Asparagus Weeds

Best Practice Management Manual

Natural Heritage Trust
Helping Communities Helping Australia

Government of South Australia
Department of Water, Land and Biodiversity Conservation

national asparagus weeds management committee

A.asparagoides
A. africanus
A.densiflorus
A.declinatus
A.plumosus
A.scandens
A.virgatus

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Produced by the Department of Water, Land and Biodiversity Conservation
on behalf of the National Asparagus Weeds Management Committee

Foreword

The information presented in this manual is of a general nature aiming to give readers an understanding of the best practice management methods currently in use for Asparagus weeds. Information provided for herbicides use is based on field research. These may not match with current herbicide label recommendations. Individual State legislation may demand that an off label permit be obtained from the Australian Pesticides and Veterinary Medicines Authority (APVMA) prior to use. Please adhere to this advice for your own safety and for the good of the environment.

No permission from the APVMA is required for the use of biological control agents associated with bridal creeper, on condition that it is not packaged and sold as a commercial product.

Many of Australia's most invasive weeds, in both agriculture and in the natural environment, have been deliberately introduced as garden plants. This manual aims to assist land managers in identifying, controlling and managing one of the worst groups of these garden escapees; ornamental Asparagus weeds including the Weed of National Significance (WoNS) bridal creeper.

In 2000, bridal creeper was declared a WoNS by the Australian Government. With this declaration came the development of the Bridal Creeper *Asparagus asparagoides* Strategic Management Plan, to ensure a nationally consistent approach to managing bridal creeper and preventing the spread of other Asparagus weeds. The implementation of the plan is overseen by the National Asparagus Weeds Management Committee (NAWMC). The Committee is made up of representatives from all affected States, researchers and community members who volunteer their time. The only full time employee is the National Bridal Creeper and Asparagus Weeds Management Coordinator, who acts as the executive officer to the Committee. Funding for the operation of the Committee is provided by the Natural Heritage Trust, the Federal Defeating the Weed Menace programme and in-kind contributions from State agencies. Community groups contribute through their time and expertise.

The strategy has three main aims: raising awareness of Asparagus weeds, reducing the spread of the weeds and decreasing their impact through the development of control options such as the biological control agents for bridal creeper. Success has been achieved in all three of these aims, particularly in the area of biological control redistribution undertaken by the CSIRO Entomology division and the Department of Primary Industries in Victoria. This manual forms part of our first objective, to raise awareness of the weeds and offer some best practice management advice on what to do about them.

The first section of this manual contains practical information on how to develop a weed management plan and is aimed at land managers who may be embarking on a new project or tackling a weed incursion for the first time. This section will ensure that work can be undertaken in a systematic manner to ensure long-term results and reduce duplication of effort. The sections that follow consist of identification and management information for individual Asparagus weed species.

This is the first edition of this manual. It has been developed with the most accurate information available at the time of going to print. Because weed management is a dynamic field with continuous advances in control methods, the sections dedicated to the individual Asparagus weeds have been lodged on the bridal creeper page on the Weeds Australia website, which is located at http://www.weeds.org.au/WoNS/bridalcreeper/. These pages will be updated as new information and research findings become available. Please visit this site and download any updated sections before commencing field work.

Dennis Gannaway
National Bridal Creeper and Asparagus Weeds Management Coordinator

A copy of the Bridal Creeper *Asparagus asparagoides* Strategic Managment Plan is available online at - http://www.weeds.org.au/WoNS/bridalcreeper/

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Section 01 : **Developing a Weed Management Plan**

This section has been developed as an introductory guide to creating a weed management plan for anyone who has an interest in managing Asparagus weeds. While this publication focuses on Asparagus species, the principles described can be applied to any weed in any patch.

Why plan?

Good weed management is about good land management. This is true whether you are dealing with environmental or agricultural weeds. Think in terms of restoring natural ecosystems, protecting remnant stands of vegetation, or increasing the productivity of agricultural land. In the long run this approach will reduce the damage done by weeds to our environment and economy, and will prevent the reinvasion of areas where time and valuable resources have already been expended.

Making landscapes resistant to weed invasion requires integrated weed management. The most effective control is achieved when a variety of methods are used to target vulnerable aspects of a weed, its lifecycle, or its environment,

Since weed management is a long-term exercise the most systematic and effective way to deal with a weed problem is by creating and implementing a plan. Developing and following a weed management plan is important because it will:

- be an essential information tool. Data that is gathered will become the basis from which informed decisions can be made, which will in turn increase the chances of successfully managing a weed problem.
- help identify the best time to control weeds and the best methods to use.
- help to prioritise the use of limited resources available to control weeds in the most effective manner.
- enable planners to monitor results, measure progress against objectives, adapt the plan according to changing conditions and to take advantage of any opportunitie that occurs.
- provide documented evidence of the nature and extent of the problem. It will be very useful to support funding applications and will also provide a basis to report progress to funding bodies.

Developing a weed management plan requires time and strategic thought. It is also important to allow time to review what progress has been made against set objectives and explore ways to improve the overall success of a plan. The natural environment is not static and many factors change from month to month, season to season or year to year that impact on the effectiveness of weed management. The plan may require modifications over time to accommodate such fluctuations. However, it is important that changes are made based on evidence gained whilst monitoring the results of the work carried out.

The following are suggested steps to developing a weed management plan. These steps relate to developing a plan for a bushland site but the same principles can be applied to those looking to control weeds on private properties.

Step 1: carry out a site assessment.
Step 2: set objectives based on priorities and resources available.
Step 3: develop and implement an action plan to achieve objectives.
Step 4: monitor performance and change actions as necessary.

Prevention is better than cure. As a plan is developed and implemented, it is helpful to imagine that the weeds were never there in the first place! It is far more cost effective to prevent weed problems than to cure them. The majority of Australia's weeds were deliberately introduced from overseas, either as garden species or plants for agriculture.

Section 01

Step 1: Site assessment

To carry out a site assessment, a prior understanding of weeds, local plants, birds and animals will be very useful. Do not underestimate the time needed to complete a site assessment. It will be time well spent, as a comprehensive collection of relevant information in the early stages will save considerable time down the track and help to avoid a range of potential problems.

A site assessment can be broken down into the following tasks:

a) preparing a site information sheet.
b) preparing a weed management map.
c) establishing photo points.

a) Preparing a site information sheet

Develop a simple spreadsheet, which indicates the names of the weeds, their location with respect to the native vegetation and what resources are being used to control them. This can be tailored for each individual site. Together with a weed management map and photo point images, the site information sheet allows essential information to be recorded. The sheet can also provide useful information to others who may be involved in planning at local, regional, state or national levels.

Become familiar with the site

Before designing a site information sheet, take time to walk around and observe the site to gain an appreciation of which weeds, other vegetation and animals are present. Make notes on these and other aspects that may affect any work on the site. Such observations may include the presence of hazards (e.g. disused wells, dumps or feral bee hives) or weeds on neighbouring properties. It may take a few visits over several months to get to know the site, especially if it is an unfamiliar site. Plants will be much easier to identify when in flower, so visits should coincide with the range of flowering times of known weeds in the area and in nearby areas.

Obtain background information

As part of the site assessment it will be useful to collect a range of background information about the site including:

- the exact location of the site using a map or Global positioning System (GPS) coordinates.
- land ownership. The landowner must give permission to access the site, and for any work, including weed mapping, to be undertaken. If it is public land, obtain permission from the appropriate authority. Ensure you know where all the property boundaries are located.
- what regulations exist that may affect the planned work, e.g. herbicide legislation, regulations regarding the use of fire, or laws protecting native vegetation.
- who else uses the area and what other people have an interest or association with the site. Determine if they need to be informed of the work to be undertaken or encouraged to avoid certain areas at given times.
- how the weeds invaded the area. The manner in which weeds came to be present on the site may be evident, e.g. from a neighbouring property, dumped garden waste, spread by recreational activity, established following ground works, or spread along stream banks. Knowing how the weed got there will enable the cause to be addressed to prevent reinfestation.
- fire history dating back over the last decade or two, the intensity and the area which was affected. Find out if the site is subject to periodic hazard reduction burning. This may help or hinder future weed management.
- disturbance history in general, e.g. previous land use, floods, or livestock grazing.
- safety risks, e.g. locations of wells, dumped metals, barbed wire, stinging insect nests, power lines, underground cables, cliffs, or loose rocky slopes. This knowledge will help

people to safely work on the site.

- logistical details such as site accessibility and the location of gates.
- locating any previous maps, photos or work that may have been undertaken on the site to gain further knowledge and avoid duplication of effort.

Note that if isolated occurrences of weeds are encountered at this stage, and the identity can be confirmed, it may be worthwhile to remove or treat them immediately before they spread and become more difficult to control. If there is any doubt as to the identity of a plant, or how to treat it, contact your local weed management authority. Each time the site is visited, check under tall trees where birds are likely to perch for signs of new bird-dispersed weeds. This is particularly relevant to Asparagus weeds.

b) Preparing a weed management map

A weed management map is more than a map of where weeds are located on a site. It should also be a record of what other features are present that will have an impact on planning.

Time spent mapping will provide valuable information in order to:

- accurately target weed control activities.
- budget costs and time required to implement control measures.
- monitor how well controls are working.
- highlight other important issues that will influence the restoration of the identified site.

Mapping helps to keep the planning ahead of the doing. Mapping will provide information regarding changes to conditions on a site over time. This information will help to identify if any management changes are required to the plan. It also provides the basis to effectively communicate progress and results to volunteers, contractors, funding bodies and other interested parties.

At a local level, and for the purposes of an individual site assessment, it is not necessary to develop elaborate maps. The idea is to keep it as simple as possible, but to still produce maps that are useful. There is no need to map every weed species that occurs on a site. It is a matter of deciding what are the priority weeds to manage in light of the threat they present and the resources available to do the work. For further information, see section headed “Determining weed priorities”.
Keep things manageable and consider the following:

- nature of the identified weeds,
- size of the site,
- terrain variations,
- ease of access,
- how many helpers are available and their level of mapping experience.

All mapping exercises should be planned to minimise disturbance to native vegetation. Avoid trampling desirable vegetation, especially in sensitive bushland.

A case study

Figure 1 is an example of a simple sketch map incorporating basic information and using colour codes to identify weed location and extent. Areas containing native vegetation and a possible safety risk (an old dump) are also included in the example. The approximate scale for this map is 1:2000, so 25mm on the map represents 50m on the ground. The information contained within this map will be referred to throughout this section to help illustrate the weed management process.

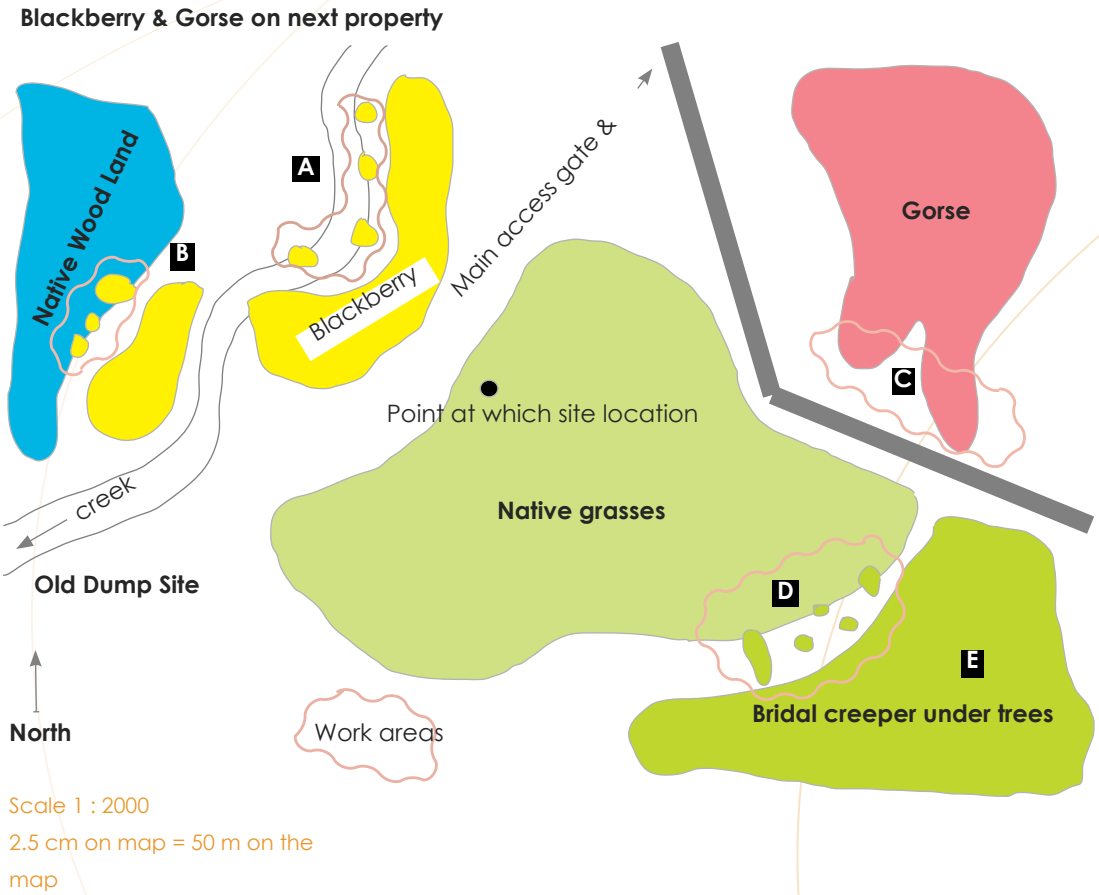


Figure 1: Sketch map example

Area infested with bridal veil	0.70ha
Area infested with gorse	0.44ha
Area infested with blackberry	0.67ha
Area of native grassland	2.1ha
Area of native woodland	0.71ha

Creating a map

To assist in the preparation of a weed managment map, it is helpful to obtain a large-scale topographic map, i.e. a 1:10,000 or 1:5,000 scale, unless the area involved is extensive covering more than 100ha, in which case a 1:25,000 or smaller scale map may be needed. An aerial photograph of the site can also provide an excellent format on which to base a weed managment map. Topographic maps and aerial photographs can be obtained from state or territory government departments or private suppliers. The idea, in either case, is to get an accurate representation of the identified site or property over which a clear transparency sheet can be placed. Information can then be recorded using coloured, permanent and waterproof marker pens. Numerous transparent overlays are useful when developing a map: one overlay could capture site features and another be devoted solely to weed infestations. The use of different overlays can make each section of the map easier to interpret and will also help determine management options.

It is vital that a site is correctly located on the map or aerial photo. Features such as rock piles, cliffs, gates etc on the ground must agree with those on the map or photo. If not then note the features that have changed since the map or photo was created.

If an appropriate topographic map or aerial photo is not available then the preparation of a hand drawn map can make an acceptable alternative. In order to produce a good quality, hand drawn map it will be necessary to:

- accurately locate the site on a smaller scale map (e.g. a 1:125,000 or 1:250,000 scale) or use a GPS.
- estimate and record the scale that has been used to prepare the weed map. For instance, what distance does 10mm on the map cover on the ground?
- record any key features of the site on the map so that they can be correctly orientated in the future.
- use a compass to establish a North arrow.
- Use graph paper, or divide a sheet of paper into even grids, to help accurately record features on the map. Once a scale has been established, details like the area of infestation, extent of native vegetation, and the length and position of roads can be accurately documented.

It is best to map a site one section at a time, mapping all the target weeds that occur in that section. This reduces the amount of walking needed over the area, minimising impacts, which is particularly important for bushland sites. If several people are involved then each individual should be allocated a clearly defined area to map. Each individual map must be labelled with the date and a section identification number to avoid confusion later.

It is important to keep a balance between trying to make an accurate map, the time needed to prepare it and the needs of the people who will use it. The goal is to have a map that is accurate enough to allow progress to be monitored and for others working on the site to find their way around and identify the locations of weeds and relevant features. Given the size of the example site in Figure 1, a simple hand drawn map is sufficient. However, for larger scale situations that include numerous infestations on many properties, a more elaborate map may be required. In these more complex situations mapping may need to be carried out with appropriate local or state/territory authorities and/or private contractors.

When to map

The targeted weed species will determine the best time to map. For Asparagus weeds, such as bridal creeper and bridal veil, this will be in mid-winter to mid-spring when growth is vigorous. Mid-summer will see these weeds retreat below ground, making mapping impossible. Ground and climbing Asparagus may be mapped as late as mid-summer if sufficient rains have been received. Larger woody weeds, trees and shrubs that are easy to identify can be mapped at any time. For smaller shrubs, herbs and grasses that are more difficult to distinguish it may be easier to map when the weeds are in flower, or at other distinctive stages of their life cycle.

As with all weed work remember safety first. Consider prevailing weather conditions, safety of site access (e.g. roads not too wet or boggy) and note the position of potential hazards before commencing work.

Surveying the site for weeds

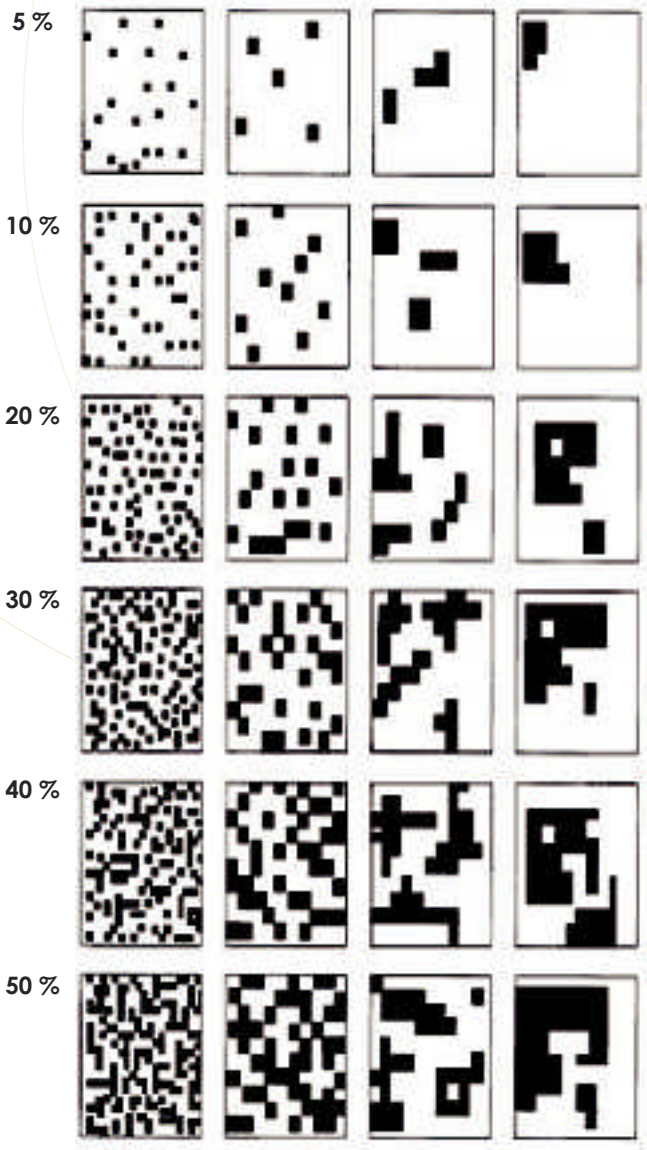
Start at one edge of the site and walk across it at regular, parallel intervals. The intervals may be 10 to 50m apart **depending** on the vegetation type and visibility. A compass or hand held GPS unit are useful to help maintain an accurate position. Where there are obstructions across the grid path, observations should be made from the best available position.

