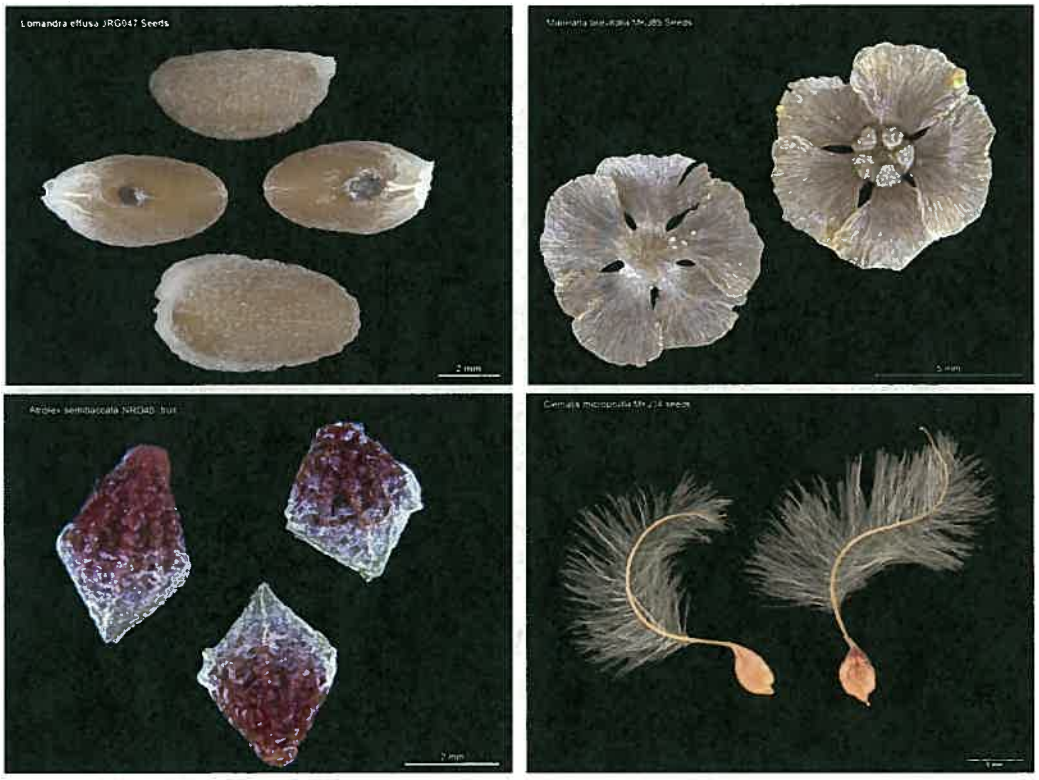
Report for Hillgrove Resources Ltd

Germination Research on Selected Taxa for the Kanmantoo Restoration Technology Project.



Progress Report August 2014

South Australian Seed Centre Botanic Gardens of Adelaide

Summary

The underlying aim of the project is to assist the rehabilitation of indigenous plant communities and the revegetation of disturbed areas according to the Kanmantoo Copper Mines Environmental Management Program.

In vitro laboratory experiments to determine the germination requirements of *Lomandra effusa* showed that up to 74% of seeds collected from Frahn's Scrub in late November germinated after treatment with gibberellic acid (1000 mg/L) and 62% germinated with no treatment. These results are encouraging for developing an effective propagation method based on seed germination. The effect of seed maturity on germination was further investigated and the results indicate that maturity is a key determinant of germination capacity.

Seed from 22 seed collections obtained from EBS Ecology were screened for viability and seed purity. The results showed that 14 of the seed collections tested had high viability determined by x-ray imaging and cut testing.

Seedling photos were taken from the species obtained from EBS the previous year of the project. Providing these images will support the identification of seedlings emerging during monitoring of direct seeding programs.

Soil samples taken from different depths at the Hillgrove site were tested for seedling emergence in the Adelaide Botanic Garden Nursery. It was found that 78% of nondormant seeds germinated from the top 50 mm of soil. This information will assist management decisions regarding weed seed deposits and their possible removal from the site.

