Guidelines for field releases of the sea spurge biocontrol agent, the fungus *Venturia paralias*

Background information on the biocontrol agent

What is sea spurge?

Sea spurge (*Euphorbia paralias*) is a highly invasive weed that infests coastal dune ecosystems across southern Australia. The weed currently extends along the southern coastline from just above Perth, in Western Australia, to the Mid North Coast of New South Wales. Dense infestations also occur throughout Tasmania. Sea spurge outcompetes native vegetation, reduces habitat quality for nesting shorebirds and, when damaged, releases a toxic latex that can harm humans and animals. Sustained sea spurge control is costly, labour intensive and is frequently hampered by re-invasion from ocean-dispersed seeds.

What is the biocontrol agent for sea spurge?

The biocontrol agent is a fungus, called *Venturia paralias*, that causes disease in sea spurge. It was originally isolated from diseased sea spurge plants in France. Through extensive host-specificity studies undertaken by the CSIRO, the fungus was shown to be highly specific to sea spurge and poses no danger to Australian flora. It was approved in 2020 for release into the Australian environment for the biocontrol of sea spurge.

The fungus infects leaves of sea spurge, causing brown leaf lesions. From infected leaves it moves to the stem, where it causes dark brown to black lesions that progressively extend along the stem. Under humid conditions, the fungus produces spores on lesions that spread to other nearby sea spurge plants by wind and rain to begin new infections. The fungus impedes the photosynthetic capacity of sea spurge leaves and disrupts the translocation of water and photosynthates in the stem. If the fungus establishes widely and causes severe disease symptoms, it will likely decrease the reproductive output of sea spurge plants and become an important addition to existing sea spurge management practices in Australia.

For more information on sea spurge or the biocontrol agent, please visit our website:

https://research.csiro.au/nswweeds/sea-spurge/

Please contact CSIRO staff if you require assistance or have any questions:

Gavin Hunter: gavin.hunter@csiro.au

Caroline Delaisse: caroline.delaisse@csiro.au

The release program for the sea spurge biocontrol agent is supported by co-investments from CSIRO and the NSW Government through its Environmental Trust

Selecting the location for release

The sea spurge biocontrol agent can be released anywhere where sea spurge occurs. However, please ensure that you have obtained access permission from the landowner/land manager where you plan to release the sea spurge biocontrol agent. Releasing the agent in a dense infestation of sea spurge is ideal because it will increase chances of more sea spurge plants becoming infected as the agent naturally spreads in future. If possible, it is recommended to release the agent on sea spurge plants that are either sheltered from direct sunlight and/or strong winds (e.g., sea spurge growing next to a large shrub). As the agent prefers cooler/humid areas, being sheltered from sunlight and strong winds may assist its establishment.

It is also important to remember that in areas where sea spurge occurs, there may also be nests of local shorebird species. Please ensure that you are not disturbing nesting areas, especially when releasing the agent during the height of nesting season.

Release methods

To release the biocontrol agent on sea spurge plants in the field, we will provide you with a kit that contains a dried culture of the fungus from which you can prepare a spore suspension to spray on to sea spurge plants. The spore suspension made from the dried culture will be sufficient to spray approximately 2–5 sea spurge plants.

The kit's content:

1. A 50 ml plastic screwed-cap tube containing pieces of a dried culture of the fungus (**Tube B**).
2. A 50 ml plastic screwed-cap tube containing a few droplets of the surfactant TWEEN 80 (**Tube A**). Due to the hydrophobic nature of sea spurge leaves, the surfactant is necessary to ensure that the fungal spores adhere to leaves. TWEEN 80 is non-hazardous and safe to use.
3. A square piece of cheese cloth that will be used for filtering.
4. A small plastic spray bottle and spray nozzle.

Material to be supplied by the user:

- Tap water, if low in chlorine, or bottled water.
- Two small pebbles or stones that can fit into **Tube B**.

Things to know before you start preparing the spore suspension:

- Once you have prepared the spore suspension, it should be used within 6 hours as spore viability gradually decreases.
- Plan to spray sea spurge plants with the spore suspension late in the afternoon, preferably close to dusk. This will reduce the amount of time that spores are exposed to the sun's UV and decrease evaporation rate so that moisture is retained on the sprayed plants for as long as possible to facilitate spore germination.

Preparing the spore suspension of the fungus:

See Figure 1 and YouTube video (url: https://youtu.be/Mv8CCnjIlV8) for a visual illustration of the methods

1. Fill **Tube A**, to the 50 ml mark, with fresh water (avoid water with high chlorine). Screw the cap on and vigorously shake the tube for a few seconds, to mix water and TWEEN 80. Once mixed, pour the liquid from **Tube A** into **Tube B**.
2. Add two small pebbles/stones into **Tube B**. Screw the cap back on **Tube B** and vigorously shake the tube so that pebbles disrupt the surface of the dried culture pieces. Leave **Tube B** to sit for 30–50 minutes in a cool place (not in full sun) to allow spores in the suspension to rehydrate.
3. Prepare your other, now empty **Tube A**, with the piece of cheese cloth. Place the cheese cloth into **Tube A** to form a well. Filter the liquid from **Tube B** by gradually pouring it through the cheese cloth into **Tube A** to produce the spore suspension.

