perfumed flowers are white, pink or purple in colour and they are pea-like. The flowers hang from the branches in showy tresses up to 15 cm long. The individual flowers are up to 2 cm wide. The plant produces brown seedpods that are 5 – 10 cm long and 1 – 2 cm wide.

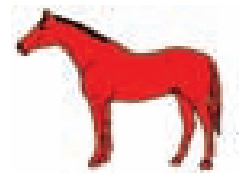
Black locust produces suckers and these may grow to form dense clumps that crowd out other plants. Black locust is used as rootstock for grafted varieties of robinia that are sold through



Photo: Ken Harris



Garden ornamental, shade tree, park tree and street tree. Considered a weed in some areas.



nurseries. If the roots of these grafted plants are disturbed, the black locust rootstock can produce numerous sucker plants that are very hard to control.

Management notes

- Black locusts are not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.
- Black locust should be removed from horse paddocks if present. If suckers appear after the tree has been removed they should be cut off close to the base and the stump should be painted with herbicide.
- Take care not to tie a horse near black locust trees as the horse may chew the toxic bark.

Jatropha species are native to the Caribbean and tropical Central and South America. They are declared noxious weeds in Western Australia,

Queensland and the Northern Territory. *Jatrophas* contain a toxic lectin called curcin in all parts of the plant, particularly in the seeds.

Jatropha

Bellyache bush

(cotton leaf physic nut, black physic nut)

Jatropha gossypifolia [Euphorbiaceae]

Growth and identification

Bellyache bush is an upright shrub or small tree growing to 3 m in height and occasionally to 4 m.

The plant produces seeds that are explosively released from the seedpods and can be spread

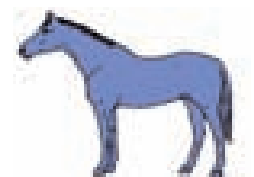
by water run-off. Bellyache bush also produces suckers that originate from the roots.

The stems are thick and are densely covered in hairs when young. The leaves are purple in colour and sticky when young. Older leaves are bright green. The leaves can be up to 10 cm in

Lectins



Weed of pastures, open woodlands and waterways.



width and are alternately arranged on the stems. The leaf stalks are up to 7 cm long. The leaves have 3 or 5 pointed lobes and the stalks and leaf edges are covered in sticky hairs.

Flowering occurs in summer and autumn. The flowers have 5 purple or red coloured petals and yellow centres. The flowers grow in clusters from the point where the leaves attach to the stem.

The plant produces a seed capsule that is green and hairy.

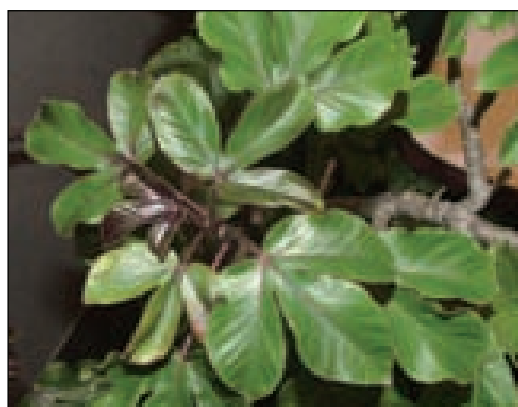


Photo: Sheldon Navie

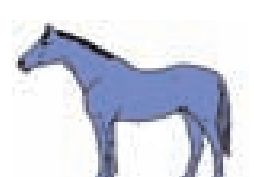
Physic nut

(Cuban physic nut, Brazilian stinging nut, curcas bean, purge nut, black vomit nut)

Jatropha curcas [Euphorbiaceae]



Weed of pastures, open woodlands and roadsides.

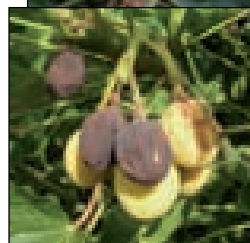
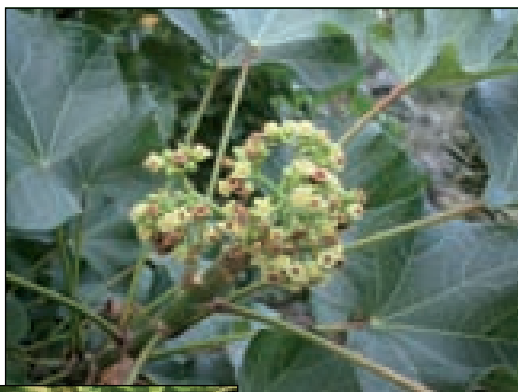


Growth and identification

Physic nut is an upright shrub or small tree growing to 4 m in height. It produces seeds that are explosively released from the seedpods and can be spread by water run-off. Physic nut also produces suckers that originate from the roots.

The stems are thick and are sparsely covered in hairs when young. The leaves are dark green in colour and are smooth and shiny. The leaves can be up to 15 cm in width and are alternately arranged on the stems. The leaf stalks are up to 13 cm long. The leaves are heart-shaped and have 3 or 5 shallow lobes.

Flowering occurs throughout the year. The flowers are small and pale yellow to greenish in colour. The flowers grow in clusters from the point where the leaves attach to the stem. The plant produces a fleshy seed capsule that is green initially but turns to yellow and then dark brown as it matures.

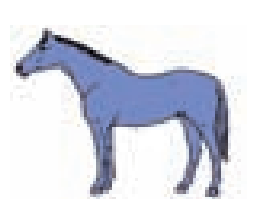


Photos: Sheldon Navie

Management notes

- *Jatropha* are not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.
- *Jatropha* should be removed from horse paddocks if present.

Beans



Some beans contain lectins in varying amounts and some contain other anti-nutritional factors. Moist heat is a method commonly used to make beans safe to include in horse rations. The beans can be crushed and then soaked in boiling water for 2 hours.

Be sure to correctly identify each component when formulating feed rations for horses. This

is especially important when using peas or beans (known as grain legumes or pulses). A case report from the United States describes a situation in 2003 where a batch of complete feed included raw white kidney beans. The bean was included in the ration in the mistaken belief that it was from the pea family (*Pisum spp*). On one farm twenty-one horses were fed the

ration and within 4 hours of ingesting the feed twenty horses showed signs of colic. Ten hours after exposure one horse showed neurological symptoms such as tremors, blindness and seizures and this horse was euthanased. All other horses

recovered. On a second farm eighteen horses were fed the same ration and all developed colic within 4 hours of ingestion. All of these horses recovered with treatment.

Red kidney beans *Phaseolus vulgaris*



Lima bean *Phaseolus lunatus* (also known as *Phaseolus limensis*)



Broad beans, faba beans *Vicia faba*



Propyl disulfide

All plants from the *Allium* genus contain propyl disulfide.

The ingestion of propyl disulfide can lead to the formation of oxygen free radicals that damage the membrane of red blood cells and cause the cells to release haemoglobin. The haemoglobin binds to the inside of

the red blood cells to form what are called 'Heinz bodies'. The damaged red blood cells are removed from circulation, resulting in anaemia.

Poisoning of horses by these plants is very uncommon. An overseas study showed that the inclusion of relatively large amounts of onion tops in the diet

of horses can induce anaemia within a week and this anaemia can become life threatening within less than 2 weeks. The study demonstrated that plants from the *Allium* genus are toxic to horses, especially when fed in large amounts over time. Some species of *Allium* are important pasture weeds in Australia and may be a risk to horses.

Signs of propyl disulfide poisoning

- Dark red-brown urine
- Pale mucous membranes
- Increased heart rate
- Staggering and partial paralysis in severe cases

- 'Onion breath' is a distinctive sign of propyl disulfide poisoning

Horses generally recover over the course of several weeks if the source of the propyl disulfide is removed.

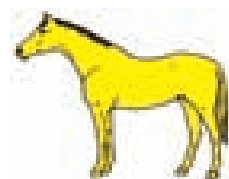
Fluid treatment can help with recovery in severe cases. Abortion has been reported in pregnant mares suffering significant anaemia.

Allium spp

[Alliaceae]



Native bushland species, pasture weeds, cultivated garden ornamentals and food crops.



The *Allium* genus of plants includes onion, garlic, leek, shallot and chive. The genus also contains several plants that are important weeds of gardens, pastures and crops. Three cornered garlic (*Allium triquetrum*) and crow garlic (*Allium vineale*) are declared noxious weeds in several states.

Growth and identification

Plants in the *Allium* genus usually have an onion or garlic odour when crushed. The plants grow from bulbs that are sometimes surrounded by small 'bulblets'.

The leaves of allium can be solid or hollow and they can be flat, cylindrical and tapering, or they can be triangular in cross section.

The flowers are umbellate, which means that the stalks of the individual flowers arise from a single



Chives (*Allium schoenoprasum*)

point at the top of the main flower stem. The flowers are usually white or pink.

Management notes

- Onion tops from cultivated onions should not be fed to horses as an alternative feedstuff.
- Avoid grazing horses on pastures infested with plants from the *Allium* genus.
- Ornamental alliums are not suitable for planting along paddock fences or in areas where horses are kept.
- Alliums found as weeds in paddocks should be removed by hand (ensure that all of the bulblets are removed from the ground) or they can be sprayed with herbicide. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.

Garlic supplements

Garlic (*Allium sativum*) is a popular feed supplement for horses. In a recent study (Pearson et al, 2005), horses were fed freeze-dried garlic at a daily dose of 0.2 g/kg over several months and these horses developed Heinz body anaemia.

The researchers concluded that horses would voluntarily eat garlic in sufficient quantities to cause toxicity. Further studies on safe dose rates for garlic supplements are indicated. Horse owners should take care when feeding garlic as a supplement, especially if fed over long periods.

Thiaminase

Thiaminase is an enzyme that can be found in some plants. Thiaminase destroys dietary thiamine (vitamin B1) in the digestive tract before it can be absorbed. This leads to a thiamine deficiency. Sufficient levels of thiamine are necessary for the normal metabolism of energy. In horses, this

disruption to energy metabolism leads to neurological problems.

Thiaminase poisoning is not commonly reported as the plants are unpalatable to horses. Horses may eat thiaminase-containing plants if other fodder is scarce. Poisoning could occur if horses

are fed hay contaminated with plants containing thiaminase.

Thiamine deficiency can develop after 1 – 2 months grazing pasture infested with thiaminase-containing plants or after ingestion of contaminated hay. The symptoms are progressive and appear in the general order of the list below.

Signs of thiaminase poisoning

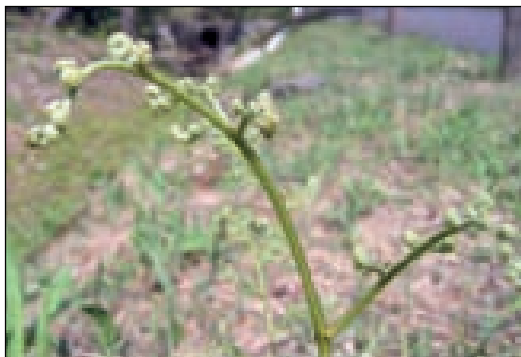
- Rapid weight loss, even if the horse has a good appetite
- Lethargy
- Irregular heart rate
- Incoordination when asked to walk, ‘staggers’
- Wide stance with arched back. The horse may appear to be ‘crouching’
- Severe tremors may develop and the horse may be unable to rise if it falls down
- Pulse becomes fast and weak
- The horse may lie down, convulse and die

After the initial symptoms appear the disease progresses rapidly and without veterinary attention, the horse may die within 2 - 10 days. Fluid therapy, the administration of activated charcoal and intravenous thiamine hydrochloride injections are used to treat affected horses.

Bracken

Pteridium spp [Dennstaedtiaceae]

Bracken is native to Australia and it is considered a weed in many parts of the country. There are several species of bracken but the most common is *Pteridium esculentum*. The hardy, persistent



underground root system (rhizomes) of bracken give the plant a competitive edge over pasture species and it can quickly become the dominant species. Old, fallen leaves form a mulch cover that can prevent the germination of desirable species in pastures.

Bracken poisoning is uncommon in horses. The plant is usually unpalatable but may be eaten if other pasture is scarce. Poisoning could occur through the ingestion of contaminated hay. Affected horses are said to have ‘bracken staggers’.

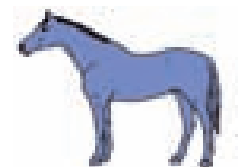
Growth and identification

Bracken is a true fern that does not produce flowers or seeds. The plant reproduces by spores that occur in continuous lines on the undersides of the fronds. The spores are tiny and can be dispersed great distances by wind or water run-off. Bracken also has an extensive underground root system that gives rise to new shoots. Sections of rhizome can be transported to new areas during cultivation or other practices that move soil.

The plant has stiff upright fronds that grow on hard brown stalks. The fronds can grow 0.5 – 1 m in height and occasionally to 1.5 m. The plant is an annual but in some areas it persists for 2 years. The fronds appear in spring and they are coiled and bright green when young. As the fronds mature they unfurl and become harder and darker in colour.



Grows in open forests, grasslands and native bushland. Weed of pastures.



Above left: immature bracken frond
 Left: mature bracken frond

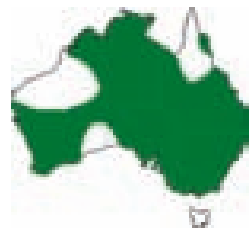
Management notes

- Avoid grazing horses on pastures infested with bracken.
- Check hay for bracken contamination.
- To prevent the spread of bracken rhizomes ensure that machinery is cleaned if it has been used in bracken infested areas.
- Cultivation of the soil in summer will break up the rhizomes and bring them to the surface where they dry out and die. This should be done each summer over 2 – 3 years.
- Repeated slashing to destroy fronds before they mature can decrease the production of spores. Slashing should be done monthly from late spring through to late summer and this technique will need to be continued over at least 3 years.
- Herbicides can be used in conjunction with the above methods. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.

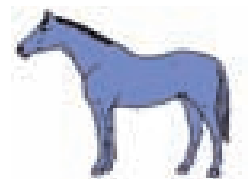


Nardoo

Marsilea drummondii [Marsileaceae]



Found in and adjacent to waterways, lakes and waterholes. Grows abundantly in pastures after flooding.



Nardoo is a native Australian plant. It can grow quickly after flooding to become the dominant ground cover in pastures. The plant contains very high levels of thiaminase in the early stage of growth. Horses are most at risk of exposure to nardoo after flooding. Nardoo has reportedly caused poisoning in horses in Australia, although cases are rare.

Growth and identification

Nardoo is an aquatic plant that can grow in water, in mud at the edge of inland lakes, waterholes, roadside drains or rivers and in other areas after flooding has occurred. The plant is a perennial fern that produces fronds that are upright when growing in mud and floating when growing in water.

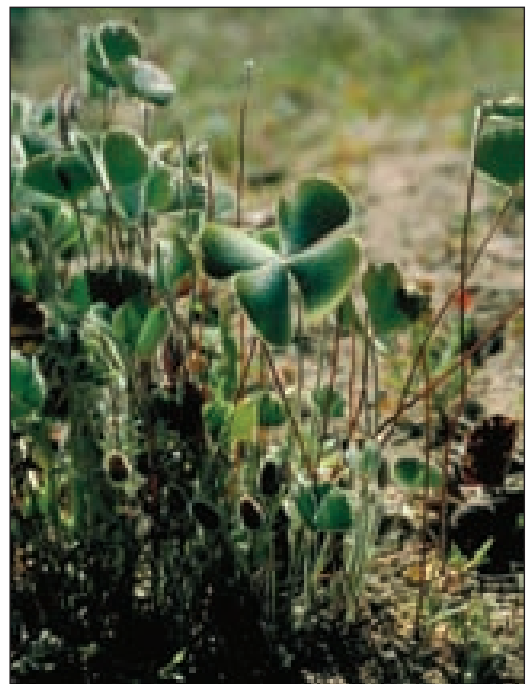
The fronds of the plant consist of 2 pairs of leaflets that resemble a four-leaf clover. The plant produces spores inside an organ called a sporocarp and this hard structure is about the size of a pea.

The plant can produce spores and germinate in response to changes in moisture. The plants thrive in mud but as the ground dries out the plant dies. The sporocarp drops off the plant and can remain viable for 20 – 30 years. When the area again floods the sporocarp opens and new plants germinate.

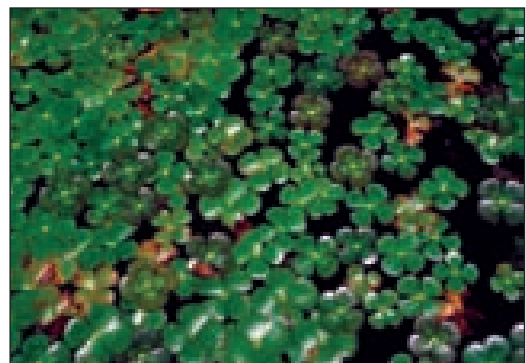
Waterfowl can spread nardoo because ingested sporocarps pass through the birds intact. The spore cases can also be spread by floodwaters and by wind.

Management notes

- Avoid grazing horses on nardoo infestations.
- Move animals to alternative pasture if nardoo infestation occurs after flooding.



Nardoo growing in mud



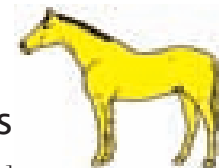
Nardoo growing in water

Rock ferns

Cheilanthes spp [Adiantaceae]



Most commonly found amongst rocks, in open forests and woodlands. The ferns are not often found in open pastures.



Rock ferns are native Australian ferns. The plants contain high levels of thiaminase but there are no confirmed reports of poisoning in horses caused by rock fern. The risk to horses from this fern is very low.

Growth and identification

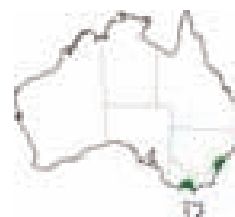
Rock ferns are clumping plants that have green fronds. The ferns can grow from 2 – 40 cm in height and they produce spores.

Management notes

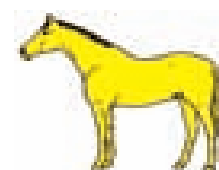
- Remove rock ferns from paddocks if found growing as weeds.

Horsetails

Equisetum spp [Equisetaceae]



Present in some Australian gardens. Grows as a weed near populated areas. It is present around Adelaide, Sydney and scattered areas of New South Wales. Small outbreaks have been recorded in Tasmania, Victoria and Queensland.



Horsetails are native to Europe, North America and Asia. They were introduced to Australia as ornamental garden species and in some areas they have spread from gardens and have caused infestations that have been difficult to control. Horsetails are not widespread in Australia at present but they are on the Federal Government's *Alert List for Environmental Weeds* because of their potential to cause significant damage in this country. Horsetails are declared noxious weeds in all states except the Northern Territory. Cases of horse poisoning caused by the ingestion of horsetails in pasture or as contaminants of hay have been reported in other countries where the plant is more common.

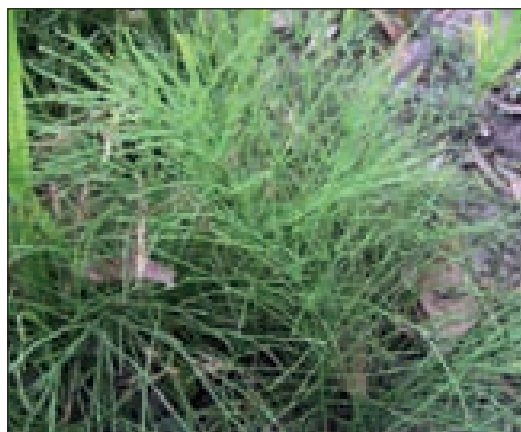
Growth and identification

Horsetails are primitive plants that do not produce true flowers. They are upright perennials that grow to 50 cm to 1.2 m in height depending on the species. The plants produce green sterile shoots that branch and are hollow. The plants also produce fertile pale brown unbranched shoots. The fertile shoots bear fruiting cones and they die back each year. Both types of shoots have joints that break easily when pulled. The shoots grow from long underground stems (rhizomes) that can be very deep in the soil.

Sections of rhizome can be transported to new areas during cultivation or other practices that move soil. Horsetails can also be spread through the dumping of garden waste containing rhizomes.

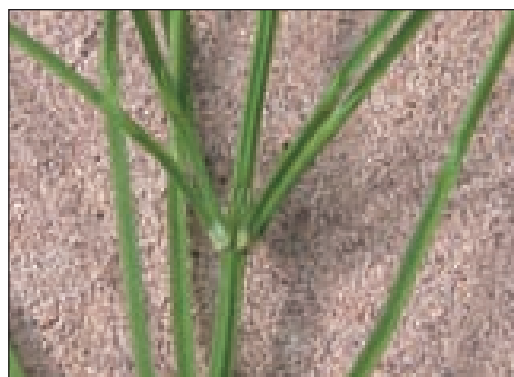
Very small leaves grow on the shoots in rings of 6 – 18 and the leaves are joined at the base to form a rim of teeth around the stem.

The fruiting cones are up to 4 cm long and they contain numerous pale green or yellow spores.



Above: Young horsetail plant.

Right: Closeup of horsetail stem showing the point of attachment of a ring of leaves. Note the joints on the stem and on the leaves.



Management notes

- Do not grow horsetails as ornamental plants.
- Horsetails are not common in Australia but it is important to be aware of the plants both for their potential toxicity to horses and their potential to be an invasive weed.
- Control of horsetails is extremely difficult. Most herbicides have a limited effect as they can not penetrate the plant. Hand pulling the weed is ineffective as the plants break off along the stem and it is difficult to remove all parts of the rhizomes from the ground. The plant can regrow from even the tiniest bit of rhizome that has been left in the ground. Control of horsetails requires specialised techniques and expert assistance. Outbreaks of the weed should be reported immediately to your local council or to your state or territory weed management agency.

Terpenes

Diterpene esters

Diterpene esters are present in the sap of plants of the genus *Euphorbia*. The amount of toxins contained in the sap varies between species.

Diterpene esters are skin and gastrointestinal tract irritants. The toxins activate an enzyme that causes damage to the structure of tissue cells and they cause the dysfunction of several other enzymes.

The sap in euphorbias is toxic in fresh or dried plants. Most species have relatively low toxicity and cause only mild effects if ingested. The most toxic euphorbias are the leafy spurges and these plants are commonly found as pasture weeds and can sometimes be found as contaminants of hay. Cases of euphorbia poisoning in horses are not commonly reported in Australia.

The plants are usually unpalatable to horses but may be eaten if other pasture is scarce. Poisoning could also occur through the ingestion of contaminated hay.

The onset of symptoms can occur within minutes of ingestion of euphorbia plant material containing high levels of diterpene esters.

Signs of diterpene ester poisoning

- Irritation and blistering of the mouth and the skin around the mouth
- Salivation
- Colic and diarrhoea can occur in severe cases

Topical ointments can be used to treat skin irritation. Veterinary attention should be sought, especially if symptoms are severe.

Leafy spurges

Euphorbia is a very large and diverse genus with over 1500 species, around forty of these can be found in Australia. The distinguishing features of this genus are the milky sap of the plants and the unique structure of the flowers. The flowers are usually very small and consist of both male and female flowers. Bracts that look like leaves or petals surround the flowers. The bracts are often green but can also be brightly coloured, for example the red bracts of poinsettia.

Described below are two euphorbias that are commonly found as weeds in pastures.

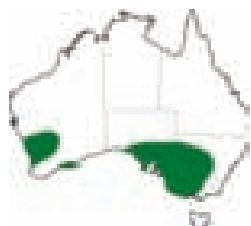


The red flower bracts of poinsettia

False caper

(Geraldton carnation weed, terracina spurge)

Euphorbia terracina [Euphorbiaceae]



Weed of pastures, roadsides, gardens and crops.

False caper is native to the Mediterranean region. It is a common weed in crops and pastures in Australia and it is a declared noxious weed in South Australia and Western Australia.

Growth and identification

False caper is an upright perennial that grows to 1 m in height. The plant has numerous green to reddish stems that arise from ground level. The stems branch towards the top of the plant above a whorl of leaves. These smaller branches support the flowering stems that grow at the top of the plant.

The leaves are bright green or yellowish-green. The lower leaves are alternately arranged and do not have stalks. The upper leaves are arranged on opposite sides of the stem and they are smaller than the lower leaves.

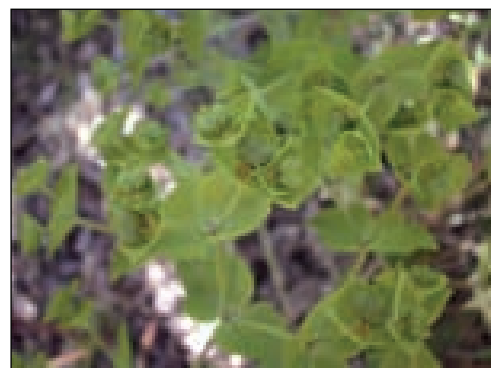
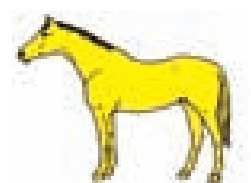


Photo: Sheldon Navie

Flowering occurs in spring and summer. The flowers consist of several tiny male flowers and one female flower. A pair of green leafy bracts surrounds the flowers.



Petty spurge

(milk weed)

Euphorbia peplus [Euphorbiaceae]

Petty spurge is native to North America. It is commonly found as a weed in gardens and pastures in Australia.

Growth and identification

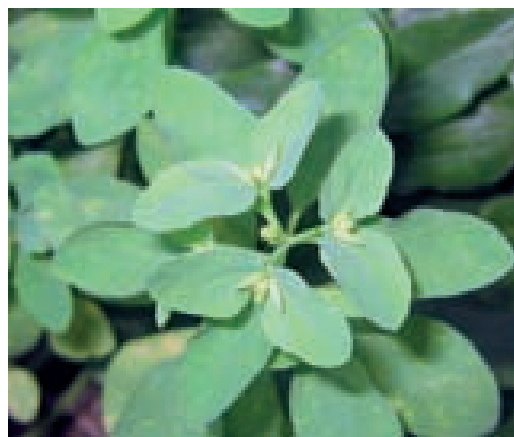
Petty spurge is an upright annual that grows to 50 cm in height. The plant usually has a single stem but it sometimes has 2 or 4 stems that arise from ground level.

The leaves are pale green. The lower leaves are alternately arranged along the stems on short stalks. The upper leaves are arranged on opposite sides of the stem and are smaller than the lower leaves.

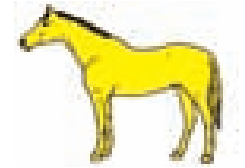
Flowering occurs in winter and spring. The flowers consist several tiny male flowers and one female flower. Yellow-green leafy bracts surround the flowers.

Management notes

- Avoid grazing horses on pasture infested with *Euphorbia* species.
- Check hay for euphorbia contamination.
- Individual plants should be pulled out by hand or spot sprayed with herbicide. Wear gloves to avoid the irritant milky sap.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.



Weed of pastures, roadsides and gardens.



Meliatoxins

The tree known as white cedar contains Meliatoxins. All parts of the tree are extremely poisonous but it is thought that the fruits are most toxic. The tree contains various other toxins including alkaloids and resins.

There are no confirmed reports of horse poisoning due to the ingestion of white cedar leaves or fruit in Australia. The tree has caused poisoning in many other livestock species and some reports suggest that horse poisonings

have occurred in other countries. The leaves and fruit are bitter and unpalatable.

The mechanism by which meliatoxins cause poisoning is presently unknown.

