Silverleaf nightshade

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Introduction

Silverleaf nightshade (*Solanum elaeagnifolium*) is a deep-rooted summer-growing perennial plant from the tomato family Solanaceae.

Silverleaf nightshade may be confused with other Solanaceae species, quena and western nightshade. However, there are distinct features which make silverleaf nightshade quite different from other species (see Table 1).

The serious reduction of crop and pasture production makes silverleaf nightshade one of the worst weeds in New South Wales. It is readily spread by seed and root segments and once established is very difficult to control.

Silverleaf nightshade contains alkaloids which are toxic to stock, although the incidence of poisoning in Australia has been very low as it is generally avoided by most stock.

Silverleaf nightshade is declared a noxious weed in some parts of NSW (see page 6).

History

Silverleaf nightshade is a native of North America and is the most widespread perennial weed in Arizona. It was first found in Australia in 1901 at Bingara on the north-west slopes of NSW.

Silverleaf nightshade is now found throughout most parts of NSW, south-eastern Queensland, Victoria, South Australia and Western Australia.

There are slight physiological differences between silverleaf nightshade colonies, which are thought to be due to repeated introductions of the weed into Australia.

Description

The typical silverleaf nightshade is an erect, multi-stemmed perennial plant growing up to 60 cm. The leaves are 5–10 cm long, have wavy edges and are silvery-green with a paler undersurface.

Short, brown-yellow spines approximately 5 mm long occur on the stems and petioles (short stems attaching the leaves to main stems). Flowers up to

Silverleaf nightshade flowers can be purple or white.

(Photos: A. Johnson)
25 mm in diameter have five purple or white petals with five yellow stamens 7–9 mm in length.

Berries are green striped, round, smooth, commonly 1 cm in diameter and turn yellow-orange when ripe.

Green berries that are only four weeks old and as small as 7 mm in diameter can contain viable seeds. Plants produce up to 60 berries, each containing 10–210 seeds.

Silverleaf nightshade has sharp spines on the stems and petioles and often on the underside of veins and the midrib of the leaves. (Photo: J.J. Dellow)

Table 1. Comparing the characteristics of silverleaf nightshade, quena and western nightshade.

<table>
<thead>
<tr>
<th></th>
<th>Silverleaf nightshade</th>
<th>Quena</th>
<th>Western nightshade</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Habit</strong></td>
<td>Stout, erect</td>
<td>Short, erect</td>
<td>Short, erect</td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td>30–100 cm</td>
<td>Up to 30 cm</td>
<td>30 cm</td>
</tr>
<tr>
<td><strong>Leaves</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– margins</td>
<td>Wavy edges, lower leaves lobed</td>
<td>Straight or slightly wavy edges</td>
<td>Often folded along midrib</td>
</tr>
<tr>
<td>– length</td>
<td>5–10 cm</td>
<td>Up to 5 cm</td>
<td>Up to 5 cm</td>
</tr>
<tr>
<td>– colour</td>
<td>Silvery-green</td>
<td>Grey-green</td>
<td>Grey-green</td>
</tr>
<tr>
<td></td>
<td>Lighter undersurface</td>
<td>Lighter undersurface</td>
<td>Lighter undersurface</td>
</tr>
<tr>
<td><strong>Spines</strong></td>
<td>Sharp on stems and petioles, few on leaves; often on underside of veins and midrib</td>
<td>Rarely occur</td>
<td>Mainly on stem and leaves</td>
</tr>
<tr>
<td></td>
<td>Occasionally absent.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flowers</strong></td>
<td>Blue to purple, occasionally white</td>
<td>Blue to purple</td>
<td>Blue to purple</td>
</tr>
<tr>
<td>– petals</td>
<td>5 pointed petals (rarely 4)</td>
<td>5 pointed petals</td>
<td>Only 4 petals</td>
</tr>
<tr>
<td>– stamens</td>
<td>5 stamens 7–9 mm long</td>
<td>5 stamens 3.5–5 mm long</td>
<td>4 stamens 3.5–5 mm long</td>
</tr>
<tr>
<td><strong>Calyx</strong></td>
<td>Recurved, no spines</td>
<td>Clasping, no spines</td>
<td>–</td>
</tr>
<tr>
<td><strong>Fruit</strong></td>
<td>Round, smooth</td>
<td>Ovid-shaped small bump at apex</td>
<td>Cone-shaped small bump at apex</td>
</tr>
<tr>
<td>– size (diameter)</td>
<td>6–12 mm</td>
<td>Up to 12 mm</td>
<td>Up to 12 mm</td>
</tr>
<tr>
<td><strong>Colour</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– unripe</td>
<td>Light and dark green stripes</td>
<td>Pale green</td>
<td>Pale green</td>
</tr>
<tr>
<td>– ripe</td>
<td>Yellow to orange</td>
<td>Yellow</td>
<td>Yellow</td>
</tr>
</tbody>
</table>

Roots of silverleaf nightshade can penetrate to depths of at least two metres. Farmers have even reported roots as deep as five metres. Each plant is usually part of a colony with inter-connecting root systems which helps give silverleaf nightshade its tremendous competitive ability and persistence.
Life cycle

Silverleaf nightshade regenerates from seed or from rhizomatous root material.