   NOTE: If the cheese cloth becomes clogged and the liquid has difficulty passing through, gently tap the tube on a hard surface.
4. Once all the liquid is filtered into **Tube A**, remove the cheese cloth and discard with **Tube B** into a rubbish bin. Pour the spore suspension from **Tube A** into the supplied **spray bottle** and add additional water to fill the **spray bottle**. Attach the **sprayer head**.
5. Spray actively growing, healthy shoots of sea spurge plants with the spore suspension contained in the spray bottle until all the foliage is covered in droplets. The content of the spray bottle should be sufficient to spray 2–5 plants.

   NOTE: If prevailing conditions are windy, spray plants upwind so the wind does not carry the spore suspension droplets away from plants.

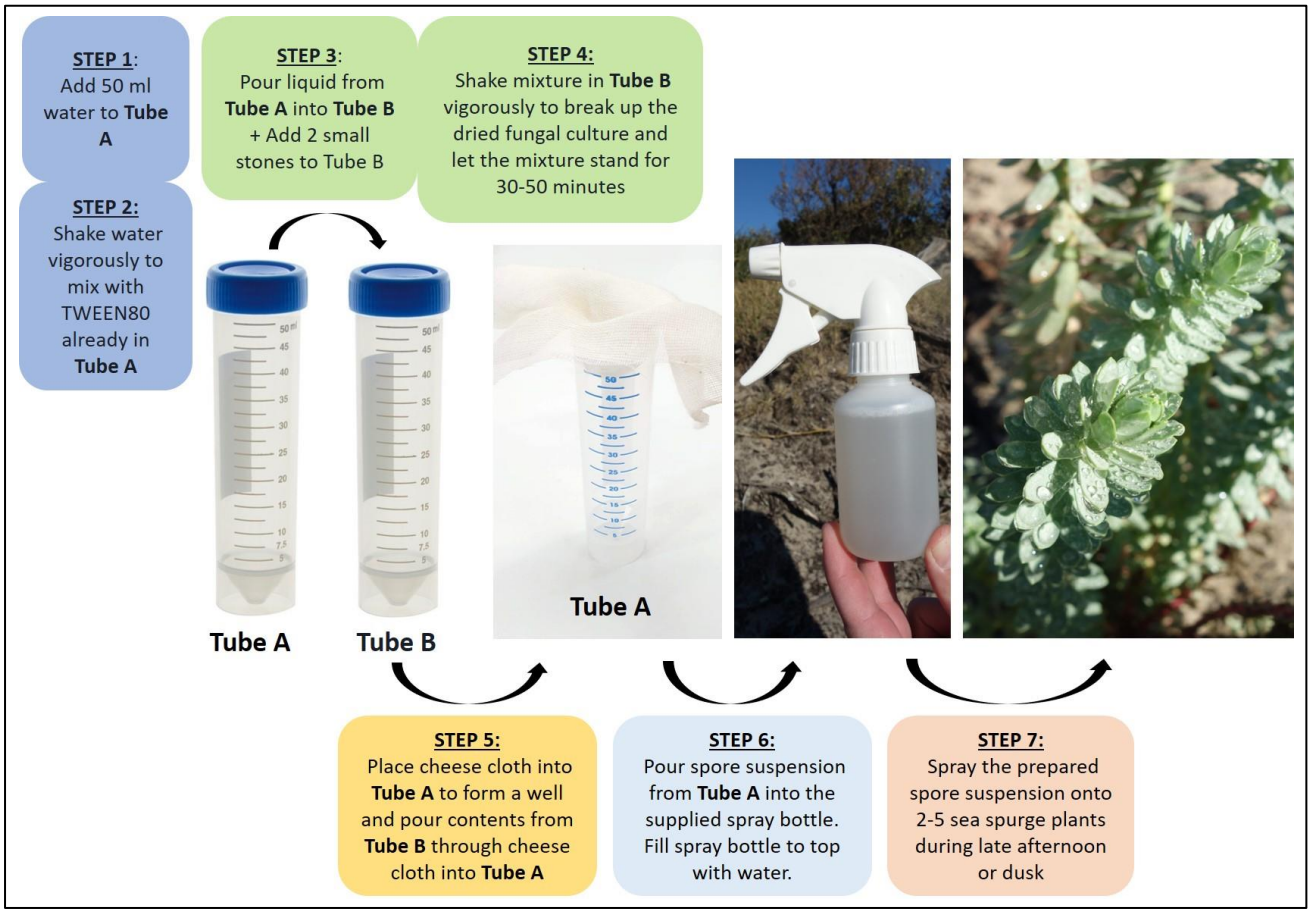

Figure 1. Diagram illustrating the steps involved in preparing the spore suspension of the sea spurge biocontrol agent and the application of the spore suspension onto sea spurge plants.