Weeds may occur in discrete clumps, in which case their location should be marked on the site or sketch map. It might also be useful to provide explanatory notes of where to find small infestations (even a single plant). For example, a brief comment might be; 'go north past the dump for about 20m then look to the western side of river red gum'. This will help others to locate small occurrences. In Figure 1, small outlier infestations of blackberry and bridal creeper are identified by dotted lines. Where a species dominates it is more appropriate to mark the boundaries of the infestation. This is has been done with the large blackberry, bridal creeper patches and all of the gorse on the map.

Determining weed density

Weed density describes what proportion of the area of each infestation is covered by which weed species. This is usually expressed as a percentage of the area of infestation. There are a number of ways that weed density may be determined, each with advantages and disadvantages. Much like weed mapping, weed density needs to be determined with sufficient accuracy to be useful, but without exhausting available resources. For the purposes of community-based or local scale weed work, a visual assessment of density will suffice. It should be noted that the results would not be as accurate as scientific quadrat or transect sampling.

Knowing the density of weeds on a site helps prioritise weed control efforts and assess how well they have worked. Being able to measure weed density enables accurate objectives to be set.



Visual assessment is the simplest way to determine weed density. It is quick and easy and useful for smaller sites and most species. To improve the accuracy of visual assessments please refer to Figure 2, which illustrates how different weed densities, as a percentage of ground cover, may look.

Figure 2: A guide for the visual assessment of weed infestation as a percentage of ground cover. Bayley, D (2001) Efficient Weed Management. NSW Agriculture Paterson NSW.

Establishing photo points

Periodically take pictures of the site to record changes in vegetation over time. This will be useful to assess regeneration of the site as well as changes in weed populations. Photographs should be taken using clearly marked photo points.

Establishing photo points involves marking out reference points on the ground so that photos can be taken of the same area over the seasons and years to determine changes in vegetation.

Some tips for setting up and using photo points are as follows:

- mark the location of each photo point. This can be done with a star dropper or a tin lid fixed securely into the ground.
- use a 'camera post', 1.4 -1.6m high, to rest the camera on. This may be the location marker. What is important is that the height is the same for each photo.
- place a second marker 10m from the camera post in the direction of the photo area. Each time a photo is taken place a sighter pole (e.g. a star dropper) at this point and affix a label with sufficiently large writing on it that it will be clear in the resulting photo (keep the label to file with the photo). Create an identification number and date the photo to avoid confusion as to where and when the photo was taken.
- where possible, align the photo in a north–south direction to avoid excessive sun or shadow.
- if possible avoid steep terrain.
- take photos as frequently as necessary to reflect changes in vegetation but make sure that photos are taken at the same time each year to allow comparisons to be made.
- establish enough photo points to get good sample coverage of the site, the vegetation on it and the particular weed species of concern.

Step 2: Setting objectives

Analysing the weed map, together with information collected on the site information sheet, helps determine weed priorities and develop objectives and actions to address them.

Determining weed priorities

The decision on what weeds take highest management priority should be based on an assessment of two main factors, namely: what degree of impact does each weed have on the site, and the feasibility of their control. The matrix outlined in Table 1 will help the decision making process:

Table 1: Determining weed management priorities

	Weed threat	
	Low	High
Feasibility of control		
Difficult	4th Priority	2nd Priority
Easy	3rd Priority	1st Priority

Whether a weed represents a low or high threat, is dependant upon a number of factors that relate to its invasiveness and impacts, for example:

- its ability to establish amongst existing vegetation,
- its competitiveness when established,
- the likelihood of long distance dispersal (e.g. by birds, stock, wind, water, or by machinery),
- the extent of reduction in desired vegetation caused by the weed,
- the change the weed causes to natural ecosystems.

To make an informed decision, prior knowledge of weeds and the problems they represent is required. Consult weed control agencies, local governments, regional Natural Resource Management Board or Catchment Management Authority local Landcare groups, Friends of Parks or nurseries in your state or territory for assistance.

Setting objectives

Objectives are statements of intended outcomes that should be achieved within set timeframes and can be measured. It can be useful to set objectives for the short term, i.e. 1 to 2 years, and then over the medium to longer term, i.e. up to 5 to 10 years or beyond.

Objectives should reflect what has been earmarked for protection or restoration, rather than on simply weed management alone, for example:

- a near-term objective for the example site in Figure 1 may be to protect the remnant native woodland and grassland from weed invasion. To achieve this priority, weed species that occur within the native vegetation will need to be treated first.
- medium to long-term objectives may be to reduce the extent of gorse, blackberry and bridal creeper by 50 per cent; re-establishing native species in the treated area; and to reduce by half the amount of time needed for ongoing control work.
- a long-term objective may be to completely restore the site with appropriate indigenous native vegetation and stop the site being a source of gorse, blackberry and bridal creeper spread downstream and onto neighbouring properties.

Objectives should be chosen that would bring satisfaction to those involved. Unachievable objectives will only produce exhaustion and disillusionment.

Management approaches

When determining the objectives also consider the main management approaches available, particularly eradication and containment.

Eradication of the identified weed at the site area, whilst desirable, may not be realistic. For a weed to be eradicated the following conditions need to be present:

- the weed occupies only a small area and will not reinvade from adjoining areas.
- all of the infested area is known.
- the weed is obvious and easy to find at very low density.
- the control method used will kill all plants before maturity.
- the weed seed does not remain dormant in the soil, or newly germinated plants are detected and killed before new seeds are released.
- if the plant has produced seeds they have not been dispersed.
- the available resources must enable initial treatment, regular surveys and control for the lifespan of the seed bank.

Weeds that are in the early stages of invasion may be candidates for eradication. If this can be done, ongoing vigilance will still be required to identify any new occurrence.

Containment of weed species, to prevent and control new infestations, is likely to be a more realistic management approach if the weeds are widespread and well established. Containment is a worthwhile exercise as it protects areas of native vegetation, reduces new weed infestations and reduces the need for future control by limiting the extent and severity of infestations.

The key to containment programs is to focus on treating isolated satellite infestations, rather than core infestations. The objective is to prevent weed populations extending beyond the perimeter of the core infestation.

> Weed management is important for the success of native vegetation regeneration or revegetation work but it is not the only factor. Consult with local experts to determine the best ways to encourage regeneration or improve the success of revegetation.

Containment also involves the restoration of treated areas through regeneration of native vegetation or revegetation of the area where weeds have been removed. Preferably this is done with local provenance native plants (species that are native specifically to the identified area), or the establishment of other desirable species. The restoration of the site will limit opportunities for weeds to reinvade.
If working in a group, discuss the weed priorities and management approaches together to reach consensus. If the entire group is involved in setting the objectives then all members are more likely to feel motivated to achieve the outcomes. Keep in mind that some level of weed infestation is likely to be a fact of life. The main objective will usually be to keep infestations to a manageable level so that the threat to the natural ecology of the site is reduced.

Step 3: Developing and implementing the action plan

The next step in creating a weed management plan involves creating a list of action points and allocating time, people and resources to each objective. A simple action plan is included in this section, which records actions for the example site in Figure 1. The following principles of weed management were considered when devising the action points for the example plan:

- always work from the least weed infested areas to the worst.
- minimise soil disturbance.
- if restoring natural bushland let native plant regeneration or revegetation establishment dictate the rate of weed removal.

Consideration should also be given to drainage patterns on the site. It is best to 'start at the top' as many weeds can spread by movement of their seed or other plant parts down watercourses and slopes. By starting at the top the risk of weeds reinfesting treated sites downstream or down slope is reduced. However, a lot of control work can be undone as a result of reinfestation by seeds or other propagules from weeds on neighbouring properties. This highlights the importance of coordinating efforts with those responsible for neighbouring properties.

The action plan needs to be written with the following questions in mind:

- what weeds and what locations are the highest priorities?
- what resources are available?

- what management options will be most effective, minimise environmental damage and make the site more resilient to weed invasion?

Blackberry and gorse are both invasive species that can threaten natural ecosystems. On the example site, the blackberry may be a higher priority than gorse as it is starting to invade the native woodland and it is growing along the stream. Keep in mind that both the blackberry and the gorse may be providing habitat for native fauna. If so, their removal needs to be staged gradually to allow native vegetation to regenerate, or revegetation to establish, so that an alternate habitat is available.

Having decided what priorities are the most important, the following decisions need to be made:

- what control methods will be applied to each weed?
- when and how often they will be applied?
- who will do the work?
- what monitoring needs to take place to measure the impacts of the methods used?

Assessing the resources required

People: This is the most important resource in any weed work. Making sure that all people undertaking a weed managment project are properly trained and motivated is the key to long-term success. Think about the following 'people' aspects when developing an action plan:

- what skills and experience do people bring to the project? What training and advice is available to give people the skills they need? Allow time for this to occur.
- if working with a group, be aware that individuals will have varying amounts of time to commit to the project and this needs to be accommodated.
- ensure people are aware of safety issues and understand the risks associated with weed work, e.g. safe herbicide handling, use and clean up; insect and snake bites; sunburn; correct lifting procedures for heavy items; and use of sharp tools. In the example map, everyone working on the site should be informed of the old dump. Make sure that well-equipped first aid kits are on hand and that people know how to use them.
- ensure people know what they are expected to do on the site during each session and who to go to for help and advice.
- assess if people need to be covered by insurance and if so ensure the policy covers appropriate risks.
- avoid burnout. This is the biggest problem that groups and individuals encounter with weed projects. It is essential therefore that action plans set realistic tasks that can be carried out in a reasonable timeframe and that plans are made to enjoy the process. Celebrate milestones, share experiences and pat each other on the back every now and then!

Finance: A financial plan should be prepared to allocate funds available to the costs associated with implementing the plan. It is important to budget for the long term and to allow for a sustained effort and ongoing follow-up work. When dealing with well-established infestations it is preferable to use resources to contain the infestations and remove weed threats from the best native vegetation and carry out ongoing follow-up. Do not spend all the available resources in one season to attack a major infestation leaving nothing for follow-up. This will only create disturbance, encouraging reinfestation or new infestations by other weed species.

Many costs are self evident, such as the purchase of chemicals if required, or the purchase or rental of machinery and equipment. Some costs may be less apparent and may include the following:

- safe lockable storage in which to store chemicals.

- purchasing protective clothing, safety equipment and a first aid kit.
- carting and dumping costs for any weed material removed from the site.
- fencing to protect revegetation.
- purchasing of aerial photographs or other maps to help with mapping work.
- fee-based training courses for people involved in the weed management program.

Carefully think through all the likely costs that may be involved. To save costs, check what equipment and supplies are available for loan, or at reduced cost through various groups, such as Landcare or Catchment groups. For further assistance with developing a financial plan for weed management contact the local state or territory weed control authority.

Funding: There may be a number of sources of funding to assist with weed management work. Over recent years the Australian Government's Natural Heritage Trust and Envirofund have been major sources of funding for projects. Applications for funding need to demonstrate that a clear plan exists to meet objectives that are in line with those of the funding provider. Applications also need to show how progress will be monitored and success will be measured. Developing a weed plan, which includes clear objectives, budgeted actions to achieve the objectives, and monitoring activities to evaluate progress, will help meet a funding providers' need for information. Weed control contacts in each state or territory will be able to assist with more information on sources of funding.

Time: Allow enough. Learn from experience: the time taken to carry out tasks in the first instance will provide a guide for future planning. Be aware that seasonal changes will impact on the plan. Favourable conditions will not always be available to carry out control activities. Wetter or drier years will impact on weed populations and factors such as site regeneration. These impacts need to be recognised and schedules adjusted accordingly. It is necessary to inform funding providers of any changes to the plan and why they are necessary.

Selecting control options

Each control method has its own advantages and disadvantages and these need to be considered in light of the requirements of the identified site and the objectives that have been set.

Integrated weed management

In many cases the most cost effective and sustainable way to control weeds is to combine or integrate a number of different control methods. Each method chosen needs to target weed species when they are most vulnerable. Knowledge of the life cycle of each targeted species is essential to determine the timing of different treatments.

A sample plan

Table 2 is a simple example of a first year action plan based on the fictional site in Figure 1.

Table 2: Example action plan. Year 1

Month	Blackberry	Gorse	Bridal creeper	Location	Who
Site assessment, mapping and photo point establishment completed in spring of the previous year					
JAN	Spray			A	Joe Bloggs
FEB	Spray			A	Jane Doe
MAR					
APR	Cut & Paint			B	
MAY	Cut & Paint		Map and take photos	B	
JUNE			Dig isolated plants	D	
JUL			Release biocontrols	D	
AUG				C	
SEP			Apply Herbicides	C	
OCT	Map & Take photos	Map & Take photos	Spray boundary of large infestation	All	
NOV	Spray			A	
DEC	Spray			A	
Note: This calendar is a simple example only, actual method used and timing of application will depend on local conditions. Seek advice from appropriate authorities.					

Using the map references from Figure 1, the blackberry treatments have been divided into two areas: Area A, where the infestation is away from native vegetation, and Area B where isolated plants occur near or in native vegetation. Note that Area A includes an isolated patch to the south of the main infestation. In this example, spraying the blackberry has only been planned for infestations away from native vegetation. Because of the proximity to native vegetation, considerable care will be needed to avoid spray drift and off- target damage. The herbicide used will need to be registered for use near waterways as the infestation is near a stream. This is a common location for blackberry.

As herbicides are unlikely to completely kill blackberry in one application, follow-up work is included in the plan. For Area B, cut and paint applications have been planned to minimise risk to native vegetation. This is a labour intensive method and blackberry plants are not the easiest to work with due to their prickly nature, so protective clothing, heavy gloves, and thick clothing and footwear will be required.

Each activity is scheduled so that the method used will be most effective relative to the weed's growth stage.

Step 4: Monitoring performance and making changes

Monitoring is often the most neglected area of weed management, yet it is a vital part of the weed management cycle. Monitoring progress will help identify the following factors:

- how well control measures are working.
- the rate of spread of weeds or the establishment of desirable vegetation.
- new threats to native vegetation.
- any issues that have arisen that will affect site restoration.

By gathering and monitoring fresh information, the weed management plan can be altered as needed to improve results and respond to changes in the environment.

Monitoring involves mapping the site at regular intervals, taking photos at selected photo points and revisiting site information to check if any data needs updating. Monitoring activity should focus on:

- changes in the extent of weed populations, i.e. is more or less area covered
- changes in the density of weed cover.
- occurrences of other weed species.
- unexpected impacts of weed control activity, e.g. off-target damage, erosion or invasion by other species.
- changes in the extent and condition of native vegetation or other desirable vegetation.
- changes in any conditions which will impact on site restoration work.

Ongoing mapping needs to take place at a similar time to when the original map was created to allow valid comparisons. By creating successive site maps and making a fresh assessments of weed density each time, a useful comparison can be made over time showing changes to natural vegetation and weed spread. Comparing successive photographs taken from the same photo points will help to identify changes. Whilst photographs can effectively portray change, the reasons for change may not always be evident in the images.

Observations need to be made about seasonal conditions or other factors that may impact on the results. For example, if the season that has passed was particularly dry, weed populations may have declined due to water stress rather than fromcontrol work. Unexpected site disturbances, such as fire and vehicle impacts, also need to be considered when monitoring results and setting or readjusting plans for the following seasons.

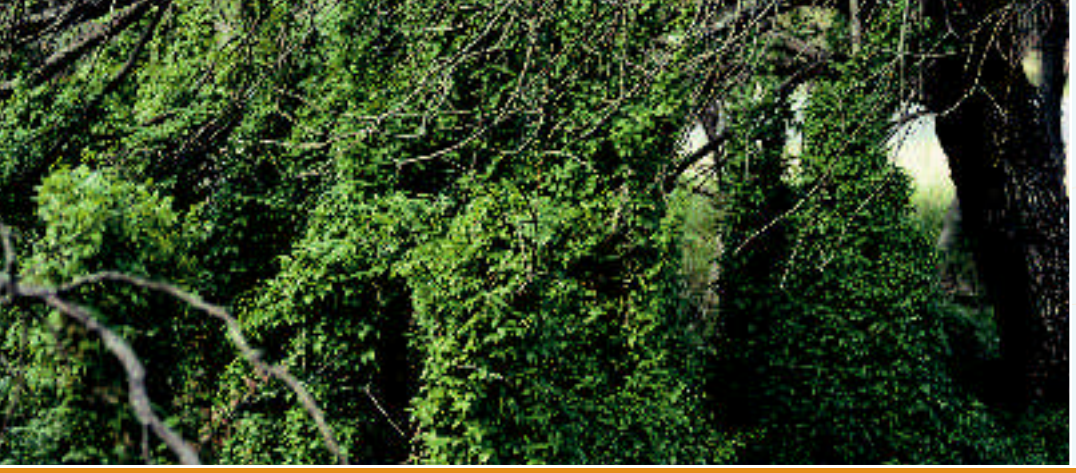
Recording

Accurately recording of information on both the site information sheet and the weed map is essential if a detailed understanding of how a site is changing over time is to be achieved. Reviewing the various photographs, maps and information sheets will enable informed management decisions to be made. By following this process, any changes that are made will be based on documented results and can be substantiated.

The information presented in this section has been adapted from module 1 of the Introductory weed management manual produced by the Weed CRC. The manual consists of four modules, which cover the following areas:

Module 1 - Developing and implementing a weed management plan
Module 2 - Weed Control methods for community groups
Module 3 - Collecting and preparing plant specimens for identification
Module 4 - Presentation of information to small groups

All four modules are available online from
www.weeds.crc.org.au/publications/weed_man_guides.html
or telephone (08) 8303 6590



Curtain of bridal creeper:
Photo DWLBC

Section 02 : **Common Bridal Creeper**

Asparagus asparagoides (L.) Druce

Other species names:

Asparagus asparagoides (L.) W. Wight
Myrsiphyllum asparagoides (L.) Willd
Asparagus medeoloides (L.f.) Thunb
Dracaena medeoloides L.f.
Medeola asparagoides L.
Elachanthera sewelliae
Luzariaga sewelliae

Other common names:

Bridal veil creeper
Florist's smilax, Baby similax,
False smilax, Similax

Bridal creeper : Flora of NSW

Bridal creeper *Asparagus asparagoides* is one of southern Australia's worst weeds, recognised as such with its declaration as a Weed of National Significance (WoNS). It is very aggressive and highly invasive in bushland, capable of smothering native ground flora and small shrubs. It forms a thick tuberous root mass, which inhibits growth of other plants and prevents over-storey regeneration. Berries are readily consumed by birds and foxes, enabling rapid dispersal of seeds. Bridal creeper invades a variety of environments including coastal areas, wet and dry sclerophyll forests, heathland, woodland, mallee shrubland, riparian areas, citrus orchards and pine plantations (Blood 2001). Bridal creeper tolerates a wide range of soil and climatic conditions and, unlike many other weeds, can readily establish in undisturbed areas. Growing conditions can vary from dense to part shade, alkaline to acidic soils of light and heavy textures, and even areas of frequent frost. The perennial root system ensures it can survive drought conditions.