Information from several species that occur in vegetation communities that will be restored at the site has been loaded on to the Seeds of South Australia website (http://saseedbank.com.au/). We aim to add the data from this project to the website after pressing and lodging a specimen of each species in the Sate Herbarium. This website will be a useful reference for the rehabilitation team at the Kanmantoo site as well as a way to share information with the wider community.

Introduction

Lomandra effusa is a component of five of the vegetation communities recorded from the Kanmantoo Copper Mine site (EBS Ecology survey), including the threatened ecological communities, *Eucalyptus odorata* woodland and *Lomandra effusa* grassland. The propagation of *Lomandra* species for large scale restoration presents some difficulty as vegetative propagation can be unreliable and seed germination is often slow and/or sporadic. However, the most cost effective method of producing *Lomandra effusa* seedlings is through seed germination which would provide the best outcome for maintaining genetic diversity and ensure long term sustainability of the population on the rehabilitation sites. One of the initial aims of this project is to experiment with different approaches to propagate *Lomandra* species from the site, including novel germination techniques and traditional nursery methods.

Another aim of the project is to assist the success of restoration by assessing seed quality, and identifying dormancy mechanisms in seed collections. These experiments are still in progress and not all of the results are available to date. Seed collected from 21 species were obtained from EBS and have been assessed to determine the purity of the seed collection and the viability of the seed. This study will deliver information about the condition of the seeds held in storage that will be used for restoration and provide feedback for seed collectors in the future. Seeds from the collections provided last year were sown into pots and the seedlings were photographed to document the appearance of each species as the adult leaves emerged. These images will be useful for monitoring revegetation after direct seeding at the Hillgrove site.

Soil samples were collected from an area of the Hillgrove Kanmantoo mine site that will be scraped to remove the soil weed seed bank before seeding and planting the area with local vegetation. The aim of this study was to determine how the soil seeds bank is fractionated through the top 100 mm of soil. Soil seed banks have been investigated in various habitats and seed densities are reported to be high beneath disturbed areas and arable fields (Leck et al, 1989). The distribution of seeds in the soil profile will depend on the seed size and shape as well as the soil structure and particle size. Wind, water, mechanical disturbance (digging or ploughing), animal foraging and insect activity can also effect seed dispersal and thereby influence the structure of the soil seed bank profile.

It has generally been reported that most of the seeds in the soil seed bank in arable grasslands occur within the top few cm of soil. Weed seeds measured in a no tillage system in Wisconsin found that 60% of seeds were in the top 1 cm of soil and decreased logarithmically to a depth of 19 cm (Yenish et al, 1992). Another study from a Mediterranean grassland found that 98.9% of viable weed seeds were situated in the top centimetre of soil with a significant fall in the in the number of seeds as the depth increased (Traba et al, 2004).

Information about species from the *Eucalyptus odorata* grassy woodland and Iron-grass grassland communities that are the focus of the restoration program at the Kanmantoo site is currently being compiled into the Seeds of South Australia website (saseedbank.com.au). Information about seed collecting, cleaning and germination is presented on this site as well as detailed photographs of plants and seeds. Information sheets for 12 species have been attached to the end of this report.

Materials and Methods

Seed Collection

Seed collections of *Lomandra effusa* were made from Nugents Hill (Hillgrove Kanmantoo site) and Frahn's scrub. Two seed collections were made at different times from Frahn's Scrub to compare the effect of collection time on maturity and seed viability. Seeds from *Lomandra densiflora* from Frahn's Scrub and *Lomandra multiflora* ssp *dura* from Finniss Oval were also collected for testing as they form part of the *Eucalyptus odorata* woodland vegetation community. The collections used for testing are listed below:

Lomandra effusa

Hillgrove Nugent's Hill - 22.11.2013

Frahn's Scrub – 23.10.2013

Frahn's Scrub – 22.11.2013

Lomandra densiflora

Frahn's scrub - 02.12.2013

Lomandra multiflora* ssp *dura

Finniss Oval - 08.01.2014

Seed collection from other species was carried out by EBS and seed samples were picked up from their office. The species are listed in Table 2.