Seedlings emerge at any time from late spring until autumn, depending on rainfall. Emergence occurs more in disturbed soils than on crusted, compacted or undisturbed soil. Under favourable conditions up to 80% of fresh seed can germinate. Germination is greatest at depths of 1–3 cm, with optimum soil temperature above 15°C (at 3 cm).

Flowering usually begins in November and can continue until March. Berries are produced from December to March.

Berry formation coincides with carbohydrate translocation to the roots. Plants are dormant in winter when stems die back. The colony then produces new shoots in spring.

Seed longevity

Recent research has shown that silverleaf nightshade seed remains viable in the soil for a much shorter period than originally indicated. In trials, within 36 months 80% of fresh seed had decayed. For managing silverleaf nightshade, three to five years of controlling seedlings and seed set will significantly reduce seed numbers in the soil.

Spread

The spread of silverleaf nightshade is influenced by land use and rainfall patterns. It will grow on most soil types. Silverleaf nightshade will grow from seed and root segments in summer rainfall areas. In southern NSW, with less reliable summer rainfall, vegetative propagation is more common.

Land use, for example cultivation or livestock movement, will determine spread. Seed is spread by birds, water and livestock, particularly sheep. Most viable seed passes through the animal’s digestive system in two weeks, making this a mandatory ‘clean out’ period before stock can be moved to clean areas.

Cultivation breaks the roots into many small segments and can spread them over the paddock. Root segments can travel larger distances in soil on or attached to machinery. New plants can regenerate from pieces as small as 1 cm. Research shows that root segments, if kept moist, can remain viable in soil for up to 15 months.

Figure 1. Silverleaf nightshade life cycle
Impact

A survey of farmers in Victoria, New South Wales and South Australia shows that silverleaf nightshade has spread widely throughout the wheat belt of these states. On average, the total farm cost for silverleaf nightshade was $1730 per year for control and $7786 per year in production losses. Approximately 24% of infestations reported were medium to dense and 76% were rare to scattered. The average infestation size in New South Wales was 218 ha. The most affected land use was cropping 56% followed by grazing 34% (McLaren et al. 2004).

Cropping

Yields of summer broadleaf crops such as cowpeas, soybeans, sunflowers, mungbeans, cotton and horticultural crops can all be significantly reduced by silverleaf nightshade. This is due to strong competition by the weed and the lack of suitable in-crop herbicides. Trials have recorded a yield reduction of 50% in summer crops.

In winter crops, the competition is less obvious. The silverleaf nightshade only directly competes with the crop in late spring. Most of the yield losses are due to the depletion of soil moisture and nutrients in the summer prior to the crop.

One barley trial (1975) found that nine stems per square metre in the fallow reduced the barley yield by 12% in the following winter. Where glyphosate has been used in the fallow to control silverleaf nightshade, wheat yields have increased by 14% in normal years and up to 70% in drier years.

Pastures

Dense infestations of silverleaf nightshade can severely reduce autumn–winter production of annual pastures such as clover and ryegrass. When silverleaf nightshade was controlled, sub clover production eight weeks after autumn rain increased by 1500 kg/ha dry matter.

Stock

Stock poisoning from alkaloids contained in the silverleaf nightshade has occurred, but this is uncommon. Silverleaf nightshade is only moderately palatable to stock although it is toxic if eaten. Ripe fruit are the most poisonous part of the plant. Symptoms include profuse diarrhoea and profound nervous depression. There can be significant weight loss and eventually death, possibly due to heart failure, after 7 to 14 days of sickness.

Control

Silverleaf nightshade colonies are not easily controlled due to the extensive interconnecting root systems. Silverleaf nightshade has a tremendous capacity to regenerate from root fragments.

Continual vigilance is required when managing silverleaf nightshade. Colonies can re-establish even though they may have been treated for several seasons.

Cropping

Silverleaf nightshade infestations in cropping paddocks can be suppressed through the routine management of the crop. A well managed crop will reduce the available soil moisture to the weed and the use of herbicides to control other in-crop weeds can also assist with the suppression of silverleaf nightshade.

Silverleaf nightshade colonies can outcompete pastures and crops. (Photo: A. Johnson)
Summer cereal crops such as sorghums, maize and millets compete directly with silverleaf nightshade for moisture and using 2,4-D amine, fluoroxypr, atrazine or picloram according to the label to control in-crop weeds can provide some suppression of silverleaf nightshade. Seek advice before using these products as there are some restrictions specific to each crop on the herbicide label.

Winter cropping can be successful if silverleaf nightshade is suppressed during the summer months. Triazine-tolerant canola allows the use of atrazine for the control of numerous in-crop winter weeds and the subsequent residues can effectively suppress silverleaf nightshade seedlings and suckers in spring.

Using picloram herbicides to control winter cereal crop weeds may also provide residual suppression of silverleaf nightshade seedlings and suckers in spring.