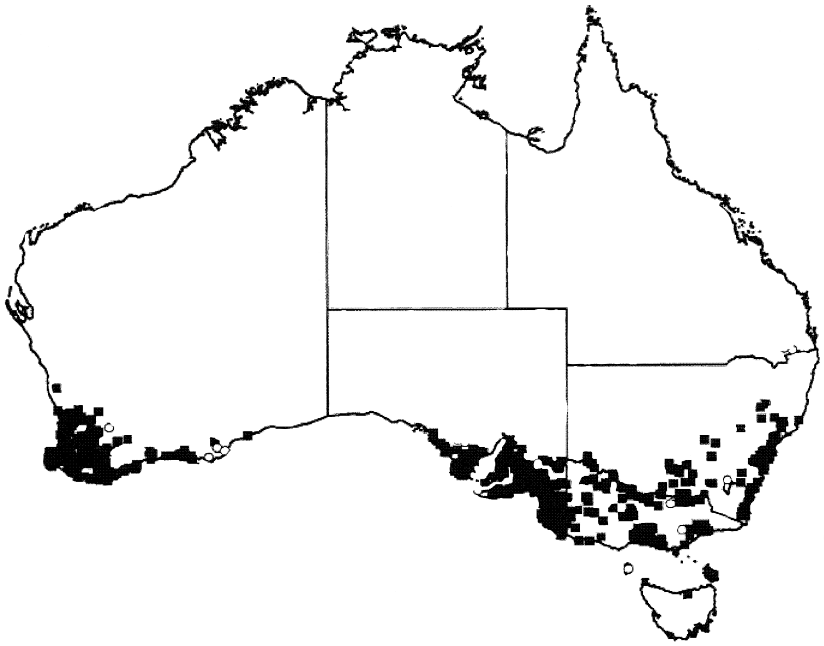
Current and predicted distribution

Bridal creeper has spread extensively throughout southern Australia and is found mainly in the winter rainfall zones (Morin et al. 2006). However, it does occur in areas with even rainfall such as coastal New South Wales (ARMCANZ 2001). Bridal creeper is widely distributed through south-west Western Australia, southern South Australia and Victoria. It is present as isolated populations across much of central, eastern and southern New South Wales (including Lord Howe Island), with larger infestations in coastal areas. Small, scattered infestations in north-east and south-east Tasmania are currently under management with an objective of eradicating the plant in the next ten years (ARMCANZ 2001). Bridal creeper has also invaded parts of New Zealand.

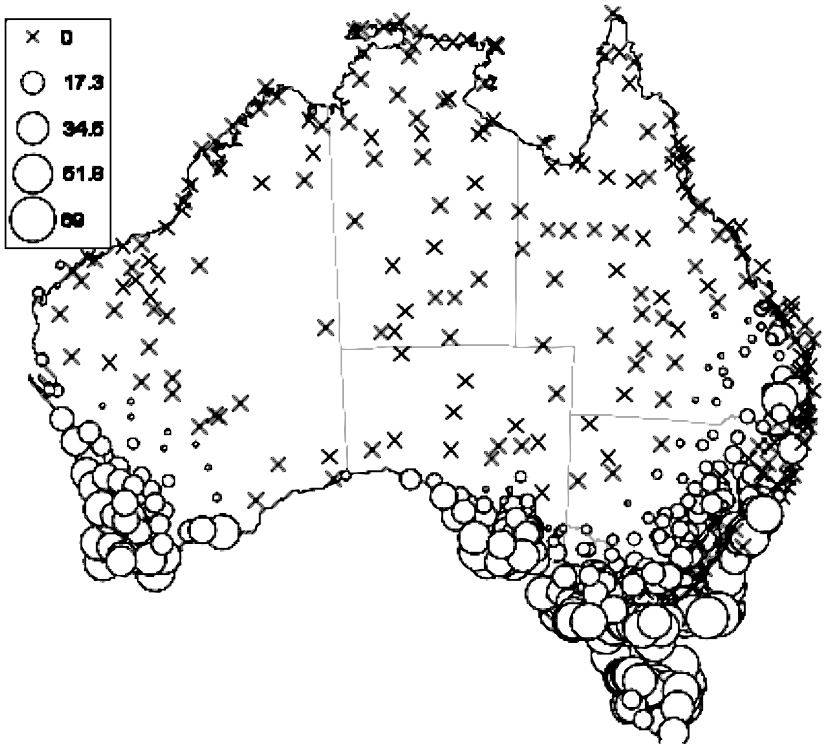
Climate matching models suggest that the full extent of its growth range has not yet been reached. If no action is taken it is likely to spread further into regions that have an annual rainfall greater than 350mm (Stansbury 1999). This includes central-northern and far south-eastern coasts of Western Australia, far south-western coast and northern agricultural districts of South Australia, northern and south-western Victoria, central and southern New South Wales, south-east Queensland and northern and eastern Tasmania. In areas that have lower annual rainfall it would mainly be found in irrigated areas, wet microhabitats and gardens.

On a local scale, bridal creeper invades a wide range of natural ecosystems, with isolated remnant vegetation on roadsides and farms being particularly susceptible. Revegation plantings such as shelterbelts are also prone to invasion as bird movements to these areas increase. Bridal creeper also grows well in citrus orchards and pine plantations. It has been found in a wide range of soils (Morin et al. 2006), commonly in sandy soils with an abundance of leaf litter (Stansbury 1999). It particularly thrives in alkaline sandy soils that have had nutrient addition from fertilisers, such as drainage lines, roadsides next to farms and orchards. High soil temperatures during the summer months inhibit productivity with low survival rates for seedlings (Stansbury 1999).

Map 1 – Current distribution National (Morin et al 2006



Map 2 – Potential distribution National (Scott & Batchelor 2006)



Introduction into Australia

Bridal creeper is likely to have arrived in Australia via Europe or the Americas (Scott 1995) as an ornamental plant. It was first recorded in Australia in 1857 in a nursery catalogue and by the 1870's it was a common garden plant (ARMCANZ 2001). The lush green foliage has been used in floral arrangements, particularly in wedding bouquets, up until as recently as 1995 (Stansbury 1999). It was listed as present in the South Australian Botanic Gardens in 1871 (Robertson 1983) and recorded as

naturalised in South Australia sometime between 1871 and 1937 (Kloot 1986). It was listed as a plant under cultivation in the Melbourne Botanic Gardens in 1883 (Stansbury 1999). Bridal creeper was listed in garden catalogues in Western Australia in 1905, however, it is likely that it had been available some time before then (Scott 1995). During the 1950's it was first recorded as naturalised in south-western Australia.

Dispersal methods

Seed is spread via a number of dispersal mechanisms. The ripened berries are dark red and sticky, attracting frugivorous birds, which disperse seeds over varying distances. Most seed dispersal events are restricted to less than 100 metres, particularly if the berries are consumed by small birds, such as silvereyes *Zosterops lateralis*. Rare long distance dispersals, up to several kilometres, have been reported (Stansbury 2001). The main dispersers of bridal creeper seed have been identified as the silvereye and blackbird *Turdus merula* (Stansbury 2001; Raymond 1994). Other species such as the red wattlebird *Anthochaera carunculata*, singing honeyeater *Acanthagenys rufogularis*, common starling *Sturnus vulgaris*, little crow *Corous lennetti*, ringneck parrot *Barnadius zonarius* and Emu *Dromaius novaehollandiae* have been observed feeding on the fruit (Cooke & Robertson 1990; Stansbury 1996).

Foxes *Vulpes vulpes* and rabbits *Oryctolagus cuniculus* have also been recorded eating the berries and spreading seed through their scats.

Other methods of dispersal include water-aided dispersal with movement of seeds down creeks, streams, ditches and drains. Earth moving machinery such as backhoes and graders are responsible for digging up tubers and depositing them in other sites where they shoot from the rhizome.

Humans still remain a key disperser of bridal creeper. The dumping of garden rubbish into the bush and roadside vegetation, illegal sales at markets and the exchange of plants by gardeners all contribute to the continued dispersal of this noxious weed.

Legal status of the weed

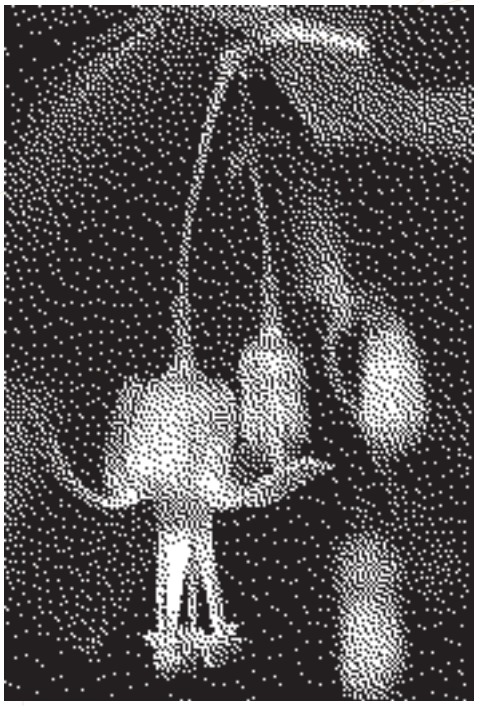
Bridal creeper has been declared a noxious weed under all State and Territory legislation.

Description and life cycle

The above ground morphology and the known life cycle of bridal creeper is described below. This information will greatly assist field identification of this weed.

Annual shoots emerge from the underground rhizomes at or before the onset of autumn rains (Morin et al. 2006). Earlier emergence can occur in areas where summer rainfall is higher. Shoots may be visible throughout the year in areas that receive summer rains or are irrigated. Initial growth is rapid and shoots grow upright to twine amongst nearby shrubs, trees and other supports . If shoots fail to attach to a support they become more prostrate as developing leaves weigh them down.

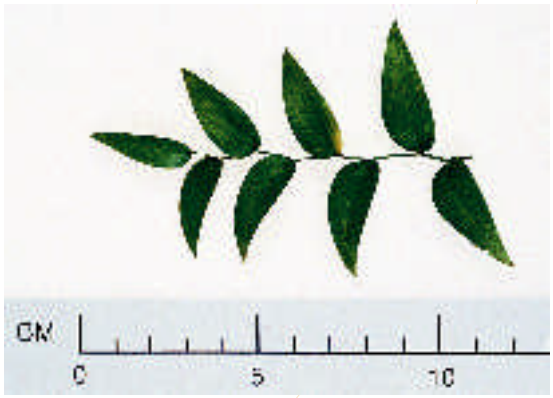
Growth ceases in November to December and plants turn yellow and die back down to the rhizome. The plant survives below ground until the following autumn.

Flowers	Appearance and characteristics
Bridal creeper flower: Photo DWLBC 	• greenish white, solitary, 6 petalled, 6-10mm in diameter • develop during late winter and early spring (Aug-Sep) • flowers are nectariferous and scented, and are visited by the introduced honeybee Apis mellifera (Cooke & Robertson 1990) • there is a three-year period from germination before bridal creeper plants reach flowering size (ARMCANZ 2001)
Berries and seeds	**Appearance and characteristics**
 **Ripe and green berries: Photo DWLBC**	• berries are produced in early spring (Oct-Nov) and are initially green, turning pink then red/burgundy during November-December • small, pea-sized berries, measuring 6-10mm in diameter • fruit production may exceed 1000 berries/m^2 (ARMCANZ 2001) • fruit production can vary substantially from year to year and between sites • below average autumn-spring rainfall shorten the growing season thereby limiting fruit production • plants in densely shaded areas or in open habitats that receive a lot of sunshine also have a limited fruit set

Berries persisting well into summer: Photo DWLBC

- shoots growing up support structures (e.g. trees, shrubs, fences) have greater fruit production than those growing on the ground
- seeds are 3-4mm in diameter, black and shiny with 1-9 contained within each berry
- bridal creeper is self fertile
- bridal creeper has a relatively short-lived seed bank of several years
- seeds in the leaf litter and at soil depths up to 10cm germinate during autumn and winter

Cladode (Leaves)	Appearance and characteristics



- cladodes (leaf-like branches) are broadly ovate but sharply pointed, shiny green, 10 - 70mm long x 4 - 30mm wide with many longitudenal nerves.
- clododes are borne in groups on small side-branches, or solitary and alternate along the stem.
- cladodes begin to yellow and fall as berries ripen and stems begin to dry and die back, usually in early December.

Tubers and Rhizome	Appearance and characteristics

Tubers arranged around the rhizome: Photo DWLBC

- numerous fleshy tubers (25–42 mm long and 8–20 mm wide) ending in roots are densely arranged along a branching rhizome (underground stem with shoot buds).
- the tuberous root mat, up to 10cm thick, can account for up to 90% of the plant's biomass.

Large underground tuber mat: Photo Weeds CRC

- the tubers provide and store water, energy and nutrients that enable the plant to survive over summer and allow rapid shoot growth in autumn.
- the tubers also act as a physical barrier that impedes the root growth of other plants and often prevents their seedling establishment.
- the majority of the rhizome shoot buds produced do not grow into shoots each autumn, but act as a buffer against adverse affects that may cause existing shoots to die prematurely, e.g. disturbance due to cultivation, fire, hand-pulling or knockdown herbicides.
- this characteristic allows bridal creeper to persist for decades, compensating for the weeds short-lived seed bank.
- bridal creeper can regrow from rhizome fragments, which often occurs when plants are moved by road making machinery (Cooke & Robertson 1990).

Sources: Blood 2001; Muyt 2001; Clifford & Conran 1987; Harden 1993; Jessop & Toelken 1986; Raymond 1994; Parsons & Cuthbertson 2001; Morin et al. 2006

Controlling infestations

There are a variety of methods available for controlling bridal creeper, ranging from herbicide application to biological control agents. Choosing an appropriate control method depends on a number of factors including:

- size and density of the infestation
- accessibility
- time and resources available
- type of environment invaded (e.g. conservation area or citrus orchard)
- growth stage of the plant (life cycle)
- features of the landscape (e.g. proximity to waterways or cliffs)

Keeping bridal creeper out of uninfested areas

The national ban on the sale and movement of bridal creeper must be enforced, as preventing establishment of infestations is the most cost-effective means of weed control. Gardeners should be discouraged from planting it on their properties. The safe disposal of bridal creeper should be encouraged and an emphasis placed on replacing noxious plants with non-invasive species.

Map

Finding out what you are dealing with is a crucial component in determining the extent of the problem. A detailed map should record information such as:

- the total area invaded
- areas of vegetation that are under threat from invasion
- which areas are eradicable
- infestations that are most likely to be major seed sources
- locations for buffer zones

Bridal creeper infestations are often found under tall trees, power lines and fence lines, or anywhere birds are likely to perch. Given this knowledge, each time a field area is visited the following checks should occur:

- check tree corridors, roadside vegetation and taller trees on the verge of native vegetation areas.
- always search up to several hundred metres further from where the last plant was found to ensure that all bird dispersed seedlings are located.

Accurate field observations mean that a successful containment and control program can occur around pre-existing infestations. Where bridal creeper is found, a buffer zone needs to be established. Allow at least a 500m wide buffer zone around the edge of the infestation. It is imperative that this buffer zone be kept free of any seedlings to limit further spread. Work back from the buffer zone towards the centre of the infestation.

Physical removal

Physical removal involves carefully excavating around and under the tuberous root mass and levering it out with hand tools. This control method is only effective if all of the tuberous root mass, including the rhizomes, are dug up and removed from sites.

Digging, sometimes referred to as grubbing, is only effective on small isolated infestations or after several years of herbicide treatment on larger sites. Be aware that the act of digging out the tubers can create considerable soil disturbance allowing bridal creeper and other dormant weed seeds to germinate. Once the plant has been grubbed it is best to replace the soil and leaf litter to prevent erosion.

Plants should be grubbed during autumn and winter, while soils are still moist and before fruit forms. Slashing or pulling off the foliage prior or during flowering will prevent fruit production and may slowly deplete the tubers of energy over time but it is unlikely to eradicate an infestation.

Disposal of weed material

If bridal creeper is controlled through grubbing it is imperative that all tubers and rhizomes are bagged immediately and taken off site. The extracted material must be placed in a black bag (garbage bag or something similar) and left out in a sunny spot to 'cook' the tubers. After 2-3 months, dispose of this material through the local government kerbside collection or take it to the rubbish tip for deep burial. Do not compost or mulch root material as rhizome fragments can reshoot.

Herbicide treatment

Application of herbicides has been an effective form of control. Both selective and non-selective herbicides can be used and spraying should be conducted during the winter to early spring flowering period when the plants are actively growing. Do not spray if plants are under any sort of stress, as herbicide will not be absorbed effectively. Application of herbicides can be very effective after a prescribed burn in late summer or early autumn, but beware of off-target damage.

Bridal creeper infestations are often located in areas of native vegetation and therefore great care should be taken to avoid spraying herbicide onto surrounding foliage and soil. The use of a hand sprayer, or wiping herbicide directly onto leaves will help to reduce off target damage to native plants. Mixing a dye in with the herbicide will minimise missed areas and prevent over spraying. Weather conditions should be calm, with low wind and no immediate rain expected.

From May to June bridal creeper can be sprayed with a 600g/kg Metsulfuron methyl product, such as Brush-off® or Ally®, at a rate of 5g/100L water plus a surfactant such as BS1000® at rates as indicated on the label. From July to early September use a 360g/L Glyphosate® product such as Zero® or Roundup® at the rate of 1L/100L water plus a penetrant such as Pulse® (Weed Control Notes, APCC).

It is important that the product label is read carefully before using any herbicide. Any deviation from the labels' instructions may require an off-label-use permit issued by the Australian Pesticides and Veterinary Medicines Authority (APVMA). The APVMA can be contacted via their website at http://www.apvma.gov.au/index.html. Some off-label-permits for the control of bridal creeper have already been issued. These can be found by searching the APVMA site, using the words bridal creeper and Asparagus in the relevant pest/product line on the permit search page. Ensure spray equipment is correctly calibrated and maintained. Herbicide should be applied every year in order to prevent seed set and to exhaust the tubers.

Control in horticulture

Bridal creeper thrives in citrus orchards with their fertiliser and irrigation regimes, often surviving through the normally dry summer months. Its smothering foliage and tuberous root mass compete with citrus roots and contribute to reduced tree growth, fruit production and susceptibility to diseases such as collar rot.