Seed Cleaning and Quantification

Seed batches were initially weighed and then the amount of seed in the sample was estimated after cleaning the seed and comparing the weight of pure seed to the whole sample weight. Seed cleaning was done using a combination of sieving and aspiration to remove twigs and debris from the collections. Alternatively, when cleaning to pure seed was difficult, a purity test was performed where 1g of the sample was weighed out and the seed in that subsample was picked out and

weighed to determine the percent purity of the seed batch. The weight of one seed was quantified by weighing five replicates of 20 seeds to determine the average weight per seed. The following formula was used to calculate the number viable seeds per kilogram of seed sample:

(1000/weight of 1 seed (g)) x (% viability/100) x (%purity/100) = number of viable seeds/kg

Seed Viability Testing

Seed viability was tested using the following methods.

X-ray: Seeds were x-rayed using a Faxitron X-ray MX-20 Specimen Radiography System. Up to 50 seeds were aligned onto an adhesive strip to capture an x-ray image. The images of the seeds were scored as viable where the seed appeared to be filled. X-ray is a non-destructive test that can assess seed fill for large numbers of seeds in a seed lot.

Cut Testing: Twenty seeds were dissected with a scalpel and aligned with adhesive and photographed under a dissecting microscope fitted with a camera. Seeds containing full white or cream endosperm and whole embryos were scored as viable. Cut testing was used to confirm the results of the x-ray.

Germination Screening

Lomandra seeds were put through a germination test to assess rates of germination for different seed collections with and without pre-treatment with gibberellic acid. The treatments were set up as follows:

1) Control – seeds were soaked in sterile RO water (10 mL) for 24 h.
2) GA treatment – seeds were soaked in a solution of gibberellic acid (1000 mg/L) (10 mL) for 24 h.

A total 50 seeds were used for each treatment, after soaking the seeds were placed onto sterile sand in Petri dishes and sealed with a thin strip of cling wrap. Plates were incubated at 15˚C with a 12 hour photoperiod. The plates were scored for germination on a weekly basis for at 16 weeks.

Germination was scored when the radicle had grown to at least half the length of the seed coat. Germinants were removed after scoring.

Seedling Photos

Seeds were sown directly into potting soil and grown outside on benches under daily irrigation. Photos were taken as the seedlings developed to show the morphology of the young plant. Typically when the first few adult leaves had opened.

Soil Sampling Experiment

Collection of Soil Samples

Soil samples were taken on the 2nd of May 2014 from the paddock adjacent to the seed production area that has previously been used for cropping and grazing for many years. Soil samples were taken from 10 sites within the paddock that were selected at random. Soil samples were extracted using the equipment shown in Figure 1 A. Firstly the mattock was used to loosen the soil. The spade was used to cut a smooth face into the soil profile Figure 1 B. The metal tube (10 cm diameter) was then hammered into the soil up to 25 mm then the trowel was inserted below the tube which was lifted out and the soil from inside the tube was placed into a zip-lock bag. The metal tube was replaced and hammered in another 25 mm to take the second sample. This was repeated until four samples had been removed from the site, each one from an increased depth. The samples corresponded to the first 0-25 mm of the soil profile, then 25-50 mm, 50-75 mm and lastly 75-100 mm.

Figure 1. Soil sample collection. A) Tools used for sampling; B) Soil profile to 150 mm.

Sample Preparation

Soil samples were processed on the day of collection at the Adelaide Botanic Gardens (ABG) Nursery. A sample of 150 g was weighed out from each bag and spread onto a tray containing wet, heat sterilized (autoclaved) sand as shown in Figure 2. The sample size allowed a thin layer (~ 5 mm) of soil to be spread over the damp sand. The utensils were cleaned after weighing each sample to avoid contamination between samples. The trays were placed in the glass house under irrigation (misted daily for 10 mins). Emerging plants were scored on a weekly basis, monocots and dicots were counted separately. Control trays contained sand only.

Figure 2. Sample preparation at the ABG nursery.