Signs of meliatoxin poisoning

There is little information available on the signs of poisoning or treatment options for meliatoxin poisoning in horses. This lack of information probably reflects the rarity of white cedar poisoning in horses. If a horse were to ingest the leaves or seed of this tree, the following signs may be seen:

- Diarrhoea and straining
- Colic
- Excess salivation
- Incoordination and excited behaviour
- Seizures
- Depression
- Paralysis, coma and death

Signs of poisoning usually appear within 2 hours of ingestion and the symptoms are progressive. Immediate veterinary attention should be sought if it is suspected that a horse has been poisoned by white cedar. Once the symptoms become severe there is little chance of recovery.

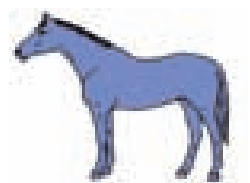
White cedar

(cape lilac, Chinaberry, Persian lilac, Texas umbrella tree, tulip cedar, umbrella cedar)

Melia azedarach [Meliaceae]



Adaptable tree that is grown in gardens and as a street tree and park tree. The tree is native to the Kimberly region and has naturalised in other areas of Australia.



White cedar is native to southeast Asia and northern Australia. It is commonly grown as a street tree and in gardens in Australia.

Growth and identification

White cedar is a deciduous tree that usually grows to around 15 m in height but can grow taller. The furrowed bark of the tree is grey-brown in colour.

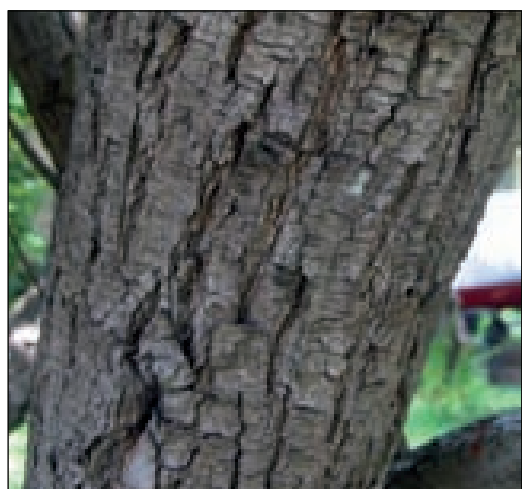
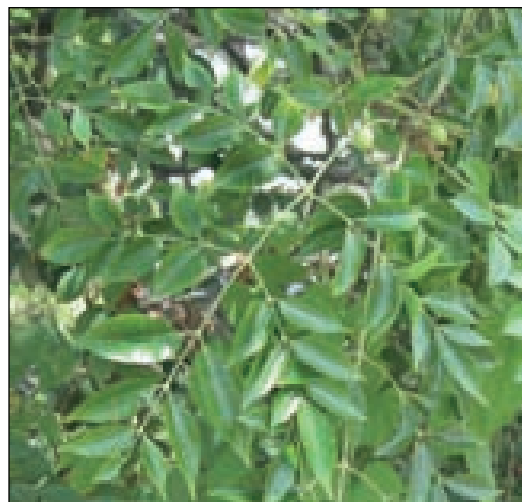
The leaves can be up to 45 cm long and are branched, with leaf branches bearing 3 – 5 pairs of leaflets. The leaflets are usually around 7 cm long by 2.5 cm wide. The edges of the leaves are toothed.

The tree bears mauve or lilac flowers in spring to early summer. The flowers appear in drooping clusters that can be up to 20 cm long. Each flower has 5 spreading petals.

The tree produces green fruits that dimple and turns yellow or brown with maturity. The fruits are about 1.5 cm wide and are fleshy around a hard centre. The fruits often stay on the tree after the leaves have fallen in late winter.

Management notes

- White cedar is not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.
- Do not put clippings of white cedar in areas where horses may access them.



Other toxins

Black bean

The ripe seeds of this tree contain an unknown toxin or toxins. Cases of poisoning through the ingestion of black bean seeds are uncommon in all livestock species. Ingestion of the seeds has been reported to cause poisoning in cattle and less commonly in horses.

The toxins in ripe black bean seeds can cause severe irritation of the gastrointestinal tract and in horses there have been reports of sudden death, however this is a very rare occurrence.

The seeds of black bean trees are usually avoided by horses but may be eaten when other forage is scarce,

particularly in dry seasons and during times of prolonged drought. The greatest risk occurs when large numbers of ripe black bean seeds have fallen to the ground and are accessible to horses.

The tree is common in some areas of Australia and it should be considered a risk to horses.

Signs of black bean poisoning

The ingestion of ripe black bean seeds can cause severe irritation of the gastrointestinal tract and the signs of poisoning that may be seen include:

- Depression
- Weight loss
- Diarrhoea that may contain blood. The faeces may appear dark and 'tarry'
- Laboured breathing
- Frequent urination
- Sudden death can occur in some rare cases.

Veterinary attention should be sought if black bean poisoning is suspected in a horse. Fluid therapy and the administration of activated charcoal may be used to help with recovery.

Black bean

(Moreton Bay chestnut)

Castanospermum australe [Fabaceae]

Black is native to Australia. The tree is most suited to warm rainforest areas, however it is a hardy species that has been utilised as a park tree, shade tree and garden ornamental in many areas of eastern Australia.

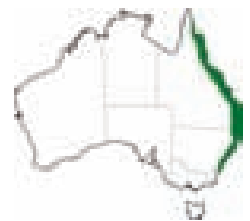
Growth and identification

Black bean is a large tree that grows to 40 m. The leaves are 30 – 60 cm long and are dark green and shiny. The leaves have leaflets arranged along a centre leaf stem. The leaflets are elliptical in shape and can be up to 12 cm long. The branches are low and spreading when the tree is grown in open space.

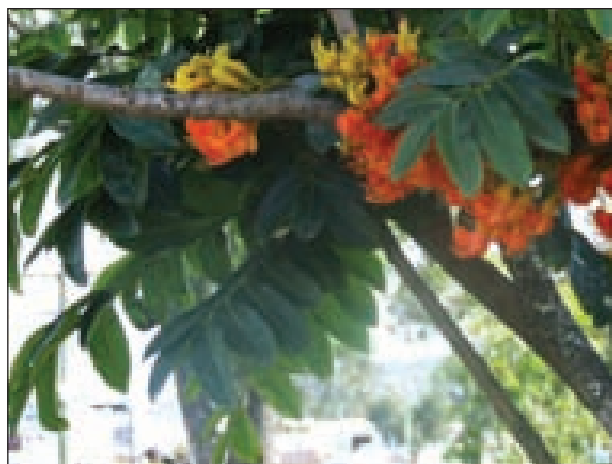
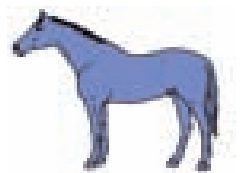
The tree flowers in mid - late spring and bears sprays of red and yellow pea-shaped flowers. The flowers are 3 – 4 cm long. The tree produces large cylindrical pods that can be up to 25 cm long. The pods split in two and have up to 5 large bean-type seeds inside.

Management notes

- Black bean is not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.



Occurs naturally in rainforest areas. Grown as an ornamental in parks, along streets and in gardens.



Photos: Pat Offord

Crofton weed and Mistflower

Crofton weed is a significant pasture weed in Australia and it is highly toxic to horses. The toxin that causes poisoning in horses has not yet been identified.

Regular ingestion of the weed causes chronic lung disease and the condition has been reported in horses in Australia and in several other countries.

The exact mechanism by which the toxins in crofton weed cause damage to the lungs of the horse is unknown. The air sacs in the lungs become inflamed and subsequent scar tissue

is produced (fibrosis). The fragile walls of the air sacs are permanently damaged and this leads to a reduced ability of the lungs to transfer oxygen to the bloodstream. The horse develops a cough and is unable to tolerate exercise. Horses are the only animals affected by the ingestion of crofton weed.

Experimental feeding studies have shown that the ingestion of mistflower can cause the same symptoms in horses as those seen with crofton weed poisoning. The toxicity of mistflower is thought to be less than that of

crofton weed and there have been no confirmed reports of poisoning cases outside of the feeding studies.

Horses will readily eat crofton weed and mistflower and they will sometimes eat these plants in preference to other pasture species. The plants can be found as contaminants of hay, although the toxicity of the dried plants is less than when fresh. The plants are most toxic when in flower.

Crofton weed poisoning in horses is known as 'Numinbah horse sickness' in New South Wales and 'Tallebudgera horse disease' in Queensland.

Signs of crofton weed and mistflower poisoning

The toxins in crofton weed and mistflower are thought to have a cumulative effect. The symptoms of poisoning may develop after only a few weeks or after several months of grazing infested pasture. The toxin in these plants damages lung tissue and the signs include:

- Coughing, particularly during exercise

- Exercise intolerance
- Depression
- Loss of condition
- Laboured breathing
- Respiratory failure leading to death

There is no known treatment for the condition and lung damage caused by these plants is largely permanent. Early recognition of the signs of poisoning and removal of the source of the toxic

plants from the affected horse's diet is essential to prevent further damage to the lungs. Moderately to severely affected horses may never again be capable of strenuous exercise and may be at risk of sudden respiratory failure if forced to exercise. Veterinary attention should be sought if crofton weed or mistflower poisoning is suspected in the horse.

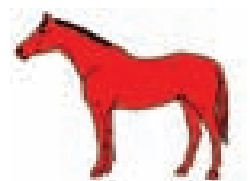
Crofton weed

(catweed, sticky eupatorium, Mexican devil, sticky snakeroot)

Ageratina adenophora (also known as *Eupatorium adenophorum*, *Eupatorium glandulosum* or *Eupatorium pasdadense*) [Asteraceae]



Weed of pastures, roadsides, waterways, bushland, forests and crops.



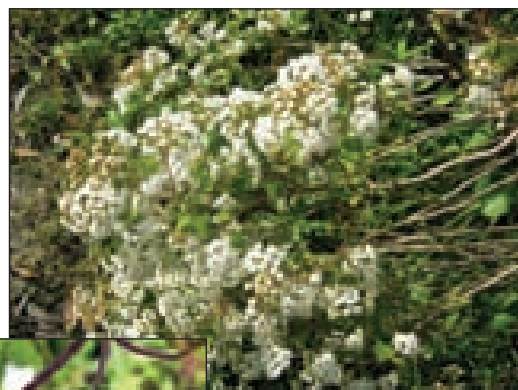
Crofton weed is native to Mexico. Crofton weed spreads rapidly and it can quickly become the dominant species in a pasture. It is declared a noxious weed in New South Wales and Western Australia.

Growth and identification

Crofton weed is an upright perennial that usually grows 1 – 2 m tall but can occasionally grow to 3 m. The plant produces seeds that are easily spread by wind or water run-off. The seeds can also be spread through contaminated hay and other feedstuffs. Mature plants can produce up to 100,000 seeds each year.

Many branching stems are produced from a woody base. Young stems are densely covered in sticky hairs and older stems are woody. The stems can be green, reddish or purplish in colour.

The leaves are arranged on opposite sides of the stem and can be up to 7.5 cm long by 5 cm



wide. The leaves have stalks up to 4 cm long and these stalks are covered in sticky hairs. The leaves can be trowel-shaped to triangular and the tip is sharply pointed. The edges of the leaves are serrated or scalloped.

Flowering usually occurs from spring to early summer in northern regions and from late summer to autumn in southern regions. The flowers are around 7 mm across and they do not

have any true petals. The flower is made up of many tiny tubular florets surrounded by a row of bracts. The florets are white and are around 5 mm long. The flowers are arranged in clusters at the tips of the branches. The small slender seeds are blackish-brown and are slightly curved. They are topped with a ring of whitish hairs that are about twice as long as the seed. The hairs drop off the seed at maturity.

Mistflower

(creeping crofton weed, small crofton weed, cat's paw, river eupatorium, white weed)

Ageratina riparia (also known as *Eupatorium riparium*) [Asteraceae]

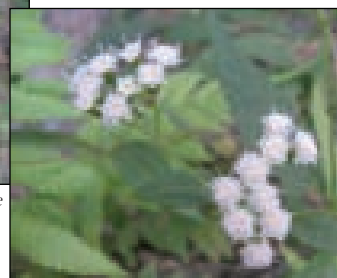
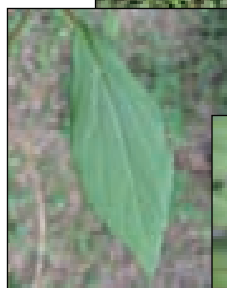
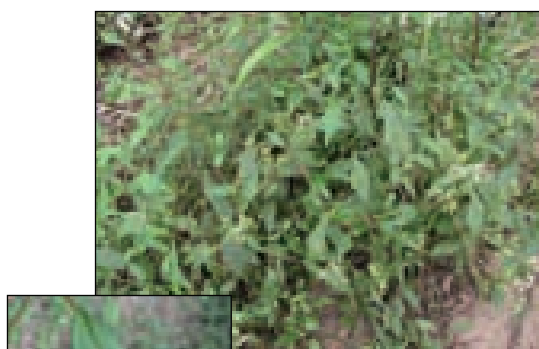
Mistflower is native to Mexico and South America. It can quickly become the dominant species in pastures and it has been declared a noxious weed in New South Wales, the Northern Territory and Western Australia.

Growth and identification

Mistflower is a scrambling perennial that usually grows 40 – 60 cm tall but can grow to 1 m. The plant produces seeds that are easily spread by wind or water run-off. The seeds can attach to animals, clothing or vehicles and can be spread through contaminated hay and other feedstuffs.

The many branching stems are relatively weak and tend to grow sideways at first and then upward (decumbent). The stems have nodes from which new roots can grow. The stems are sparsely covered in fine hairs and are often purplish in colour.

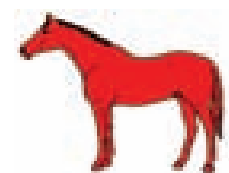
The leaves are arranged on opposite sides of the stem and have stalks up to 1.5 cm long. The lance-shaped leaves can be up to 7.5 cm long by 2.5 cm wide and they taper to a point at both ends. The edges of the leaves are serrated with forward-pointing teeth.



Photos: Sheldon Navie



Weed of pastures, roadsides, waterways, bushland, open forests and rainforests clearings.



Flowering usually occurs from late winter to spring, with most of the flowering occurring in mid-spring. The flowers are very similar to those of crofton weed.

Management notes

- Do not graze horses on pastures infested with crofton weed or mistflower. Horses will not avoid eating these weeds and they may prefer them to other pasture species.
- Check batches of hay and chaff for crofton weed or mistflower contamination. The dried plants have lost some of their toxicity but chronic consumption may still cause poisoning.
- Individual plants can be pulled out by hand or spot sprayed with herbicide. Mature plants will need to be dug out with a mattock as regrowth can occur if the crown is left behind.
- The use of herbicides on larger infestations is most effective if done in late summer to autumn. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Regularly slash infested pasture to reduce flowering and seed production. Slashing weakens the plants, giving desirable pasture species a chance to recover and compete. Slashing does not make the pasture safe for horses as they will eat the dried plants from the ground. Horses should not be reintroduced to the paddock until the weeds have been completely removed and this may take several seasons.
- The establishment of competitive pastures can control crofton weed and mistflower. The weeds can not germinate in densely growing pasture. Implement grazing management techniques to ensure a good ground cover to prevent crofton weed or mistflower establishing in bare patches.
- Graze adult non-pregnant goats on heavily infested paddocks as they are more tolerant to the toxins and they will readily eat the weeds. Heavy grazing by goats can suppress seed set in crofton weed and mistflower. Do not leave the goats on the infested pasture continuously as toxicity problems can occur.

Australian stringhalt

Flatweed has been implicated as the cause of the condition known as Australian stringhalt. The weeds smooth flatweed and dandelion may be associated with Australian stringhalt but this has not been confirmed. It is thought that the development of Australian stringhalt may involve particular environmental factors or the growth of a soil fungus on the suspected weeds. Research is needed to define the exact plants responsible

for, and the conditions under which, Australian stringhalt develops in horses.

The condition most commonly occurs in Australia but it has also been reported in New Zealand and North America.

Australian stringhalt usually occurs in late summer or early autumn and it most commonly occurs after a break in dry weather or drought conditions. Horses that graze poor quality pastures

infested with a high concentration of the weeds seem to be most at risk. Usually a number of cases are seen in the one herd, although single cases have been reported.

The toxin or toxins that cause stringhalt in horses are unknown. The symptoms seen with this condition are a consequence of damage to the long nerves. The symptoms usually appear abruptly and may worsen over several weeks.

Signs of Australian stringhalt

- Involuntary flexion and delayed extension of the hocks. This exaggerated flexion of the hind limbs is more noticeable when backing or turning and the flexion can be so severe that the front of the fetlock may strike the belly. Horses sometimes adopt a 'bunny hop' gait. Both hind limbs are usually affected and the forelimbs are occasionally affected.

- Wasting of the muscles can occur around the hindquarters and occasionally around the forelimbs.
- 'Roaring' may develop if the nerves supplying the larynx are affected.

Horses will usually recover if moved to paddocks that are free of flatweed and other suspected weeds. The recovery time varies and may take days or up to 18 months, with the average

recovery time being 6 - 12 months. Veterinary attention should be sought if Australian stringhalt is suspected in a horse. Research has shown that the drug phenytoin may provide some benefit to recovery. Surgical treatment to remove a tendon from the hind leg is an option in horses that do not respond to other treatment methods.

Identification note: Dandelion and the flatweeds are very similar. The main distinguishing feature is that the flatweeds have branched solid stems whereas dandelion has unbranched hollow stems. Flatweed is also similar to hawkbit (*Leontodon taraxacoides*), with the main difference being that hawkweeds have unbranched solid stems.

Flatweed

(catsear, false dandelion)

Hypochoeris radicata (also known as *Hypochoeris radicata*) [Asteraceae]

Flatweed is native to Europe. It is highly competitive in pastures and it can become the dominant species, especially in degraded pastures and during drought conditions.

Growth and identification

Flatweed is an upright perennial that grows to 80 cm in height. The plant produces numerous seeds that are easily distributed by wind, water run-off, or through animal and vehicle movements.

The plant forms a rosette of leaves and each leaf can be 5 – 20 cm long. The leaves usually have scaly hairs on both sides. The leaves are lance shaped, have wavy or toothed edges and a blunt tip.

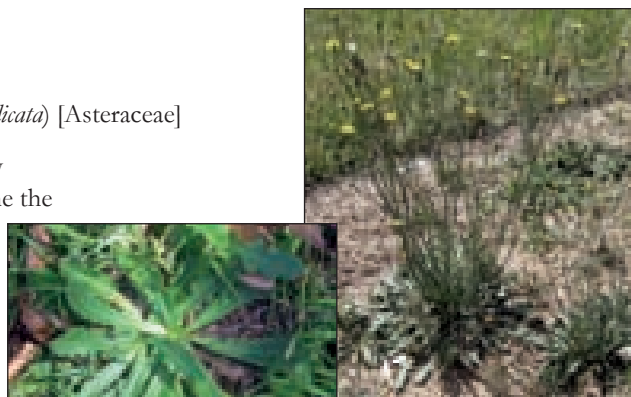
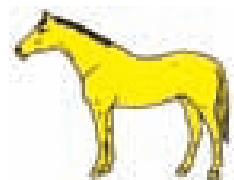
The plant produces several flowering stems from the centre of the rosette. The branching stems bear daisy-like flowers at their tips and the flowers can be up to 1.5 cm across. The numerous petals are bright yellow.

As flowering finishes, slender brown-orange seeds appear and a tuft of white hairs that are around 1 cm long top each seed. The flowering stems die

back when flowering has finished and the plant remains in a semi-dormant state as a rosette over winter. New flowering stems are produced the following spring.



Weed of gardens, pastures, grasslands, and roadsides.



Smooth flatweed

(smooth catsear)

Hypochoeris glabra (also known as *hypochoeris radicata*) [Asteraceae]

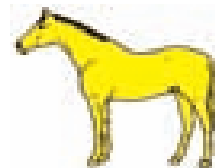
Smooth flatweed is native to Europe. It is highly competitive in pastures and it can become the dominant species, especially in degraded pastures and during drought conditions.

Growth and identification

Smooth flatweed is very similar to flatweed. The distinguishing feature is that smooth flatweed usually has hairless leaves whereas flatweed usually has hairy leaves.



Weed of gardens, pastures, grasslands, and roadsides.



Dandelion

(pissabed)

Taraxacum officinale [Asteraceae]

Dandelion is native to Europe. It is highly competitive in pastures and can become the dominant species, especially in degraded pastures and during drought conditions.

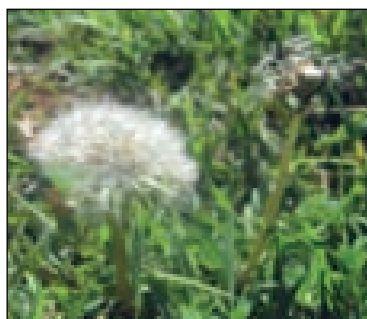
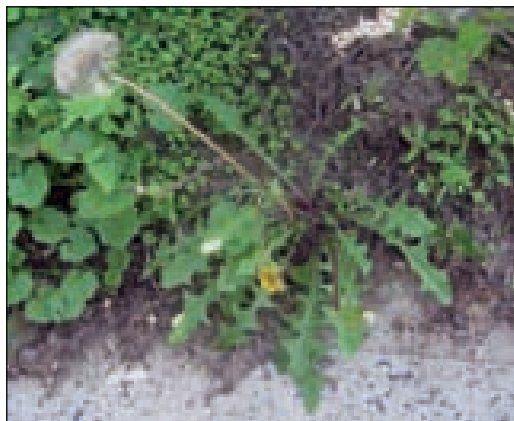
Growth and identification

Dandelion is an upright perennial that grows to 40 cm in height. The plant produces numerous seeds that are easily distributed by wind, water runoff, or through animal and vehicle movements.

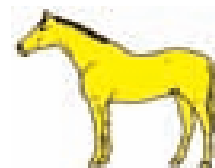
The plant forms a rosette of leaves and each leaf can be 5 – 40 cm long. The leaves can be hairless or can have a sparse covering of hairs. The leaves are lance-shaped, have wavy or toothed edges and a sharp tip.

The plant produces several flowering stems from the centre of the rosette. The unbranched hollow stems bear daisy-like flowers at their tips and the flowers can be up to 2 cm across. The numerous petals are bright yellow. As flowering finishes, slender seeds appear and a tuft of white hairs that are around 6mm long top each seed.

The flowering stems die back when flowering has finished and the plant remains in a semi-dormant state as a rosette over winter. New flowering stems are produced in the following spring.



Weed of gardens, pastures, grasslands, and roadsides.



Management notes

- Avoid grazing horses on pastures infested with flatweed, smooth flatweed or dandelion.
- Individual plants can be pulled out by hand or spot sprayed with herbicide.
- Establish competitive pastures.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- If it is not practical to remove these weeds from pastures, observe horses for signs of stringhalt. This is especially important in the high-risk periods of late summer or early autumn and after a break in dry weather or drought conditions

Nightshades

The plants in the *Solanum* genus are generally known as the nightshades. There are around 1500 species of *Solanum* found worldwide and over one hundred of these can be found growing in Australia. Solanums are grown as garden ornamentals or for food (potatoes) and many species are important agricultural weeds. The closely-related tomato plant (*Lycopersicon esculentum*) contains toxins similar to those in plants of the *Solanum* genus.

The toxic effect that ingested solanum plant material will have on a horse depends on the species, the stage of

growth of the plant, the part of the plant eaten and the amount of plant material consumed. In general the leaves and green fruits of solanums are the most toxic parts of the plants.

Solanums contain a variety of toxic compounds and all species are reportedly toxic to horses if ingested. One of the main toxic compounds found in solanums is solanine. Solanine is a glycoalkaloid and structurally it is a glycoside containing a steroid alkaloid nucleus with a side chain of sugars. Solanums can contain other glycoalkaloids, glycosides and alkaloids.

These toxic compounds can have effects on the gastrointestinal tract and/or the nervous system, depending on the combination of toxins in ingested plant material.

Despite the widespread occurrence of solanums in Australia and the reported toxicity, there are very few confirmed reports of poisoning in horses. Most solanum plants are unpalatable but they may be eaten if no other forage is available. Poisoning could also occur through the ingestion of contaminated hay, although many horses will avoid solanum plants in hay.

Signs of solanum poisoning

Ingestion of solanum toxins that affect the nervous system may produce signs such as:

- Depression
- Drowsiness
- Dilated pupils
- Salivation
- Laboured breathing
- Incoordination
- Muscle weakness
- Involuntary urination
- Convulsions
- Paralysis
- Loss of consciousness

Ingestion of solanum toxins that affect the gastrointestinal system may produce signs such as:

- Colic
- Diarrhoea that can contain blood
- Constipation and intestinal stasis (food is not moved through the gut) if a large amount of toxin has been consumed

Veterinary attention should be sought if solanum poisoning is suspected in a horse. Mild to moderately affected horses should make a full recovery

with supportive veterinary care. Veterinary treatment will depend on the symptoms displayed in the affected horse. The treatment options may include the administration of activated charcoal, the administration of fluids and electrolytes and the administration of certain drugs. The ingestion of large amounts of toxic solanum plant material can result in sudden death, or death within 3 - 4 days in the most severe cases.

Solanums

The *Solanum* genus is large and diverse. The plants in this group include annual and perennial herbs, shrubs, small trees and climbing plants. Most solanums are covered in hairs and some have prickles. The flowers of plants in this group

are usually star-shaped and the plants all produce berries. Described in this section are some of the solanums that commonly grow as weeds in horse paddocks.

Blackberry nightshade

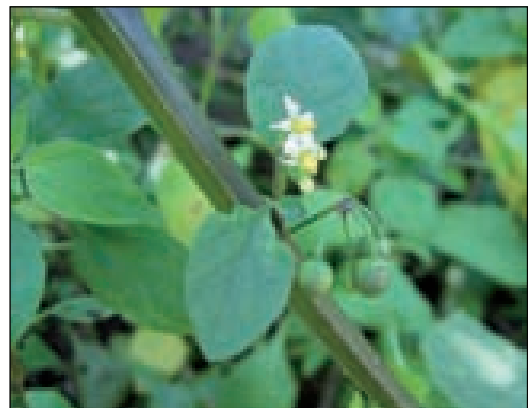
Solanum nigrum [Solanaceae]

Blackberry nightshade is native to Europe.

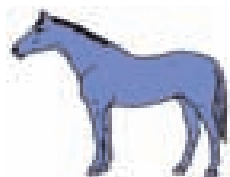
Growth and identification

Blackberry nightshade is an upright, short-lived perennial shrub that grows to 1 m in height. The plant produces seeds that can be spread by water run-off, through animal and vehicle movements or as contaminants of hay or grain.

The branched stems and the leaves are green and they are often tinged with purple. The leaves are oval-shaped with a pointed tip and they are around



Weed of pastures, crops, gardens, parklands, waterways and roadsides.



6 cm long by 2.5 cm wide. The edges of the leaves can be entire or can sometimes have shallow lobes. The leaves are alternately arranged along the stem and the leaf stalks are up to 3 cm long.

Flowering occurs in spring and summer. The small star-shaped flowers are white and they appear in groups of 4–12 flowers. The plant

produces round berries that are green when young and black or purple-black when mature. The berries are up to 8 mm across.