Citrus growers employ a number of control techniques such as spraying with herbicide, manual removal of tubers and/or skirting (pruning the lower branches of citrus trees) to enable the weed to be slashed or spot sprayed. Recently, the use of biological control agents such as the leafhopper and rust fungus have proven to be effective control agents in reducing the vigour of bridal creeper in orchards.

Other control methods

Other less common control methods include grazing and fire. Grazing by wallabies and sheep can successfully keep bridal creeper at low levels and prevent fruit production. However, grazing should be considered as an opportunistic control method and not relied upon to eradicate an infestation. The use of fire in controlling large infestations has proven successful. Fires during late summer and early autumn burn both native vegetation and bridal creeper, improving access for later spraying. Bridal creeper is often the first plant to emerge post-fire therefore herbicides can be carefully applied before native plants regenerate.

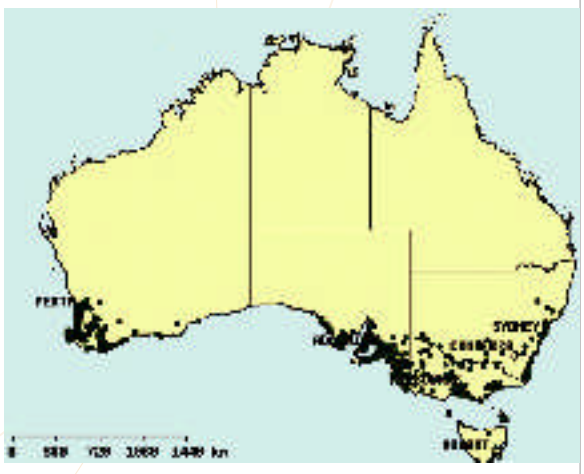
Follow-up and monitoring

Follow-up work and monitoring of controlled areas is extremely important. Areas that have been grubbed should be monitored carefully for regrowth, either from fragmented rhizomes or from a disturbed seed bank. It may take several years for an area that has been grubbed to be free from bridal creeper. Plants that have been sprayed with herbicide should also be monitored annually to ensure that control efforts have been effective.

Bridal creeper leafhoppers cannot be collected from a National Park or A-class reserve without a permit. Collections from private property can only be undertaken with landholders consent.

Biological control of bridal creeper

One of the reasons bridal creeper is a relatively uncommon plant in South Africa is the high number of natural enemies, which predate on it and keep it in check. When bridal creeper arrived in Australia its natural enemies were left behind and it was able to grow, reproduce and spread unhindered. Research on suitable biological control agents began in the late 1980s when surveys for suitable control agents were undertaken in South Africa. In May 1999 the first biocontrol agent, the bridal creeper leafhopper, was approved for release in Australia. The release of the rust fungus followed in 2000 and the leaf beetle in 2003.

Bridal creeper leafhopper *Zygina sp.*	**Appearance and characteristics**
 **Leafhopper on bridal creeper leaf: Photo University of Adelaide**  **White marking indicating leafhopper damage: Photo DWLBC**	• adult leafhoppers are white, 2-3mm long and live on the underside of bridal creeper leaves. • eggs are laid on the leaves with the first instar nymphs hatching in 4-7 days. • the nymph will progress through four stages over a period of 2-4 weeks culminating in the adult leafhopper. • each female lays about 200 eggs over a six week period, and several generations are produced each year. • leafhoppers are winged and although they can fly a distance of 15–30cm, they prefer to 'hop' between plants or amongst foliage. Dispersal of leafhopper populations is therefore relatively slow.  **National leafhopper release sites: Courtesy CSIRO Entomology**

The bridal creeper leafhopper *Zygina sp.* damages bridal creeper by feeding on the photosynthetic leaf cells. White spots and lines appearing on leaves indicates feeding. This is often the only sign that they are present. As leafhopper populations build up and damage increases the plant is unable to produce enough energy, slowing down the formation of flowers, fruit and the production of new tubers. This continual stress forces plants to use existing tuber reserves, which become exhausted over time.

Sourcing leafhopper for release

In 2000, the CSIRO undertook a program to establish leafhopper nursery sites throughout Australia. The current aim is for community groups to use these nursery sites to redistribute hoppers to other areas and thereby speed up the natural spread of the agent. A detailed map of release sites is available from the following website http://www.ento.csiro.au/weeds/bridalcreeper/project.html. For information on local release sites contact the authorised officer at your regional natural resource management board.

A site is considered heavily infested with leafhoppers when most of the foliage is 80-90% white. When this occurs it is possible to transport some of the insects to another site, aiding the natural spread of the insect. Successful harvesting of insects involves taking sufficient foliage and insects to inoculate the new infestation without adversely affecting the nursery site. This should be undertaken before October. Before leafhoppers can be harvested, they should be present at a site for at least 18 months after the initial release.

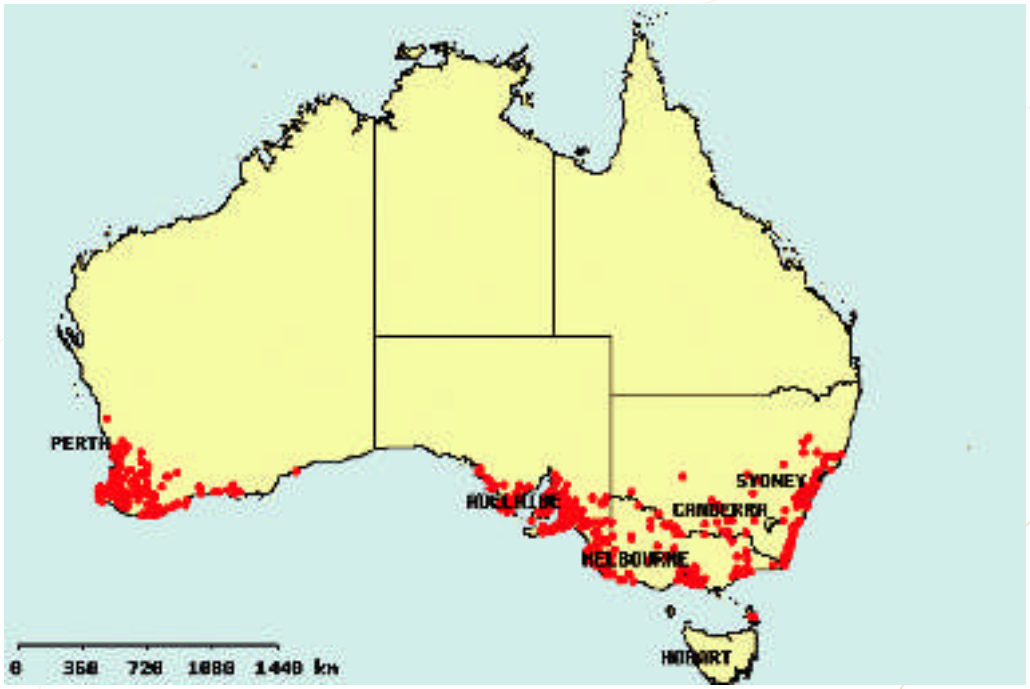
Redistributing leafhoppers

In order to redistribute the leafhopper, the following steps should be taken:

Equipment required	Method
• a few large, plastic bags • secateurs	To collect the leafhopper do the following: • cut a large bunch (enought to fill a shopping bag) of heavily infested foliage and quickly put it into the plastic bag. • try and harvest the foliage early in the morning when temperature is low in order to collect some adults. seal the bag with an elastic band; keep it out of the sun and travel to the release site. At the new release site do the following: • remove the harvested foliage from the plastic bag over the bridal creeper infestation. • tease the foliage apart and spread thinly over the resident bridal creeper, pushing the foliage into the infestation as you go. • invert the plastic bag and shake off any nymphs and adults stuck to the bag. Within a week, the harvested foliage will have died and the nymphs and adults on the foliage will have moved on and started to feed on the resident bridal creeper.

Rust fungus *Puccinea myrsiphylli*	**Appearance and characteristics**
 **Rust fungus on bridal creeper cladode: Photo CSIRO Entomology**	• Rust fungus first appears as a yellow spots on the bridal creeper leaf. • Rust completes its entire life cycle exclusively on bridal creeper. • The fungus destroys leaf tissue which reduces the photosynthetic surface of the leaf and diverts nutrient away from the host plant. • This retards development by reducing stem, fruit, rhizome and tuber production. • The rust is readily spread via spores.
 **Yellowing of bridal creeper effected by rust : Photo DWLBC**	

The best time to redistribute the rust fungus is when production of the most infective spore stage is at its peak. Orange, powdery spores can be easily rubbed off large pustules on leaves. This stage is normally between July and September but this will depend on seasonal conditions



Rust fungus release sites: Courtesy CSIRO Entomology

The bridal creeper rust fungus *Puccinia myrsiphylli* was approved for release in Australia in 2000. The rust fungus completes its lifecycle exclusively on bridal creeper. It has a complicated lifecycle with five spore stages including one that survives over summer when the bridal creeper has senesced (retreated underground). By destroying leaf tissue, the rust fungus reduces the photosynthetic surface of the plant. The plant sheds infected leaves prematurely, limiting flower and fruit production.

The first signs of the rust generally appear in early autumn. During the winter months the incidence and severity of rust increases and reaches a peak in spring when plants are flowering and fruiting. The rust fungus does not spread internally throughout the plant and therefore must reinfect bridal creeper every growing season to be effective.

The timing and levels of rust fungus populations depends on seasonal conditions. In 2005, South Australia had an extremely dry autumn and it was not until August that the first signs of rust were seen on bridal creeper populations on the Fleurieu Peninsula. Conversely, 2004 was an excellent year for rust, with consistent rains during autumn and winter providing good conditions for infection and spread.

Sourcing the rust fungus

In 2000, the CSIRO undertook a program to establish rust fungus nursery sites throughout Australia. The current aim is for community groups to use these nursery sites to redistribute rust to other areas and thereby speed up the natural spread of the agent. A detailed map of release sites is available from the following website http://www.ento.csiro.au/weeds/bridalcreeper/project.html. For information on regional release sites contact your local noxious weeds officer.

Redistributing the rust fungus

The following instructions provide details on how to spread the rust fungus onto uninfected bridal creeper infestations. This was the original method used by CSIRO to establish the nursery sites.

Safety tip – always use gloves and a facemask when working with rust-infested bridal creeper as breathing in spores may aggravate any pre-existing respiratory ailments. Always obtain permission to remove plant material, particularly from national parks and state reserves.

Equipment required	Method
• plastic bags • secateurs • clean spray bottle containing water • large plastic sheeting • pegs	• collect sufficient infected bridal creeper from a site already infected. This is simply done by cutting material and transporting it in large garbage bags. • slide the handful of infected foliage back and forth to dislodge spores from pustules and allow them to be deposited on the under surface of healthy leaves. A handful of infected bridal creeper (approximately 30cm^2) will inoculate approximately an area of 1-2 m^2. Leave the used rusty material at the inoculation site. • after inoculation, gently mist the area with water using a hand held spray bottle. • wrap the inoculation site in plastic sheeting for about 16-24 hours. Secure the sheeting with pegs to ensure a humid environment. If the site is in a sunny position, take off the plastic the next morning to avoid overheating. • return to the site regularly to check on progress of the rust. Rust pustules should be visible after 3-4 weeks.

The best time to release rust fungus is during misty rain. However, as long as it rains within 2 days, infection should still be successful. The most important factors for successful inoculation are wet bridal creeper leaves.

It is also important to think of the prevailing winter winds. Inoculating on the upwind edges of infestations will allow for a rapid, natural spread of rust spores throughout the entire infestation. Animal and human movement through a bridal creeper infestation will also help to spread rust spores. Road corridors can spread rust well via the wind generated by vehicle movement. The rust fungus will not totally eradicate an infestation. It may takes several years before a significant reduction in bridal creeper density is evident.

Rust fungus 'spore water'

A community group on Kangaroo Island, South Australia, developed a second method of distributing rust spore known as 'spore water'. Spore water is simply a mixture of rust spores and rainwater. This method works by rinsing rust-infected bridal creeper leaves in rainwater and spraying out the resulting slurry. It is necessary to use rainwater, as mains water and minerals in bore water may adversely affect the rust spores. A clean spray unit, lines and spray gun is also imperative as residual herbicide may adversely affect the rust spores.

The following guidelines for mixing and spraying spore water are from the Kangaroo Island Bridal Creeper Control Committee:

Equipment required	Method
• well rusted bridal creeper leaves • rainwater • container to wash off rust in to (e.g. fish bin or similar) • 60-litre garbage bags • clean spray unit of any sort • sieve (1mm mesh) • gloves and facemask	The method below is based on a 15 litre spray unit. Adjust quantities for the amount of spray required. One plastic shopping bag of infected bridal creeper leaves will make approximately 15 litres of sporewater. • take a handful of infected leaves and dunk them into a bucket of rainwater • swish the leaves around in the bucket for 30-60 seconds to dislodge the spores into the water. Place washed-off leaves into another bag. Repeat until you have dunked all the leaves. • the water should turn a browny colour. This is spore water • remove filters from a clean spray unit • strain spore water from the bucket into the spray unit sieving out any leaves or debris • spray the weeds with the mixture, following the technique outlined below

A good rule of thumb is 4 kg of leaf to 100 litres of rainwater

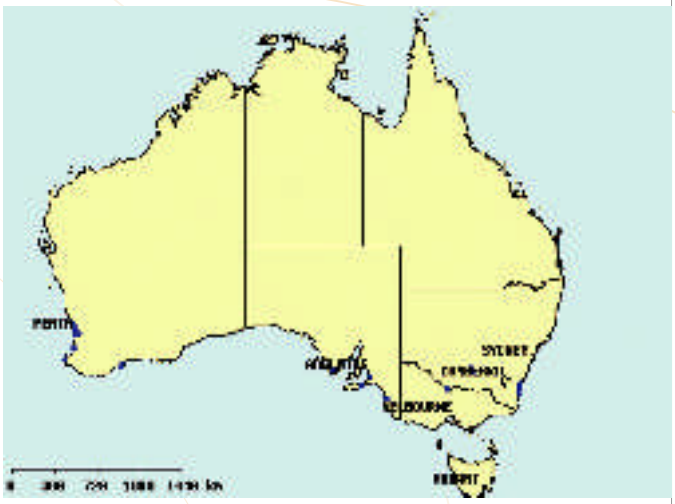
Spraying sporewater

- start at the top of the infestation and work downwards, spray until run-off, paying particular attention to the underside of leaves. Use the finest mist possible
- spray the spore water solution as soon as possible after mixing, as the spores lose viability the longer they are kept in solution
- try to keep the spore water solution agitated while in the spray tank to minimise spores sticking to the sides of the tank
- as there is no threat of off-target damage, spore water can be liberally applied to bridal creeper in all areas where it occurs, including native vegetation and near watercourses.

Following up after spraying

Follow-up monitoring of the release sites should take place a month after initial spraying. If no sign of the rust is seen within two months another dose of spore water will be required. However, it must be remembered that the spore water technique does not work in all areas. Repeated failure to establish may indicate that a different application technique is required for the identified area. Monitoring and recording activities at the spray site is important so that work is not unnecessarily duplicated.

A PowerPoint presentation on how to make spore water is freely available from bridal creeper page at:
http://www.weeds.org.au/docs/BC_How_to_make_spore_water.ppt

Leaf beetle *Criocerus sp*	
Leaf beetle 	
Bridal creeper leaf beetle: Photo CSIRO Entomolgy	**Leaf beetle release sites: Courtesy CSIRO Entomology**

The bridal creeper leaf beetle (Crioceris sp.) is the third biological control agent available to combat bridal creeper. It was approved for release in May 2002. Since then it has been released at nursery sites in Western Australia, South Australia, New South Wales and Victoria. It has established at some of these sites but populations are slow to build-up. Widespread establishment of this agent will need significant technical expertise, currently limiting redistribution to government agencies. From autumn to early winter, adult females lay eggs on expanding shoots and leaves of bridal creeper, either singly or in groups of up to 10. Both the adults and larvae feed exclusively on the plant's young, expanding tissues. The leaf beetle damages bridal creeper by stripping the young stems of shoots and leaves. This action prevents bridal creeper from climbing, reducing fruit production. The action of the leaf beetle is expected to complement that of the rust fungus and the leafhopper.

Biological controls are unfortunately not a silver bullet. They are governed by natural events such as drought, fire and predation which will effect their rate of dispersal and efficacy.

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Appendix

Growth Calender - bridal creeper												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flowering												
Fruiting												
Dieback												
Regrowth												
Germination												
General Growth Pattern												
Growth pattern in suitable conditions												
Adapted from Weed CRC Bridal Creeper Weed Managment Guide												

Bridal veil infestation: Photo DWLBC

Section 03 : **Bridal Veil**

BRIDAL VEIL

Asparagus declinatus L

Other species names:

Myrsiphyllum declinatum

Syn. Asparagus crispus

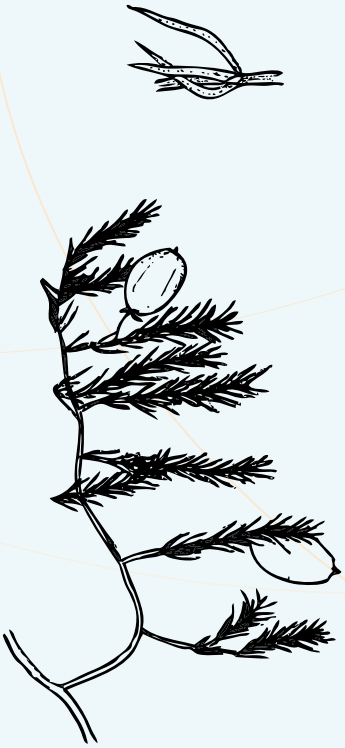
Other common names:

Pale berry asparagus fern

Asparagus fern

Bridal creeper

South African creeper



Bridal veil :Flora of NSW

Bridal veil *Asparagus declinatus* is native to the Western Cape region of South Africa. It is a highly invasive and aggressive environmental weed that can successfully out-compete and displace native flora (Leah 2001). Bridal veil produces scrambling and weakly climbing annual shoots, which can grow up to 2-3m in length. It forms a dense, underground, tuberous root mass that prevents native plant recruitment and regeneration. Bridal veil shares many characteristics with its close relative, bridal creeper, including a similar lifecycle, potential for spread and impacts on native vegetation. If not controlled, bridal veil has the potential to become a severe threat to biodiversity.