Statisitcal Analysis

Data were analysed using Minitab 17. Difference between the group means was determined by one way ANOVA. Pairwise differences were calculated using a Tukey test.

Results and Discussion

Germination Testing of *Lomandra species*

The germination rates of *Lomandra effusa* seeds were tested from three collections (Table 1). None of the seeds germinated from the first collection from Frahn's scrub, made on the 23rd of October 2013. However, seeds that were collected a month later on the 22nd of November had high levels of germination in the control (62%) and after treatment with gibberellic acid (74%). This result demonstrates that *Lomandra effusa* seeds collected too early may not have developed fully and, in that case, they will not germinate. Mature seed has the key features of a dark, conspicuous hilum, and evidence of the micropyle (shown in the previous report). Images of the collections are shown in Figure 3, the differences in the colour of the seeds and the dark hilum can be observed with the naked eye. The seeds from Hillgrove that were collected on the 22nd of November appeared to be less mature than the seeds from Frahn's scrub collected on the same date. These seeds had a lower level of germination in the control (42%) and after treatment with gibberellic acid (56%) than those collected at Frahns. This result may be due to the fact that the some of the seeds from Hillgrove were still immature and not ready to germinate.

Figure 3. Seeds of *Lomandra effusa* collected from Frahn's scrub (A and B) and Hillgrove (C).

These results show the importance of collecting fully mature *Lomandra* seed. The maturity of the seeds can be examined before collection. The capsules should be darkened and have started to split with evidence of mature seed inside. *Lomandra effusa* is likely to be mature in late November to early January, in areas near the Hillgrove site, depending on seasonal conditions.

The other *Lomandra* species tested differed in their level of germination and response to gibberellic acid. *Lomandra multiflora* ssp *dura* had a high level of germination in the control (78%) but had low germination levels after treatment with a high concentration of gibberellic acid (1000 mg/L). *Lomandra densiflora* had lower germination levels than the other species with 32% of seeds germinating after treatment with gibberellic acid (10000 mg/L). These seeds will undergo further testing to investigate the germination requirements of this species.

Table 1 Summary of Results.

Species	**Collection**	**Treatment**	**% germination**
Lomandra effusa	Frahn's scrub 23.10.13	Control	0
		GA (1000mg/L)	0
Lomandra effusa	Frahn's scrub 22.11.13	Control	62
		GA (1000mg/L)	74
Lomandra effusa	Hillgrove 22.11.13	Control	42
		GA (1000mg/L)	56
Lomandra densiflora	Frahn's scrub 02.12.2013	Control	16
		GA (1000mg/L)	32
Lomandra multiflora spp *dura*	Finnis Oval 08.01.14	Control	78
		GA (1000mg/L)	10

Lomandra effusa **Preliminary Nursery Trial**

Seven plants of varying sizes of *Lomandra effusa* were dug up from the Kanmantoo Copper mine site (June 2013) from an area marked for clearance to grow in pots for testing methods of vegetative propagation. These were placed into pots and are being kept in the Mount Lofty Nursery and had all survived transplanting after 6 months.

The plants have now been growing in pots for just over a year and five of them are still in a healthy condition. However, division has not been attempted as there is no sign of new growth emerging to date. These plants will continue to be monitored for new growth over the coming months.

Testing Seed Collections

Seed quality has been investigated using x-ray imaging for 21 species and 22 seed batches provided by EBS. The x-ray images have been compiled and are shown in Appendix 1.

Table 2. Species list with viability results, % purity of the bulk seed mix and estimated number of viable seed per kilogram of bulk seed.