Pastures

Good ground cover and competitive perennial pastures can be a key element in controlling silverleaf nightshade. Spring and summer dominant pastures are important as they strongly compete with silverleaf nightshade during its growing season.

Lucerne is deep rooted and dries out the soil profile limiting the colonies’ growth and regeneration. In areas where there is frequent summer rainfall perennial grass pastures provide better competition. Perennial grasses also suppress weed seedling emergence.

When grazing pastures where silverleaf nightshade is present it is important to maintain plant competition to discourage silverleaf nightshade growth.

Livestock, particularly sheep, should not be allowed to graze fruiting plants. About 10% of seed that passes through the digestive tract remains viable. Seed can take up to 2 weeks to pass through the gut.

Herbicides

Silverleaf nightshade seedlings need to be controlled immediately after harvest of winter crops or senescence of winter pastures. Silverleaf nightshade seedlings are readily controlled by all registered herbicides.

Spot spraying small infestations with Tordon 75D® or registered glyphosate herbicides is important to prevent silverleaf nightshade colonies from expanding. Good herbicide coverage is essential for effective control. Spray to thoroughly wet plants but avoid excessive run-off, a total of 2,000 to 3,000 litres of spray solution per hectare is recommended as per the label instruction.

To date there is no herbicide registered that is able to eradicate a silverleaf nightshade colony with a single application. However, colonies can be suppressed and run down with persistent management which includes annual herbicide applications and the prevention of berry-set.

When using herbicides on established silverleaf nightshade colonies, timing of control is very important to ensure that the roots are killed as well as the stems. Spraying colonies is most successful when plants are fresh after rainfall. If the plant is stressed or dormant the herbicides will have little or no effect.

Colonies will require control over several years. Use a number of herbicides in a program and seek advice from your district agronomist on the best program options for your district.

Program options could include spraying new shoots in late spring or early summer with 2,4-D amine, as this assists with exhausting root reserves and it results in uniform berry formation. Follow up by spraying with glyphosate or 2,4-D amine at early berry formation to prevent viable seed maturation. Use of 2,4-D amine is allowed under APVMA permit PER9786 which expires 8 March 2012. Copies of the permit can be viewed on or downloaded from the APVMA website, www.apvma.gov.au

Spray rate and adjuvant information is available from your district agronomist.

At the end of summer, during early berry formation, there is usually a movement of carbohydrates and nutrients into the root system and herbicides such as glyphosate can be carried from the leaves into the roots to enhance the control effect.

For a list of registered herbicides for controlling silverleaf nightshade in crops and pastures see the Noxious and environmental weed control handbook, available from NSW DPI bookshop, 1800 028 374 or www.dpi.nsw.gov.au/weeds

Cultivation

Cultivation is not a useful tool to use against silverleaf nightshade, and is more likely to drag root pieces to clean areas. All parts of the root system are capable of forming shoot buds. Suitable herbicides need to be used, rather than cultivation.

Slashing

Slashing is not an option for managing silverleaf nightshade as it recovers readily after slashing even under dry conditions. Silverleaf nightshade can also form berries close to the ground which will not be controlled by slashing.
Biological

After exhaustive studies in North America and Argentina, it was concluded that currently identified natural enemies of silverleaf nightshade would not adapt to the dry summer conditions in southern Australia.

The most damaging agent is the nematode *Orrinia phyllobia* which forms galls on leaves and stems but it is not suitable as it is not host specific.

The fungus *Verticillium dahliai* has also been identified as killing isolated scattered plants but is not considered to be of practical significance.

The South African researchers have identified a Chrysomelid beetle (*Leptinotarsa texana*), which feeds on silverleaf nightshade but it was not released as the agent also attacks eggplant.

Allelopathy

Allelopathy is the release by a plant of chemical compounds that inhibit other species.

South Australian experience has shown some eucalypt trees may have allelopathic effects on silverleaf nightshade. The most promising have been *Eucalyptus brokwayi* (Dundas mahogany), *E. dundasii* (Dundas blackbutt), *E. spathulata* (Swamp mallet) and *E. salubris* (Gimlet gum).

These trees gave good control to just outside their drip lines. These species are currently being investigated in NSW.

Quarantine

If silverleaf nightshade is only present in some areas it is vital to quarantine those areas.

Preventing the spread of silverleaf nightshade will save years of problems later. Lock stock up for two weeks before moving them onto a clean paddock if they have been grazing on silverleaf nightshade infested paddocks when ripe berries are present.

Clean down machinery for plant fragments when moving from infested to clean areas. Silverleaf nightshade can reshot from 1 cm of root fragment. Monitor clean paddocks regularly so infestations can be eradicated before they become a problem.

Noxious weeds legislation

Silverleaf nightshade is declared as a Class 3 or 4 noxious weed throughout most of New South Wales under the *Noxious Weeds Act 1993* (see Figure 2).

Class 3 control requirements are that ‘the plant must be fully and continuously suppressed and destroyed’.

Figure 2. Declarations of silverleaf nightshade in New South Wales.
Class 4 control requirements are that ‘the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the Local Control Authority’.

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