Current and predicted distribution

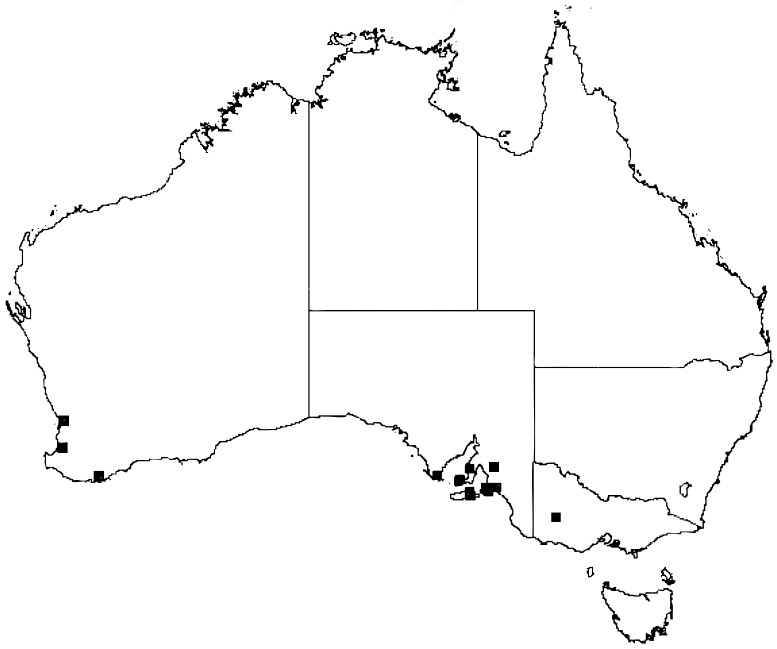
Bridal veil has naturalised in South Australia and Western Australia. It is a greater problem in South Australia where there are several distinct populations. Serious infestations occur on the eastern end of Kangaroo Island where it is commonly found along roadsides, on private properties and in native vegetation areas. Four distinct populations occur on the Fleurieu Peninsula, namely; Victor Harbor and surrounds, Finniss-Milang region, Myponga Reservoir and Happy Valley Reservoir. Other minor populations occur around the Adelaide metropolitan region including Cherry Gardens and the Mitcham hills.

Infestations have been found in several areas on Yorke Peninsula; namely in Inneston, South Kilkerran, Stansbury and Corny Point. Eyre Peninsula has several populations in Lincoln Lakes (an old dump site), in four National Parks, Coffin Bay, and along 2.6km of roadside in Tootenilla where it has been spread by graders. Small infestations have been discovered in the South east of South Australia.

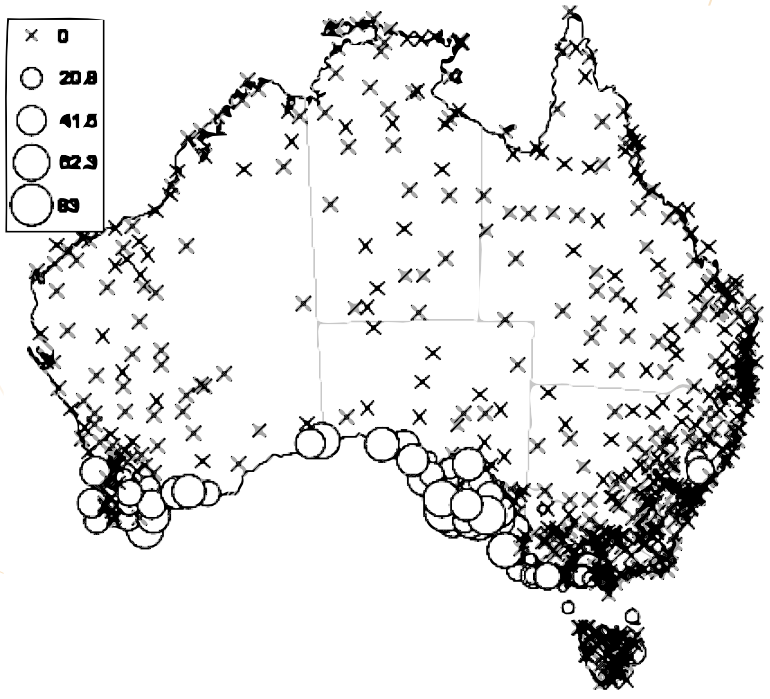
At least three established populations occur in Western Australia; Kings Park and Botanic Gardens in Perth, Bunbury, 180km south of Perth and north-west of Albany (Pheloung & Scott 1996; Keighery 1996, K. Batchelor pers. comm.).

The significance of bridal veil as an environmental weed is confirmed by distribution-climatic modelling with CLIMEX, which identifies a potentially wide suitable range, including south-west Western Australia, coastal South Australia, Victoria and eastern Tasmania (Pheloung & Scott 1996). The northern drier regions of Australia are considered unsuitable for bridal veil.

Map 1 : Current known distribution of bridal veil (Scott & Batchelor 2006)



Map 2: Potential distribution of bridal veil (Scott & Batchelor, 2006)



Introduction into Australia

Bridal veil was introduced into Australia as an ornamental plant (Jessop & Toelken 1986) and was first recorded as a garden plant in 1870 (Pheloung & Scott 1996). The first naturalised occurrence of bridal veil in South Australia was recorded on Kangaroo Island in 1954 (Weidenbach 1994). On the mainland, it was first recorded in 1966 near Victor Harbor and has since increased its range dramatically (Weidenbach 1994).

Dispersal methods
Initial seed dispersal observations of bridal veil in South Australia indicate the main dispersers are medium to large gregarious birds such as the grey currawong, Australian magpie, red wattlebird and brush wattlebird (Bass & Lawrie 2003). Other likely bird dispersers are the common blackbird, raven, common bronzewing, honeyeaters and silvereye. The attractiveness of bridal veil fruits to birds has been confirmed through monitoring fruit removal in South Australia. Research found that 69-80% of tagged fruits was removed during October and November (Bass & Lawrie 2003); similar removal rates to what has been observed for bridal creeper (Raymond 1996b).

Dispersal distance for bridal veil is likely to be greater than that of bridal creeper, given the difference in fruit size and array of bird dispersers. The fruit of bridal veil is nearly double the size of bridal creeper and thus has a stronger dispersal association with larger birds due to the relationship between bird gape width and fruit diameter (Bass & Lawrie 2003). Larger birds, such as currawongs, can ingest up to 15 bridal veil fruits and fly up to 10km before regurgitating seeds. If the fruits consumed by such birds averaged 6 seeds per fruit, one dispersal event could equate to 90 seeds (Bass & Lawrie 2003). Smaller birds such as silvereyes and honeyeaters are likely to consume far less fruit with each event therefore would ingest a lesser number of seeds, and disperse seed a far shorter distance ranging from 1-100m. This short distance dispersal is an important factor in the occurrence of infill plant invasions, resulting in higher density infestations.

Other potential dispersers of bridal veil include brush-tailed and ringtail possums, foxes and small rodents. Damage to fruits, possibly by a bush rat, have been observed on the Fleurieu Peninsula. There is also the potential for lizards, such as the sleepy lizard, to disperse bridal veil as white or pale coloured fruit is associated with frugivory by lizards (Lord & Marshall 2001).
Dispersal can also be aided by water movement of seeds down creeks, streams, ditches and drains. Earth moving machinery such as backhoes and graders are capable of digging up tubers and depositing them in other sites where new plants shoot from the rhizome.

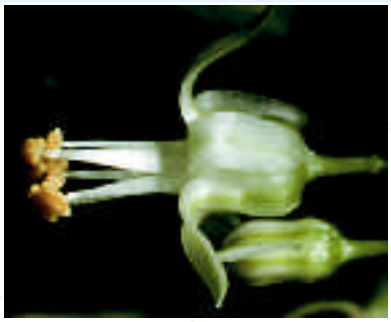
Humans continue to be a major distributor of the weed. The dumping of garden rubbish into the bush and roadside vegetation, unregulated sales at community markets and the exchange of plants material by gardeners all contribute to the ongoing dispersal of this serious weed.

Legal status of the weed
South Australia is the only State to have declared bridal veil a noxious weed. Serious consideration should be given by other States and Territories to declaring this weed to prevent it from establishing itself to the same extent as bridal creeper.

Description and lifecycle
The life cycle of bridal veil is as follows. Shoots begin to appear after the first autumn rains, usually during April or May, and scramble across the ground but do not generally climb to the same extent as bridal creeper. The onset of cool winter weather sees shoots eventuate into dense foliage becoming deep green in colour.

Above ground plant matter begins to whither and die off when temperatures rise, usually during November-December, though drying fruit has been observed to stay on the plant through to January. Over the hot summer months bridal veil senesces back to the underground tuberous root mat.

The above and below ground morphology of bridal veil is detailed below. This information will greatly assist in the field identification of this weed.

Flowers	Appearance and characteristics
 Bridal veil flower: Photo DWLBC	• greenish white, bisexual and 5-8mm in diameter. • flower buds appear during July and flowers open in August. • flowers are nectariferous and attract the introduced honeybee *Apis mellifera*.

Berries and Seeds	Appearance and characteristics
 Green bridal veil berries: Photo DWLBC	• green ovoid berries are initially light green but turn pale translucent white as they mature. • fruit is on average 10mm long by 7mm wide. • fruit begins to form during August and September. • seeds are black, globose, 2.5-3.5mm in diameter with an average of 5-8 seeds per fruit.

Bridal veil cladodes (leaves): Photo DWLBC

Cladodes (Leaves)	Appearance and characteristics
	• cladodes are blue-green, soft, needle-like 3-10mm. • densely arranged in groups of 3 along short, finely-branched side shoots off a wiry, main stem.

Root system	Appearance and characteristics
 **Tubers and fine roots of bridal veil: Photo DWLBC**	• extensive underground root system consisting of branching rhizomes, which bear numerous bulb-like tubers or storage organs. • stems emerge from the rhizome. • The tuberous root mass generally occupies the top 15cm of the soil. • Tuber and root mass accounts for 85% of the total mass of the plant.

Digging up bridal veil tuber mats: Photo DWLBC

Growth rate

There is little knowledge of the growth rate of bridal veil. Based on research conducted by Raymond (1996a) it could be inferred that it has a similar growth rate to bridal creeper. The underground, tuberous root mat ensures that during periods of unfavourable conditions (such as during a dry season or extended drought period) the plant can draw on nutrients and moisture contained within the storage organs (Pate & Dixon 1982). Observations made on bridal veil vigour and fruiting capacity during the 2002 drought in South Australia found that during this period, foliage turned a pale yellow colour and growth rate and vigour was reduced. Similarly, fruiting levels were lower than average during that season suggesting drought conditions adversely affect bridal veil (Bass & Lawrie 2003).

Controlling infestations

The main methods of control are digging out, or grubbing, the above and below ground parts of the plant, cutting back the foliage and herbicide application. Choosing an appropriate control method depends on a number of factors including:

- size and density of the infestation.
- accessibility to the area.
- time and resources available for treatment.
- type of environment affected.
- features of the landscape (e.g. proximity to waterways or cliffs).

Keeping bridal veil out of uninfested areas

Nurseries should not sell bridal veil and gardeners should be discouraged from planting it on their properties. Safe disposal of bridal veil should be encouraged and an emphasis placed on replacing existing plants with non-invasive species.

Find out what you are dealing with

Mapping is a crucial component in establishing the following factors:

- the total area invaded.
- areas of vegetation that are under threat from invasion.
- which areas are eradicable.
- infestations that are most likely to be major seed sources.
- where to locate buffer zones.

Bridal veil infestations are often found under tall trees, power lines and fence lines or anywhere that birds are likely to perch. Whilst in the field, it is important to check the following for signs of infestation:

- tree corridors, roadside vegetation and taller trees on the verge of native vegetation areas
- always search up to several hundred metres further from where the last plant was found to ensure that all bird-dispersed seedlings are located.

Allow at least a 500 metre wide buffer zone around the edge of an infestation. It is imperative that this buffer zone be kept free of any seedlings to limit any further spread. Work back from the buffer zone towards the centre of the infestation.

Physical removal

Physical removal of bridal veil involves carefully excavating around and under the tuberous root mass and then levering it out with hand tools. This control method is only effective if all of the tuberous root mass, including the rhizomes, are dug up and removed from the site. Hand digging is

only effective for small, isolated infestations or after several years of herbicide treatment on larger infestations. The act of digging out the tubers can create considerable soil disturbance, allowing bridal veil and other weed seeds that have been lying dormant to germinate. Once the plant has been dug out it is best to replace the soil and leaf litter to prevent erosion. Plants should be grubbed during autumn and winter while soils are still moist and before fruit forms. Slashing or pulling off the foliage of bridal veil will prevent fruit production and may slowly deplete the tubers of energy over time but is very unlikely to eradicate an infestation.

Disposal of weed material

If bridal veil is controlled through physical removal, it is imperative that all tubers and rhizomes are bagged immediately and taken off site. Material should be placed into a black plastic bag and left out in a sunny spot to 'cook' the tubers. After 2-3 months, this material should be disposed of through the local government kerbside collection or taken to the rubbish tip for deep burial. Do not compost or mulch the root material, as under the right conditions rhizome fragments may still reshoot.

Herbicide treatment

Applying herbicide is the most common method of controlling this weed. Research had shown that the most effective herbicide is glyphosate + Pulse Penetrant®, sprayed during the winter to early spring flowering period when plants are actively growing. However, leaves of bridal veil are fine and waxy which can make herbicide application difficult, as the chemicals do not adhere to the leaves very well. Trials by the Kangaroo Island Asparagus Weeds Committee have shown that emulsifiable vegetable oil mixed with glyphosate + Pulse will help the chemicals to stick. There is currently no specific herbicide registration for bridal veil.

It is important that the product label is read carefully before using any herbicide. Any deviation from the labels' instructions requires an off-label-use permit issued by the Australian Pesticides and Veterinary Medicines Authority (APVMA). For further information, contact the APVMA via their website at http://www.apvma.gov.au/index.html.

Do not spray herbicide if plants are under any sort of stress, as herbicide will not be absorbed effectively. Bridal veil infestations are often located in areas of native vegetation and so great care should be taken to avoid spraying surrounding foliage and soil. The use of a hand sprayer, or wiping herbicide directly onto leaves, will help to reduce any off-target damage to native plants. Mixing dye in with the herbicide will help minimise missed areas and prevent over spraying. Weather conditions should be calm with low wind and no immediate rain expected.

Ensure spray equipment is correctly calibrated and maintained. Herbicide applications need to be repeated in subsequent years to progress towards eradication of an infestation. The first glyphosate application can reduce bridal veil cover by >90% and cause substantial tuber death. Follow-up herbicide application must occur within two years after a previous spray to avoid fruit set. The number of herbicide applications required to achieve total eradication is not known, but may take up to 10 years. Annual sprays may shorten the time to achieve eradication, but lack of foliage may limit effective herbicide uptake throughout the root system.

Other control methods

Other less common control methods include grazing and fire. Grazing by cattle and sheep can successfully keep bridal veil at low levels and prevent fruit production. Sheep will graze on the new shoots and are more likely to chew it down than cattle. However, bridal veil is not a preferred food source for sheep and cattle and so grazing should be considered as an opportunistic control method and not relied upon to eradicate an infestation.

The effectiveness of fire as a control method is yet to be verified. Previous experiments using fire have had little impact on the underground tuber mat due to difficulties in maintaining fire intensity. In some high rainfall regions of South Australia, it has been observed that tubers grow in the leaf litter. A high intensity fire may 'cook' and ultimately destroy these tubers. Results from fire trials in late 2006 will be posted on the following website - http://www.weeds.org.au/WoNS/bridalcreeper/

Follow-up and monitoring

Follow-up work and monitoring of controlled areas is extremely important. Areas that have been grubbed should be monitored carefully for any signs of regrowth. It will take several years for an area that has been grubbed to be free from bridal veil. Plants that have been sprayed with herbicide should be monitored post-spraying to ensure that control efforts have been effective.

Biological control

At present there are no biological control agents for bridal veil in Australia.

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Growth Calender - bridal veil												
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Dieback												
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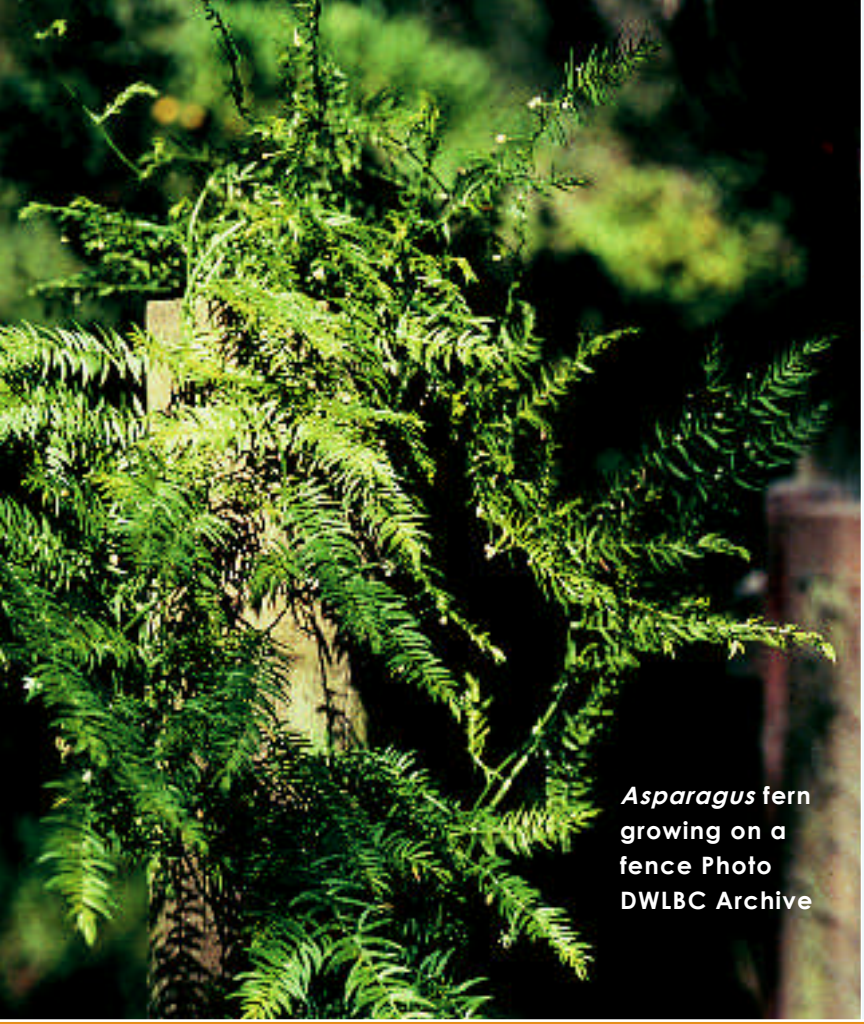
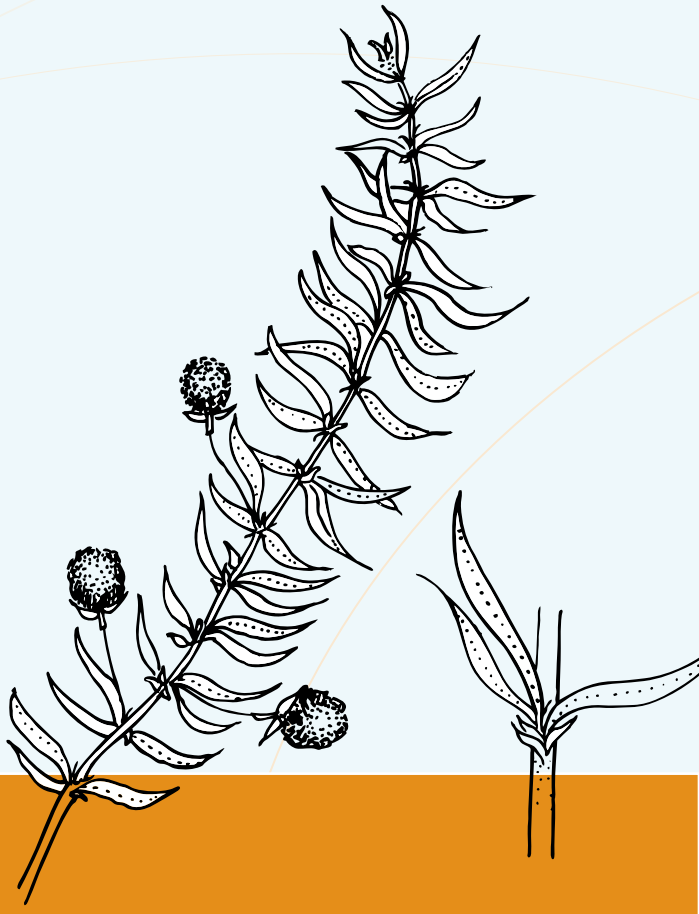


***Asparagus* fern growing on a fence Photo DWLBC Archive**

Asparagus Fern : Flora of NSW



Section 04 : **Asparagus Fern**

Asparagus fern

Asparagus scandens Thunb.