Monitoring and evaluation

In return for receiving the sea spurge biocontrol agent, please return the following information within two weeks of release to CSIRO researchers via email (or telephone). All personal information will be treated confidentially:

- Name of participant.
- Affiliations (i.e. were releases made as a private property owner, as part of a coordinated 'working bee' at a Bushcare or Landcare site, etc).
- Release date(s) and time.
- Release location (This may be in the form of GPS coordinates, a location description, or mud map sketch).
- Number of tubes, containing the biocontrol agent, sprayed at each location.
- Approximate number of sea spurge plants that were sprayed with the biocontrol agent.
- Prevailing weather conditions at time of release (eg., approximate temperature, sunny, rain, overcast etc.).
- (optional) A photo depicting the general condition of the habitat infested with sea spurge.

Information should be emailed to Caroline Delaisse (caroline.delaisse@csiro.au, +61 2 62183525).

If convenient, please return to the release site after approximately 10 weeks and record the presence or absence of characteristic dark brown to black stem lesions caused by the biocontrol agent (Fig 2 and next page Fig 3). We encourage participants to get close to the plants/stems when checking for lesions, and if uncertain, to take a photo of the stem symptoms and email these to us.

Figure 2. Characteristic disease symptoms caused by the sea spurge biocontrol agent. Dark brown to black stem lesions on stems and (less commonly) leaves of sea spurge plants.

Figure 3. Dark brown to black stem lesions on stems of sea spurge plants caused by the biocontrol agent.

FAQ

Who is eligible to receive the biocontrol agent?

Participants can include private citizens, government agencies (e.g., NPWS, LLS, DPIE, Council, etc.) and members of volunteer community groups (e.g., Bushcare, Landcare etc) based in New South Wales, Victoria, and Tasmania. If you know of interested parties who would like to participate, please encourage them to email Caroline Delaisse (caroline.delaisse@csiro.au) to register their interest in the biocontrol program. The biocontrol agent will be provided to registered participants at regular intervals between 2021 and 2023. The specific timing of delivery will be determined by prevailing climate conditions, quantity of available material for release and level of demand from registered participants. The release kit will be sent via post. Participants should release the agent as soon as possible upon receiving their package. However, the release kit can be stored for a maximum of eight days before preparing the spore suspension to spray onto sea spurge plants in the field.

Is it safe to release the biocontrol agent into the Australian environment?

In 2017, CSIRO began rigorous evaluation of the risks that the fungus *Venturia paralias* could pose to non-target plants in Australia. Research focused on species within the family Euphorbiaceae. This extensive host-specificity testing was performed in a biocontainment facility and involved exposing sea spurge and non-target plant species to the fungus under optimal conditions for infection. It was found that the fungus is highly specific to sea spurge and based on these research results and following a comprehensive risk assessment process and public consultation, the Federal Department of Agriculture, Water and the Environment (DAWE) approved the release of the biocontrol agent into the Australian environment. The information package that supported the application to release the agent in Australia, which includes all results, can be found here:
https://www.agriculture.gov.au/biosecurity/risk-analysis/biological-control-agents/risk-analyses/completed-risk-analyses/ra-release-venturia-paralias

What effect will the biocontrol agent have on native ecosystems?

Provided that the sea spurge biocontrol agent establishes widely in Australian coastal ecosystems and causes severe disease symptoms on sea spurge, we are confident that it will reduce the reproductive output of plants in the long term. This will have a positive effect on affected ecosystems and the biocontrol agent will become an additional tool for management of sea spurge in Australia.

How should the biocontrol agent be used alongside other control treatments for sea spurge?

Biocontrol can provide a sustainable, landscape scale approach for sea spurge management with no chance of off-target damage to native plants. Although the biocontrol agent will not entirely replace the need for other control methods, it may minimise the need for these in some sensitive ecosystems over many years. The benefits of biocontrol may also include reduced effort to manage sea spurge (time and labour), reduced amount of herbicide required, and reduced risk of off-target damage, which equate to a reduction in cost.

It still, however, remains the responsibility of site custodians to meet the terms of any weed control compliance order imposed by the relevant authority in the area selected for a biocontrol release. Release of a biocontrol agent cannot be used as an excuse to not control sea spurge or other weeds at a site. There is no guarantee that the biocontrol agent will establish and have an impact on sea spurge at the release site.