Identification note: Glossy nightshade (*Solanum americanum*) is very similar to blackberry nightshade. The berries of glossy nightshade are shiny and the berries of blackberry nightshade are dull.

Apple of Sodom

(Dead Sea apple, bitter apple, poison apple, black-spined nightshade)

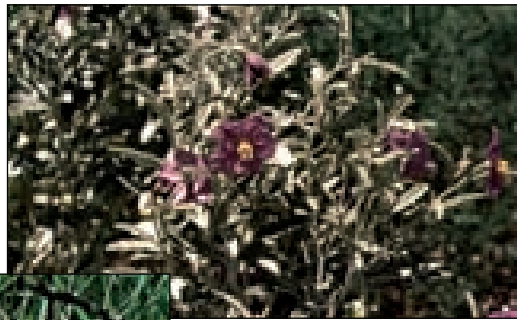
Solanum linnaeanum (also known as *Solanum bermannii* or *Solanum sodomeum*) [Solanaceae]

Apple of Sodom is native to southern Africa and the Mediterranean region. It is declared a noxious weed in Victoria, Tasmania and Western Australia.

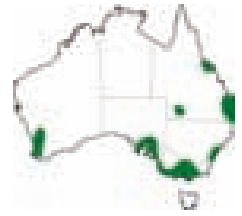
Growth and identification

Apple of Sodom is an upright or spreading perennial shrub that usually grows to 1 m in height. The plant produces seeds that are not usually spread far from the parent plant. Spiny stem fragments can attach to animals and the seed can be spread considerable distances through the movement of these animals.

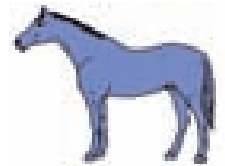
The branched stems are green or purplish when young and they turn brown or grey as they mature. The stems and leaves are covered in many yellow-coloured prickles that can be up to 1.5 cm long. The young stems and the leaves are also covered in tiny star-shaped hairs. The leaves are alternately arranged along the stems and they have stalks that are up to 2.5 cm long. The oval-shaped leaves can be up to 15 long by 8 cm wide and they are deeply lobed.



Photos: Ken Harris



Weed of pastures, open woodlands, roadsides and waterways.



The plant flowers in spring and summer. The star-shaped flowers are usually purple and they appear in groups of 3–6 flowers. The flowers are up to 3.5 cm in width. The plant produces round berries that are green with white mottling when young and yellow when mature. As the berries dry out they turn brown-black and they become wrinkled. The berries can be up to 3.5 cm across.

Silverleaf nightshade

(bitter apple, silver horsenettle)

Solanum elaeagnifolium [Solanaceae]

Silverleaf nightshade differs to other nightshades in that the ripe berries of the plants are more toxic than the green berries. The plant is native to the United States and Mexico. It is declared a noxious weed in Victoria, New South Wales, South Australia, Tasmania and Western Australia.

Growth and identification

Silverleaf nightshade is an upright perennial that usually grows 30–60 cm in height. The plant dies back each year and regrows from the perennial rootstock. It produces seed that can be spread by water run-off, animal and vehicle movements and as contaminants of hay or grain. The plants have a network of underground roots that can give rise to new shoots. The plants can spread through the dispersal of root fragments during cultivation or other practices that move soil.

The branched stems and the leaves are covered in many fine star-shaped hairs that give them a silvery or grey appearance. The stems are also covered in many yellow or reddish coloured prickles that can be up to 0.5 cm long. The leaves

are alternately arranged along the stems and they have stalks that are up to 3.5 cm long. The lance-shaped leaves can be up to 12 cm long by 3.5 cm wide and they have wavy or scalloped edges.

The plant flowers in late spring and summer. The star-shaped flowers can be purple, mauve, blue or violet and they appear in groups of 1–4 flowers. The flowers are up to 4 cm wide. The plant produces round berries that are green with darker coloured striations when young. The berries are yellow or orange when mature and can be up to 1.5 cm across.

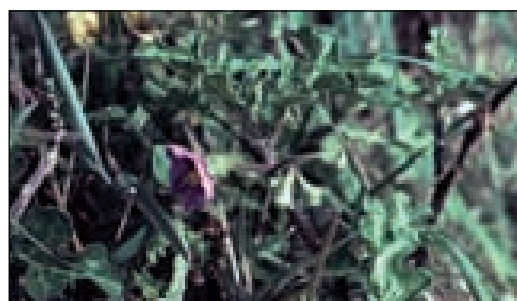
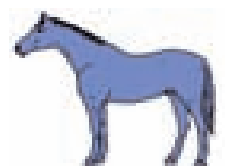


Photo: Ken Harris



Weed of pastures, crops and roadsides.



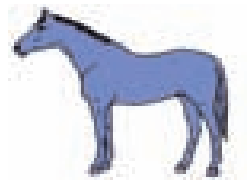
Buffalo burr

(spiny nightshade)

Solanum rostratum [Solanaceae]



Weed of pastures, crops and roadsides.



Buffalo burr is native to the United States and Mexico. The plant is declared a noxious weed in Victoria, New South Wales and Western Australia.

Growth and identification

Buffalo burr is an upright or spreading annual that usually grows 20 – 50 cm tall. The plant produces seed that can be spread as contaminants of hay or grain. The seeds are contained in prickly burrs that can spread when they attach to animals. Older plants can detach at ground level and become ‘tumbleweeds’.

The branched stems are green when young and become woody with age. They are covered in

many fine star-shaped hairs that give them a greyish appearance. The stems are also covered in yellow prickles that can be up to 1.5 cm long. The leaves are alternately arranged along the stems and they can be up to 15 cm long by 8 cm wide. The leaves are deeply divided and the edges are lobed.

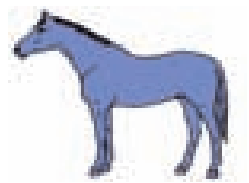
The plant flowers in spring and summer. The star-shaped flowers are bright yellow and they appear in groups of 1 – 10 flowers. The plant produces egg-shaped or rounded berries that are green when young and black when mature. The entire fruit is surrounded in a prickly bract that forms a burr.

Management notes

- Avoid grazing horses on pasture infested with solanums.
- Check hay for solanum contamination.
- Individual plants should be pulled out by hand or spot sprayed with herbicide.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.

Potatoes

Solanum tuberosum [Solanaceae]



Green potato peelings are the most toxic part of this plant, particularly the peelings of sun-greened potatoes. The leaves and other parts of the plant are also toxic. Potatoes were reportedly the cause of a fatal poisoning in a horse after it ingested old potatoes that had been dumped in a compost heap in a horse paddock.

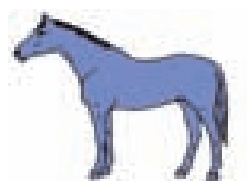
Management notes

- Do not grow potato plants in horse paddocks or in areas where horses are kept.
- Do not compost old potatoes or place plant clippings in horse paddocks or in areas where horses are kept.
- Do not feed potato peelings to horses.



Tomatoes

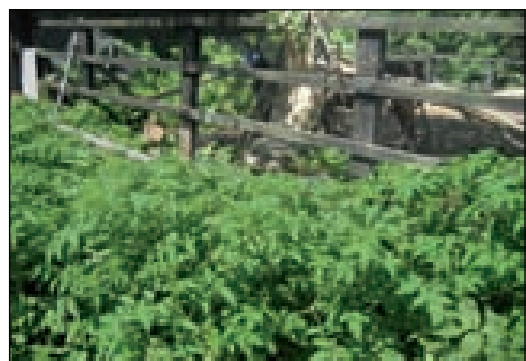
Lycopersicon esculentum [Solanaceae]



The leaves of the tomato plant and unripe tomatoes contain toxins that are potentially poisonous to horses.

Management notes

- Do not grow tomato plants in horse paddocks or in areas where horses are kept.
- Do not compost green tomatoes or place plant clippings in horse paddocks or in areas where horses are kept.



This vegetable patch has been planted close to a horse yard. The tomato plants are just out of reach of the horses.

Chillagoe horse disease

The ingestion of the crotalarias known as trefoil rattlepod and Chillagoe horse poison can induce severe ulceration on the lining of the oesophagus and the upper part of the stomach in horses. Horses will readily eat these species of crotalaria and may selectively graze the plants even when other forage is

available. Horses are at an increased risk of developing Chillagoe horse disease when rain produces a flush of growth in these plants.

Despite the wide distribution of these plants, cases have been recorded only from central coastal and northern Queensland. It is likely that large

intakes of the plants are required before poisoning occurs.

The toxins that cause these effects in horses are presently unknown. Other species of *Crotalaria* can cause pyrrolizidine alkaloid poisoning if ingested. (see pages 7, 9-11)

Signs of Chillagoe horse disease

- Ulceration of the oesophagus
- Frequent licking of lips
- Teeth grinding
- Drooling
- In severe cases the oesophagus may become partially or completely blocked and the horse may be unable to swallow food

or water. Severely affected horses can die if the oesophagus becomes completely blocked.

Veterinary attention should be sought and the affected horse should be removed from pastures containing crotalaria if Chillagoe horse disease

is suspected. Veterinary treatment and supportive care may help with recovery. In severe cases a veterinarian can try to pass a stomach tube past any blockage in the oesophagus to supply nutrition to the horse while the oesophageal ulcers heal.

Trefoil rattlepod

Crotalaria medicaginea var. *neglecta* (formerly known as *C. trifoliatrum*) [Fabaceae]

Growth and identification

Trefoil rattlepod is an upright annual or perennial that grows to 1 m in height.

The leaves have 3 narrow egg-shaped leaflets that can be up to 3 cm long by 1.5 cm wide. The lower surfaces of the leaves are densely hairy.

The plant flowers throughout the year. Flower spikes appear at the tips of the branches and they can be up to 10 cm long. The numerous pea-shaped flowers are yellow and are sometimes streaked with red. The plant produces small hairy or hairless pods.

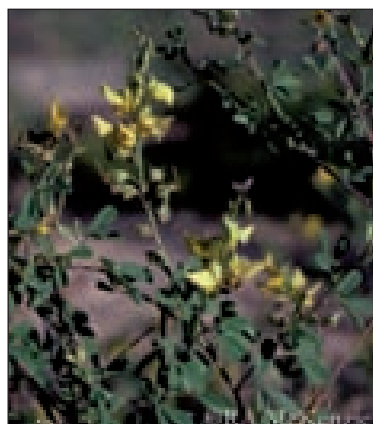
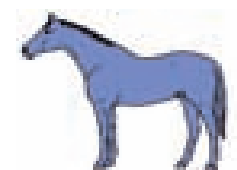


Photo: Ross McKenzie



Found in pastures, grasslands and waterways.



Chillagoe horse poison

Crotalaria aridicola ssp. *aridicola* [Fabaceae]

Growth and identification

Chillagoe horse poison is a semi-upright perennial that grows 50 – 60 cm in height.

The plant has slender branched stems and a woody taproot. The leaves have 3 wedge-shaped leaflets.

The plant flowers in autumn to winter. Flower racemes appear at the tips of the branches and the flowers grow in crowded clusters. The pea-shaped flowers are yellow. The plant produces triangular-shaped pods.

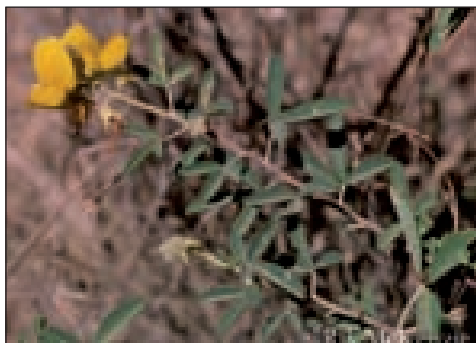
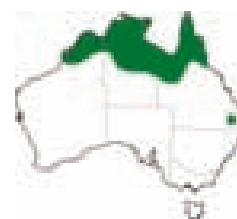
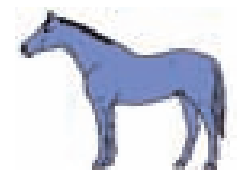


Photo: Ross McKenzie



Found in pastures, grasslands and waterways.



Management notes

- Avoid grazing horses on pasture infested with crotalaria.
- Improve pastures to increase desirable grasses.
- Isolated small plants can be pulled out by hand or spot sprayed with herbicide.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.

Avocado

All parts of avocado trees are poisonous to horses but the leaves contain the highest levels of toxins. The leaves of avocado trees are toxic

even when fallen and dried. The toxin in avocado trees is called persin but the mechanism by which it causes toxicity in animals is not known.

Cases of horse poisoning after ingestion of material from avocado trees are uncommon but have been reported in Australia and overseas.

Signs of avocado poisoning

The signs of avocado poisoning in horses are variable and may include:

- Non-infectious mastitis and reduced milk production in lactating mares
- Swelling of the lips, mouth, head, neck and chest
- Colic
- Diarrhoea
- Lethargy
- Loss of appetite
- Shortness of breath and heart problems in severe cases
- Severely affected horses may die suddenly from heart failure or respiratory failure

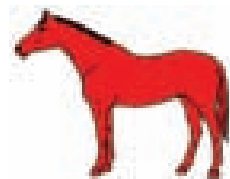
Veterinary attention should be sought immediately if avocado poisoning is suspected and treatment will depend on the symptoms the horse displays. Most horses fully recover from avocado poisoning, although milk production may not return to normal levels in lactating mares. Horses displaying signs of heart and lung damage may have ongoing complications.

Avocado

Persea americana [Lauraceae]



Garden ornamental, shade tree and fruit tree.



Growth and identification

Avocado trees can be tall and upright or low and spreading, depending on the variety. Tall growing varieties can grow to 15 m in favourable conditions. The trees are evergreen but the leaves are shed and regrow throughout the year, in cooler regions the tree can be semi-deciduous.

The leathery leaves are dark green and glossy and are variable in size depending on the variety. The tree has small greenish-yellow flowers that grow where the leaves join the branch. The plant produces pear-shaped avocado fruit. Flowering and fruit development can occur at different times of the year depending on the variety.

Management

- Avocado trees are not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.
- Do not put clippings from avocado trees in areas where horses may access them.



Senna

The toxic plants in this group that occur in Australia and may be a risk to horses are *Senna occidentalis* and *Senna obtusifolia*. Both of these plants are declared noxious weeds in several states.

Many Australian plants in the *Senna* genus were previously in the *Cassia*

genus and this can cause some confusion when identifying plants from these genera. See page 5 for more information on obtaining a precise identification of a plant species.

The toxins in plants of the *Senna* genus have not been identified. Poisoning

mainly occurs in cattle but poisoning cases in horses have been reported in Australia. All parts of the plants are toxic, especially the seeds. The plants are unpalatable to horses and are usually avoided. Poisoning could occur through contamination of grain with senna seed or plant material.

Signs of senna poisoning

The toxins contained in senna cause muscle damage and severe liver damage in horses. The signs that may be seen include:

- Depression
- Muscle tremors
- Incoordination and swaying gait

- Shortness of breath
- Heart irregularities
- Death

Senna poisoning in horses is uncommon but is usually fatal. Veterinary attention should be sought immediately if senna poisoning is

suspected. There is no specific treatment for senna poisoning but veterinary treatment and supportive care may increase the chance of survival and help with subsequent recovery.

Coffee senna

(Nigerian senna, ant bush, arsenic bush, sickle pod, stinkweed, stinking pea, septicweed)

Senna occidentalis (formerly known as *Cassia occidentalis*) [Fabaceae]

Coffee senna is native to the tropical and subtropical regions of the Americas. It is a declared noxious weed in the Northern Territory and Western Australia.

Growth and identification

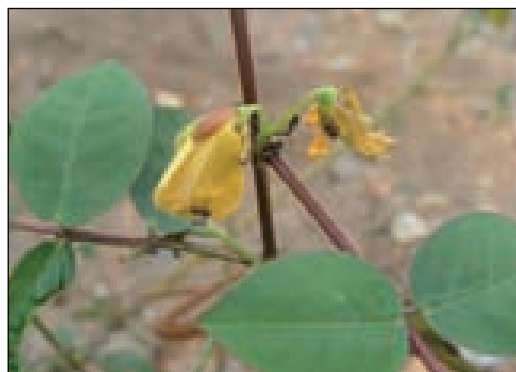
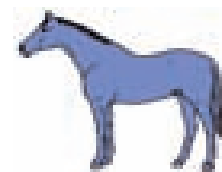
Coffee senna is an upright annual or biennial shrub that grows to 2.5 m in height. The plant produces seeds that are spread by water run-off, as contaminants of transported hay and grain or through animal and vehicle movements.

The branched stems are reddish-purple and are somewhat square-shaped or grooved when young. Mature stems are greenish-brown and are more rounded in shape. The leaves are alternately arranged along the stem. The leaves are up to 20 cm long and are compound, having 3 – 5 pairs of oppositely arranged leaflets. Each leaflet is around 3 cm long and is egg-shaped with a pointed tip. There is a dark gland at the base of each leaf stalk.

Flowering occurs in summer and autumn. The 5-petalled flowers are bright yellow and are about 3 cm across. The flowers appear in clusters of 2 - 6 in the forks of the uppermost leaves. The plant produces cylindrical pods. The pods turn dark brown as they mature and they have paler brown stripes at the edges. The pods can be up to 13 cm in length.



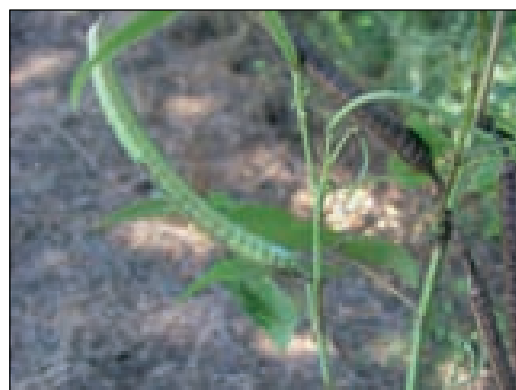
Weed of pastures, open woodlands, crops and roadsides.



Flowers. Photo: Sheldon Navie



Young plant. Photo: Sheldon Navie

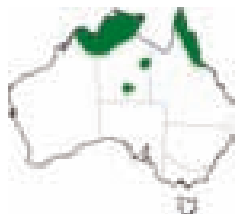


Pods. Photo: Sheldon Navie

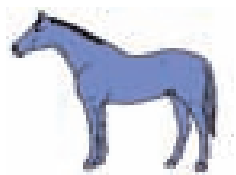
Sicklepod

(Java bean, Chinese senna, coffee weed, foetid cassia, arsenic weed)

Senna obtusifolia (also known as *Senna tora* and formerly known as *Cassia obtusifolia* or *Cassia tora*) [Fabaceae]



Weed of pastures, open woodlands, crops and roadsides.



Sicklepod is native to the Caribbean region and tropical America. It is a declared noxious weed in Queensland, Western Australia and the Northern Territory.

Growth and identification

Sicklepod is an upright annual or biennial shrub that can grow to 2.5 m but is usually less than 2 m in height. The plant produces seeds that are spread by water run-off, as contaminants of transported hay and grain or through animal and vehicle movements.

The branched sprawling stems are covered in soft hairs. The leaves are alternately arranged along the stem. The leaves are compound, having 2 – 3

pairs of oppositely arranged leaflets. Each leaflet can be up to 6.5 cm long and the leaflets furthest from the stalk are the largest. The leaflets are egg-shaped and have a rounded tip. The leaflets usually have tiny hairs along their edges.

Flowering occurs from late summer through to early winter. The 5-petalled flowers are bright yellow and are about 1.5 cm across. The flowers grow on stalks up to 3 cm long and appear in the forks of the uppermost leaves. The plant produces rounded, sickle-shaped pods. The pods turn greenish-brown as they mature and they are slightly indented between the seeds. The pods can be up to 18 cm in length.

Management notes

- Coffee senna and sicklepod should be removed from horse paddocks if they are found growing as weeds.
- Isolated young plants can be pulled out by hand or spot sprayed with herbicide. Ensure all parts of the plant are removed from the ground.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Slashing infested pasture can keep the plants to a manageable size and will weaken them, allowing desirable pasture species a chance to recover. Use blunt slasher blades to shatter the stems for maximum effect.
- Establish competitive pastures. Heavily infested areas should be cultivated and sown with desirable pasture species.

Red clover and alsike clover

The toxins associated with red clover and alsike clover poisoning are not presently known. There is some evidence that the toxic effects may be caused by a mycotoxin-producing fungus that is commonly associated with these clovers.

The horse seems to be the only animal species susceptible to poisoning by red clover and alsike clover. The toxins in these clovers cause liver damage with secondary photosensitisation.

Poisoning of horses by alsike clover and red clover has been recorded in

Canada, the United States and several other countries but there are no confirmed Australian reports in the literature.

Clovers are usually present in pasture as part of a mix of legumes and grasses. Most reports of red clover and alsike clover poisoning in the literature have noted that the pasture grazed by affected horses was dominated by clover, or that ingested hay contained large amounts of clover. Researchers estimate that a diet containing greater than 50% red clover or alsike clover

can cause liver damage in horses. The condition can occur at any time of year but it seems to occur most often after an unusually long and wet spring.

The effects of the toxins are cumulative and signs of poisoning can appear within 2 – 4 weeks of ingesting red clover or alsike clover but in some cases it may be months before signs appear. The time of onset and the severity of symptoms depend on the amount of toxic clovers in the diet of the horse.

Signs of alsike clover and red clover poisoning

The initial sign of poisoning is usually photosensitisation that is a secondary effect of liver damage. Horses with areas of unpigmented skin are most commonly diagnosed with red clover or alsike clover poisoning and this is probably because they are more susceptible to photosensitisation. Horses with dark skin may show no sign of photosensitisation before the appearance of other signs indicating liver damage. These horses are at most risk because the disease is often at a more advanced stage when diagnosed. The signs of poisoning are variable and may include:

- Photosensitisation - redness and swelling of the skin in unpigmented areas. The nose,

lips and around the eyes are areas commonly affected. The skin may crack and weep fluid.

- Depression
- Aimless wandering
- Head pressing - the horse may push its head against a wall or other surface
- Incoordination
- Loss of appetite
- Yawning
- Muscle tremors
- Mild colic
- Blindness
- Inability to swallow
- In severe cases the horse may progress to episodes of violent excitation, then coma and death

There is no specific treatment for red clover and alsike clover poisoning. Veterinary attention should be sought if red clover or alsike clover poisoning is suspected in a horse. A comprehensive liver function test can assist in the diagnosis of horses showing signs of red clover or alsike clover poisoning.

Mild cases will usually recover if the toxic clover is removed from the diet. Horses displaying signs of photosensitisation should be kept out of the sun to help the skin heal. Veterinary treatment and supportive care may help with recovery. Horses showing signs of advanced liver disease have little chance of survival.

Identification note: Clovers can be very difficult to tell apart. Before implementing any management strategies in regards to red clover or alsike clover it would be prudent to have the clover species positively identified. See page 5 for more information on obtaining a precise identification of a plant species.

Red clover

Trifolium pratense [Fabaceae]



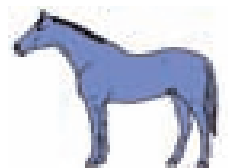
Growth and identification

Red clover can be upright or the stems may droop downwards. The stems are up to 50 cm long and may be hairless or covered in hairs. The plant has leaves made up of 3 leaflets. The leaflets are up to 5 cm long and 1.5 cm wide and each leaf has a light green or white inverted crescent-shaped marking in the middle.

The pink or purple flower heads are spherical in shape and are around 2.7 cm across. The flower heads are borne on stalks. Each flower head is made up of around 100 small flowers.

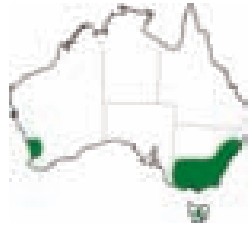


Pasture legume. Red clover is widely cultivated.

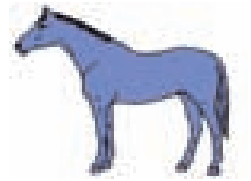


Alsike clover

Trifolium hybridum [Fabaceae]



Pasture legume. Alsike clover is not commonly cultivated in Australia.



Growth and identification

Alsike clover can be upright or the stems may droop downwards. The stems are up to 60 cm long and may be hairless or covered in hairs. The plant has leaves made up of 3 leaflets. The leaflets are up to 3 cm long and 1.8 cm wide and they are borne on the end of long stalks. The

leaflets do not have the leaf markings that appear on the leaflets of red clover.

The white or pink flower heads are spherical in shape and are around 2.5 cm across. The flower heads are on a stalk that is usually longer than the stalk of the leaves. Each flower head is made up of 20 – 40 small flowers.

Management notes

- Avoid grazing horses on pasture that is dominated by red clover or alsike clover.
- Check hay for red clover or alsike clover.

Selenium poisoning

Selenium is an essential dietary nutrient for horses but excessive amounts of selenium in the diet can cause toxicity. The amount of selenium found in a plant depends on the species and the soil selenium level where the plant grows. Soils in some parts of Australia have particularly high levels of selenium

and some plant species that grow in these areas can accumulate selenium in their leaves at potentially toxic levels. Two native Australian plants are known to accumulate selenium and have been associated with selenium poisoning of horses in Australia.

Horses that graze plants containing high levels of selenium may develop chronic selenium poisoning and this is sometimes known as 'alkali disease'. The plants are not usually palatable to horses but may be eaten if other forage is scarce.

Signs of selenium poisoning

- Hair loss from the mane and tail
- Horizontal cracks in the hoof wall
- In severe cases the hoof wall may slough off

Affected horses should be moved to a paddock that does not contain selenium-accumulating plants. Veterinary advice should be sought to devise a suitable low-selenium diet for

the horse to help with recovery, yet still provide adequate nutrition. A gradual recovery should occur as the affected hooves grow out.

Selenium weed is a native Australian plant.

Growth and identification

There are 2 forms of selenium weed, one being hairless and the other being covered in fine, soft hairs. Both forms of selenium weed are found only in the Hughenden- Richmond area of north Queensland.

Selenium weed is an erect or semi-erect perennial that grows to 80 cm in height.

The leaves are made up of paired leaflets along a central leaf stem. The leaflets are around 2 cm long and are heart-shaped with a tapering point.

The flower heads are borne on a spike that grows from the point where the leaf meets the stem. There are 20 – 40 small yellow pea-shaped flowers on each flower head. The plant produces pods that are dark brown when mature. Each pod contains 1 – 4 seeds.

Neptunia amplexicaulis [Fabaceae]



Mapoon bush is an Australian native plant.

Growth and identification

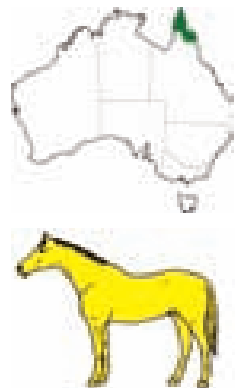
Mapoon bush is found only on Cape York Peninsula in northern Queensland.

Mapoon bush is a shrub that can grow to 1 m in height. The shrub has a straggly appearance and can grow as a climber in shaded areas.

The pale green leaves are oval-shaped and can grow to 12 cm in length. The leaves are thick and have a leathery feel.

The plant has white star-shaped flowers that grow to 1.5 cm across and are surrounded by white leafy bracts.