Other species names:

Myrsiphyllum scandens

Other common names:

Asparagus fern

Climbing asparagus

Climbing fern

Myrsiphyllum

Snakefeather (NZ)

Asparagus fern *Asparagus scandens*, also known as climbing asparagus, is a perennial twining vine. It is a close relative of bridal creeper and bridal veil, which are two serious asparagus weed species in southern Australia. Asparagus fern is an aggressive plant, producing underground tubers which form dense impenetrable mats. It competes with native plants for nutrients, light and space. It is a shade tolerant plant preferring moist sites.

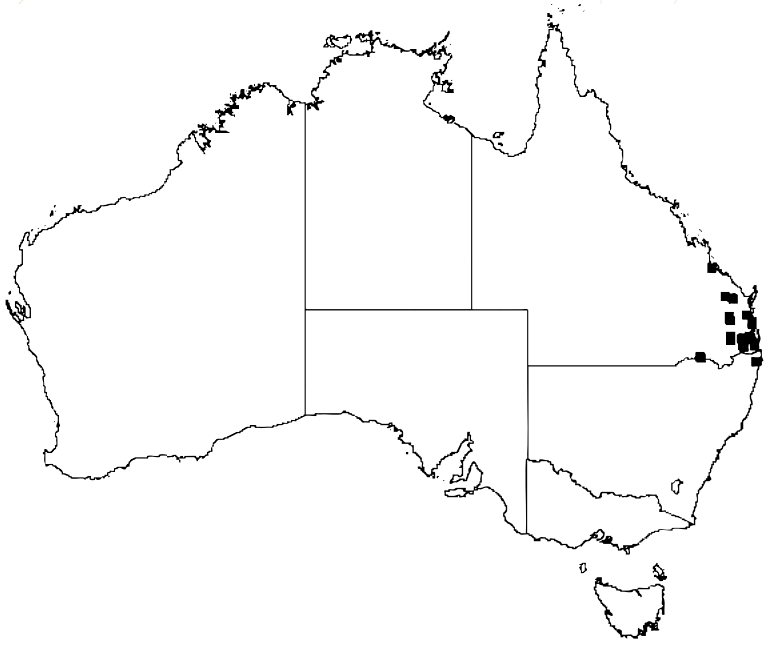
In New Zealand, where Asparagus fern is a serious problem, native seedling regeneration has been prevented and soft barked plants and seedlings strangled or smothered (Timmins & Reid 2000). It is an emerging weed within Australia, and has the potential to seriously impact on Australia's biodiversity.

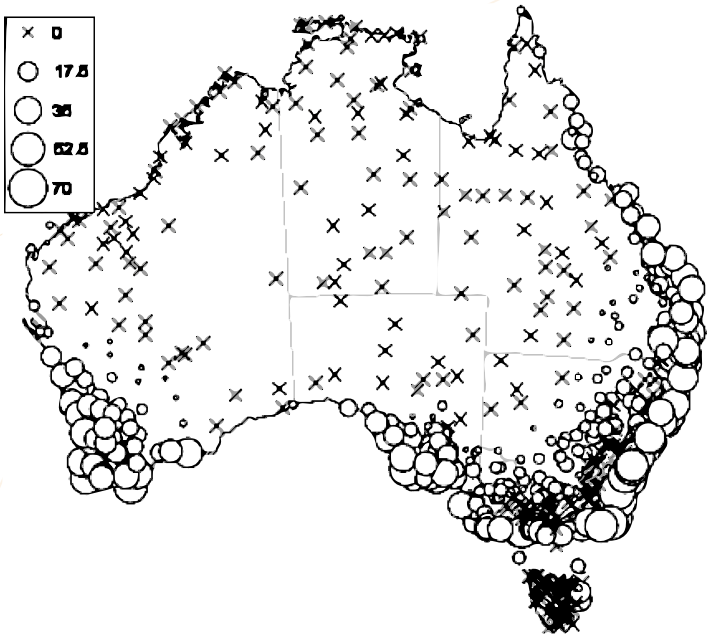
The ability of Asparagus fern to survive drought, frost and fire in Australia is an area that has not been extensively researched, however some inferences can be made. Observations of Asparagus fern in the Adelaide Hills, South Australia suggest that it can survive frosts. This region experiences very cold temperatures and frequent frosts during winter. In addition, the area has a high average rainfall. The weed is mostly found in cool, wet climates, however populations have been found in dry forests suggesting that it can tolerate dry or even drought conditions (Timmins & Reid 2000).

Current and predicted distribution

Asparagus fern has been identified by Keighery (1996) as a potentially serious weed of the summer rainfall areas of Australia. It is recognised as invasive in New South Wales, occasionally naturalised in the Sydney region, and southern Victoria (Harden 1993). It is naturalised in northern mainland Tasmania and on Flinders Island where it invades along the edges of native vegetation (Timmins & Reid 2000). In Western Australia, infestations have recently been found at Denmark and Albany; in Agonis and Banksia woodland around Wilson Inlet and Frenchman's Bay (Brown et al. 2002). In South Australia, infestations are located in several sites on the Fleurieu Peninsula and within a reserve near the town on Millicent in the South East. A larger infestation is centred around several suburbs in the Adelaide Hills.

Map 1 : Current known distribution of Asparagus fern (Scott & Batchelor, 2006)





Map 2: Potential distribution of Asparagus Fern (Scott & Batchelor, 2006)

Section 04

The weed has a wide tolerance range, it grows in disturbed and undisturbed forests, in deep shade and in wet and dry open forest. Given the weed's ability to adapt to varying conditions, action must be initiated now to prevent further spread.

Introduction into Australia

The exact date that Asparagus fern was introduced into Australia is unknown. Considering the date of introduction of bridal creeper and bridal veil it could be assumed that Asparagus fern was introduced at around the same time, i.e. the late 19th century. Its fern like appearance and attractive flowers suggest it was brought here as an ornamental plant. This is a classic example of a garden plant that has jumped the fence and invaded native vegetation.

Dispersal methods

Birds eat the orange fruits of the Asparagus fern and disperse the small seeds. Its bi-coloured display of orange fruits against green foliage and its often-vertical growth pattern allows birds to easily pick them. Blackbirds are probably the main dispersers of seed. Other large birds, such as Currawongs, Magpies, Ravens and Wattlebirds are also thought to ingest the fruits. Seeds are most commonly dispersed a short distance, up to 200m, however long distance dispersal events over several kilometres may also occur. Foxes and possibly rabbits may also be potential dispersers.

Other methods of dispersal include water-aided dispersal with movement of seeds down creeks, streams, ditches and drains. Earth-moving machinery such as backhoes and graders are responsible for digging up tubers and depositing them in other sites where they shoot from the rhizome. Seeds can also be transported in mud caught on vehicles and shoes.

The most prominent disperser of Asparagus fern remains humans. The dumping of garden rubbish into the bush and roadside vegetation, sales at markets and nurseries and the exchange of plants by well intentioned gardeners all contribute to the continued dispersal of this attractive but invasive plant.

Legal status of the weed

Tasmania is the only state to have declared Asparagus fern at the time of writing this publication.

Description and life cycle

Unlike other temperate asparagus weeds, Asparagus fern does not die back during the hot summer months. It continues to grow throughout the year culminating in it flowering and fruiting during late winter and early spring. See Appendix 2.

Flowers	Appearance and characteristics
 Flower : Photo DWLBC	• small, white to pinkish, 6 petalled, borne singly and are 5-7mm in diameter. • flowers are produced from August to October. • male and female flowers live on separate plants.
Berries and Seed	**Appearance and characteristics**

Berries containing seeds: Photo DWLBC

- fleshy, globular berries, 5-7mm in diameter, are produced from late October
- berries change from a green colour when first produced to an orange-red when ripe
- stems that receive higher amounts of light tend to produce more fruit than stems in darker areas
- ripe fruit can remain on the plant from one season to the next (Timmins & Reid 2000)
- fruit production is not as abundant as for bridal creeper and bridal veil.
- Fruits mostly have one seed, 2-3mm in diameter and a shiny black colour.

Cladodes (Leaves)	Appearance and characteristics

Cladodes (leaves): Photo DWLBC

- Leaves are deep green and scale like, are 5-15mm long and 0.5-1.5mm wide.
- Asparagus fern leaves are broader than that of bridal veil but narrower than bridal creeper.

Root system	Appearance and characteristics
 **Fibrous root system : Photo DWLBC**	• Underground tuber root mass forms a mat from the short branching rhizome. A key difference between Asparagus fern and bridal creeper or bridal veil is that tubers are narrow and infrequently arranged along the length of the root system. • Tubers vary between 5 – 10 mm wide and 10 – 50 mm in length. • in mature plants, the roots contribute 87-92% of the total mass. Source: Blood 2001; Muyt 2001; Timmins & Reid 2000

Growth rate

Studies in New Zealand (Timmins & Reid 2000) have found that the growth rate of new Asparagus fern shoots is variable. Thirty new shoots were tagged on well-established plants at a site near Wellington and their length was regularly measured over a 10-month period. Only a third of the stems increased in length. However their lengths differed considerably, between 70-1020 mm. The remaining shoots were either found to be shorter or the same length. The rest were lost or dead (Timmins & Reid 2000). It was also observed that new Asparagus fern shoots are easily damaged when handled and this may explain why some shoots do not increase in length.

Controlling infestations

The main methods for controlling Asparagus fern are digging out the above and below ground parts of the plant, cutting the foliage and herbicide application. Choosing an appropriate control method depends on a number of factors including:

- size and density of the infestation,
- accessibility,
- time and resources available,
- type of environment invaded,
- features of the landscape (e.g. proximity to waterways or cliffs).

Keeping Asparagus fern out of uninfested areas

Nurseries and informal markets must be stopped from selling Asparagus fern and gardeners should be discouraged from planting it on their properties. Safe disposal of Asparagus fern should be encouraged and an emphasis placed on substituting existing plants with non-invasive species.

Find out what you are dealing with

Mapping is a crucial component in order to determine:

- the total area invaded by Asparagus fern,
- areas of vegetation that are under threat from invasion,
- which areas are eradicable,
- infestations that are most likely to be major seed sources,
- where to locate buffer zones.

Asparagus fern infestations are often found under taller trees, power lines and fence lines or anywhere that birds are likely to perch. Therefore it is essential to check the following:

- tree corridors, roadside vegetation and taller trees on the verge of native vegetation areas.
- always search up to several hundred metres further from where the last plant was found to ensure that all bird dispersed seedlings are located.

Allow at least a 500 m wide buffer zone around the edge of an Asparagus fern infestation. It is imperative that this buffer zone be kept free of any Asparagus fern seedlings to limit any further spread. Work back from the buffer zone towards the centre of the infestation.

Physical removal

Physical removal involves carefully excavating around and under the tuberous root mass before levering it out with hand tools. This control method is only effective if all of the tuberous root mass, including the rhizomes, are dug up and removed from site. Digging, or grubbing, only effective for isolated infestations or after several years of herbicide treatment on larger infestations. The act of digging out the tubers can create considerable soil disturbance allowing Asparagus fern and other weed seeds that have been lying dormant to germinate. Once the plant has been grubbed it is best to replace the soil and leaf litter to prevent erosion.

Grub plants during autumn and winter, while soils are still moist and before fruit forms. Dug material should be immediately placed in a strong bag and taken off site. Material can be transferred into a black plastic bag and left out in the sun to, 'cook' the tubers and rhizomes. This process takes about 2-3 months after which time the bag can be disposed of in the kerbside waste collection or taken to the rubbish tip for deep burial. Do not compost or mulch root material as root fragments can reshoot.

Slashing or pulling off the foliage will prevent fruit production, and may slowly deplete the tubers of energy over time, but it is unlikely to eradicate an infestation. In order to prevent seed set, the foliage should be slashed in July, which is before the plant flowers.

Herbicide treatment

Herbicide application is the most effective control mechanism for larger infestations. Care must be taken when applying herbicide in native vegetation areas to avoid off-target damage. Selective herbicide gives better results and it is best to spray during winter and spring when the plant is actively growing. Plants up to 60cm high can be sprayed until the plant is wet but not dripping. Plants that are taller than 60cm should be cut back to a height of 30-60cm and then sprayed. This reduces the amount of herbicide needed, ensures spraying is done in a controlled manner, and minimises the damage to native species. The cut material will die without further treatment. The best herbicide mix available is Glyphosate (Roundup®) at a rate of 1% (100ml in 10L of water) + Pulse® for small plants (Brown et al.). Follow up is essential to ensure plants do not reshoot from the rhizome.

There is currently no herbicide registered for exclusive use on Asparagus fern. It is important that the product label is read carefully before using any herbicide. Any deviation from the label's instructions requires an off-label-use permit issued by the Australian Pesticides and Veterinary Medicines Authority (APVMA). The APVMA can be accessed via their website at http://www.apvma.gov.au/index.html.

Follow-up and monitoring

Follow-up work and monitoring of controlled areas is extremely important. Areas that have been grubbed should be monitored carefully for regrowth. New plants can arise from fragmented rhizomes or from a seed bank that may have been disturbed by machinery or hand digging. It may take several years for an area that has been grubbed to be free from Asparagus fern. Plants that have been sprayed with herbicide should be monitored post-spraying to ensure that control efforts have been effective.

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Appendix

Growth Calender - Asparagus Fern

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flowering								■	■	■		
Fruiting									■	■	■	
Dieback												
Regrowth	■	■	■	■	■	■	■	■	■	■	■	■
Germination			■	■	■	■	■	■				
General Growth Pattern		■	■	■	■	■	■	■	■	■	■	■
Growth pattern in suitable conditions				■	■	■	■	■	■	■	■	■

Adapted from Weed CRC Bridal Creeper Weed Managment Guide

GROUND (BASKET) ASPARAGUS

Asparagus aethiopicus L.

Note that this name has previously been misapplied as Asparagus densiflorus (Kunth) Jessop (Batchelor and Scott 2006).

Other species names:

Protasparagus densiflorous

Asparagus aethiopicus

Asparagus sprengeri

Other common names:

Basket asparagus

Asparagus fern

Sprengi's fern

Bushy asparagus

Emerald asparagus

Ground (Basket) Asparagus: Flora of NSW

Ground Asparagus gone wild: Photo DWLBC Archive

Potted ground asparagus: Photo DWLBC Archive

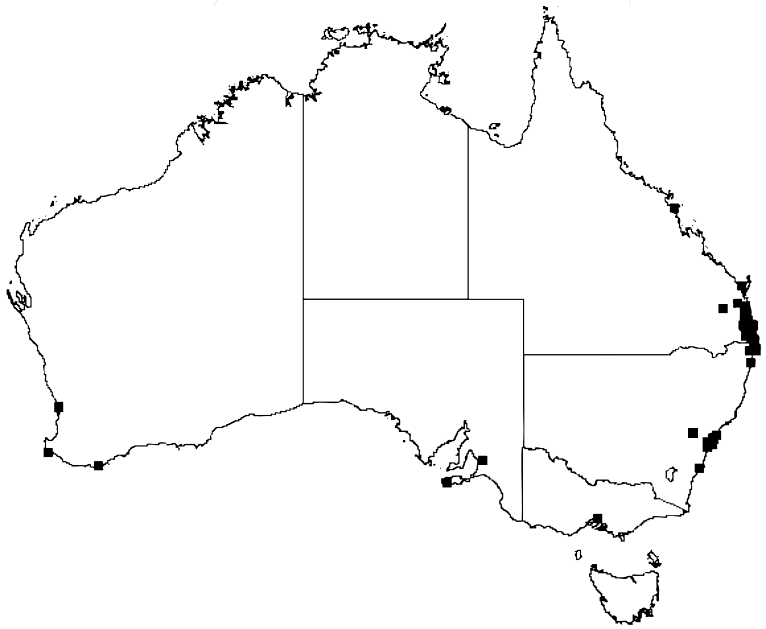
Some confusion exists amongst the weed management community as to which of the two species, *Asparagus aethiopicus* and *A. densiflorus*, are present within Australia. Possibly both occur, but more study is required to get a definitive answer as to which species occurs and at what location within the country. At the time of writing this manual, it was agreed that both species should be treated as the same plant and managed accordingly.

Ground asparagus is a multi-stemmed, bushy, prostate, perennial shrub, which forms a thick mat of tuberous roots. It grows particularly well in shaded areas and in low fertility, shallow, sandy soils. The weed is prevalent in coastal, urban and bushland sites, particularly around housing developments where disturbances by machinery provide ongoing invasion opportunities.

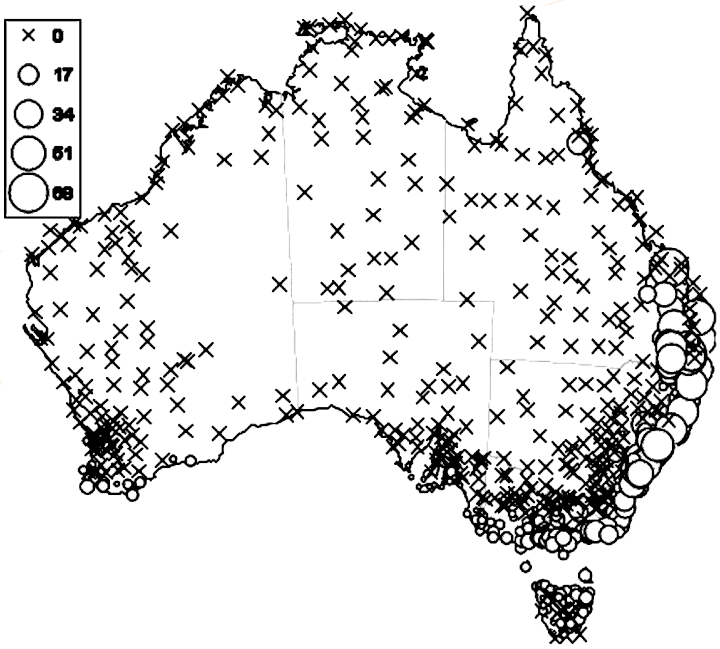
In cultivation, basket asparagus seedlings produce water storage tubers at 2 weeks after germination, with flowering about 20 months after germination (Vivian-Smith unpublished data).