#	Batch No	Species	% Viability	% Purity	# Viable seeds/kg
1	EBSKAN 58	*Acacia pycnantha*	80	91	30,834
2	EBSKAN 77	*Allocasuarina verticillata*	70	100	157,303
3	EBSKAN 98	*Anthosachne scabra*	80	1	1,361
4	EBSKAN 87	*Aristida behriana*	10	71	26,782
5	EBSKAN 50	*Arthropodium strictum*	48	86	216,019
6	EBSKAN 107	*Atriplex semibaccata*	14	48	16,478
7	EBSKAN 80	*Atriplex semibaccata*	82	75	168,614
8	EBSKAN 91	*Austrodanthonia sp*	94	80	8,439,955
9	EBSKAN 105	*Bursaria spinosa*	94	89	470,326
10	EBSKAN 101	*Callitris gracilis*	42	91	28,264
11	EBSKAN 104	*Chloris truncata*	46	79	1,559,657
12	EBSKAN 75	*Chrysocephalum apiculatum*	92	26	3,967,099
13	EBSKAN 102	*Convolvulus remotus*	94	100	61,486
14	EBSKAN 97	*Dodonaea viscosa*	100	99	102,659
15	EBSKAN 103	*Enchylaena tomentosa*	40	66	46,739
16	EBSKAN 94	*Eucalyptus odorata*	100	25	1,452,861
17	EBSKAN 81	*Gonocarpus tetragynus*	40	60	518,432
18	EBSKAN 83	*Goodenia pinnatifida*	90	57	210,428
19	EBSKAN 71	*Maireana brevifolia*	82	100	638,104
20	EBSKAN 90	*Themeda triandra*	28	15	11,976
21	EBSKAN 106	*Vittadinia* sp mix	100	60	727,393
22	EBSKAN 86	*Wahlenbergia stricta*	90	100	58,427,577

The majority of the seed collections had high percentages of both purity and viability, resulting in large numbers of viable seed per kilogram. It was interesting that the seeds in one of the collections of *Atriplex semibaccata* (EBSKAN107) had low viability (14%) whereas the other collection (EBSKAN80) had high viability (82%). This may be due to factors such as the timing of collection, the health of the plant during seed development, the effectiveness of pollination or predation. The collection of *Themeda triandra* (EBSKAN90) had a higher number of viable seeds (28%) than the previous collection (EBSKAN38) that was analysed last year (18%). *Aristida behriana* (EBSKAN87) had only 10% viability, which was lower than the collection tested last year (EBSKAN37) which had 64% viability.

Seedling Photos

The images of young seedlings grown from species provided last year are shown in Appendix 2. The images show the young leaves emerging and will be useful for monitoring seedling emergence after direct seeding. Most of the species have distinctive features at an early stage. However the grass seedlings look very similar at this stage.

Soil Sampling and Seedling Emergence

Seedlings were first observed within the first week after setting up the soil samples into seedling trays and maintaining moist conditions in the glass house. In general, the monocotyledon species were the first to emerge. Seedling emergence had peaked by four weeks and only approximately 2% of new germinants were observed in the last two weeks of scoring. Seedling trays and emerging seedlings are shown in Figure 4. By definition, seeds that are non-dormant germinate within 30 days but seedlings from dormant seeds may take longer to emerge (Baskin and Baskin, 2004). These seeds may require stratification at warm or cool temperatures to break dormancy. The trays will remain in the glass house where they can be monitored for further seedling emergence and species determination.

Table 3 shows the number of seedlings that emerged from the soil samples after six weeks. Of the total number of seedlings 78% emerged from the top two soil samples, indicating that a large

portion of the soil seed bank resides within the top 50 mm of soil. The average number of seedlings emerging from the 50-75 mm sample was 4.2 and in the 75-100 mm samples the average was less than 2. Figure 5 shows a graph of the average number of seedlings per site at each depth that was sampled. ANOVA analysis showed that the number of seedlings emerging from the top 25 mm was significantly higher than from the deeper samples.

A total of 189 monocotyledon seedlings were recorded and all of these appeared to be from the Gramineae family. The total number of dicotyledon seedlings was 86, indicating that a greater number of monocotyledon seeds may rest in the seed bank from this site. However, there is likely to be a number of dormant seeds buried that have not germinated during the time frame of this experiment. At this stage the young seedlings are difficult to identify but will be monitored as they grow and develop taxonomic features that can be used to assist species determination. However there appeared to be some diversity between the sites as some of the dicotyledon seedling types were only observed from one or two sample sites.

Table 3. Number of seedlings emerged from soil samples taken from 10 sites within the paddock. Number of monocotyledon seedlings is shown in A, dicotyledons in B and combined figures in C.