Morinda reticulata [Rubiaceae]



Management notes

- Avoid grazing horses on pastures infested with mapoon bush or selenium weed.
- Mapoon bush and selenium weed should be controlled in horse paddocks, especially if they are the dominating species. Seek advice from a local agronomist or weed management agency for advice on the management of these weeds on your property.
- Many Australia soils are marginally deficient in selenium and dietary supplementation of the element may be required. Contact a local agronomist or your state Department of Agriculture for advice on the soil types in your area. *Feeding Horses in Australia* (Kohnke et al, 1999) contains some very good information and recommendations concerning selenium in the diet of horses.

Privets

Reports of privet poisoning in horses in Australia are very rare. The trees are known to be toxic to many species, although little data exists on which

species may be most at risk. The toxins in privets are thought to be glycosides but this has not been confirmed. All parts of the plant are thought to be

poisonous and the risk of poisoning may be highest when new growth occurs in spring.

Signs of privet poisoning

The signs of privet poisoning are variable and are not well documented in horses but may include:

- Colic
- Diarrhoea
- Nasal discharge
- Incoordination

- Possible lung and heart problems – in severe cases sudden death from heart failure can occur

Immediate veterinary treatment should be sought if privet poisoning is suspected in a horse. Treatment options include the administration of activated charcoal to prevent further absorption of toxins from the gut and

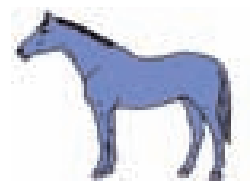
fluids to maintain hydration. In most reported cases of privet poisoning in horses the symptoms were well advanced and although the cases are not well documented, this finding may indicate that the symptoms of privet poisoning progress rapidly. Very few animals poisoned by privet have survived.

Privets

Ligustrum spp [Oleaceae]



Weeds of open woodlands, pastures, grasslands, roadsides and waterways. Privets are sometimes cultivated as hedges or windbreaks.



Privets are very common in Australia and some are grown as garden ornamentals, hedges or shade trees. The broad-leaved privet (*L. lucidum*) and Chinese privet (*L. sinense*) are declared noxious weeds in several states.

Growth and identification

Privets can be trees or shrubs ranging from 3 m to 10 m in height. All species are evergreen. The oppositely arranged leaves are mostly dark green but some species can have variegated leaves and at least one species has pale green leaves.

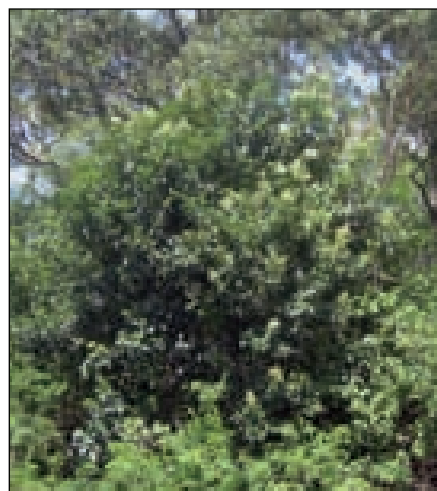
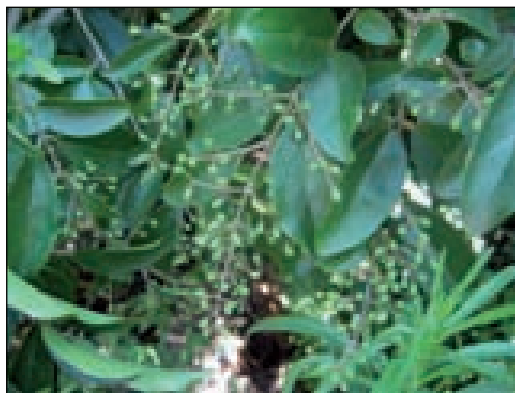
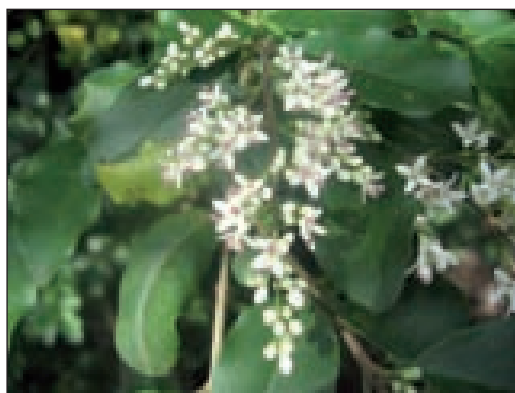
Privet flowers are white or cream in colour and many are fragrant. The flowers are very small and grow in dense or open clusters that can be 10 – 15 cm long. The plant produces clusters of berries that are usually dark blue, purplish or black and can grow up to 1cm in diameter.

Management notes

- Privets are not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.

Once established, the weed species of privet can be very hard to control.

- Small privet seedlings can be removed by hand or spot sprayed with herbicide.
- Larger plants can be cut at the base and the stump immediately painted with herbicide.
- Bulldozing privets followed by the use of herbicides can control large infestations. Follow-up use of herbicides is necessary as regrowth will occur from seeds, stem or root fragments that are left in the ground. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Establish desirable species to help prevent reinfestation of privets.



Chewing disease

Prolonged ingestion of the plants St Barnaby's thistle or hardheads can result in a disease called equine nigropallidal encephalomalacia (ENE), or 'chewing disease'. The disease is uncommon but cases have been reported in Australia and overseas.

Several potentially toxic substances are present in these plants but the primary toxins responsible for poisoning have

not been definitively identified. The exact mechanism of poisoning is not completely understood but it may involve the interference of cell function by the inhibition of important enzymes and other functional proteins. This may lead to the degeneration of nerve cells in specific parts of the brain, causing the characteristic symptoms of ENE.

Symptoms of poisoning in horses can occur after long periods (1 – 2 months) consuming significant amounts of the plants. Horses will eat these plants if there is little alternative fodder and poisoning could occur if large amounts of the plants are consumed as contaminants of hay. It has been reported that some horses will preferentially graze the plants, even when other feed is available.

Signs of chewing disease

A horse suffering chewing disease has damage to a specific part of the brain and the effect of this brain damage is that the horse is unable to move food or water to the back of its mouth.

Although horses will only develop the disease after a relatively long period of exposure to the toxins, the onset of symptoms is abrupt. A horse may seem normal one day and the next day it may seem unable to eat or drink.

The signs that may be seen include:

- Apparent inability to eat or drink. The horse may have trouble getting food into the mouth but if successful, the horse may

rhythmically chew and move its tongue around for prolonged periods in attempts to move the food around the mouth. The food often dribbles out of the mouth. The horse is able to swallow but is unable to get food into a position for swallowing.

- Dehydration
- Depression
- The horse may stand with its head so low that its nose is almost touching the ground. A horse standing in this position for long periods can develop swelling of the head.

- Frequent yawning and lip curling.
- The horse may be able to drink by putting its head deep into water and then tipping its head back.
- Muscle tremors and incoordination are seen in some cases

No treatment options are available for this disease at present and the damage to the brain is thought to be irreversible. Once the symptoms occur the disease is fatal and the horse will die of starvation if not humanely euthanased.

Hardheads

(Russian knapweed, creeping knapweed, blueweed)

Acroptilon repens (also known as *Centaurea repens*) [Asteraceae]

Hardheads is native to the region around the Caspian Sea (Russia, Turkey, Afghanistan and Mongolia). It is a declared noxious weed in all states except Queensland, Tasmania and the Australian Capital Territory.

Growth and identification

Hardheads is an upright perennial that usually grows to around 50 cm in height but can grow to 1 m. The plant produces seeds that often remain in the flower heads and they can be spread to new areas through water run-off, as contaminants of transported hay and grain, or through animal and vehicle movements. The plants have an extensive network of underground roots that can give rise to new shoots. The plants can spread through the dispersal of root fragments during cultivation or other practices that move soil.

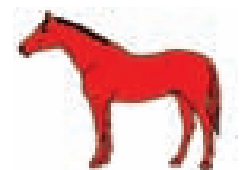
The branched stems are densely covered in greyish hairs when young. Mature stems have fewer hairs and are often grooved and ridged.

The young plant is a grey-coloured rosette that may be hairy. Leaves are lance-shaped and may have toothed or irregular edges. The leaves are up to 15 cm long and 5 cm wide. The leaves produced along the stem are alternately arranged and are smaller towards the top of the plant.

The plant flowers in its second year during late spring or summer and flowers appear singly at the tips of the branches. The thistle-like flowers are up to 2.5 cm across and are purple, pink or occasionally white. The flowers have numerous 5-lobed tubular florets that are arranged in several rows contained by broad bracts. The bracts narrow to a fine papery tip.



Weed in crops, vineyards, orchards, pastures, roadsides and waterways.



Management notes

- Check hay for hardheads contamination.
- Avoid grazing horses in pastures contaminated with hardheads.

Control of hardheads is difficult because of its underground root system and its tolerance to many herbicides.

- Isolated plants should be pulled out by hand or spot sprayed with herbicide. Ensure all parts of the plant are removed from the ground.
- Larger infestations can be controlled with certain herbicides. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- The most effective control of the weed in pastures is the establishment of competitive species.

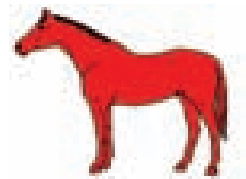
St Barnaby's thistle

(Yellow star thistle, golden star thistle, yellow cockspur, knapweed)

Centaurea solstitialis [Asteraceae]



Weed of pastures, crops and roadsides.



St Barnaby's thistle is native to southern Europe and western Asia. It is a declared noxious weed in New South Wales, Victoria and Western Australia.

Growth and identification

St Barnaby's thistle is an upright annual or biennial that usually grows 30 – 60 cm tall but can grow to 90 cm. The plant produces seeds that can be dispersed by wind, water run-off, as contaminants of hay or grain and through animal and vehicle movements.

The branched stems have spiny wings. The stems have 'woolly' fine hairs that are greyish in colour.

The young plant is a rosette with leaves up to 20 cm in length. The leaves are deeply divided or lobed, with the lobe at the tip of the leaf being larger than the others. The rosette leaves wither as the stem grows. The stem leaves are alternately arranged and have slightly toothed edges and pointed tips.

The plant flowers in late spring and summer and the flowers appear singly at the tips of the branches. The flower heads are up to 2.5 cm long and are egg-shaped. The flowers consist of numerous yellow tubular florets that are up to 2 cm long. The flower heads are surrounded by several rows of bracts. The middle bracts end in yellow spines that can be 3 cm long. Other bracts surrounding the flower head can end in smaller spines.

Management notes

- Check hay for St Barnaby's thistle contamination.
- Avoid grazing horses in pastures contaminated with St Barnaby's thistle.
- Individual plants can be pulled out by hand or spot sprayed with herbicide.
- Slash infested pasture to reduce flowering and seed production. Timing is important and the ideal time to slash the paddock is after desirable species have set seed but before St Barnaby's thistle has set seed. Seek advice from a local agronomist or weed management agency to devise the right slashing program for your property.
- The establishment of competitive pastures can control St Barnaby's thistle.
- Graze sheep, goats or cattle on heavily infested paddocks as the toxins in this plant do not affect these species.
- The use of herbicides can be an effective control measure for large infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.

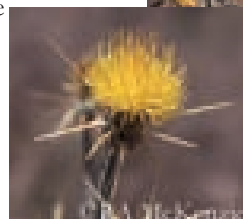
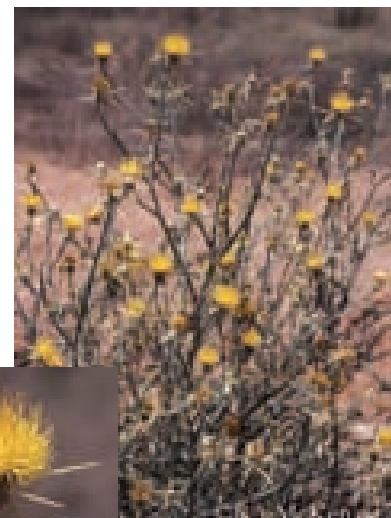


Photo: Ross McKenzie

Dune onion weed

The ingestion of dune onion weed has been associated with poisoning in Australian horses and in sheep. The weed has also been implicated in livestock poisonings in South Africa. Dune onion weed poisoning in horses is not common because the plant is usually unpalatable. The reported poisoning cases have occurred

in situations where there was little alternative forage available.

Horses are thought to be particularly sensitive to the toxins in dune onion weed, although the toxins have not yet been identified. Ingestion of dune onion weed can lead to an accumulation of fat-soluble pigment in

the nerve tissues and this leads to nerve dysfunction.

The condition seems to be most prevalent in summer and in dry periods when alternative fodder is scarce. The toxins in dune onion weed may be cumulative because signs of poisoning do not occur until animals have grazed the plant for several weeks.

Signs of dune onion weed poisoning

The signs of poisoning are progressive and occur in the general order of the following list.

- Incoordination 'staggers'
- The horse may have trouble getting up if it lies down and it may seem to be partially paralysed

- Muscle tremors
- Excessive sweating
- Full paralysis
- The horse may die from starvation, dehydration or other complications associated with paralysis.

There is no documented treatment for poisoning caused by dune onion

weed and the condition is usually fatal. Veterinary attention should be sought if dune onion weed poisoning is suspected in a horse. Treatment and supportive care may help with survival and subsequent recovery.

Dune onion weed

(strapweed, branched onion weed)

Trachyantra divaricata [Asphodelaceae]

Dune onion weed is native to South Africa. It grows in sandy soils and is most commonly found in coastal areas. It is particularly common in sand dunes and it is an important environmental weed in some areas.

Growth and identification

Dune onion weed is an upright tufted perennial that grows to 70 cm in height. The plant produces numerous seeds that can be spread by wind or water run-off. The flower stems can detach and blow as 'tumbleweeds' to disperse seeds.

The leaf blades are flat, shiny and hairless and can grow to 70 cm long. The plant flowers in winter to late spring and in summer after rain. The branched flowering stem is up to 70 cm long and can have up to 60 flowers. The petals of the white flowers have a brown centre stripe and gold colouring at the base.

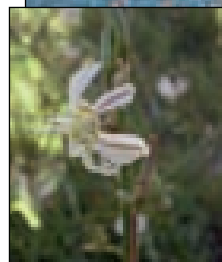
The plant produces seed capsules that are up to 1 cm long and 0.6 cm across. The smooth seeds are red-brown to black.

Management notes

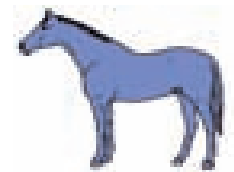
- Avoid grazing horses on pastures infested with dune onion weed.
- Individual plants can be pulled out by hand or spot sprayed with herbicide. Mature plants will need to be dug out with a fork as regrowth can occur if the deep-rooted crown is left behind.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.



Photos: Sheldon Navie



Weed of sand dunes, coastal grasslands and pastures.



Gomphrena weed

Gomphrena weed has been implicated as the cause of poisoning cases in horses. Gomphrena weed poisoning

is uncommon as the plants are usually unpalatable and a large amount must be eaten before signs of poisoning appear.

The toxin in this plant is unknown and horses are the only species known to be affected.

Signs of gomphrena weed poisoning

- Depression
- Gait abnormalities – the horse may sway and drag its hind feet when walking.
- Difficulty turning
- Incoordination – the horse may

fall and be unable to rise.

- Muscle tremors
- Convulsions followed by death

In mild cases the horse will recover if access to gomphrena weed is removed.

Veterinary attention should be sought if gomphrena weed poisoning is suspected in a horse. Treatment and supportive care may help with survival and subsequent recovery.

Gomphrena weed

(soft khaki weed)

Gomphrena celosioides [Amaranthaceae]

Gomphrena weed is native to the United States.

Growth and identification

Gomphrena weed is a prostrate (creeping) annual or perennial that grows to 25 cm in height. The stems are usually covered in fine woolly hairs but they are sometimes hairless.

The oblong-shaped leaves are opposite each other and they are dull green or grey-green in colour. The leaves can have a 'spoon-shaped' appearance and they are up to 5 cm long by 1.5 cm wide.

Flowering occurs in spring and autumn. The plant produces a rounded flower head that elongates with maturity and can be up to 4 cm long. The flower head appears at the end of the stems and it consists of a large number of crowded, small white flowers. The flowers are enclosed in shiny white papery bracts.

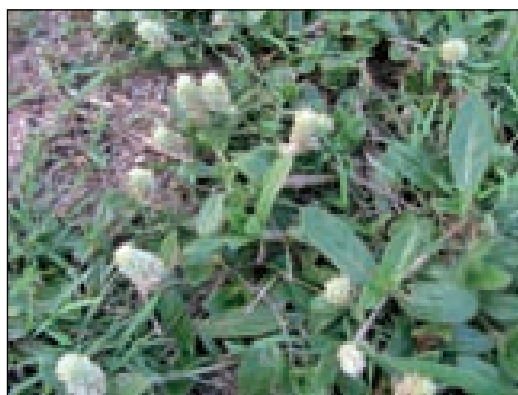
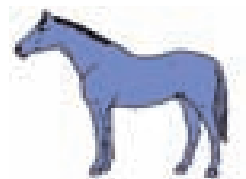
Identification note: Gomphrena weed is often confused with khaki weed (*Alternanthera pungens*). The distinguishing feature is that gomphrena weed produces papery flowers at the ends of the stems and khaki weed produces spiny flowers in the forks of the leaves. See page 5 for more information on obtaining a precise identification of a plant species.

Management notes

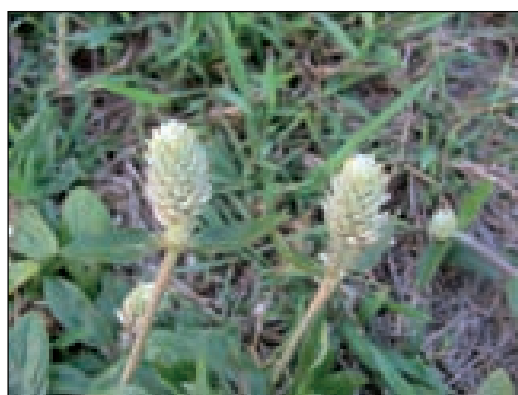
- Avoid grazing horses on pastures infested with gomphrena weed.
- Individual plants can be pulled out by hand or spot sprayed with herbicide.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Establish competitive pastures.



Weed of pastures and roadsides.



Photos: Sheldon Navie



Small flowered mallow

Small flowered mallow has been implicated as the cause of poisoning cases in horses, sheep and cattle. The incidence is rare as the plants are

usually unpalatable. There are no confirmed reports of small flowered mallow poisoning of horses in Australia but it should be considered a risk

because it is a common weed of horse pastures.

The toxin in this plant is unknown. Young animals seem to be most at risk.

Signs of small flowered mallow poisoning

- Profuse sweating
- Rapid breathing
- Incoordination – ‘staggers’
- Muscle tremors

- Symptoms worsen when the animal is forced to move or is otherwise stressed

Most animals recover when rested and when access to small flowered mallow

is restricted. Veterinary attention should be sought if small flowered mallow poisoning is suspected in a horse. Treatment and supportive care may help with recovery.

Small flowered mallow

(marshmallow)

Malva parviflora [Malvaceae]

Small flowered mallow is native to the Mediterranean region and it is commonly found as a weed in pastures.

Growth and identification

Small flowered mallow is an upright or sprawling annual that grows to 50 cm in height.

The leaves are alternately arranged along the stem and they may be covered in sparse hairs. The rounded leaves are lobed and they are 8 – 10 cm in diameter. The leaf stalk is inserted into a notch in the leaf and the leaf has 5 – 7 veins radiating from this point.

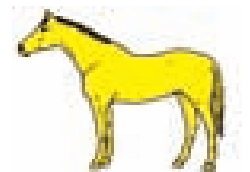
The plant flowers in spring. The flowers can be mauve, pink or white and they are clustered in the leaf forks. The flowers have 5 petals and they are surrounded by a cup-shaped structure. This structure enlarges at the end of flowering and forms a disk-shaped fruit that consists of up to 12 fused segments (see photo).

Management notes

- Avoid grazing horses on pastures infested with small flowered mallow.
- Individual plants can be pulled out by hand or spot sprayed with herbicide.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Establish competitive pastures.



Weed of pastures, crops and roadsides.



Red maple

Red maple is a native of North America. It is grown in some parts of Australia as a street tree, summer shade tree or as a garden ornamental. The tree is known for its striking autumn colour display.

The bark and the dried or wilted leaves of red maple are known to be toxic to horses. Fresh green leaves are not toxic to horses. There have been a number of cases of horse deaths caused by the ingestion of red maple leaves in North America, where the tree is very

commonly grown. There have been no confirmed cases of red maple poisoning in Australian horses.

The dried or wilted leaves of the red maple tree contain an unknown toxin that causes the formation of oxygen-free radicals that damage the membrane of red blood cells and cause the cells to release haemoglobin. The haemoglobin binds to the inside of the red blood cells to form what are called 'Heinz bodies'. The damaged red blood cells are removed from circulation, leading

to acute anaemia. Life-threatening anaemia caused by the ingestion of wilted or dried red maple leaves can occur in as little as 1 – 5 days after the ingestion of relatively small amounts of leaf material.

Poisoning cases reported in North America were most common in autumn when red maple leaves are wilted and have fallen to the ground. Poisoning cases have also been reported after storms because the leaves of fallen branches wilt and are accessible to horses.

Signs of red maple poisoning

- Feed refusal
- Weakness and depression.
- Increased respiratory rate and heart rate
- Blue or purplish tinge to the skin due to deficient oxygen in the blood
- Jaundice (characterised by a yellow colouring of the mucous membranes)
- Red-brown urine
- Abortion in pregnant mares.
- Coma and death

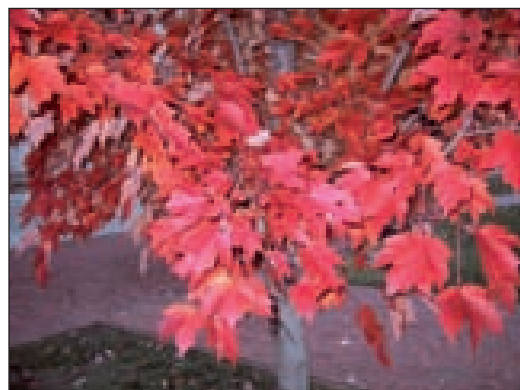
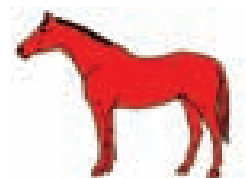
Veterinary attention should be immediately sought if red maple poisoning is suspected in a horse. Treatment may involve blood transfusions, the administration of fluids and large doses of vitamin C. Horses with advanced signs of red maple poisoning have little chance of survival.

Red maple

Acer rubrum [Aceraceae]



Shade trees, garden ornamentals and street trees.



Growth and identification

Red maple is a deciduous small to medium tree that can grow up to 20 m. The young branches are glossy, red and hairless. The bark of young trees is smooth and light grey and as the tree matures the bark becomes darker and it breaks up in long sections.

The leaves are arranged on opposite sides of the stem and each leaf is made up of 3 – 5 lobes. The leaves have serrated edges and they are light green on the upper surface with a whitish lower surface. The leaves turn bright shades of red during autumn before they fall to the ground.

The flowers are bright red. The plant produces clusters of fruit that are reddish in colour.



Photos: Mary Alice Mitchell

Management notes

- Red maple is not suitable for planting in paddocks, along paddock fences or in areas where horses are kept.

Birdsville horse disease

Plants of the genus *Indigofera* contain an unknown toxin or toxins. The ingestion of these plants can cause poisoning in horses and such cases are said to be suffering 'Birdsville horse disease'.

It is currently thought that the toxicity of *Indigoferas* is due to nitrotoxins that may occur in the plants, however this

association has not been established. The ingestion of the toxins responsible for Birdsville horse disease cause neurological problems in horses, although the exact mechanism for neurological damage is unknown.

Cases of horse poisoning caused by the ingestion of the native Australian plant

Indigofera linnaei have been reported in Australia and overseas.

The first Australian case of horse poisoning associated with another native *indigofera*, *Indigofera spicata*, occurred in Brisbane in 2004. This species has caused poisoning in horses in other countries.

Signs of Birdsville horse disease

Sign of poisoning appear after around 10 days of grazing the plant. The signs include:

- Depression
- Loss of appetite
- Progressive incoordination
- Splayed stance
- Dragging of hind feet
- Head and tail elevation
- The horse may lose control of its

hindquarters and fall when stressed or when cantering

- In severe cases the horse may lie down and death may follow

Veterinary attention should be sought if Birdsville horse disease is suspected in a horse. An affected animal should be kept calm and should be contained in a safe area to avoid injury brought about by its incoordination. Horses showing

severe signs of incoordination have little chance of survival.

The administration of gelatine may be an effective treatment in some cases. Supplementation with lucerne hay, peanut meal or linseed meal may be useful in the treatment of mild cases of poisoning or for the prevention of poisoning in areas where *indigoferas* grow.

Growth and identification

Birdsville indigo is a spreading or prostrate (creeping) plant that grows to 50 cm in height. The plant can be an annual, biennial or a short-lived perennial. The stems are thin, branched and woody and they fan out from a long taproot.

The leaves are up to 3 cm long and they have 7 – 9 egg-shaped leaflets that are each up to 1.5

cm long. The leaflets are slightly indented at the ends. The leaves and stems are covered in fine hairs giving the plant a 'silky' appearance.

The plant flowers throughout the year, usually after rain. The small red pea-shaped flowers are crowded on short spikes in the leaf forks. The flower spikes are around 1 cm long. The plant produces an oblong pod that is up to 7 mm long and is pointed at the end.



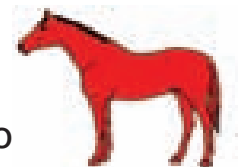
Indigofera spicata.
Photo: Sheldon Navie

Birdsville indigo

Indigofera linnaei [Fabaceae]



Common in native bushland, grasslands and along waterways. Often found in pastures.

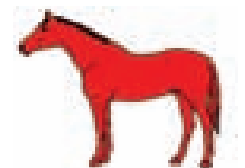


Creeping indigo

Indigofera spicata [Fabaceae]



Grows in native bushland, grasslands and along waterways. Can be found in pastures.



Growth and identification

Creeping indigo is a prostrate plant that grows to 1 m. The pale green branched stems are thin and they fan out from a long taproot. The leaves are pale green and they have 7 – 9 egg-shaped leaflets.

Flowering occurs mostly in spring. The flowers are pink or red and they are produced on short spikes in the leaf forks. The plant produces small seedpods that are pointed at the end.

Management notes

- Avoid grazing horses on pasture infested with Birdsville indigo or creeping indigo.
- Graze non-pregnant sheep or goats in heavily infested areas as these species are relatively tolerant to the toxins in *indigoferas*. Do not leave these animals on the infested pasture continuously as toxicity problems can occur.
- Individual plants can be pulled out by hand or spot sprayed with herbicide.
- The use of herbicides can be an effective control measure for larger infestations of toxic *indigoferas*. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.

Irritants

Stinging nettles

The hairs of stinging nettles can cause intense irritation on contact. The hairs contain toxins that are a mixture of histamines and amines.

All stinging nettles have the potential to act as irritants.

Horses will normally avoid stinging nettles but the risk of exposure is

high in paddocks containing large infestations of the weed.