Current and predicted distribution

Ground asparagus has naturalised in south-east Queensland and along the coast of New South Wales, where it has invaded coastal environments, littoral rainforests, rainforests, frontal dunes, sclerophyll forests and coastal heath. It is considered to be a serious threat to coastal bushland around Sydney. Heavy infestations exist on the western edge of Burleigh Heads National Park, Queensland (Csurses and Edwards 1998). It is also recorded in South Australia and Western Australia



Map 1: Current distribution of ground asparagus (Scott & Batchelor, 2006)



Map 2: Potential distribution of ground Asparagus (Scott & Batchelor, 2006)

Introduction into Australia
Ground asparagus is native to South Africa where it occurs in a range of coastal habitats, including rocky areas and woodlands (Csurses & Edwards, 1998). The plant was initially distributed through the sale of nursery stock.

Dispersal methods
It is spread by the growth of rhizomes originating from dumped garden waste and through seed dispersal by birds (Armstrong and Buchanan, 2000). Ground asparagus is still sold as an ornamental garden plant in some parts of Australia (Weeds Australia, 2005).

Legal status of the weed
At present Ground asparagus is only declared as a noxious weed in New South Wales and Queensland where it is posing the most severe threat.

Description and life cycle
Ground asparagus is a perennial shrub or scrambler, commonly grown in gardens and parks as an ornamental plant. Mature plants have prickly scales along stems, cream flowers and green to red fruit. In established colonies, the mass of above ground organs, together with numerous seedlings completely suppress the growth of other native species (Ellison, 1995).

The life cycle of ground asparagus is as follows:

- young seedlings establish and continue to produce tubers during wet periods (February to April).
- non-flowering shoots emerge during autumn (April to May).
- vegetative regeneration occurs in winter (June to August).
- flowering shoots occur 20 months after germination, during late winter-early spring (August to September).
- plants begin to form fruits and set seed from late September to October.
- plants may dieback during the hot summer months from December through to mid February, however the tubers will ensure survival.

Flowers	Appearance and characteristics
 Flower of the ground asparagus: Photo DWLBC	• cream-pinkish 3-4mm long

Berries and Seeds	Appearance and characteristics
 Red and green berries: Photo DWLBC	• globular berries, 5-8mm in diameter and ripen to bright red.

Cladodes (Leaves)	Appearance and characteristics
 **Fine cladodes of ground asparagus : Photo DWLBC**	• flattened, needle-like cladodes 2-5 per axil, 15-25mm long.

Root system	Apperance and characteristics
 **Fibrous root system showing tubers: Photo DWLBC**  **Tuber and root mass: Photo DWLBC**	• fleshy, whitish-brown tubers and rhizomes forming thick underground fibrous clumps and mats.

Controlling infestations

Physical removal

Eurobodalla Shire Council in New South Wales suggests that when digging out plants, only the root system in the smallest plants should be removed, as the amount of soil disturbance involved with larger infestations would be unacceptable. Rhizomes and tubers should be disposed of carefully and not left in contact with the ground. If the plants are fruiting at the time of treatment, the fruits should also be disposed of carefully, preferably by burning or deep burial.

Herbicide treatment

A number of control methods have been used at sites in New Zealand, Sydney and Lord Howe Island which include:

- foliar application of metsulfuron methyl herbicide at 1g/450mL of water per square metre. No regrowth was reported one year after treatment
- cutting and painting stems using a mixture of full strength metsulfuron methyl and glyphosate herbicides. Results have recorded no regrowth for 15 months after treatment
- scraping a 200mm section of each frond near the crown of the plant and applying full strength glyphosate along the scrape (Armstong et al. 2006).

Herbicide screening trials conducted in Queensland (Armstrong and Buchanan, 2000; Buchanan et al., 2006) found that foliar spray application at 6g metsulfuron methyl (i.e. 10g Brush-Off®) plus 100mL BS1000® surfactant per 100 L water gave the most successful control in a range of seasons.

Please remember to follow the instructions on the label of any herbicide that is being used. Permits are required from the Australian Pesticides & Veterinary Medicines Authority (APVMA) should there be any deviation from the manufacturers recommended dosages and application methods. The APVMA can be contacted at (02) 6271 6384 or http://www.apvma.gov.au/permits/permits.shtml

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Appendix

Growth Calender - Ground Asparagus

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flowering								■	■			
Fruiting									■	■		
Dieback	■	■										■
Regrowth		■	■	■	■	■	■	■	■	■	■	■
Germination		■	■	■								
General Growth Pattern		■	■	■	■	■	■	■	■	■	■	■
Growth pattern in suitable conditions				■	■	■	■	■	■	■	■	■

Adapted from Weed CRC Bridal Creeper Weed Managment Guide

Section 05
Appendix

CLIMBING ASPARAGUS

Asparagus africanus Lam.

Other species names:

Protasparagus africanus

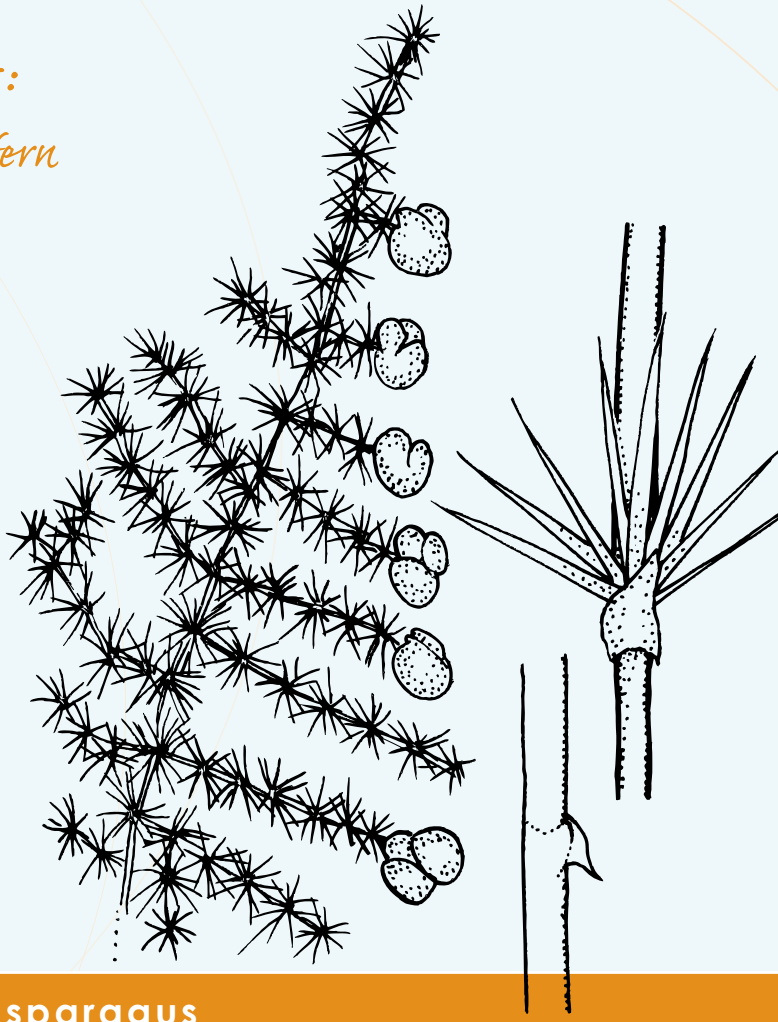
Other common names:

Orange fruited asparagus fern

African asparagus

Other climbing asparagus weeds:

Asparagus plumosus



Drawing of Asparagus plumousus, closely related to A. africanus. Flora of NSW

Climbing asparagus invading remnant vegetation. Photo DNRMW

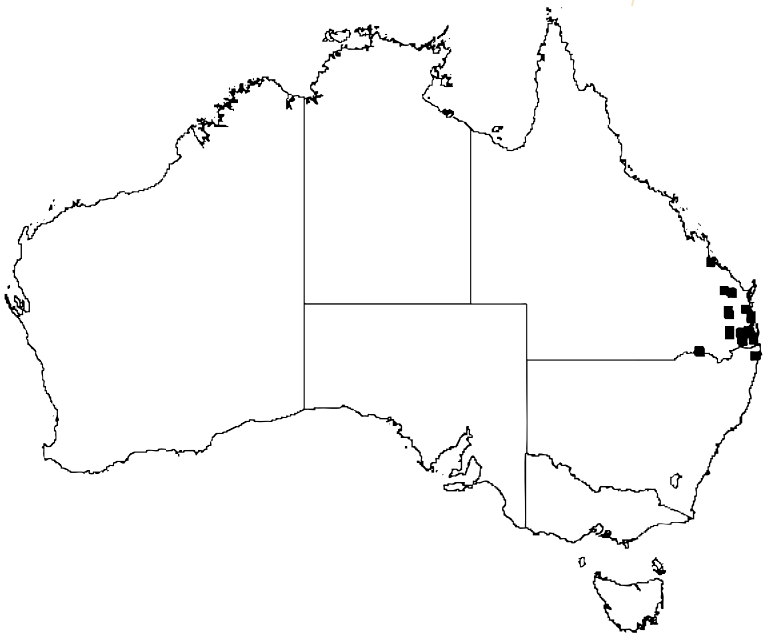
Climbing asparagus growing on a fence line. Photo DWLBC

Climbing asparagus is a perennial climber reaching up to 8m into trees, and can often completely cover smaller trees, understorey shrubs and ground layer plants. Roots are fibrous and form dense mats just below the soil surface, which presumably interferes with the establishment and survival of seedlings of native species (Stanley 1994). The stems of mature plants originate from a fleshy underground crown up to 60cm in diameter. Each stem measures 1-2cm in diameter and possess numerous, persistent, curved spines, each up to 2cm long (Stanley 1994).

This species is most prominent in remnant semi-evergreen vine thicket/ Brigalow forest communities, particularly in the Marburg-Boonah districts of southern Queensland, and is also present in many moist gullies. It out competes and smothers much of the native vegetation among which it occurs (Conran and Foster 1986).
In cultivation, climbing asparagus plants flower 36 months after germination (Vivian-Smith unpublished data). Mature plants generally flower in response to the first major rains after the August to September dry period, which is characteristic of subtropical eastern Australia (Stanley 1994).

Current and predicted distribution
In Australia, climbing asparagus is found in rainforest, brigalow communities, some wetter eucalypt communities and adjacent roadside areas. Climbing asparagus has been mapped from Lismore in northern New South Wales to Rockhampton in central Queensland, and extend 100-120km inland.

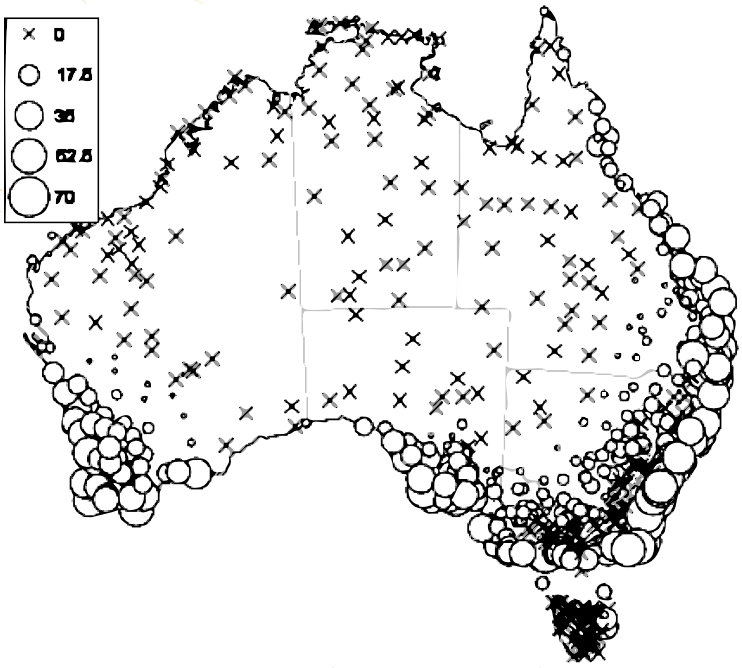
Map 1: Current national distribution. (Scott & Batchelor 2006)



Section 06

Introduction into Australia
A native of southern Africa, the exact date of introduction to Australia is not known but the species was probably introduced as an ornamental plant. It has been found growing as an ornamental climber in older gardens. The Queensland herbarium holds specimens collected from naturalised plants in 1976. Naturalised plants were known from the Ipswich area west of Brisbane in the early 1940's (Stanley 1994).

Map 2: Potential national distribution. (Scott & Batchelor, 2006)



Dispersal methods

In south-eastern Queensland, it has been observed that the silvereye (Zosterops lateralis lateralis (Latham)) and the southern figbird (Sphecotheres viridis vieilloti Vig. & Horsf.) feed on the ripened fruit of climbing asparagus (Conran and Foster, 1986). Transported soil, which has been contaminated with rhizomes and fruit containing seeds, has also been linked to the dispersal of climbing asparagus. Careless dumping of garden waste along roadsides and in native bushland is a contributing factor in the establishment of this asparagus weed.

Legal status of the weed

This weed is only declared in New South Wales and Queensland where it is posing the most threat.

All States and Territories periodically update their weed legislation. To check the updated weed list visit Australian Weeds Committee noxious weeds database at http://www.weeds.org.au/noxious.htm.

Description and life cycle

The life cycle of climbing asparagus is as follows:

- young seedlings establish and continue to produce tubers during wet periods from February to April.
- non-flowering shoots emerge during the autumn months of April and May.
- vegetative regeneration occurs in winter, from June to August.
- flowering shoots occur 20 months after germination, during late winter-early spring (August to September).
- plants begin to form fruits and set seed from late September to October.
- plants may dieback during the hot summer months from December through to mid February, however the sub-surface rhizomes will ensure the plants' survival.

Flowers	Appearance and characteristics
 Flowers of the climbing asparagus. Photo DNRMW	• cream-white, 5-7mm long • present from September to November.

Berries and Seed	Appearance and characteristics
 Black climbing asparagus seed within bird scat, along with others. Photo DNRMW	• depressed globular berry, 5-6mm in diameter and ripening to a bright orange-red colour • 1-2 seeds per berry, globular 3-4mm diameter and black.

Cladodes (leaves) and Stems	Appearance and characteristics
 **Climbing asparagus cladode, after treatment with herbicide. Photo DWLBC**  **Stems of the climbing asparagus with distinctive recurved spines. Photo DNRMW**	• linear or somewhat flattened, 8-10mm long and approx. 0.5mm wide • stems have numerous persistent recurved spines each up to 2cm long.

Root system	Appearance and characteristics
 **Stems growing from fibrous underground crown. Photo DNRMW**	• fleshy, whitish-brown rhizomes forming thick underground fibrous crown.

Controlling infestations

Physical removal

An experiment conducted at Tallegalla in south-east Queensland during 2000 and 2001 found the most effective method was mechanical removal, where the plant crowns were dug out and placed above the ground. Removing the plants from the soil and leaving them exposed above the surface was the quickest way to kill climbing asparagus. The plants desiccated quickly and were dead by 30 days after treatment. Although removing climbing asparagus crowns is very effective, it is time consuming and would only be suitable for isolated plants or small infestations. A mattock was used to dig out each crown and their attacked roots were suspended in a nearby shrub to ensure no re-rooting occurred. For this reason, removing climbing asparagus is impractical for larger-scale infestations (Armstrong,et al. 2006).

Herbicide treatment

The most effective herbicide treatment trialed during an experiment conducted at Tallegalla in south-east Queensland during 2000 and 2001 was a basal bark application of 24g triclopyr ester (40mL Garlon® 600) or 10g fluroxypyr ester (50mL Starane® 200) L-1 diesel. Plant health reduced quickly after application (within 40 days) although plants remained alive for many months. It took 300 days before all plants died, although no regrowth occurred after this time (Armstrong et al. 2006. A key finding of this investigation was that climbing asparagus is not susceptible to metsulfuron-methyl.

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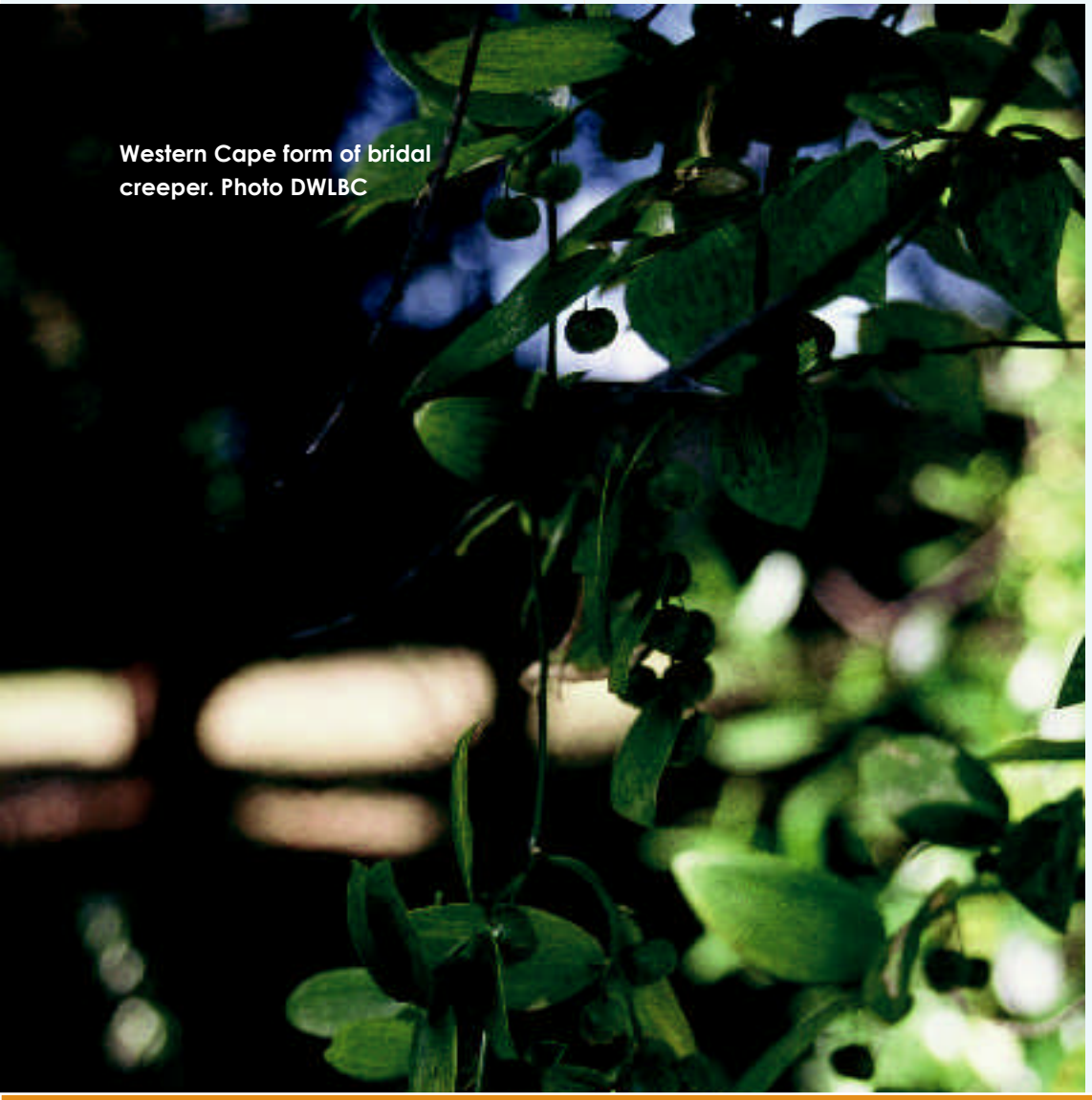
Growth Calender - Climbing Asparagus												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flowering												
Fruiting												
Dieback												
Regrowth												
Germination												
General Growth Pattern												
Growth pattern in suitable conditions												
Adapted from Weed CRC Bridal Creeper Weed Managment Guide												

WESTERN CAPE FORM OF BRIDAL CREEPER

Asparagus asparagoides

Other common names:

South-western Cape form of bridal creeper



Western Cape form of bridal creeper. Photo DWLBC

Section 07 : **Western Cape form of Bridal Creeper**

Until 2003, it was generally accepted that the bridal creeper present in Australia originated from a single South African variety. In 2003 an amateur botanist, Kath Alcock of Naracoorte, South Australia described and illustrated a different form of bridal creeper growing near the coastal town of Port MacDonnell. Unfortunately, the implications of her discovery were not realised by authorities at the time and it was not until officers from the CSIRO and DPI Victoria came across the same plants in 2004, whilst releasing bridal creeper biological control agents, that conformation of the existence of a second form was received. In June 2006 other infestations were found in the Adelaide Hills.