A	**Monocot seedlings**		
Depth	**Total #**	**Mean**	**%**
0-25 mm	110	11.0	58
25-50 mm	44	4.4	23
50-75 mm	26	2.6	14
75-100 mm	9	0.9	5

B	**Dicot seedlings**		
Depth	**Total #**	**Mean**	**%**
0-25 mm	39	3.9	45
25-50 mm	21	2.1	24
50-75 mm	16	1.6	19
75-100 mm	10	1.0	12

C	**Total seedlings**		
Depth	**Total #**	**Mean**	**%**
0-25 mm	150	15	54
25-50 mm	65	6.5	24
50-75 mm	42	4.2	15
75-100 mm	16	1.9	7

Figure 4. A) Soil samples spread out into seedling trays and placed in the glass house under irrigation. B) Seedlings emerging from soil samples taken from different depths. Soil from two sites are shown (front and back) at different depths shown from right to left 0-25 mm , 25-50 mm, 50-75 mm, 75-100 mm. Seedlings were photographed after 6 weeks. (Note – the very small green spots are small lichens and were not recorded)

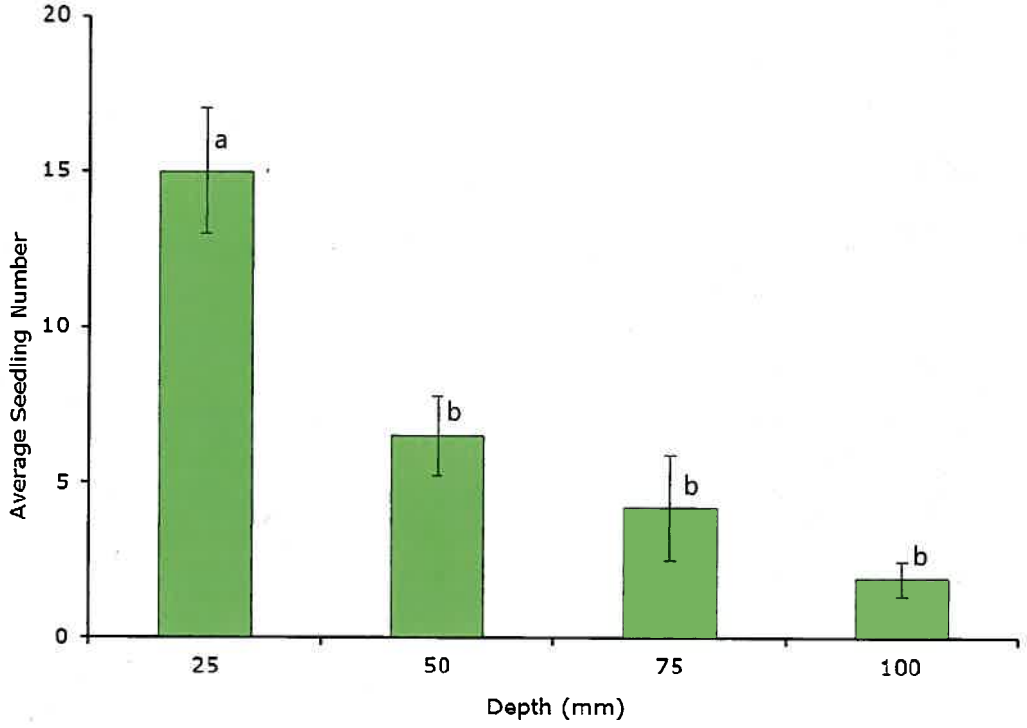


Figure 5. Number of seedlings from 10 sample sites that emerged from different soil depths. Data is shown as the mean for each depth with standard error bars, letters represent statistical difference between samples.

Seeds of South Australia

Several of the species from the plant communities at Hillgrove have been loaded onto the Seeds of South Australia website (saseedbank.com.au) and printed versions have been compiled in Appendix 3. We aim to load more of these species on the website and will add the information from the germination experiments from this project. However, as we have obtained and lodged a specimen in the State Herbarium for all of the plant species entered on the website we will do the same for the plants that the seeds were collected from before entering the data.