Signs of stinging nettle poisoning

- Skin irritation and discomfort
- Hives may be seen around the muzzle if the plant is accidentally contacted while grazing. Hives can appear on any body part if

- the horse has rolled in a patch of stinging nettles
- In severe cases the horse may show signs of incoordination and muscle weakness

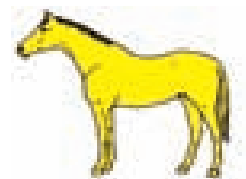
Symptoms of exposure to stinging nettles usually resolve within a few hours. In horses showing severe symptoms veterinary attention should be sought. The administration of sedatives and analgesics will reduce discomfort.

Stinging nettles

Urtica spp [Urticaceae]



Weeds of pastures, crops and roadsides.



There are around fifty species of stinging nettle found worldwide and three of these species grow in Australia. A native species, scrub nettle (*Urtica incisa*) and an introduced species, small nettle (*Urtica urens*) are commonly found in Australian pastures. Giant nettle (*Urtica dioica*) is an introduced species that is found in pastures but it is not as common as the other two stinging nettle species.

Growth and identification

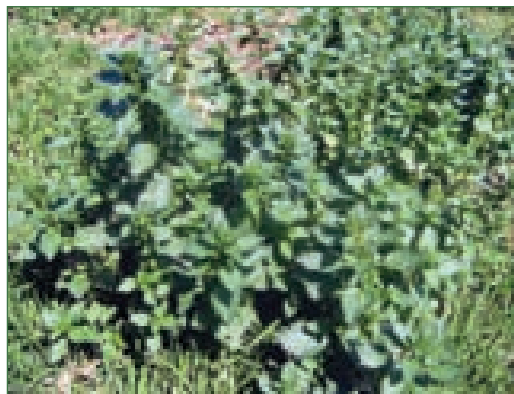
Stinging nettles are annual or perennial plants and they range in height from 60 cm to 1.5 m in height.

The leaves and stems of the plants are covered in stiff stinging hairs. The leaves are oppositely arranged along the stems and the edges of the leaves are toothed. The leaves usually have 3 – 5 prominent veins at their base and they are attached to the stem by stalks.

The flowers are pale green or white and they appear in branched clusters that sometimes droop from the stem. The flowers of most species are around 1 mm in width. Flowering usually occurs in spring.

Management notes

- Avoid grazing horses on pastures infested with stinging nettles.
- Individual plants can be removed by hand (be sure to wear gloves!) or they can be spot sprayed with herbicide.
- The use of herbicides can be an effective control measure for larger infestations. Seek advice from a local agronomist or weed management agency to select the most appropriate herbicide and spray program for your property.
- Establish competitive pastures.
- Mowing or slashing paddocks infested with stinging nettles is not recommended as these practices will spread the seed and promote the emergence of new plants.



Gympie stinger

The stalks and leaves of the Gympie stinger are covered in tiny stinging hairs that contain a toxin called moiridin. If

the stinging hairs penetrate the skin, the toxin causes intense pain that can last for days. Poisoning by Gympie

stinger is rare but it has been reported to occur in horses, dogs and humans in Australia.

Signs of gympie stinger poisoning

- Initial tingling sensation developing into intense pain
- Horses have been reportedly driven to frenzy and self-destruction by the pain

Reports of horses having been affected by Gympie stinger are rare. There are no known options for treatment and reports in the literature suggest that

affected horses have not survived the self-destructive behaviour brought on by the pain of the toxin in this plant.

Gympie stinger

(Mulberry-leaved stinger)

Dendrocnide moroides [Urticaceae]

Growth and identification

Gympie stinger is a native shrub. It is a foundation species and can consequently be found growing at the edges of rainforests and in clearings.

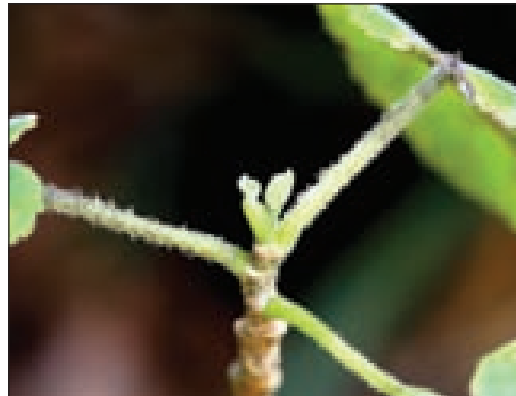
Gympie stinger grows to 4 m in height.

The leaves are broadly egg-shaped or heart-shaped with a tapering tip. The leaves can be 10 – 25 cm in length and 8 – 20 cm wide at the base. The edges of the leaves are toothed. Stinging hairs densely cover the upper surface of the leaves and are sparse on the lower surface. The leaf stem is 10 – 20 cm long.

The plant flowers in summer and the flowers are small and yellowish-green. The plant produces a cluster of small 'wart-like' nuts that are borne on a stalk.

Management notes

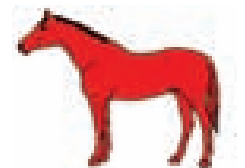
Poisoning of horses by Gympie stinger is an unusual event and would only occur if the horse contacts the leaves of the shrub.



Photos: Calder Chaffey



Found in coastal and subcoastal rainforests.



- Care should be taken when riding horses through rainforests or along the fringes of rainforests.
- Horse paddocks bordering rainforests may pose a minimal risk and should be checked for the presence of the shrub.

Plant associated mycotoxins

Mycotoxins are poisons produced by fungi. Some mycotoxin-producing fungi occur on growing plants or on stored feed and the ingestion of these plants or feed can cause poisoning. Mycotoxins can grow on the outside of the plant material (saprophytes) or they can grow inside plant structures such as the seed or the stem (endophytes).

Horses can be exposed to mycotoxins in several different ways. Some pasture grasses contain mycotoxin-producing fungi and animals may ingest these

toxins while grazing. Mycotoxins can accumulate in some cereal grains during growth and are then ingested by horses in concentrate feeds. The storage of feed in conditions favourable for the growth of fungi is another source of mycotoxins in the diet of horses.

Mycotoxin poisoning from various sources has been reported in Australia. It is not common for a number of reasons. Mycotoxins only accumulate in pasture grasses under certain conditions and most pastures are safe

most of the time. Horse owners are aware that feed should be stored in dry conditions and accidentally 'spoiled' feed is usually discarded. Horses are relatively sensitive to 'off' odours and will usually reject mouldy feed. Healthy horses can usually overcome the potential effects of ingesting feed containing low levels of mycotoxins and problems may only occur when these low levels of mycotoxins are ingested over a long period.

Perennial ryegrass staggers

Perennial ryegrass staggers is a condition that is sometimes seen in animals grazing pasture containing perennial ryegrass. The condition can also occur after the ingestion of ryegrass hay that has been infected with mycotoxin-producing fungi.

Perennial ryegrass staggers is mainly a problem of sheep and cattle but it is also known to affect horses. It is a significant problem for horses in New Zealand and there have been reports

over the past few years of cases in Australian horses.

Infection of perennial ryegrass by the toxin-producing endophyte fungus *Neotyphodium lolii* (formerly known as *Acremonium lolii*) causes perennial ryegrass staggers. The fungus produces several toxins but the main toxin implicated in ryegrass staggers is a neurotoxin called lolitrem B.

Perennial ryegrass is an important pasture grass in temperate areas of

Australia and it is the dominant pasture species in many areas.

Recent research has shown that almost all perennial ryegrass that grows in Australia contains mycotoxin-producing endophyte fungi. The endophyte is beneficial to perennial ryegrass because it increases seedling vigour and the production of seed – without the endophyte, perennial ryegrass would be of little benefit as a pasture grass.

Signs of perennial ryegrass staggers

- The horse may appear normal while grazing but will startle to sudden stimuli.
- If handled or otherwise disturbed the horse may tremble and appear uncoordinated.
- If the horse is asked to move the legs may splay and hind limb flexion is exaggerated.

- The horse may collapse and then get back to its feet after a few minutes.
- Perennial ryegrass staggers usually resolves once access to ryegrass pasture has been removed. The risk to horses is injury caused by uncoordinated movements or a panicked response to

stimuli. The horse should be kept in a quiet, secure area to prevent excitement and possible injury. Veterinary attention should be sought if perennial ryegrass staggers is suspected in a horse. In severe cases the horse may receive fluids and other medications.

Perennial ryegrass

Lolium perenne [Poaceae]

Identification note: Distinguishing between different grasses can be extremely difficult and only a very basic description is given here. See page 5 for more information on obtaining a precise identification of a plant species.

Growth and identification

Perennial ryegrass is a densely tufted annual or short-lived perennial grass that grows to 80 cm in height. The grass generally lies flat but is upright during vigorous growth periods.

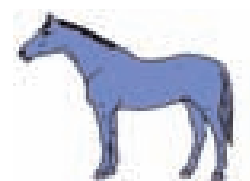
The leaves of perennial ryegrass are hairless and the leaf sheaf is often pinkish or red in colour.

The leaves are ribbed on the upper surface and shiny underneath. The newly emerging leaves are folded.

The plant produces a flower spike that can be 10 – 25 cm long. Short flower spikelets are arranged along the sides of the centre spike.



Pasture grass.



Management notes

- Perennial ryegrass is an important pasture species and the risk of a horse being affected by perennial ryegrass staggers in Australia is low, however good grazing practices will further reduce the risk.
- Do not allow animals to graze perennial ryegrass-dominant pastures close to the ground where mycotoxin levels are highest.
- Slash the paddock if perennial ryegrass is the dominant species and it goes to seed.
- Use a mix of grass species so that perennial ryegrass is not the dominant grass.
- New varieties of perennial ryegrass are available which contain no-endophyte or low-mycotoxin-producing endophyte. However, if the pasture already contains perennial ryegrass it is not practical to over-sow with newer varieties because they will quickly be contaminated with the mycotoxin-producing endophyte.
- Watch for symptoms during the high-risk period of summer to autumn. This is especially important if pasture has been grazed low, or if summer rains have produced a flush of perennial ryegrass.

Paspalum staggers

‘Paspalum staggers’ is a condition that is sometimes seen in animals grazing pasture containing paspalums. The condition is most commonly reported in cattle but there have been occasional reports of horses suffering paspalum staggers in Australia and in a number of other countries.

Growth of fungi from the genus *Claviceps* on grass flower heads produces a substance known as honeydew. Honeydew is a sweet liquid that contains spores of the fungus. The

honeydew is spread between grass flowers by insects. Once the fungi have spread to new plants, the spores grow in the flower head and form an endophyte structure that is called an ergot. The ergot falls off the plant and remains in the soil over winter. In the following spring the ergot forcibly ejects spores to infect developing grass flower heads and the cycle starts over.

Claviceps ergots can occur in a variety of pasture grasses and grain crops including ryegrasses, cereal rye, phalaris

and paspalum. Animals suffering the toxic effects of ingesting ergots are said to be suffering ‘ergotism’. In Australia, the main risk of a horse developing ergotism is through the ingestion of paspalum that has been infected with the fungi *Claviceps paspali*. Such horses are said to be suffering ‘paspalum staggers’.

Ergots produce several toxins but the main toxins implicated in paspalum staggers are neurotoxins called paspalitrems A and B.

Signs of paspalum staggers

Paspalum staggers produces signs that are identical to the signs of perennial ryegrass staggers.

- The horse may appear normal while grazing but will startle to sudden stimuli
- If handled or otherwise disturbed the horse may tremble and appear uncoordinated

- If the horse is asked to move the legs may splay and hind limb flexion is exaggerated
- The horse may collapse and then get back to its feet after a few minutes

Paspalum staggers usually resolves once access to paspalum pasture has been removed. The risk to horses is injury

caused by uncoordinated movements or a panicked response to stimuli. The horse should be kept in a quiet, secure area to prevent excitement and possible injury. Veterinary attention should be sought if paspalum staggers is suspected in a horse. In severe cases the horse may receive fluids and other medications.

Paspalum

Paspalum spp [Poaceae]

Growth and identification

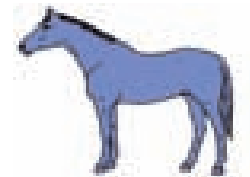
Around twenty one species of paspalum grow in Australia.

Paspalums are tufted perennials that grow 50 cm to 1.5 m in height but are usually around 1 m. Paspalums produce underground stems that can produce new growth of the grasses.

The leaf blades of paspalum are usually hairless and the newly emerging leaves are usually rolled. The inner junction of the leaf sheath and leaf blade is thin and translucent and it may have a few hairs.



Pasture grass.

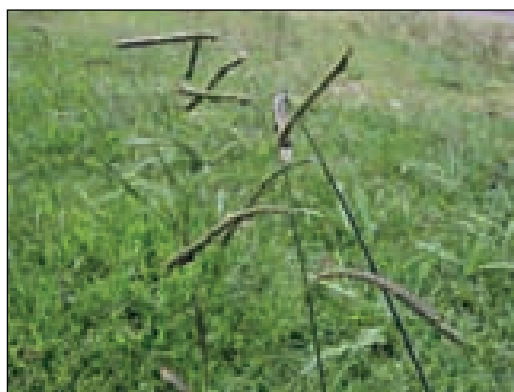


The plant produces one or more flower spikes that arise from the same stem. The flower spikelets are arranged along one side of the flower spikes either singly or in pairs. The seed of paspalums are slightly 'sticky' to touch and they can attach to clothing or animals.

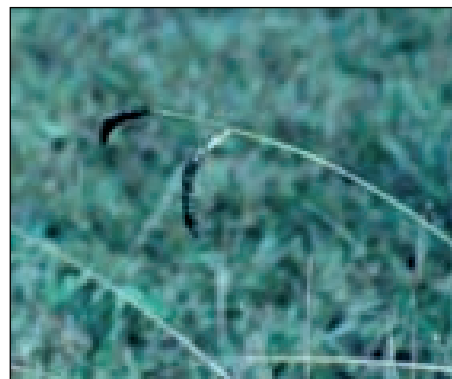
Management notes

Paspalum is a widespread and useful summer-growing pasture species. The risk of a horse being affected by paspalum staggers in Australia is low, however good grazing practices will further reduce the risk.

- Do not allow animals to graze paspalum-dominant pastures close to the ground where mycotoxin levels are highest.
- Slash the paddock if paspalum is the dominant species and it goes to seed.
- Use a mix of grass species so that paspalum is not the dominant grass.
- Watch for symptoms during the high-risk period over summer and autumn. This is especially important if pasture has been grazed low, or if summer rains have produced a flush of paspalum.



Paspalum seed heads



Claviceps ergots on paspalum seed heads
Photo: Peter Windsor

Endophytes and pregnant mares

There is evidence to suggest that mares are sensitive to low concentrations of the alkaloids produced by endophyte fungi that grow on grasses and cereal grains. The ingestion of low levels of these toxins may adversely affect pregnant mares and their young foals.

This syndrome has been reported in mares fed oats contaminated with

Claviceps infected ryegrass seeds and in mares grazing *Neotyphodium* infected tall fescue. These endophyte fungi grow on many other pasture grasses and cereal grains, (see perennial ryegrass staggers and paspalum staggers for more information on these fungi, pages 92-93). The toxic effects to mares of low levels of endophyte alkaloids may be the same for all grasses or cereal

grains that have been infected with endophyte fungi. Case reports are uncommon, particularly in Australia.

The extent of this problem has not been fully investigated and precisely which fungi and their associated grasses and cereal grains are capable of causing this problem in pregnant mares is unclear.

Signs of endophyte alkaloid poisoning in pregnant mares

- | | | |
|---|---|---|
| <ul style="list-style-type: none"> • Extended gestation period • Dystocia (difficulty birthing) • Lack of milk production • Premature separation of the | <ul style="list-style-type: none"> • placenta and other placental irregularities • Weak or dead foals that may have suffered trauma or asphyxiation | <p>due to a difficult birth, or may be weakened because of placental insufficiency.</p> |
|---|---|---|

Management notes

- Late gestation mares should not be grazed on endophyte-infected pastures or fed endophyte-infected grains or hay.

Aflatoxins

Aflatoxins are mycotoxins produced by several strains of the fungus *Aspergillus*. Animals affected by the ingestion of aflatoxins are said to be suffering aflatoxicosis. Horses are susceptible to the condition but reports of cases in Australia are not common.

The condition in horses is not as well documented as for other livestock species. Aflatoxins primarily affect the liver and aflatoxicosis can be acute

or chronic, depending on how much aflatoxin has been ingested. Chronic aflatoxicosis is more common than the acute form of the condition.

Aflatoxin-producing *Aspergillus* can infect high-energy grain crops during growth. Some of these grains that are commonly used in horse feed rations include corn, wheat, oats and barley. Some feed protein-meal additives can accumulate aflatoxins during growth

and these include cottonseed, copra (a by-product of coconut processing) and sunflower seeds.

Aflatoxins can accumulate in stored feeds and in feed additives when conditions are favourable for the growth of *Aspergillus*. Moisture, high humidity and warm temperatures promote the growth of the fungus. Damaged or cracked grains are most at risk because the fungus can not penetrate intact grain.

Signs of aflotoxicosis

Acute poisoning – if high levels of aflatoxins have been consumed the expected signs in horses may include:

- Feed refusal
- Depression
- Difficulty breathing and increased heart rate.
- Abdominal straining may be seen and the horse may develop diarrhoea with the presence of blood

- In severe cases the horse may die from extensive liver damage

Acute aflatoxicosis in horses is very rare and there is no specific treatment for the condition. Veterinary attention should be sought and unless liver damage is severe, most horses will recover with supportive care.

Chronic poisoning – if low levels of toxin are consumed over several days or weeks the expected signs may include:

- Soft stools
- Weight loss

In cases of chronic aflatoxicosis the condition of the horse usually improves when the contaminated food has been removed from the diet.

Management notes

- Feed should always be stored in dry, cool conditions.
- Always buy feed from reputable sources to ensure that it has been stored properly and that quality grain has been used in concentrate feeds.
- Feed that has been wet and uneaten portions of wetted-feed should be discarded.
- Protein meals such as copra meal should be dry and free flowing.

Copra meal that has been stored correctly.



Equine leukoencephalomalacia

Equine leukoencephalomalacia is an uncommon condition caused by the consumption of corn or other grains that have been infected with the fungus *Fusarium verticilloides* (formerly *Fusarium moniliforme*). The fungus produces toxic chemicals called fumonisins and horses are thought to be particularly sensitive to these toxins.

Fumonisin is formed when grains are infected with *Fusarium verticilloides* in the field. At particular risk are damaged crops or crops that have been

harvested soon after rain. Corn is the most commonly affected grain but oats have also been associated with cases of equine leukoencephalomalacia.

Equine leukoencephalomalacia has occasionally been reported overseas and there have been a small number of reports in Australia, most notably an outbreak in 1995 that resulted in the death of three horses. In that particular case, all three horses suffered neurological problems. One was found dead in the paddock and two were

destroyed after showing a progression of symptoms. Laboratory tests confirmed the presence of *Fusarium verticilloides* in the corn component of the horses' grain ration.

There is limited information available on the mechanism of fumonisin poisoning or the signs that may be seen in horses affected by the ingestion of the toxin. Recent research work has shown that fumonisins can cause heart dysfunction in the horse as well as liver dysfunction.

Signs of equine leukoencephalomalacia

- Jaundice (characterised by a yellow colouring of the mucous membranes)
- Neurological disorders - incoordination, apparent blindness, depression and aimless circling

- The horse may easily startle.
- Head pressing - the horse may push its head against a wall or other surface
- Difficulty breathing
- The horse may die from liver failure, heart failure or from the destruction of brain matter

There is no current treatment available apart from supportive veterinary care and ensuring that toxic feedstuffs are immediately removed from the diet of the horse. Early diagnosis and treatment will increase the chance of survival for the horse.

Management notes

- Feed should always be stored in dry, cool conditions.
- Always buy feed from reputable suppliers to ensure good quality corn and oats has been used in feed mixes. This also applies to pelleted feed that has corn or oats as a component.

Lupinosis

Lupinosis is caused by the ingestion of lupins that have been infected with the fungus *Diaporthe toxica*. The fungus produces toxic chemicals called phomopsins.

Lupinosis is a disease that primarily affects sheep. Horses are also susceptible to the toxic effects of phomopsins and although case reports are rare, the disease is usually fatal in horses. Lupinosis should not be confused with lupin poisoning

associated with quinolizidine alkaloids in lupin plants (see page 26).

Lupins are grown extensively in Western Australia and there has been an increase in lupin cropping in Victoria over the past several years. Poisoning can occur when animals graze fungi-infected lupin stubble, or are fed lupin hay contaminated with fungi.

The highest risk period for lupinosis is summer to autumn. Warm, moist

conditions favour growth of the fungus *Diaporthe toxica*. Stubble remains toxic for several months once it has been infected with the fungus. New varieties of lupin that are resistant to fungal infection have greatly reduced the risk of this disease in Australia.

Horses are not often grazed on lupin stubble or fed lupin hay, however in times of drought lupin is sometimes used as an alternate feedstuff.

Signs of lupinosis

There is little information on the mechanism of phomopsin poisoning in horses or the signs that may be

seen in horses affected by the ingestion of the toxin. Phomopsins affect the liver, kidneys and pancreas. The toxin

is particularly poisonous to horses and death can occur suddenly.

Management notes

- Ensure that horses do not have access to lupin stubble or lupin hay that is not a fungal-resistant variety.
- Lupin stubble is safer immediately after harvest than later in the season.

Plant associated bacterial toxins

Corynetoxins

Corynetoxins are toxins produced by the bacteria *Rathayibacter toxicus*. This bacterium normally lives in the soil but it can sometimes infect the seed heads of certain grasses. The bacterium gains entry to the seed head by adhering to a parasitic nematode that infects the seed head. The nematode, *Anguina funesta*, forms a gall that takes the place of the developing grass seed. The bacterium multiplies inside the nematode gall and a toxic bacterial gall is formed. Seed heads may look normal or they may be somewhat twisted and deformed and some may exude a yellow slime.

Grasses containing corynetoxins are poisonous to all livestock species. Animals are at risk if they ingest the infected grasses, the stubble after hay

has been cut, or the hay of infected grasses. Hay cut from infected grasses can remain toxic for years. The grasses that have been known to accumulate corynetoxins in Australia are annual ryegrass, blown grass and annual beardgrass.

On ingestion of infected grass or hay, the corynetoxins are absorbed into the bloodstream and are transported to tissues where they accumulate. The toxins cause damage to small blood vessels in the brain and this can lead to a disruption in the supply of oxygen to parts of the brain, resulting in brain damage. The corynetoxins also inhibit an important enzyme leading to the disruption of several metabolic processes.

Most cases of poisoning occur in late spring to early summer. This corresponds to the end of flowering and the period that toxins are highest in grasses infected with *Rathayibacter toxicus*. Cases can occur at other times of the year when animals graze infected stubble or ingest infected hay or grain.

Cases of corynetoxin poisoning in Australian horses are not common. One report describes poisoning in several horses from three farms in Western Australia. The horses had eaten meadow hay containing annual ryegrass infected with *Rathayibacter toxicus*. Many of the affected horses died. Corynetoxin poisoning of horses has also been reported in South Australia and in northern New South Wales.

Signs of corynetoxin poisoning

The signs of poisoning occur abruptly and include:

- Muscle tremors and shivering.
- Incoordination, stumbling, stiff-legged gait

- Wide stance
- Convulsions and death

Affected animals should be moved to a quiet area and should be supplied with water and good quality food.

Veterinary attention should be sought immediately if corynetoxin poisoning is suspected in horses. Horses that survive corynetoxin poisoning can take up to a month to make a full recovery.

Annual ryegrass

Lolium rigidum [Poaceae]

Animals affected by corynetoxins in annual ryegrass are said to be suffering 'annual ryegrass toxicosis'.

Annual ryegrass is native to the Mediterranean region. It is highly valued as a pasture grass as it provides good early season grazing. On the downside is the potential for annual ryegrass toxicosis that can occur after the grass has flowered and set seed.

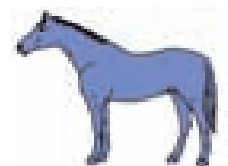
Growth and identification

Annual ryegrass is an upright annual that can grow to almost 1 m in height. The grass produces large numbers of seeds and a large seed bank can accumulate in areas where the grass grows. Seeds are small and light and can be easily distributed by wind or water run-off.

The stems of annual ryegrass are hairless and are reddish-purple towards the base, particularly on young plants. The leaf blades are shiny and hairless. The flowering stems are flat and grow to 30 cm in length.



Pasture grass. It can be an important weed in cereal crops in some areas.

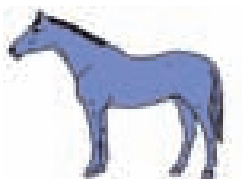


Blown grass

Lachnagrostis filiformis (formerly *Agrostis avenacea*) [Poaceae]



Often found in pastures but it is not usually valued as a forage species and is considered a weed in some areas.

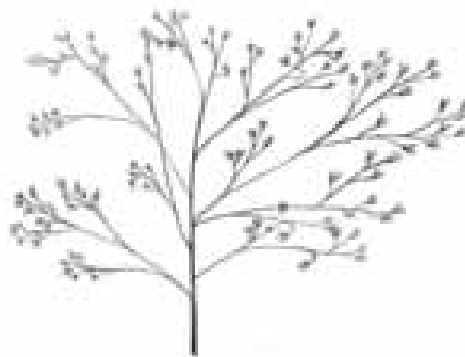


Blown grass is an Australian native grass.

Growth and identification

Blown grass is an upright or semi-upright annual or perennial grass that grows to 70 cm in height. The lower parts of the leaves are sheathed around the stem. The leaf blades have shallow grooves along their length.

The flower spike can be up to 30 cm long and the flower spikelets are spreading when mature. Once the seed drops the flower spike usually breaks off.

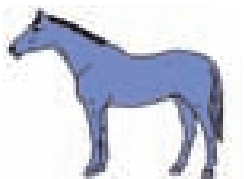


Annual beardgrass

Polygogon monspeliensis [Poaceae]



Mainly grows in moist areas and is commonly found growing along waterways. The grass can also be a weed in pastures.



Annual beardgrass is native to the Mediterranean region. It is often found in pastures but it is not valued as a forage species and is considered a weed in some areas.

Growth and identification

Annual beardgrass is a loosely tufted annual that grows to 80 cm in height. The lower part of the leaves is sheathed around the stem. The leaf blades are flat and have a prominent midvein.

The flower spike is up to 11 cm long. It is soft, compact and bristly.



Management notes

- Avoid introducing the nematode and the bacteria that cause corynetoxin poisoning onto farms that are free of the problem. Do not feed hay or grain in paddocks if the feed has come from areas where the organisms causing corynetoxin poisoning are known to occur. Only use certified seed when improving paddocks.
- Graze permanent pasture through late winter and spring to remove the early flower heads of annual ryegrass, blown grass and annual beardgrass. This prevents the grasses from setting seed and thus prevents nematode infestation and subsequent bacterial infection of the nematode galls.
- Annual ryegrass hay should be cut between the time that the grass starts to flower and the end of flowering. Seed heads are most toxic when seed is set and this occurs just after flowering has ended.
- Hay with a high percentage of annual ryegrass seed heads should not be fed to horses.

An integrated weed management approach is necessary to control annual ryegrass, blown grass or beard grass growing as weeds in pastures.

- A management plan that includes grazing, cultivation and herbicide use should be devised to control these grasses on farms where corynetoxin poisoning may be an issue. Seek advice from a local agronomist or weed management agency to select the most appropriate management program for your property.