Investigations revealed that this was the South-western Cape form of bridal creeper; described in South Africa as a form of *Asparagus asparagoides* (Kleinjan and Edwards, 1999). Within Australia the National Asparagus Weeds Management Committee (NAWMC) temporarily shortened the name to Western Cape form of bridal creeper . The scientific name of *Asparagus asparagoides* remains the same.

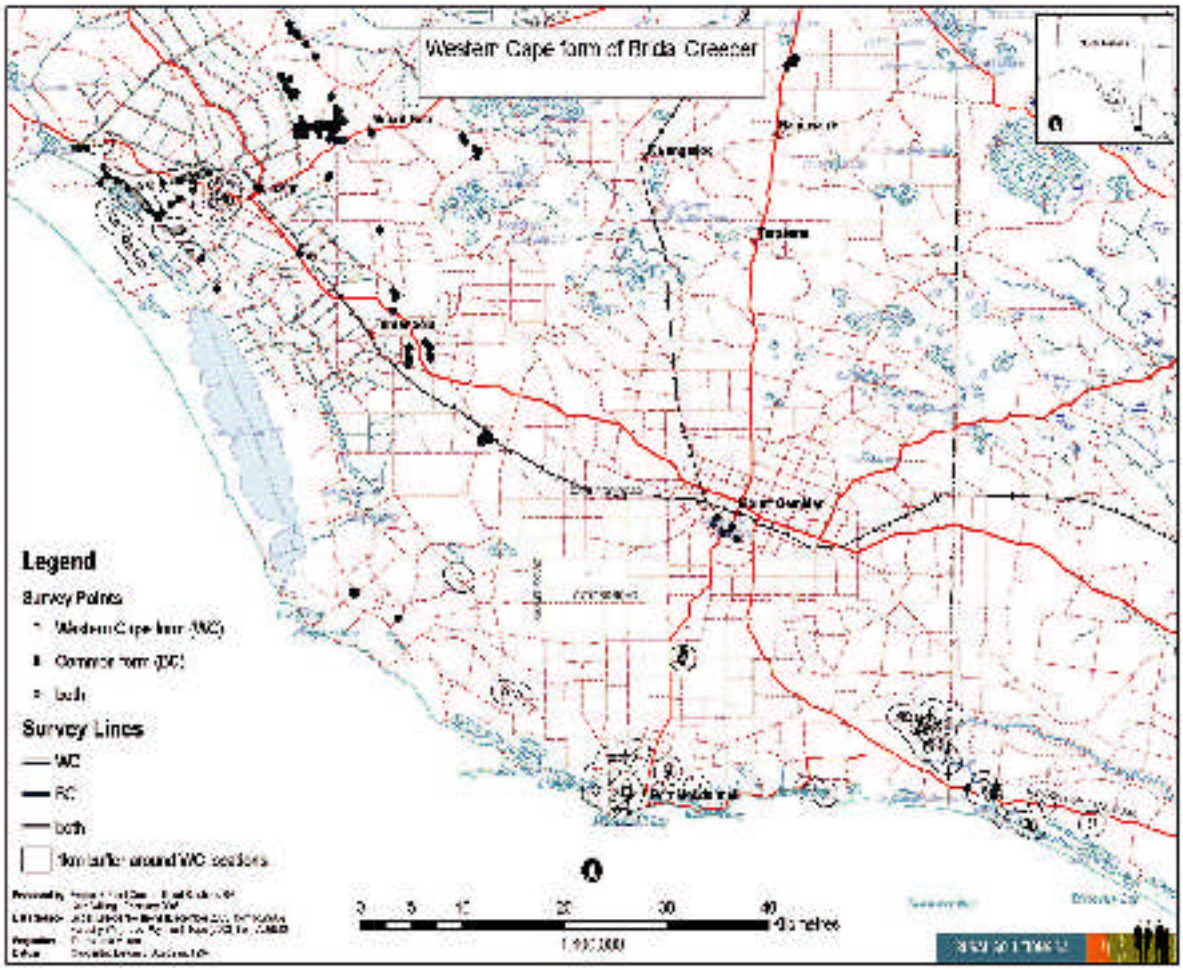
What makes this finding significant is the discovery of this form's resistance to the common bridal creeper rust fungus *Puccinia myrsiphylli* . The implication being that the Western Cape form could potentially re infest remnant vegetation cleared of common bridal creeper. With an inherent resistance to the rust in the environment, the plant could spread with little hindrance. Only costly chemical and physical removal will contain the weed. Effective and expedient management is required to prevent the Western Cape form from reaching its potential growth range across Southern Australia.

In early 2006 a management strategy was developed by the NAWMC, involving community and State agencies from South Australia and Victoria to treat all known infestations in the border region with herbicide and eradicate outlying populations identified in a comprehensive mapping exercise undertaken in 2005. In the Adelaide Hills a similar mapping exercise was undertaken in September and a management plan developed for implementation in late 2006 and followed up in 2007.

Vigilance is required from all land managers to ensure that this form of bridal creeper is not growing on their property. Any finding must be reported to your local noxious weed authority.

Current and predicted distribution

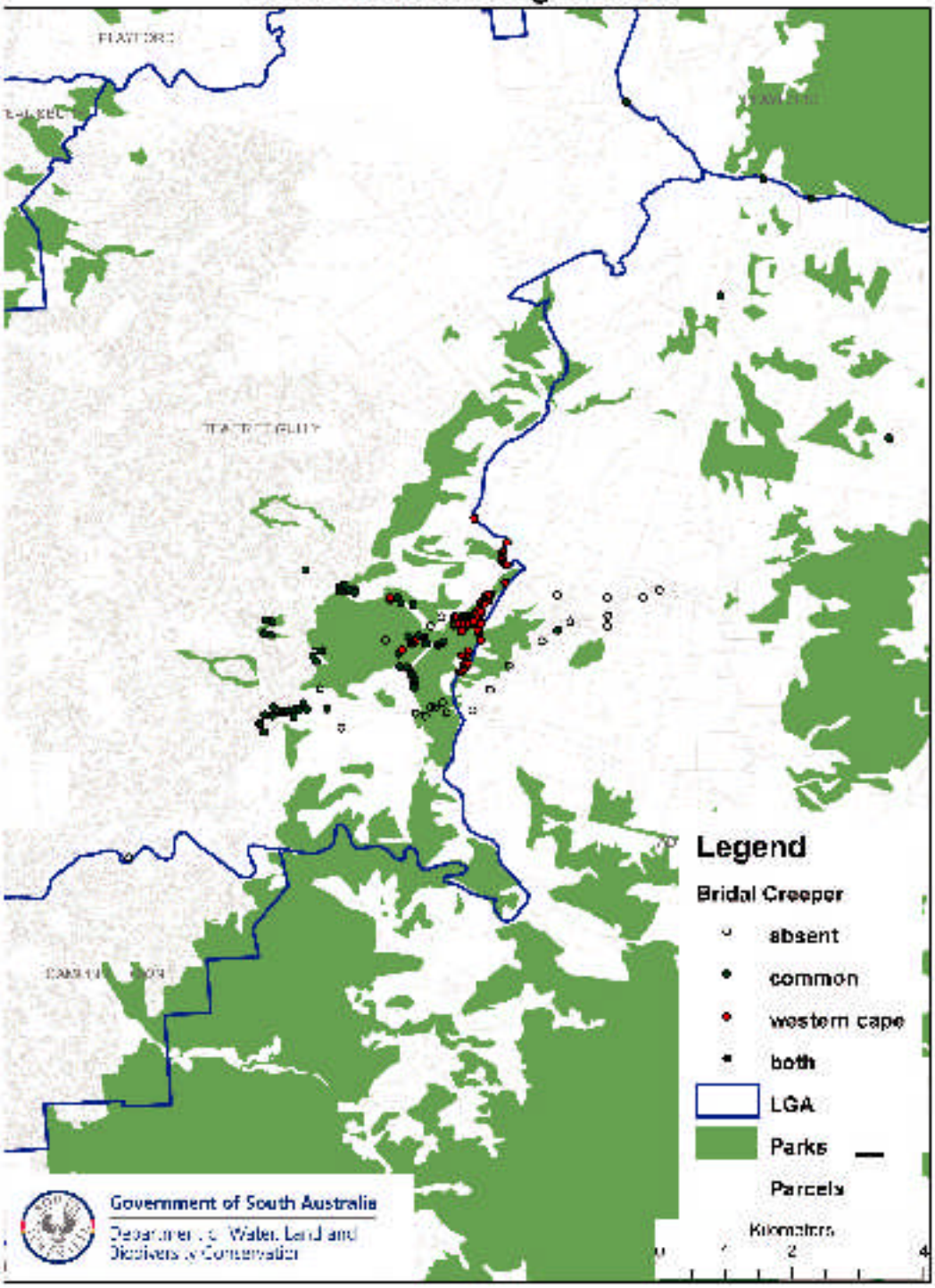
In 2005 a project, funded through the Federal Government's Defeating the Weed Menace programme successfully mapped the growth range within the higher rainfall border region between South Australia and Victoria. A second mapping effort to determine the growth range in the Adelaide Hills will be completed in October of 2006. The results of the South East SA and Victoria survey is available from the bridal creeper webpage at www. weeds.org.ao/bridalcreeper/ . The results of the 2006 Adelaide Hills survey will be available on the same webpage from November 2006.



Maps 1 & 2 : Current known distribution of The Western Cape form at time of publishing manual.

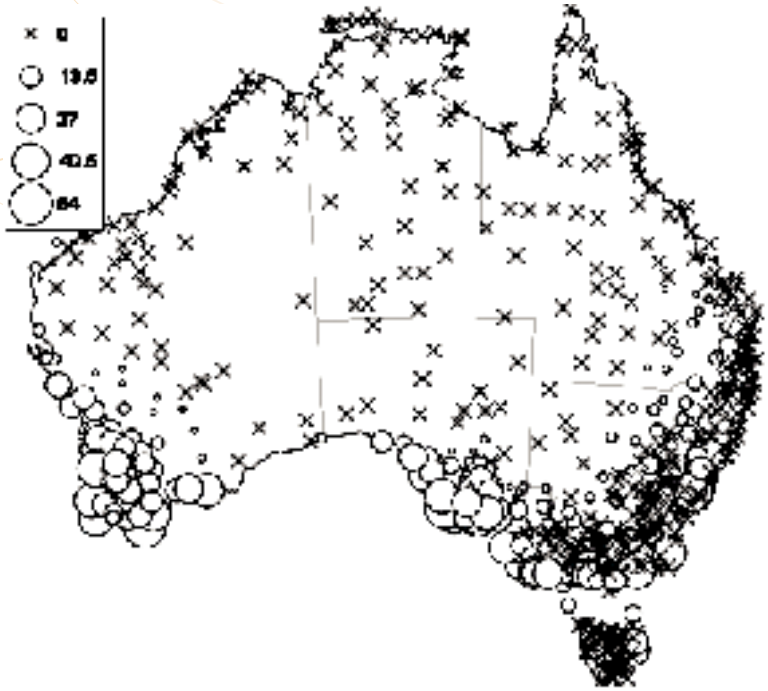
Section 07

Distribution of Bridal Creeper in Anstey Hill Recreation Park and surrounding areas.



Section 07

Map 2: Potential Distribution of Western Cape



Predictive mapping based on matching the climatic conditions within the weeds original home range in South Africa shows that it can potentially grow along all Australian coastlines with a Mediterranean climate.

Dried remains of previous years growth under trees. Photo DWLBC

Growth Cycle

The growth habit of this form is similar to that of the common bridal creeper. Shoots appear after first rains in early autumn. Initial growth is rapid and shoots grow upright to twine amongst nearby shrubs, trees and other supports. Flowering commences in August and first fruits in late September. Leaves turn yellow and drop off at the beginning of summer leaving a taggle of dried stems with blackened fruit attached. Green cladodes have been observed on the plant as late as January where it is growing in moist conditions and under shade. Appendix 1 graphically depicts the plants life cycle.

Distribution method

The Western Cape form is distributed in much the same manner as the common bridal creeper. The main vectors are birds, foxes and possibly rabbits. The dumping of garden waste onto roadsides and into remnant bushland is undoubtedly how the initial infestations would have been established. Trading or sharing of plant material by gardeners is the most likely answer as to how the weed has appeared in the four distinct geographic areas.

Emu scat containing black Western Cape bridal creeper seed. Photo DWLBC

Variance between the two forms of Bridal Creeper

While the two forms can be identified by visual inspection of the above ground portion of the plant, this is often difficult because both forms may display the same characteristics depending on growing conditions. The most reliable method of identification is to dig up the tubers of the mature plant.

Cladode (Leaf)	Appearance and characteristics
	**Cladode (Leaf)** The cladodes of the two forms may appear similar depending on growing condition. In general the cladode of the Western Cape is larger than the common form. It is thick with a waxy feel as opposed to the common form's soft feel and high sheen. The colour of the Western Cape form is a dark blue green while the common form tends to be a bright green colour. A detailed description of the cladode is set out in Appendix 2. Do not rely on the cladodes for identification, as it may be difficult to distinguish between the two forms unless they are growing in close proximity to each other.

Western Cape Cladodes: Photo RSSA

- Dark green colour
- Leathery texture
- Flatter leaf
- Waxy texture
- Larger than the common form

Berries and Seeds	Appearance and characteristics

Berry of the Western Cape form. : Photo RSSA

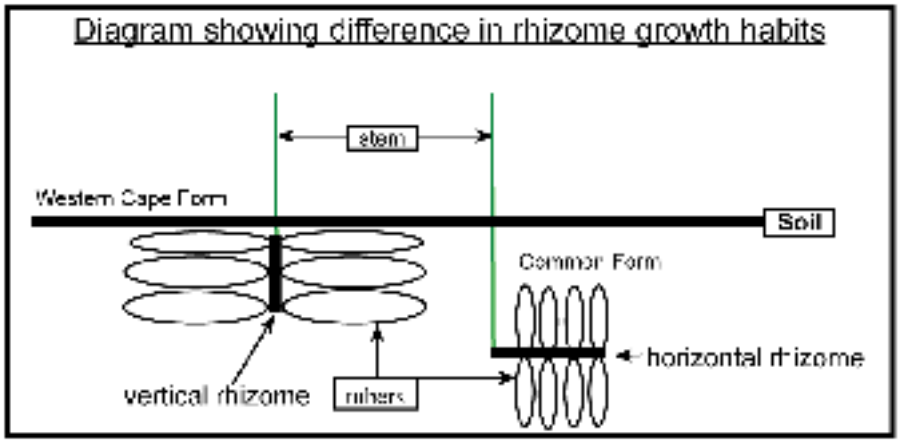
A small variation between the shape berries of the two forms can be distinguished but again this is not a reliable method of identifying the plant. The berry of the Western Cape has three distinct lobes while that of the common form has six lobes.

Berry of common form: Photo RSSA

Tubers	Appearance and characteristics
 **Tubers of the Western Cape form: Photo DWLBC**	This is the most reliable feature used to distinguish between the two forms of bridal creeper. The size and growth habits of the Western Cape form are very distinctive. • large tubers. • forms a rosette around the rhizome. • each tuber ends in a fine root.
 **Tubers close to soil surface: Photo DWLBC**	• tubers grow close to the soil surface. • grow to a length of between 40mm - 75 mm. • rhizome grow vertically in the soil.
 **Comparison between the tubers of the two forms. Photo DWLBC.**	

Tubers close to the soil surface with size 11 boot: Photo DWLBC

Diagram 1: Differing growth habits of the two bridal creeper forms



Controlling infestations

At the time of writing this manual, trials to establish the most effective herbicide to be used against this form had not been completed. Results of the study will be released in the second half of 2006. All results will be posted on the bridal creeper website at http://www.weeds.org.au/WoNS/bridalcreeper/.

Until an effective control method has been developed, the same control methods used on the common form apply to this weed.

Leafhoppers damage has been observed on cladodes and the rust fungus may be present where both forms of bridal creeper coexist. Preliminary research undertaken by the CSIRO has indicated that the rust fungus attacks the seedlings of the Western Cape form. No long-term research on biological controls had been undertaken at the time of writing this manual. This section will be updated and posted to the bridal creeper website at http://www.weeds.org.au/WoNS/bridalcreeper when any new research in received.

Leafhopper damage on Western Cape cladode. Photo RSSA

The comparison poster is freely available online from www.weeds.org.au/bridalcreeper/.

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Growth Calender -Western Cape form of bridal creeper

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flowering												
Fruiting												
Dieback												
Regrowth												
Germination												
General Growth Pattern												
Growth pattern in suitable conditions												

Adapted from Weed CRC Bridal Creeper Weed Managment Guide

Notes

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