Ornamental plants

Many ornamental plants contain toxins that could cause poisoning in horses. It is important to select non-toxic species when planting out hedges or windbreaks alongside paddocks, when planting trees to improve the look

of horse properties and to provide shade, or when landscaping stable and arena areas. Toxic ornamental plants can spread seed or suckers and can sometimes encroach upon areas where horses are kept and this

is especially so in urban and semi-rural areas. An awareness of toxic ornamentals will reduce the chance of accidental exposure and the potential for poisoning in horses.

Lily of the valley

Convallaria majalis [Liliaceae]

Oleander

Nerium oleander [Apocynaceae]

Yellow oleander

Thevetia peruviana [Apocynaceae]

Mother of millions

Bryophyllum spp [Crassulaceae]

Cotton bushes

Gomphocarpus spp and *Asclepias spp* [Apocynaceae]

Foxglove

Digitalis purpurea [Scrophulariaceae]

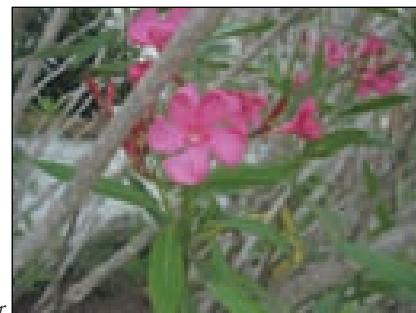
Star of Bethlehem

Ornithogalum spp [Hyacinthaceae]

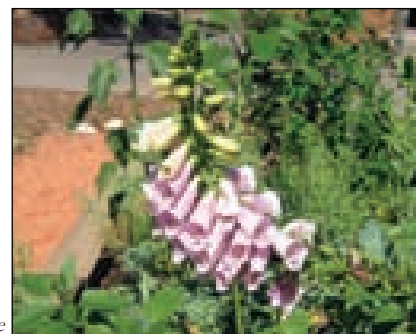
Blue periwinkle

Vinca major [Apocynaceae]

Contain cardiac glycosides (see pages 35-43).



Oleander



Foxglove

Rhododendrons and azaleas

Rhododendron spp [Ericaceae]

Sheep laurel (lambkill)

Kalmia angustifolia [Ericaceae]

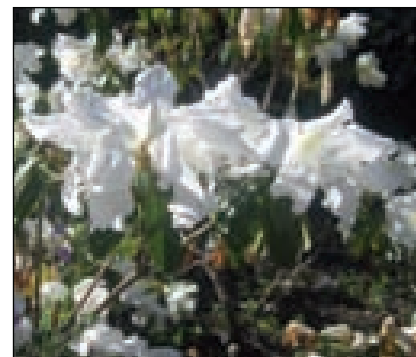
Mountain laurel (calico bush)

Kalmia latifolia [Ericaceae]

Pieris (lily of the valley shrub)

Pieris spp [Ericaceae]

Contain grayanotoxins. Signs (usually appear with 6 hours of ingestion): depression, salivation, colic, seizures, heart irregularities and incoordination. Usually not fatal unless large amounts of the plant have been eaten.



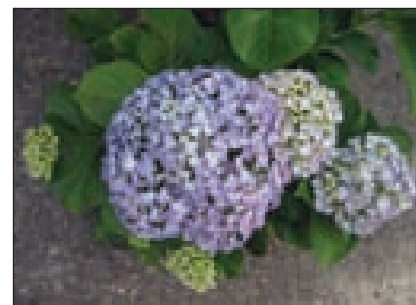
Azalea

Hydrangea

Hydrangea macrophylla [Hydrangeaceae]

Contains potentially toxic alkaloids, saponins, resins and the plant can accumulate cyanogenic glycosides (see pages 30-34).

Signs: Severe gastrointestinal irritation characterised by colic and diarrhoea that may contain blood. Seek immediate veterinary attention if hydrangea poisoning is suspected. Hydrangeas have been responsible for a small number of horse poisoning cases overseas and only a very small amount of ingested leaves can prove fatal.



Hydrangea

Common elder

Sambucus nigra [Caprifoliaceae]

Contain cyanogenic glycosides (see pages 30-34).

Plums, peaches, apricots, cherries, nectarines, almonds

Prunus spp [Amygdalaceae]

Spotted fuchsia

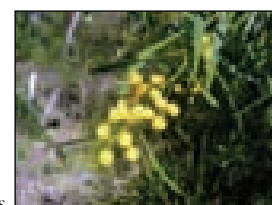
Eremophila maculata [Myoporaceae]

Wattles

Acacia spp [Fabaceae]



Common elder



Wattle flowers

Dumb cane

Dieffenbachia seguine [Araceae]

Caladium

Caladium bicolor [Araceae]

Philodendrons

Philodendron spp [Araceae]

Arum lily

(calla lily, pig lily)

Zantedeschia aethiopica [Araceae]

Peace lily

Spathiphyllum spp [Araceae]

Elephant's ear (cunjevoi)

Alocasia spp [Araceae]

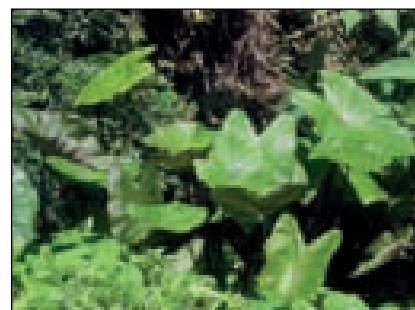
Elephant's ear (cocoyam, taro)

Colocasia spp [Araceae]

These plants contain cells known as idioblasts. Inside the cells are sharp, needle-like crystals of calcium oxalate that are packed in a gelatinous material. When the plant material is chewed, saliva or plant sap can enter the idioblasts. The gelatinous material swells and this causes the calcium oxalate crystals to shoot out of the idioblasts. The crystals can penetrate the tongue, throat and the inside of the mouth to cause severe irritation. Some of these plants also contain chemicals that aggravate the symptoms by causing an inflammatory response. Signs (can appear immediately or within hours of ingestion): head shaking, salivation, mouth and tongue swelling, depression. In very rare cases the swelling can cause airway obstruction. Affected animals may take days to fully recover. If poisoning is suspected, rinse the horse's mouth with water and seek veterinary attention.



Arum lily growing in a horse paddock



Elephant's ear

Christmas rose

(stinking hellebore, Corsican hellebore, winter rose)

Helleborus niger [Ranunculaceae]

Contains cardiac glycosides (see pages 35-43), protoanemonin (see page 44) and other toxins.

Signs (usually occur soon after ingestion): colic and other gastrointestinal problems. Neurological problems such as incoordination might be seen. Seek veterinary attention if Christmas rose poisoning is suspected.

Green cestrum

Cestrum parqui [Solanaceae]

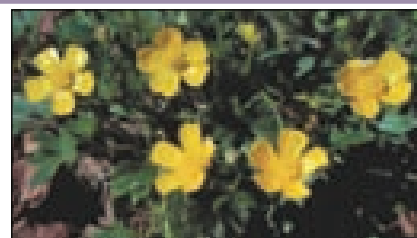
Contains carboxyatractyloside (see pages 46-49).

Night scented jasmine

Cestrum nocturnum [Solanaceae]

Clematis*Clematis spp* [Ranunculaceae]

Contain protoanemonin (see page 44).

Buttercups*Ranunculus sp* [Ranunculaceae]

Buttercups

Larkspur*Consolida ambigua* [Ranunculaceae]**Delphiniums***Delphinium spp* [Ranunculaceae]**Monkshood***Aconitum spp* [Ranunculaceae]

Contain diterpene alkaloids. Signs (usually appear within hours of ingestion): excitement, confusion, muscle tremors, weakness, collapse, respiratory paralysis and death. Very rare in horses in Australia. Important cause of poisoning in the northern hemisphere where the plants are commonly found in pastures, although cattle are the species most commonly affected. Seek immediate veterinary attention if diterpene alkaloid poisoning is suspected.

Daffodils, jonquils, paper whites*Narcissus spp* [Amaryllidaceae]**Clivia**

(kaffir lily, fire lily)

Clivia miniata [Amaryllidaceae]**Snowdrop***Galanthus nivalis* [Amaryllidaceae]**Spider lily**

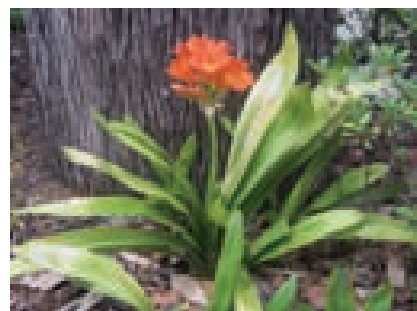
(filmy lily, sacred lily of the Incas)

Hymenocallis spp (also known as *Ismene spp*) [Amaryllidaceae]**Hippeastrum**

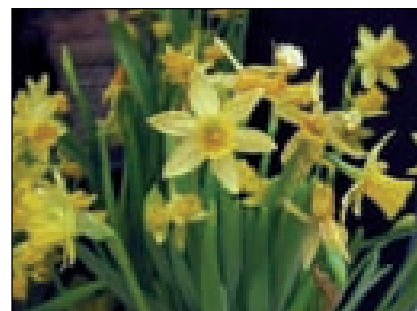
(amaryllis, Barbados lily)

Hippeastrum spp [Amaryllidaceae]**Belladonna lily***Amaryllis belladonna* [Amaryllidaceae]

Contain several alkaloids with the most important being lycorine. Signs (usually appear within 1 hour of ingestion): Salivation, colic and diarrhoea are the most commonly seen signs. Ingestion of large amounts of plant material can result in low blood pressure, weakness and incoordination. Most cases usually recovers within a few hours. If a horse is observed to eat these plants, do not give food or water for a few hours and observe animal for signs of poisoning. Seek veterinary attention.



Clivia



Daffodils

Deadly nightshade

(belladonna)

Atropa belladonna [Solanacea]**Angel's trumpets***Brugmansia spp* [Solanacea]**Corkwoods***Duboisia spp* [Solanacea]

Contain tropane alkaloids (see pages 21-25).



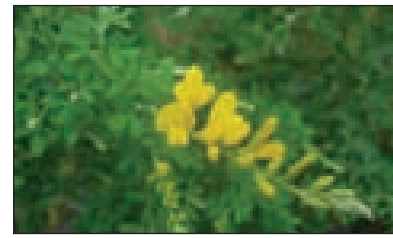
Angel's trumpet

Golden chain tree
Laburnum anagyroides [Fabaceae]

Contain quinolizidine alkaloids (see pages 26-28).

Ornamental lupins
Lupinus spp [Fabacea]

Brooms
Cytisus spp and Genista spp[Fabaceae]



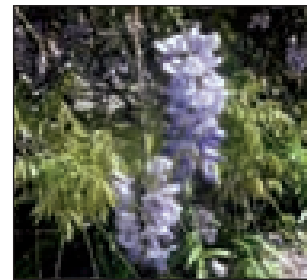
Broom.

Wisteria
Wisteria floribunda and *Wisteria sinensis*
[Fabaceae]

Contain lectins (see page 55-59).

Black locust
Robinia pseudoacacia [Fabaceae]

Bellyache bush
Jatropha spp [Euphorbiaceae]



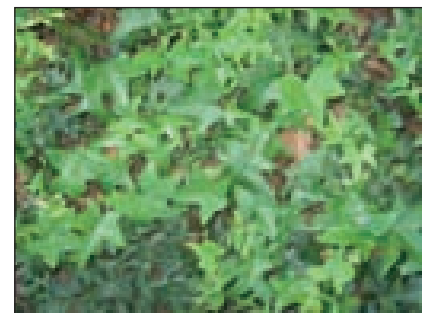
Wisteria.

Holly
Ilex aquifolium Aquifoliacea]

English ivy, common ivy
Hedera helix [Araliaceae]

Corn cockle, corn pink
Agrostemma githago [Caryophyllaceae]

Contain triterpenoid saponins. Signs: most cases result in mild diarrhoea. Cases usually recover within 24 hours. In more severe cases colic might develop. Seek veterinary attention.



Ivy.



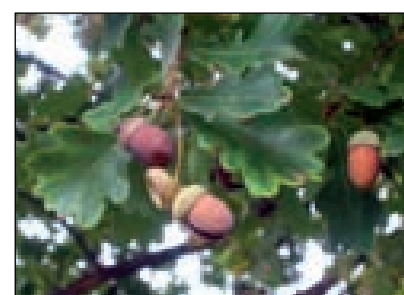
Holly.

Day jasmine
Cestrum diurnum [Solanaceae]

Contain calcinogenic glycosides (see page 50).

Oaks
Quercus spp [Fagaceae]

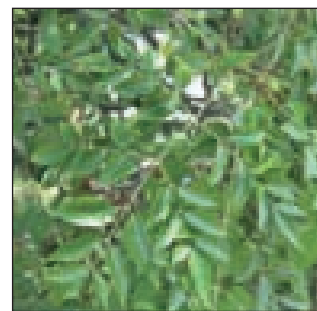
Contain tannic acid (see page 53).



Oak acorns

White cedar*Melia azedarach* [Meliaceae]

Contain meliatoxins (see page 66).



White cedar

Lobelias*Lobelia spp* [Lobeliaceae]

Contain pyridine alkaloids (see page 29).

Poinsettia*Euphorbia pulcherrima* [Euphorbiaceae]

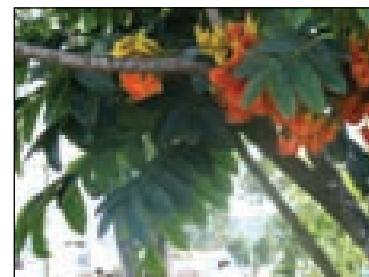
Contain diterpene esters (see pages 64-65).

Black bean

(Moreton Bay chestnut)

Castanospermum australe [Fabaceae]

Contains unknown toxins (see page 67).



Black bean. Photo: Pat Offord

English yew*Taxus baccata* [Taxaceae]

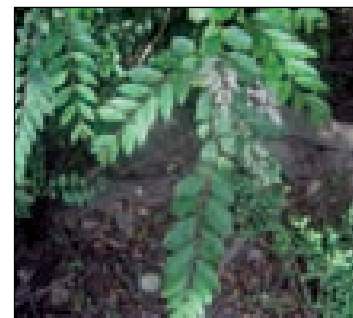
Contain taxine alkaloids (see page 20).

Avocado*Persea americana* [Lauraceae]

Contain persin (see page 76).

Privets*Ligustrum spp* [Oleaceae]

Contains unknown toxins (see page 82).



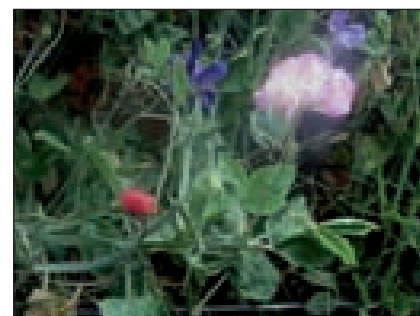
Privet

Sweet pea*Lathyrus odoratus* [Fabaceae]**Perennial pea**

(everlasting pea, everlasting sweetpea)

Lathyrus latifolius [Fabaceae]

Contain β -amino proprionitrile (BAPN). Signs: 'hopping' gait, weight shifted to front legs, stiffness in hindquarters and 'roaring' (laryngeal hemiplegia). Signs are largely irreversible. Surgery may correct roaring. Horses are sensitive to this toxin but are only likely to develop signs of poisoning if large quantities of the plants are consumed over a long period.



Sweet pea

Table of plant features and possible signs of poisoning

Key to signs of poisoning

- Food refusal and/or weight loss
- Depression
- Colic and/or diarrhoea
- Nervousness/excitability
- Jaundice
- Photosensitisation
- Head pressing
- Incoordination
- Sudden death
- Gait abnormalities and/or apparent paralysis

- Abnormal respiratory rate and/or heart rate
- Muscle tremors/weakness
- Skin irritation

- Spr - spring
- Win - winter
- Sum - summer
- Aut - autumn











Flowering time abbreviations

Herbs	Flowers	Other features	Plant	Page	Signs
Rosette base.	Branched flower spike. Purple tubular flowers. Spr.		Pateron's curse	8	●●●●●●●●
Rosette base.	Curved flower spike. Small tubular flowers along one side of spike. Win-spr.		Amsinckias	16	●●●●●●●●
Rosette base.	Flower spike. Tubular flowers. Mottled colours. Spr-early sum.		Foxglove	41	●●●●●●●●
Rosette base.	Daisy-like. 5 petals. Yellow. Spr.		Celery leaf buttercup	44	●●●●●●●●
Rosette base.	Daisy-like. Yellow. Numerous petals. Spr-sum.	Seeds in the centre of the old flower are topped with tuft of hairs.	Flatweed, smooth flatweed, dandelion	70	●●●●●●●●
Rosette base.	Purple, pink or white 'thistle' flowers. Spr-sum.	Bracts surrounding flower narrow to papery tip.	Hardheads	83	●●●●●●●●
Rosette base.	Yellow 'thistle' flowers. Spr-sum.	Bracts surrounding flower tipped with long spines.	St Barnaby's thistle	84	●●●●●●●●
Alternate. Paired heart-shaped leaflets along leaf stem.	20-40 yellow pea-shaped flowers on a flower spike.	Seedpods. Plant is only found in very small area in QLD.	Selenium weed.	81	Hair loss, cracked hooves.
Alternate. Fan-shaped with 5-13 leaflets.	Flower spike. Pea-shaped flowers. Colourful. spr-sum.	Flat seedpods.	Lupins	28	●●●●●●●●
Alternate.	Pea-shaped. Various colours. Flowering time varies with species.	Inflated seedpods 'rattlepod'.	Crotalaria	9, 75	●●●●●●●●
Alternate. 5 leaflets, 2 lower leaflets may be very small.	Pea-shaped. Yellow with red veins. Spr-sum.	Seedpods	Birdsfoot trefoil	33	●●●●●●●●
Alternate. Spreading growth habit. 7-9 egg-shaped leaflets.	Small red flowers crowded on short spikes. Throughout the year.	Seedpods	Indigoferas	89	●●●●●●●●

Alternate, decreasing in size from bottom to top of plant.	Daisy-like. Numerous petals. Usually yellow, white or pink. Flowering time varies with species.	Dandelion-like hairy seed head after flowering.	Senecios	12	
Alternate. Deeply divided, resemble the leaves of carrots.	Daisy-like. Red or yellow with black centre. Win-summer.	Wrinkled fruit.	Pheasants eye	43	
Alternate. Rounded, lobed leaves that each have 5-7 veins radiating from stem attachment.	5 petals. Mauve, pink or white flowers clustered in leaf forks. Spr.	Disk-shaped fruit capsule.	Small flowered mallow.	87	
Alternate.	Curved flower spike. Small tubular flowers along one side of spike. Flowering time varies with species.		Heliotropes	14	
Alternate. Usually dull green.	Tubular, enclosed at base in tubular bract. Flowering time varies with species.	Fruit capsule.	Tobacco	29	
Alternate. Unpleasant smell when damaged.	Tubular 'trumpet' flowers in forks of branches. Summer.	Spined seed capsule to 5cm wide.	Thornapples	22	
Alternate.	Short tube dividing into lobes. Flowering time varies with species.	Fruit capsule	Lobelias	29	
Alternate. Spines at base of leaf stalks.	Male flowers clustered at tips of branches, female flowers below. Late spr-early aut.	Burr covered in hooked spines with 2 large spines at one end.	Bathurst burr	47	
Alternate. 'Fern-like' with 'mousy' smell.	Umbrella-shaped cluster of white flowers. Spr-summer.	Cylindrical fruit.	Hemlock	25	
Opposite.	Tubular. Purple. Petals have distinctive 'twist'. Spr-summer.		Blue periwinkle	42	
Opposite. Succulent.	Tubular. Drooping clusters at top of stems. Win-early spr.	Produces 'plantlets' at edges or tips of leaves.	Mother of millions	38	
Opposite. Leaves dotted with oil glands.	Daisy-like. 5 petals. Yellow. Late spr-summer.	Reddish-brown sticky fruit capsule.	St John's wort	54	
Opposite. Dull green and 'spoon-shaped'.	Rounded cluster of small white flowers enclosed in white papery bracts. Spr and aut.		Gomphrena weed	86	
Opposite.	Clusters of small flowers. Usually white. Spr-aut.	Balloon-like green fruit. Seeds topped with long hairs.	Cotton bushes	40	
Opposite. Covered in sticky hairs.	Small white flowers arranged in clusters at the tips of the branches. Spr-summer		Crofton weed and mistflower	68	
Opposite.	Male flowers clustered at tips of branches, female flowers below. summer-aut.	Burr covered in hooked spines.	Noogoora burr	46	
Opposite. Covered in stiff stinging hairs.	Small pale green or white flowers in branched clusters. Spr.		Stinging nettles	90	
Fern fronds that can be up to 1.5m in length.	Does not produce flowers. Spores are produced on underside of leaves.	Extensive underground root system.	Bracken	61	
Fern fronds that grow up to 40cm in length.	Produces spores on leaves.		Rock ferns	63	

Fern fronds. 2 pairs of leaflets (like 4-leaf clover).	Produces spores in a hard pea-sized capsule.	Can be aquatic or grow in mud after floods.	Nardoo	62	
Whorl of thin pointy leaves at nodes.	Does not flower. Produces fruiting cones.	Deep underground stems. Uncommonly seen in Australia.	Horsetails	63	
Sheathed. Strap-like, ribbed.	6 petals. Pink or orange with yellow centre. Late win-early spr.	Produces underground 'bulbs'. Produces fruit capsules after flowering.	Cape tulips	39	
Arise from base of plant. Strap-like.	6 petals, sometimes with green midvein on outer surface. Mostly in spr.	Grows from bulbs.	Ornithogalum	42	
Arise from base of plant. Strap-like.	Flowers arise from a single point at the top of the stems. Usually white or pink. Spr-sum.	Garlic smell when crushed. Grow from bulbs.	Alliums	60	
Arise from base of plant. Strap-like.	Branched flowering stem with up to 60 flowers. White petals with brown centre stripe. Win-spr.	Seed capsule. Plant forms tumbleweed on maturity.	Dune onion weed	85	
Varies with species.	Clusters of Pea shaped flowers. Usually purple. Flowering time varies with species.	Seedpods.	Swainsonas	18	
Varies with species.	Cup-shaped bract surround a solitary female flower and 4-5 male flowers.	Milky sap.	Leafy spurges	64	
Varies with species.	Star-shaped, usually 5 lobes. Flowering time varies with species.	Berries.	Nightshades.	72	
Trifoliate.	Spherical flower heads made up of many small pink, white or purple flowers.		Red clover and alsike clover	79	
Vines					
Leaves	Flowers	Other features	Plant	Page	Signs
Alternate. Triangular or arrow-shaped.	Tubular. White to pink. Mostly sum.	Seed capsules.	Field bindweed	21	
Opposite. Thick and leathery.	Tubular, usually pale pink with darker centre. sum.	Seedpod-like fruit. Seeds topped with long hairs.	Rubber vine	37	
Opposite.	Sprays of white or pink flowers. Sum.	Flat seed pods. Distinctive red and black seeds.	Crab's eye	56	
Grasses	Leaves/stems	Flowering	Plant	Page	Signs
Low-growing.	Ligule-fringe of dense hairs.	2-6 narrow spikes from top of flowering stem.	Couch grasses	33	
Sprawling with long stems.	Ligule-fringe of dense hairs.	Numerous branched flower spikes to 8cm.	Para grass	52	
Sprawling with long stems.	Ligule-fringe of dense hairs.	2-3 flower spikes to 8cm.	Signal grass	52	
1m	Green/blue.	Cylindrical spike to 18cm. Blue/purple tips.	Paradoxa grass	17	
1m	Ligule-fringe of hairs.	3-10 flower spikes to 20cm.	Pangola grass	51	
1m	Ligule-fringe of hairs.	Bristled, branched spike to 15cm long.	Buffel grass	51	
1m	Ligule-fringe of dense hairs.	Cluster of 2-4 spikelets enclosed in a sheath.	Kikuyu	52	

1.5m	Green/blue.		Cylindrical spike to 14cm. Blue/purple tips	Blue canary grass	17	●
1.5m	Glossy leaves with prominent midrib.		Branching flowering spike.	Sorghums	31	●●●
2m	Ligule-fringe of dense hairs.		Cylindrical spike to 30cm.	South African pigeon grass	51	●
2m	Ligule-thin translucent membrane topped with hairs.		Cylindrical flower spike to 18cm.	Purple pigeon grass	52	●
3m	Ligule-thin translucent membrane.		Branched flower spike to 50cm.	Guinea grass	52	●
Variable with species.	Narrow, rolled when young.		Usually an open, branched seed head.	Panics	45	●●●
Shrubs						
Height	Flowers	Other features	Plant	Page	Signs	
To 1m	White star-shaped flowers surrounded by white leafy bracts.	Thick leathery leaves. Only found in very small area in QLD.	Mapoon bush	81	Hair loss, cracked hooves.	
To 2m	Tubular. Red and yellow. Win-spr.		Spotted fuchsia	32	●●●	
To 2m	Pink, blue or white cluster of flowers. Sum.	Yellow-brown seed capsules.	Hydrangea	99	●●●	
To 2.5m	5 petals. Clusters of yellow flowers. Sum-aut.	Long cylindrical seedpods.	Sennas	77	●●●	
To 2.5m	Tubular, white, fragrant in day. Flowers throughout year.	Fleshy berries.	Day jasmine	50	●●●	
To 2.5m	Tubular, white, fragrant at night. Sum-aut.	Fleshy berries.	Night scented jasmine	49	●●●	
To 3m	Tubular, usually yellow. Sum-aut.	Lance-shaped leaves, arranged in spiral pattern.	Yellow oleander	36	●●●	
To 3m	Clusters of tubular flowers. Flowers throughout the year.	Lance-shaped leaves that are alternately arranged along stem. Fleshy berries that are purple/black when ripe.	Green cestrum	48	●●●	
To 4m	Bright yellow cluster of pea-shaped flowers. Spr.	Leaves trifoliolate. Seedpods.	Brooms	27	●●●	
To 4m	Cream-yellow 'fluffy' Male flowers at bottom of flower spike. Female flowers at top of flower spike. Sum.	Large leaves, with triangular lobes and toothed edges. Produces large seed capsule.	Castor oil plant	55	●●●	
To 4m	5 petals, red or purple with yellow centres. Late Sum.	Leaves with 3 or 5 pointed lobes. Seed capsule.	Bellyache bush	57	●●●	
To 4m	Clusters of yellow-greenish. Flowers throughout the year.	Heart shaped leaves with 3-5 lobes. Seed capsule.	Physic nut	58	●●●	

To 4m		Small yellowish-green clusters. Wart-like nuts. Sum.	Leaves covered in stinging hairs.	Gympie stinger	91	
To 5m		Tubular 'trumpet' flowers. Spr-summ.	Leaves oval with toothed or wavy edges.	Angel's trumpet	23	
TREES						
Height		Flowers	Other features	Plant	Page	Signs
To 5m. Tree or shrub.		3-4cm across, usually pink. Mostly summ.	Seedpods.	Oleander	35	
To 7m.		Drooping cluster of yellow pea-shaped flowers. Spr-summ.	Leaves arranged alternately. Berries. 'Corky' bark..	Golden chain tree.	27	
To 9m. Tree or shrub.		Cluster of small white or cream flowers. Win-spr.	Leaves arranged opposite. Berries	Corkwoods	23	
To 10m. Tree or shrub.		White-cream flowers. Usually fragrant. Win-summ	Leaves up to 45cm. Each leaf has 3-5 pairs of leaflets.	Privets	82	
To 15m		5 petals. Mauve or lilac drooping clusters. Spr.	Dark green leathery leaves. Produces avocados.	White cedar	66	
To 15m		Small greenish-yellow flowers.	Needle-like leaves.	Avocado	76	
To 20m		Male-flowers-small yellow cones. Female flowers -very small green cones. Red berries. Spr.	Leaves with numerous leaflets. Seedpods.	Yew	20	
To 20m		Pea-shaped flowers that hang in tresses. Fragrant. Spr.	Deciduous. Leaves turn bright red in autumn.	Black locust	57	
To 20m		Bright red flowers. Clusters of reddish fruit.	Leaves are leathery, toothed, lobed and usually heart-shaped.	Red maple	88	
To 35m		Female-small and green. Male-drooping clusters (spring). Produces acorns. Aut.	Leaves to 60cm long. Seedpods.	Oaks	53	
To 40m		Pea-shaped. Red and yellow. Aut	Fleshy edible fruit.	Black bean	67	
Varies with species.		Pink or white blossoms.	Leathery or woody seedpods.	Prunus	31	
Varies with species.		Usually appear as clusters of yellow flowers		Acacias	33	

Glossary of terms

Activated charcoal - A form of charcoal that has been treated with oxygen. Activated charcoal has millions of tiny holes that make it very porous and able to absorb other substances. Activated charcoal administered to a horse after the ingestion of toxic plant material can reduce the effects of the ingested toxins by absorbing them from the gut before they pass through the gut wall and into the bloodstream. Activated charcoal is not digested and it passes safely through the body carrying the toxic substances with it.

Acute - An illness or disease that has a fast onset and lasts for a short period of time. Acute poisoning is characterised by a sudden onset of symptoms that quickly increase in severity. Acute poisoning can resolve through recovery or death, but if symptoms continue for a long period of time it is then referred to as chronic.

Agronomist - An expert in the management of soils, crops and pastures.

Annual - A plant that completes its entire lifecycle through one growing season or year.

Biennial - A plant that completes its entire lifecycle in 2 growing seasons or years.

Chronic - An illness or disease that is long-lasting, and sometimes recurring. Chronic poisoning is usually characterised by a gradual onset of symptoms that progress slowly in severity. Chronic poisoning can resolve through recovery or death. Symptoms may remain or recur throughout the life of a horse that eventually dies from other causes.

Colic - A general term that describes abdominal pain in the horse. Colic can range in severity from mild to severe and there are many potential causes of colic in horses. Colic is a common symptom of plant poisoning in horses. A horse that is suffering from colic may frequently look at its sides and kick at its abdomen or stamp its feet. It may also strain to pass faeces, roll frequently and violently and have an increased pulse rate and breathing rate.

Declared noxious weed - A plant that has been targeted for control because it causes or has the potential to cause significant adverse economic, environmental or social impacts. Declared noxious weeds are included in various forms of government legislation in order to prevent or minimise the damage that they may cause. This legislation is usually enacted at the state level and is monitored and enforced at local government level. [Reference: *Declared plants of Australia: An Identification and Information System*. (2004)]. More information on declared noxious weeds can be obtained from your local council or your state Department of Agriculture.

Enzymes - Specialised proteins that are necessary for the many naturally occurring biochemical reactions that occur in living organisms. For example, digestive enzymes in the gut speed up the rate at which food is broken down and digested.

Fertiliser - A substance used to enrich the soil with essential nutrients. Fertilisers improve the health of plants resulting in increased growth rates and higher yields of fruits or seeds.

Herbicide - Substances used to control or destroy unwanted plants. Selective herbicides kill only target plants and have no effect on other plant species. Non-selective herbicides kill all plant species with which they come into contact.

Incoordination - An inability to control the movements of the body, particularly the limbs. Also known as 'ataxia'.

Jaundice - Can occur as a result of conditions that adversely affect the liver or that cause an excessive breakdown of red blood cells. Jaundice is characterised by a yellow colouring of the skin and in the horse this is especially noticeable in the mucous membranes (inside surfaces of the mouth and nose). The yellow colouring is due to abnormally high levels of the bile pigment bilirubin. Jaundice is also known as 'icterus'.

Lethargy - Sluggishness or abnormal drowsiness. A lethargic horse may be unable to exercise at its normal level of activity.

Metabolism - The total of all chemical changes that take place in a cell or an organism. These chemical changes produce energy and basic materials needed for important life processes.

Naturalised - An introduced plant species (non-native) that has become established after its accidental or deliberate introduction.

Ornamental plant - A plant grown for its foliage or flowers rather than for food, pasture or other economic use.

Palatable - Pleasant tasting.

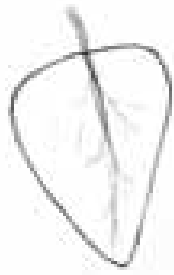
Perennial - A plant that lives for more than 2 years.

Taxonomist - A person who specialises in classifying plants or animals.

Toxin - A chemical that acts as a poison and causes illness in an animal.

Glossary of botanic features

Leaf shapes



Triangular-shaped



Oval or egg-shaped



Lance-shaped

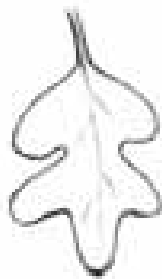


Heart-shaped

Leaf edges



Serrated or toothed



Lobed



Smooth or entire

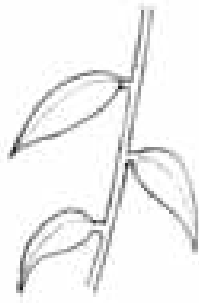


Deeply divided

Leaf arrangement



Opposite



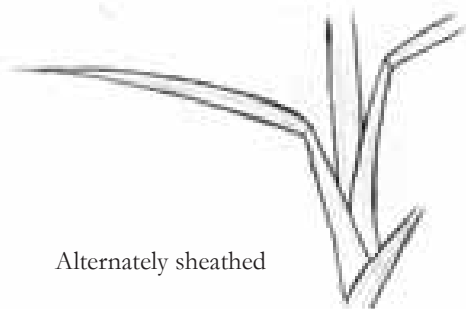
Alternate



Rosette

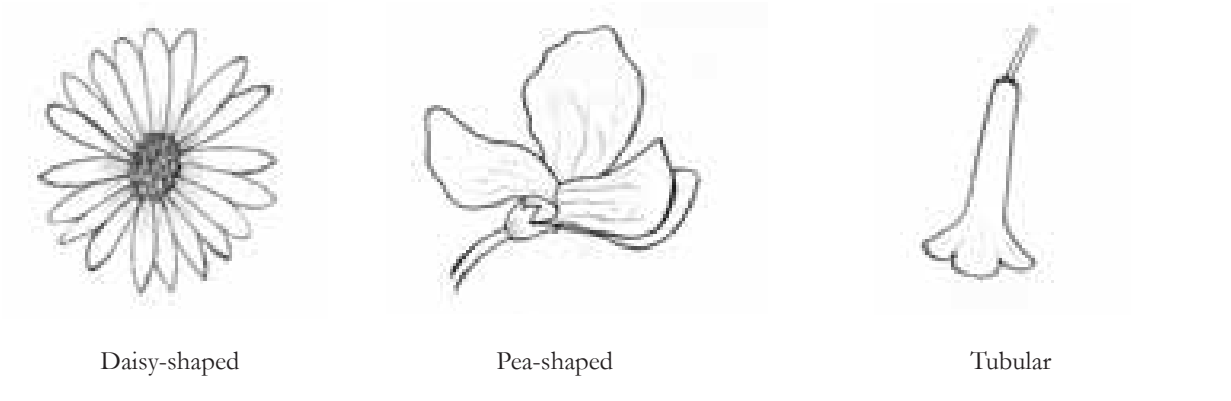


Whorl of leaves



Alternately sheathed

Flower types

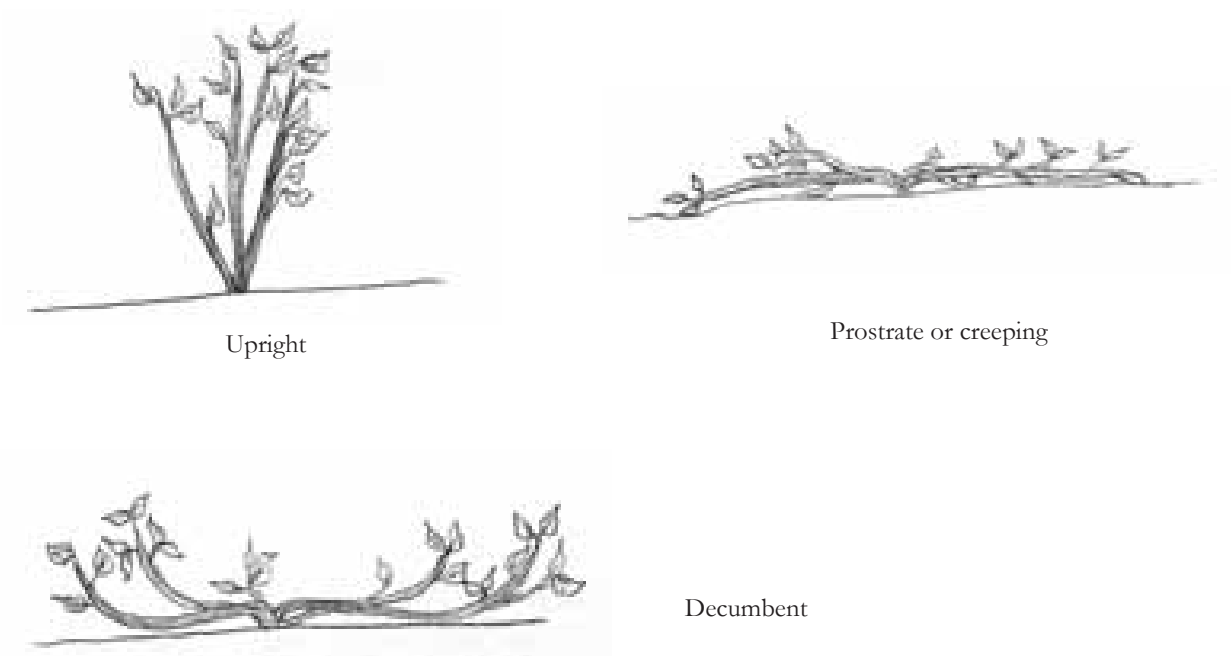


Daisy-shaped

Pea-shaped

Tubular

Growth habit

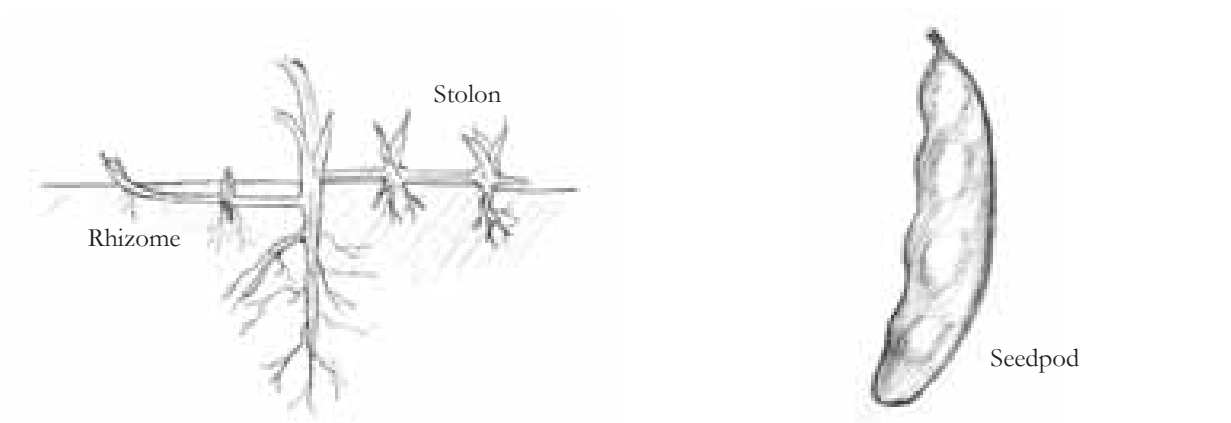


Upright

Prostrate or creeping

Decumbent

Other plant features



Rhizome

Stolon

Seedpod

References

Books

- Acamovic, T, Stewart, CS & Pennycott, TW 2004 *Poisonous plants and related toxins*, CABI Publishing, Wallington GB.
- Avery, A 1996 *Pastures for horses – a winning resource*, Rural Industries Research & Development Corporation (RIRDC), Equine Research and Development Program, Canberra, Australia.
- Bruneton, J 1999 *Toxic plants: dangerous to humans and animals*, Editions Tec & Doc; Andover, Paris, France.
- Cheeke, PR 1989 *Toxicants of plant origin*, CRC Press, Boca Rata, Florida, USA.
- Cheeke, PR 1998 *Natural toxicants in feeds, forages and poisonous plants*, Interstate Publishers, Danville, Illinois, USA.
- Dowling, RM & McKenzie, RA 1993 *Poisonous plants: a field guide*, Queensland Department of Primary Industries, Brisbane, Australia.
- Groves, RH, Boden, R & Lonsdale, WM 2005 *Jumping the garden fence: invasive garden plants in Australia and their environmental and agricultural impacts*, A CSIRO Report for WWF-Australia.
- James, LF, Keeler, RF, Bailey Jr, EM, Cheeke, PR & Hegarty, MP 1992 *Poisonous plants: proceedings of the third international symposium*, Iowa State University Press, Iowa, USA.
- Kohnke, J, Kelleher, F & Trevor-Jones, P 1999 *Feeding horses in Australia*, Rural Industries Research & Development Corporation (RIRDC), Equine Research and Development Program, Canberra, Australia.
- Lamp, C & Collet, F 1984 *A field guide to Wreeds in Australia*, Inkata Press, Melbourne, Australia.
- McBarron, EJ 1983 *Poisonous plants: handbook for farmers and graziers*, Inkata Press, Melbourne, Australia.
- Nash, D 1998 *Drought feeding for horses*, Rural Industries Research & Development Corporation (RIRDC), Equine Research and Development Program, Canberra, Australia.
- Plumlee, KH 2004 *Clinical veterinary toxicology*, Mosby, USA.
- Roder, JD. 2001 *Veterinary toxicology*, Butterworth-Heinemann, Boston, USA.
- Seawright, AE, Hegarty, MP, Keeler, RF & James, LF (Eds) 1985 *Plant toxicology*, Queensland Poisonous Plants Committee Brisbane, Australia.
- Shepherd, RCH 2004 *Pretty but poisonous: plants poisonous to people, an illustrated guide for Australia*, RG & FJ Richardson, Melbourne, Australia.
- Wrigley, JW & Fagg, M 2001 *Australian native plants*, New Holland Publishers, Australia.

Journal Articles

- Aylward, JH, Court, RD, Haydock, KP, Strickland, RW & Hegarty, MP 1987, 'Indigofera species with agronomic potential in the tropics. Rat toxicity studies', *Australian Journal of Agricultural Research*, 38(1), 177-186.
- Bhardwaj, R, Singh, A, Sharma, OP, Dawra, RK, Kurade, NP & Mahato, SB 2001 'Hepatotoxicity and cholestasis in rats induced by the sesquiterpene, 9-oxo-10,11-dehydroageraphorone, isolated from *Eupatorium adenophorum*', *Journal of Biochemical & Molecular Toxicology*, 15(5), 279-286.
- Bortell, R, Asquith, RL, Edds, GT, Simpson, CF & Aller, WW 1983 'Acute experimentally induced aflatoxicosis in the weanling pony', *American Journal of Veterinary Research*, 44(11), 2110-2114.
- Bourke, CA, Colegate, SM, Slattery, S & Oram, RN 2003 'Suspected *Phalaris paradoxa* (paradoxa grass) poisoning in horses', *Australian Veterinary Journal*, 81(10), 635-637.
- Carmalt, J, Rosel, K, Burns, T & Janzen, E 2003 'Suspected white kidney bean (*Phaseolus vulgaris*) toxicity in horses and cattle', *Australian Veterinary Journal*, 81(11), 674-676.
- Cheeke, PR 1995 'Endogenous toxins and mycotoxins in forage grasses and their effects on livestock', *Journal of Animal Science*, 73(3), 909-918.
- Colegate, SM, Anderton, N, Edgar, J, Bourke, CA & Oram, RN 1999 'Suspected blue canary grass (*Phalaris coerulescens*) poisoning of horses', *Australian Veterinary Journal*, 77(8), 537-538.
- Colon, JL, Jackson, CA & del Piero, F 1996 'Hepatic dysfunction and photodermatitis secondary to alsike clover poisoning', *Compendium on Continuing Education for the Practicing Veterinarian*, 18(9), 1022-1026.

- Cook, DR, Campbell, GW & Meldrum, AR 1990 'Suspected *Cryptostegia grandiflora* (rubber vine) poisoning in horses', *Australian Veterinary Journal*, 67(9), 344.
- Cope, RB, Camp, C & Lohr, CV 2004 'Fatal yew (*Taxus* sp.) poisoning in Willamette Valley, Oregon, horses', *Veterinary and Human Toxicology*, 46(5), 279-281.
- Cornick, JL, Carter, GK & Bridges, CH 1988 'Kleingrass-associated hepatotoxicosis in horses', *Journal of the American Veterinary Medical Association*, 193(8), 932-935.
- Copetti, MV, Santurio, JM, Boeck, AA, Silva, RB, Bergermaier, LA, Lubeck, I, Leal, AB, Leal, AT, Alves, SH & Ferreira, L 2002 'Agalactia in mares fed with grain contaminated with *Claviceps purpurea*', *Mycopathologia*, 154(4), 199-200.
- Creep, JH, Vale, W & Walsh, R 1996 'Annual ryegrass toxicosis in horses', *Australian Veterinary Journal*, 74(6), 465-466.
- Creep, JH, Mitchell, AA, Jubb, TF & Colegate, SM 1999 'Pyrrolizidine alkaloid poisoning of horses grazing a native heliotrope (*Heliotropium ovalifolium*)', *Australian Veterinary Journal*, 77(6), 401-402.
- Cross, DL, Redmond, LM & Strickland, JR 1995 'Equine fescue toxicosis: signs and solutions', *Journal of Animal Science*, 73(3), 899-908.
- Diaz, GJ and Boermans, HJ 1994 'Fumonisin toxicosis in domestic animals: a review', *Veterinary & Human Toxicology*, 36(6), 548-55.
- Evans, TJ 2002 'Endocrine alterations associated with ergopeptine alkaloid exposure during equine pregnancy', *Veterinary Clinics of North America, Equine Practice*, 18(2), 371-378.
- Freestone, JF and Seahorn, TL 1993 'Miscellaneous conditions of the equine head', *Veterinary Clinics of North America, Equine Practice*, 9(1), 235-242.
- Fu, PP, Chou, MW, Xia Q, Yang, YC, Yan, J, Doerge, DR & Chan, PC 2001 'Genotoxic pyrrolizidine alkaloids and pyrrolizidine alkaloid N-oxides - mechanisms leading to DNA adduct formation and tumorigenicity', *Journal of Environmental Science and Health. Part C, Environmental Carcinogenesis & Ecotoxicology Reviews*, 19(2), 353-385.
- Gardner, SY, Cook, AG, Jortner, BS, Troan, BV, Sharp, NJH, Campbell, NB & Brownie, CF 2005 'Stringhalt associated with a pasture infested with *Hypochoeris radicata*', *Equine Veterinary Education. Equine Veterinary Journal*, 17(3), 118-122.
- Griffin, WJ & Lin, GD 2000 'Chemotaxonomy and geographical distribution of tropane alkaloids', *Phytochemistry*, 53(6), 623-637.
- Hagglund, S 2002 'Alsike clover - undesirable in pasture grass?', *Svensk Veterinartidning, Sveriges Veterinarforbund*, Stockholm, 54(6), 332-333.
- Hamburger, M, Wang, Y, Cheng, CHK, Costall, B, Naylor, RJ, Jenner, P & Hostettmann, K 1991 'Neurotoxic sesquiterpene lactones from the yellow star thistle *Centaurea solstitialis* [the cause of a neurological disease of horses]: large-scale isolation and biological activity', *Planta Medica*, 57(8), A8-A9.
- Hasso, SA 2003 'Non-fatal aflatoxicosis in Arabian horses in Iraq', *Veterinary Record*, 152(21), 657-658.
- Heeswijck, R & van McDonald, G 1992 'Acremonium endophytes in perennial ryegrass and other pasture grasses in Australia and New Zealand', *Australian Journal of Agricultural Research*, 43(8), 1683-1709.
- Hughes, KJ, Dart, AJ & Hodgson, DR 2002 'Suspected *Nerium oleander* (Oleander) poisoning in a horse', *Australian Veterinary Journal*, 80(7), 412-415.
- Huntington, PJ, Jeffcott, LB, Friend, SCE, Luff, AR, Finkelstein, DI & Flynn, RJ 1989 'Australian stringhalt - epidemiological, clinical and neurological investigations', *Equine Veterinary Journal*, 21(4), 266-273.
- Huxtable, CR, Chapman, HM, Main, DC, Vass, D, Pearse, BHG & Hilbert, BJ 1987 'Neurological disease and lipofuscinosis in horses and sheep grazing *Trachyantha divaricata* (branched onion weed) in south Western Australia', *Australian Veterinary Journal*, 64(4), 105-108.
- Irigoyen, LF, Graca, DL & Barros, CSL 1991 'Experimental poisoning with *Cassia occidentalis* (Leg. Caes) in horses', *Pesquisa Veterinaria Brasileira*, 11(1-2), 35-44.
- Krook, L, Wasserman, RH, Shively, JN, Tashjian, AH Jr, Brokken, TD & Morton, JF 1975 'Hypercalcemia and calcinosis in Florida horses: implication of the shrub, *Cestrum diurnum*, as the causative agent', *Cornell Veterinarian*, 65, 26-56.
- Lee, ST, Stegelmeier, BL, Gardner, DR & Vogel, KP 2004 'Characterization of steroidal saponin in *Panicum virgatum* L. (Switchgrass)', *Poisonous plants and related toxins. Poisonous Plants Symposium Proceedings*, 329-334.
- Locke, KB, McEwan, DR & Hamdorf, IJ 1980 'Experimental poisoning of horses and cattle with *Swainsona canescens* var *horniana*', *Australian Veterinary Journal*, 56(8), 379-383.

- Mande, JD, Mbithi, PMF, Nguhiu-Mwangi, JA & Mbiuki, SM 1993 'Cestrum poisoning in a young horse - a case report', *Bulletin of Animal Health and Production in Africa*, 41(2), 139-141.
- Martin, BW, Terry, MK, Bridges, CH & Bailey, EM Jr 1981 'Toxicity of *Cassia occidentalis* in the horse', *Veterinary & Human Toxicology*, 23(6), 416-417.
- McConnico, RS & Brownie, CF 1992 'The use of ascorbic acid in the treatment of 2 cases of red maple (*Acer rubrum*)-poisoned horses', *Cornell Veterinarian*, 82(3), 293-300.
- McKenzie, RA 1984 'Poisoning of horses by oxalate in grasses', *Plant toxicology. Proceedings of the Australia-U.S.A. Poisonous Plants Symposium*, Brisbane, Australia, 150-154.
- McKenzie, RA 1988 'Purple pigeon grass (*Setaria incrassata*): a potential cause of nutritional secondary hyperparathyroidism of grazing horses', *Australian Veterinary Journal*, 65(10), 329-330.
- McKenzie, RA & Brown, OP 1991 'Avocado (*Persea americana*) poisoning of horses', *Australian Veterinary Journal*, 68(2), 77-78.
- Miles, CO, Menna, ME, di Jacobs, SWL, Garthwaite, I, Lane, GA, Prestidge, RA, Marshall, SL, Wilkinson, HH, Schardl, CL, Ball, OJP and Latch, GCM 1998 'Endophytic fungi in indigenous Australasian grasses associated with toxicity to livestock', *Applied and Environmental Microbiology*, 64(2), 601-606.
- Nation, PN 1989 'Alsike clover poisoning: a review', *Canadian Veterinary Journal*, 30(5), 410-415.
- Oelrichs, PB, Hill, MW, Vallely, PJ, MacLeod, JK & Molinski, TF 1983 'Toxic tetranotriterpenes of the fruit of *Melia azedarach*', *Phytochemistry*, 22(2), 531-534.
- Oelrichs, PB, Calanasan, CA, MacLeod, JK, Seawright, AA & Ng, JC 1995 'Isolation of a compound from *Eupatorium adenophorum* (Spreng.) [*Ageratina adenophora* (Spreng.)] causing hepatotoxicity in mice', *Natural Toxins*, 3(5), 350-354.
- O'Sullivan, BM & Goodwin, JA 1977 'An outbreak of *Swainsona* poisoning in horses', *Australian Veterinary Journal*, 53(9), 446-447.
- Owen, RR 1985 'Potato poisoning in a horse', *Veterinary Record*, 117(10), 246.
- Parton, K 2000 'Onion toxicity in farmed animals', *New Zealand Veterinary Journal*, 48(3), 89.
- Pearson, W, Boermans, HJ, Bettger, WJ, McBride, BW & Lindinger, MI 2005 'Association of maximum voluntary dietary intake of freeze-dried garlic with Heinz body anemia in horses', *American Journal of Veterinary Research*, 66(3), 457-465.
- Reed, KFM, Walsh, JR, Cross, PA, McFarlane, NM & Sprague, MA 2004 'Ryegrass endophyte (*Neotyphodium lolii*) alkaloids and mineral concentrations in perennial ryegrass (*Lolium perenne*) from southwest Victorian pasture', *Australian Journal of Experimental Agriculture*, 44(12), 1185-1194.
- Riet-Correa, F, Mendez, MC, Schild, AL, Bergamo, PN & Flores, WN 1988 'Agalactica, reproductive problems and neonatal mortality in horses associated with the ingestion of *Claviceps purpurea*', *Australian Veterinary Journal*, 65(6), 192-3.
- Robles M, Wang N, Kim R & Choi BH 1997 'Cytotoxic effects of repin, a principal sesquiterpene lactone of Russian knapweed', *Journal of Neuroscience Research*, 47(1), 90-7.
- Shanks, G, Tabak, P, Begg, A & P. Bryden, WL 1995 'An outbreak of acute leukoencephalomalacia associated with fumonisin intoxication in three horses', *Australian Equine Veterinarian*, 13(2), 17-18.
- Sharma, OP, Dawra, RK, Kurade, NP & Sharma PD 1998 'A review of the toxicosis and biological properties of the genus *Eupatorium*', *Natural Toxins*, 6(1), 1-14.
- Slocombe, RF, Huntington, PJ, Friend, SCE, Jeffcott, LB, Luff, AR. & Finkelstein, DK 1992 'Pathological aspects of Australian stringhalt', *Equine Veterinary Journal*, 24(3), 174-183.
- Spangler, RE 2003 'Taxonomy of *Sarga*, *Sorghum* and *Vacoparis* (Poaceae: Andropogoneae)', *Australian Systematic Botany*, 16(3), 279-299.
- Stair, EL, Edwards, WC, Burrows, GE & Torbeck, K 1993 'Suspected red maple (*Acer rubrum*) toxicosis with abortion in two Percheron mares', *Veterinary & Human Toxicology*, 35(3), 229-230.
- Todd, FG, Stermitz, FR, Shultheis, P, Knight, AP & Traub-Dargatz, J 1995 'Tropane Alkaloids and Toxicity of *Convulvulus arvensis*', *Phytochemistry*, 39(2), 301-303.
- Tukov, FF, Anand, S, Gadepalli, RS, Gunatilaka, AA, Matthews, JC & Rimoldi, JM 2004 'Inactivation of the cytotoxic activity of repin, a sesquiterpene lactone from *Centaurea repens*', *Chemical Research in Toxicology*, 17, 1170-1176.
- Vetter, J 2000 'Plant cyanogenic glycosides', *Toxicon*, 38(1), 11-36.
- Vetter, J 2004 'Poison hemlock (*Conium maculatum* L.)', *Food and Chemical Toxicology*, 42(9), 1373-1382.

Wheatley, WM, Hume, DE, Kemp, HW, Monk, MS, Lowe, KF, Popay, AJ, Baird, DB & Tapper BA 2003 'Effects of fungal endophyte on the persistence and productivity of tall fescue at 3 sites in eastern Australia', *Proceedings of the 11th Australian Agronomy Conference*, Geelong, Victoria. Australian Society of Agronomy.

Williams, MC 1980 'Toxicological investigations on *Astragalus hamosus* and *Astragalus sesameus*', *Australian Journal of Experimental Agriculture and Animal Husbandry*, 20(103), 162-165.

Williams, S & Scott, P 1984 'The toxicity of *Datura stramonium* (thorn apple) to horses', *New Zealand Veterinary Journal*, 32(4), 47.

Woods, LW, Filigenzi, MS, Booth, MC, Rodger, LD, Arnold, JS & Puschner, B 2004 'Summer pheasant's eye (*Adonis aestivalis*) poisoning in three horses', *Veterinary Pathology*, 41(3), 215-220.

Agricultural fact sheets and newsletters

Allan, H 2001 'Fireweed', Agfact P7.6.26, NSW Agriculture.

Allan, H 2002 'Pastures for horses', Agfact P2.4.3, NSW Agriculture.

Allen, J 2004 'Avoiding ARGT in high rainfall areas', Farmnote No. 2/2004, Government of Western Australia, Department of Agriculture.

Animal Health Surveillance Quarterly Report 2001, 6(4), 11.

Animal Health Surveillance Quarterly Report 2002, 7(1), 11.

Animal Health Surveillance Quarterly Report 2003, 8(4), 10.

Animal Health Surveillance Quarterly Report 2004, 9(1), 9.

Animal Health Surveillance Quarterly Report 2004, 9(2), 11, 17.

Anon 2004 'Paterson's curse *Echium plantagineum*', Fact Sheet ISBN 1 74152 038 X, State of Victoria, Department of Sustainability and Environment.

Anon 2005 'Paterson's curse and horse health', Information Sheet, Issued Sept 2005, ACT Government, Environment ACT.

Bourke, C 2000 'Annual ryegrass toxicity and blown grass/beard grass poisoning', Agfact AO.9.4, NSW Agriculture.

Clarke, L 2002 'Setaria for coastal pastures', Agnote DPI-224, NSW Agriculture.

Coventry, J 2001 'Swainsona poisoning in cattle and horses', Agnote No. K28, The Northern Territory Department of Business, Industry and Resource Development.

Dellow, JJ, Bourke, CA & McCaffery, AC 2004 'Common Heliotrope', Agfact P7.6.56, NSW Agriculture.

Dellow, JJ, Bourke, CA & McCaffery, AC 2004 'Blue Heliotrope', Agfact P7.6.57, NSW Agriculture.

Griffiths, N 2004 'Green Cestrum', Agfact P7.6.44, NSW Agriculture.

Harris, C 2003 'Tall Fescue', Agfact P2.5.6, NSW Agriculture.

Hawkins, C & Kruger, E, 2001 'Cape Tulips', Farmnote No. 10/2001, Government of Western Australia, Department of Agriculture.

Hawkins, C, Kruger, E, Peirce, M & Peirce, J 2004 'Cape Tulip Control in Pastures', Farmnote No. 81/2004, Government of Western Australia, Department of Agriculture.

Hills, LA 1999 'Johnson grass', Agnote No. F43, The Northern Territory Department of Business, Industry and Resource Development.

Hosking, JR, Sheppard, AW. & Smith, JMB, 2003 'Broom (*Cytisus scoparius*)', CRC Weed Management Systems.

Land Protection 2003 'Bellyache bush (*Jatopha gossyplifolia*)', Pest Series QNRM01262, The State of Queensland, Department of Natural Resources and Mines.

Land Protection 2004 'Crofton weed (*Ageratina adenophora*)', Pest Series QNRM01233, The State of Queensland, Department of Natural Resources and Mines.

Land Protection 2004 'Mist flower (*Eupatorium riparium*)', Pest Series QNRM01237, The State of Queensland, Department of Natural Resources and Mines.

Land Protection 2004 'Castor oil plant (*Ricinus communis*)', Pest Series QNRM01261, The State of Queensland, Department of Natural Resources and Mines.

- Locicato, S 1998 'Lotus', Agricultural Note AG0718, State of Victoria, Department of Primary Industries.
- McIlroy, DA & Faithfull, I 1998 'Hardheads/Russian knapweed', Landcare Note LC0215, State of Victoria, Department of Natural Resources and Environment.
- McKenzie, R 1998 'Big head in horses grazing tropical pasture grasses', RIRDC Equine Research News, Issue 1/98.
- McLaren, D & Turner, A 1999 'Blue Canary-grass', Landcare Note LC0257, State of Victoria, Department of Natural Resources and Environment.
- McWhirter, L 2004 'Bracken Fern', Agnote DPI-506, NSW Agriculture.
- Moore, D 2003 Rubber Vine (*Cryptostegia grandiflora*), CRC Weed Management Systems.
- Naughton, M & Bourke, C 2005 'St John's wort', Agfact P7.6.1, NSW Agriculture.
- Reed, K 1999 'Tall Fescue', Agricultural Note AG0716, State of Victoria, Department of Natural Resources and Environment.
- Rose, RJ 1995 'Australian Stringhalt', RIRDC Equine Research News, Issue 2/1995.
- Sullivan, P, Hosking, J & Sheppard, A 2003 'Paterson's curse', Agfact P7.6.51, NSW Agriculture.
- Thomas, M 2004 'Perennial Grasses – Potential Grazing Issues', Farmnote No. 29/2004, Government of Western Australia, Department of Agriculture.
- Trounce, B 2003 'Crofton weed', Agfact P7.6.36, NSW Agriculture.
- Trounce, B 2004 'Noogoora burr and Californian burr', Agfact P7.6.23, NSW Agriculture.
- Trounce, B, Hanson, C, Lloyd, S, Laconis, L & Thorpe, J 2003 'Weed Management Guide, Horsetails (*Equisetum* species)', CRC Weed Management Systems.
- Turnbull, K 1998 'Wild garlic', Landcare Note LC0179, State of Victoria, Department of Natural Resources and Environment.
- Turnbull, K 1998 'Hemlock', Landcare Note LC0183, State of Victoria, Department of Natural Resources and Environment.
- Turnbull, K 1998 'Variegated Thistle', Landcare Note LC0187, State of Victoria, Department of Natural Resources and Environment.
- Turnbull, K 1998 'Amsinckia', Landcare Note LC0198, State of Victoria, Department of Natural Resources and Environment.
- Turnbull, K 1998 'English Broom', Landcare Note LC0211, State of Victoria, Department of Natural Resources and Environment.
- Watson, RW, McDonald, WJ & Bourke, CA 2000 'Phalaris grasses', Agfact P2.5.1, NSW Agriculture.

CD Rom resources

Declared plants of Australia: An Identification and Information System, 2004 CD-ROM Centre for Biological Information Technology, The University of Queensland, Australia. <<http://www.cbit.uq.edu.au>>

Botanica on CD Rom, 1997 CR-ROM Random House, Australia.

Internet resources

Aiello, SE (ed.) 2003 'The Merck Veterinary Manual', 8th edn <<http://www.merckmanual.com>>, Merck & Co., Inc. New Jersey, USA. Accessed periodically June to December 2005.

Beasley, V (ed.) 2004 'Veterinary Toxicology', Online reference for veterinary toxicology, Accessed through <<http://www.ivis.org>>. International Veterinary Information Service (IVIS), Ithaca, NY. Accessed periodically June to December 2005.

Knight, AP & Walter, RG (eds.) 2002 'A Guide to Plant Poisoning of Animals in North America', Accessed through <<http://www.ivis.org>>, Publisher: Teton NewMedia, Jackson WY. Internet publisher: International Veterinary Information Service (IVIS), Ithaca, NY. Accessed periodically June to December 2005.

Orchard T (project coordinator) 'Australian Plant Census: A Database of Plant Names for Australia'. <<http://www.anbg.gov.au/chah/apc/index.html>>, Council of Heads of Australasian Herbaria. Accessed periodically June to December 2005.

PlantNET <<http://plantnet.rbgsyd.nsw.gov.au/>>, Botanic Gardens Trust, NSW, Australia. Accessed periodically June to December 2005.

Reference for Distribution maps

The distribution maps used in this book were generated from data obtained through 'Australia's Virtual Herbarium', <<http://www.rbgs.vic.gov.au/avh/>>. Accessed January 2006.

Index

-amino proprionitrile 103

A

Abrus precatorius 56
Acacia spp 33
Acer rubrum 88
Aconitum spp 101
Acremonium lolii 92
Acroptilon repens 83
Adonis 43
Adonis microcarpa 43
Aflatoxins 95
Aflatoxicosis 95
African star grass 33
Ageratina adenophora 68
Ageratina riparia 69
Agrostemma githago 102
Agrostis avenacea 98
Alcohols and Acids 51-54
Alkali disease 81
Alkaloids 7-29
Allium spp 60
Almonds 31
Alocasia spp 100
Alsike clover 79
Amaryllis belladonna 101
Amsinckias 16
Angel's trumpet 23
Anguina funesta 97
Annual beardgrass 98
Annual ryegrass 97
Ant bush 77
Apple of Sodom 73
Apricots 31
Arsenic bush 77
Arsenic weed 78
Arum lily 100
Asclepias spp 40
Aspergillus spp 95
Atropa belladonna 101
Australian stringhalt 70
Autumn pheasant's eye 43
Avocado 76
Azaleas 99

B

Barbados lily 101
Barooga weed 16
Bathurst burr 47
Beans 58
Belladonna 101
Belladonna lily 101
Bellyache bush 57
'Big head' 51-52
Birdsville horse disease 89
Birdsfoot trefoil 33
Birdsville indigo 89
Bishop's beard 14

Bitter apple 75
Black bean 67
Blackberry nightshade 72
Black locust 57
Black physic nut 57
Black-spined nightshade 73
Black vomit nut 58
Blown grass 98
Bluebush pea 11
Blue canary grass 17
Blue heliotrope 14
Blue periwinkle 42
Blueweed 83
Brachiaria decumbens 52
Brachiaria mutica 52
Brachyachne convergens 35
Bracken 61
Branched onion weed 85
Brazilian stinging nut 58
Broad beans 58
Brooms 27
Broughton pea 19
Brugmansia spp 23
Bryophyllum spp 38
Buffalo burr 74
Buffel grass 51
Burrweed 47
Buttercups 44

C

Caladium bicolor 100
Calcinogenic glycosides 50
Calcium oxalate 100
Calico bush 99
California fern 25
Californian burr 46
Calla lily 100
Caltha 44
Canary broom 28
Cape broom 28
Cape lilac 66
Cape tulips 39
Captain Cook tree 36
Carboxyatractyloside 46-49
Cardiac glycosides 35-43
Carrot fern 25
Cascabela thevetia 36
Cassia obtusifolia 78
Cassia occidentalis 77
Cassia tora 78
Castanospermum australe 67
Castor oil plant 55
Caterpillar weed 14
Catsear 70
Cat's paw 69
Catweed 68
Celery-leaf buttercup 44
Cenchrus ciliaris 51
Centaurea repens 83
Centaurea solstitialis 84
Cestrum diurnum 50
Cestrum nocturnum 49
Cestrum parqui 48
Cheilanthes spp 63
Cherries 31
Chewing disease 83-84
Chillagoe horse disease 75
Chillagoe horse poison 75
Chinaberry 66
Chinese senna 78
Chinkerichee 42
Chive 60
Christmas rose 100
Clasping heliotrope 14
Claviceps paspali 93
Clematis 44, 101
Clivia 101
Clotbur 47
Cockle burr 46
Cocoyam 100
Coffee senna 77
Coffee weed 78
Colocasia spp 100
Columbus grass 32
Common bindweed 21
Common cocklebur 47
Common elder 100
Common heliotrope 14
Common ivy 102
Common ragwort 12
Common thornapple 22
Conium maculatum 25
Consolida ambigua 101
Convallaria majalis 99
Convolvulus arvensis 21
Cook tree 36
Coondai couch 33
Corkwood 23
Corn cockle 102
Corn pink 102
Corsican hellebore 100
Corynetoxins 97-98
Cotton bushes 40
Cotton leaf physic nut 57
Couch grasses 33
Crab's eye 56
Creeping crofton weed 69
Creeping heliotrope 14
Creeping indigo 89
Creeping knapweed 83
Crofton weed 68
Crotalaris 9
 Chillagoe horse disease 75
Crotalaria aridicola ssp. *aridicola* 75
Crotalaria brevis 11
Crotalaria crispata 9
Crotalaria dissitiflora 9

Crotalaria eremaea 11
Crotalaria juncea 10
Crotalaria linifolia 10
Crotalaria medicaginea var. *neglecta* 75
Crotalaria mitchellii 10
Crotalaria montana 10
Crotalaria novae-hollandiae 10
Crotalaria pallida 10
Crotalaria ramosissima 9
Crotalaria retusa 10
Crotalaria spectabilis 10
Crotalaria trifoliastrum 75
Crotalaria verrucosa 10
Crow garlic 60
Cryptostegia grandiflora 37
Cryptostegia madagascariensis 37
Cuban physic nut 58
Cunjevoi 100
Curcas bean 58
Cursed crowsfoot 44

Cyanide 30

Cyanogenic glycosides 30-34

Cynodon convergens 33
Cynodon nlemfuensis 33
Cynodon plectostachyus 33
Cytisus monspellulanus 28
Cytisus scoparius 27

D

Daffodils 107
Daggerweed 47
Dandelion 71
Datura spp 22
Day blooming cestrum 50
Day jasmine 50
Day jessamine 50
Deadly nightshade 107
Dead Sea apple 73
Delphiniums 101
Dendrocnide moroides 91
Diaportha toxica 96
Dicky plant 36
Dieffenbachia seguine 100
Digitalis purpurea 41
Digitaria decumbens 51
Digitaria eriantha ssp. *pentzii* 51
Ditchbur 46

Diterpene alkaloids 101

Diterpene esters 64-65

Downy thornapple 22
Duboisia leichhardtii 24
Duboisia myoporoides 23
Dumb cane 100
Dune onion weed 85
Dwarf darling pea 19

E

Echium plantagineum 8
Elder 100
Elephant's ear 100
Endophyte 92, 93, 94

English broom 27
English ivy 102
English yew 20
Equine leukoencephalomalacia 96
Equine nigropallidal
encephalomalacia 83

Equisetum spp 63
Eremophila maculata 32
Eupatorium adenophorum 68
Eupatorium glandulosum 68
Eupatorium pasdadense 68
Eupatorium riparium 69
Euphorbia pepylus 65
Euphorbia pulcherrima 103
Euphorbia terracina 64
European cocklebur 46
European heliotrope 14
Everlasting pea 103
Eye opening tree 23

F

Faba beans 59
False acacia 57
False caper 64
False dandelion 70
Fiddlenecks 16
Field bindweed 21
Field morning glory 21
Filmy lily 101
Fierce thornapple 22
Fire lily 101
Fireweed 12
Flatweed 70
Flax 34
Foetid cassia 78
Fool's parsley 25
Foxglove 41
French broom 28

Fumonisin 95

Fusarium moniliforme 96
Fusarium verticillioides 96

G

Galanthus nivalis 101
Garlic 60
Genista monspessulana 28
Geraldton carnation weed 62
Gidee-Gidee 56

Glycoalkaloids 50, 72

Glycosides 30-50

Golden chain tree 27
Golden star thistle 84
Gomphocarpus spp 40
Gomphrena celosioides 92
Gomphrena weed 86
Grain legumes 58
Grain sorghum 32
Grayanotoxins 99
Greater periwinkle 42
Green cestrum 48
Green poisonberry 48

Grey rattlepod 9
Grey swainsona 19
Guinea grass 45, 52
Gympie stinger 91

H

Hairy darling pea 19
Hairy thornapple 22
Hardheads 83
Hedera helix 102
Hedgehog burweed 46
Heliotropes 14
Heliotropium amplexicaule 14
Heliotropium coromandelianum var.
ovalifolium 15
Heliotropium europaeum 14
Heliotropium gracile 15
Heliotropium ovalifolium 15
Helleborus niger 44
Hemlock 25
Hindu thornapple 22
Hippeastrum spp 101
Holly 102
Homeria flaccida 39
Homeria miniata 39
Horsetails 63
Hunter burr 46
Hydrangea 99
Hydrangea macrophylla 99
Hymenocallis spp 101
Hypericum perforatum 54
Hypochaeris glabra 71
Hypochaeris radicata 70

I

Ilex aquifolium 102
Indian rubber vine 37
Indigofera linnaei 89
Indigofera spicata 89
Indolizidine alkaloids 18-20
Ipomoea spp 21
Ismene spp 101
Italian cocklebur 46
Ivy 102

J

Jatropha 57
Jatropha curcas 58
Jatropha gossypifolia 57
Java bean 78
Jequirity bean 56
Johnson grass 31
Jonquils 101

K

Kaffir lily 101
Kalmia angustifolia 99
Kalmia latifolia 99
Kidney beans 58
Kikuyu 52

Kimberly horse disease 9
Kimberly horse poison 9
Knapweed 83

L

Laburnum anagyroides 27
Lachnagrostis filiformis 98
Lady Campbell weed 8
Lambkill 99
Large cocklebur 46
Larkspur 101
Lathyrus latifolius 103
Lathyrus odoratus 103
Leafy spurge 64
Lectins 55-59
Leek 60
Leukoencephalomalacia 96
Ligustrum spp 82
Lily of the valley 99
Lima bean 59
Linseed 34
Linum usitatissimum 34
Lobelia 29
Lobelia spp 29
Locust tree 57
Lolium perenne 92
Lolium rigidum 97
Lotus corniculatus 33
Lucky nut 36
Lupins 28
 Piperidine alkaloid
 poisoning 25
 Lupinosis 96
Lupinus spp 26
Lycopersicon esculentum 74
Lycorine 101

M

Madagascar ragwort 12
Madagascar rubber vine 37
Madeira broom 28
Malva parviflora 87
Maple, red 88
Mapoon bush 81
Marsilea drummondii 62
Melia azedarach 66
Meliatoxins 66
Mexican devil 68
Mexican oleander 36
Milk weed 65
Mistflower 69
Monkshood 101
Montpellier broom 28
Moraea flaccida 39
Moraea miniata 39
Moreton Bay chestnut 67
Morinda reticulata 81
Morning glory 21
Mother of millions 38
Mountain laurel 99
Mulberry-leaved stinger 91
Mycotoxins 92-96

N

Narcissus spp 101
Nardoo 62
Narrowleaf rattlepod 10
Native couch 33
Native fuchsia 32
Native thornapple 22
Nectarines 31
Neotyphodium lolii 92, 94
Neptunia amplexicaulis 81
Nerium oleander 35
New Holland rattlepod 10
Nicotiana spp 29
 Piperidine alkaloid
 poisoning 25
Nicotine 29
Nigerian senna 77
Night jessamine 49
Night scented jasmine 49
Nightshades 72
Noogoora burr 46
Numinbah horse sickness 68
Nutritional Secondary
 Hyperparathyroidism 51

O

Oaks 53
Oleander 35
One leaf cape tulip 39
Onion 60
Ornithogalums 42
Ornithogalum spp 42

P

Pangola grass 51
Panicum antidotale 45
Panicum coloratum 45
Panicum maximum 45, 52
Panicum miliaceum 45
Panicum muticum 52
Panicum virgatum 45
Panicum spp 45, 52
Paper whites 101
Paradoxa grass 17
Para grass 52
Paspalum 93
Paspalum staggers 93
Paterson's curse 8
Peace lily 100
Peaches 33
Pennisetum clandestinum 52
Perennial pea 103
Perennial ryegrass 92
Perennial ryegrass staggers 92
Persea americana 76
Persian lilac 66
Petty spurge 65
Phalaris coarulescens 17
Phalaris paradoxa 17
Phaseolus limensis 58

Phaseolus lunatus 58
Phaseolus vulgaris 58
Pheasant's eye 43
Philodendrons 100
Physic nut 58
Pieris 99
Pig lily 100

Piperidine alkaloids 25, 26

Pissabed 71
Plums 31
Poinsettia 64
Poison apple 73
Poison buttercup 44
Poison corkwood 23
Poisonous corkwood 24
Poison root 25
Polypogon monspeliensis 98
Potatoes 74
Potato weed 14
Pregnant onion 42
Prickly burrweed 47
Privets 82
Propyl disulfide 60
Proteins and Amino acids 55-63
Protoanemonin 44

Prunus spp 31

Prussic acid 30

Pteridium spp 61
Pulses 58
Purge nut 58
Purple-flowered rattlepod 10
Purple bugloss 8
Purple pigeon grass 52
Purple rubber vine 37
Purpletop 14
Pyridine alkaloids 29
Pyrrrolizidine alkaloids 7-16

Q

Queensland duboisia 24
Quercus spp 53
Quinolizidine alkaloids 26-28
Quinones 54

R

Ragwort 12
Ranunculus sceleratus 44
Rathayibacter toxicus 97
Red chamomile 43
Red clover 79
Red maple 88
Rhododendrons 99
Ricinus communis 55
River eupatorium 69
Riverina bluebell 8
Robinia pseudoacacia 57
Rock ferns 63
Rosary bean 56
Rough cocklebur 46
Rubber vine 37
Russian knapweed 83

S

Sacred lily of the Incas 101
Salvation Jane 8
Sambucus nigra 100
Scotch broom 27
Selenium poisoning 81
Selenium weed 81
Senecio amarillo 12
Senecio jacobaea 12
Senecio madagascariensis 12
Senecios 12
Senna 77
Senna obtusifolia 78
Senna occidentalis 77
Senna tora 78
Septicweed 77
Setarias 51
Setaria incrassata 52
Setaria sphacelata 51
Shallot 60
Sheep's burr 46
Sheep laurel 99
Showy rattlepod 10
Sicklepod 78
Signal grass 52
Silver horsenettle 73
Silverleaf nightshade 73
small crofton weed 69
Small flowered mallow 87
Small fruited pheasant's eye 43
Smooth catsear 71
Smooth darling pea 18
Smooth flatweed 71
Snowdrop 101
Soft khaki weed 86
Solanum hermännii 73
Solanum linnaeanum 73
Solanum nigrum 72
Solanum rostratum 74
Solanums 72
Solanum sodemeum 73
Solanum tuberosum 74
Soluble oxalates 51-52
Sorghum 31
Sorghum bicolor 32
Sorghum drummondii 32
Sorghum halepense 31
Sorghum halepense x *almum* 32
Sorghum sudanense 32
South Africa pigeon grass 51
Spanish thistle 47
Spathiphyllum spp 100
Spider grass 33
Spider lily 101
Spiny burweed 47
Spiny cocklebur 47
Spiny nightshade 74
Spotted emu bush 32
Spotted fuchsia 32
Spurges 64
Stagger wort 12
Star of Bethlehem 42

St Barnaby's thistle 84

Steroidal saponins 45

Sticky eupatorium 68
Sticky snakeroot 68
Stinging nettles 90
Stinking hellebore 100
Stinking pea 77
Stinking willy 12
Stinkweed 77
St James wort 12
St John's wort 54
Strapweed 85
Streaked rattlepod 10
Stringhalt, Australian 70
Sudan grass 32
Sunhemp 10
Swainsona 18
Swainsona canescens 19
Swainsona galegifolia 18
Swainsona greyana 19
Swainsona luteola 19
Swainsona procumbens 19
Swainsona queenslandica 18
Sweet pea 103

T

Tallebudgera horse disease 68

Tannic acid 53

Tansy ragwort 12
Taraxacum officinale 71
Taro 100

Taxine alkaloids 20

Taxus baccata 20
Teline monspessulana 28

Terpenes 64-66

Terracina spurge 64
Texas umbrella tree 66
Thevetia nereifolia 36
Thevetia peruviana 36

Thiaminase 61-63

Thornapples 22
Thorny burweed 47
Three cornered garlic 60
Tobacco 29
Tomatoes 74
Trachyandra divaricata 85
Trefoil rattlepod 75
Trifolium hybridum 80
Trifolium pratense 79
Triterpenoid saponins 102
Tropane alkaloids 21-25, 48, 49, 50
Tryptamine alkaloids 17
Tulip cedar 66
Turnsole 14
Two leaf cape tulip 39

U

Umbrella cedar 66
Urochloa decumbens 52
Urochloa mutica 52
Urtica spp 90

V

Vicia faba 59
Vinca major 42

W

Walkabout disease 9
Wanderie curse 14
Wattles 33
Wedge-leaf rattlepod 10
White cedar 66
White cestrum 50
White weed 69
Wild carrot 25
Wild heliotrope 14
Wild parsnip, 25
Wild verbena 14
Willow jasmine 48
Willow leaved jessamine 48
Winter fern 25
Winter rose 100
Wisteria 102
Wode whistle 25

X

Xanthium spinosum 47
Xanthium strumarium 46

Y

Yellow basswood 23
Yellow burrweeds 16
Yellow cockspur 84
Yellow locust 57
Yellow oleander 36
Yellow rattlepod 10
Yellow star thistle 84
Yew 20

Z

Zantedeschia aethiopica 100

Plants Poisonous to Horses

An Australian Field Guide

Mellisa Offord

RIRDC Publication No. 06/048

This book is a guide for horse owners to help them prevent plant poisoning in their horses. It clearly outlines the factors that influence the risk of plant poisoning and the ways to reduce this risk. The types of toxins that can be found in plants are discussed, along with the signs of poisoning that may be seen in horses that have ingested toxic plant material.

A description of each plant is provided, including structure, growth habit and identifying features.

Management notes suggest ways of dealing with poisonous plants on properties.

The book includes a comprehensive list of ornamental plants that are known to be toxic to horses.

The reference list is a useful resource for further reading and includes the journal articles, industry papers, books, CD Roms and Internet resources that were used to create this publication.

This guide is an addition to RIRDC's diverse range of over 1500 research publications. It forms part of our Horse Research and Development Program which aims to assist the Australian horse industry.

Most of our publications are available for viewing, downloading or purchasing online through our website:

www.rirdc.gov.au

Rural Industries Research and Development
Corporation
Level 2, 15 National Circuit
Barton ACT 2600

PO Box 4776
Kingston ACT 2604

Phone: 02 6272 4819
Fax: 02 6272 5877
Email: rirdc@rirdc.gov.au
Web: www.rirdc.gov.au

RIRDC Shaping the future