References

Leck MA, Parker VT, Simpson RL. (1989) Ecology of soil seed banks. Academic Press, London.

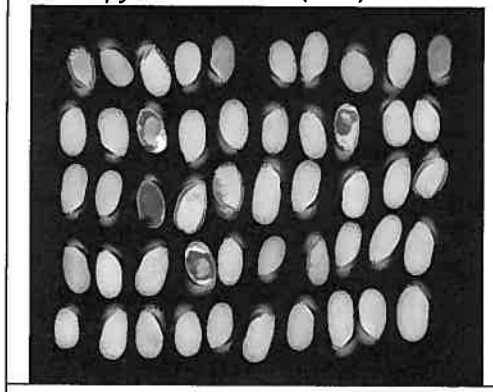
Baskin, J. and Baskin, C. (2004) A classification system for seed dormancy. *Seed Science Research* 14, 1-16.

Traba J, Azcárate FM, Peco B. (2004) From what depth do seeds emerge? A soil seed bank experiment with Mediterranean grassland species. *Seed Science Research* 14:297-303.

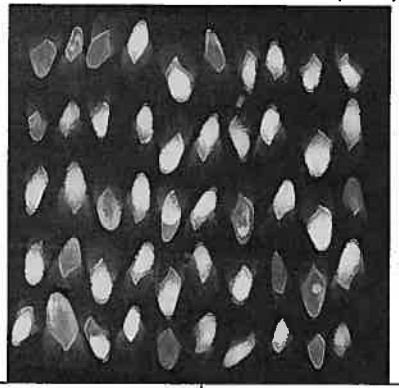
Yenish JP, Doll JD, Buhler DD. (1992) Effects of tillage on vertical distribution and viability of weed seed in soil. *Weed Science* 40: 429-433.

Appendix 1 X-ray images of seeds

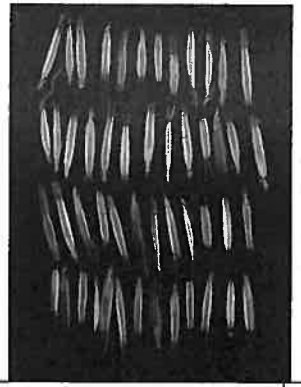
Acacia pycnantha EK58 (80%)



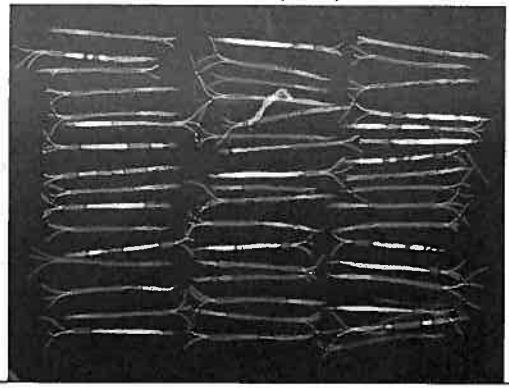
Allocasuarina verticilliata EK77 (70%)



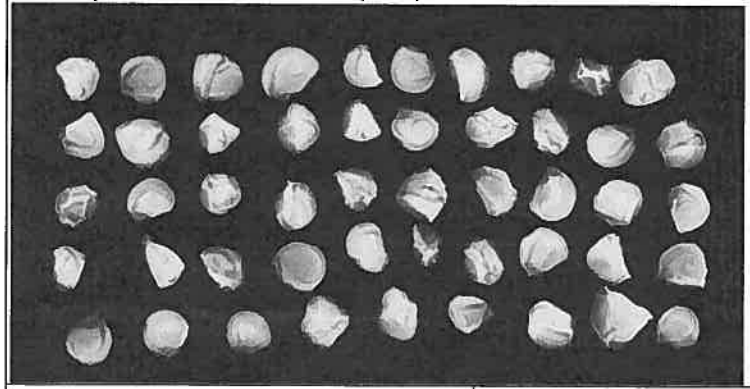
Anthosachne scabra EK98 (80%)



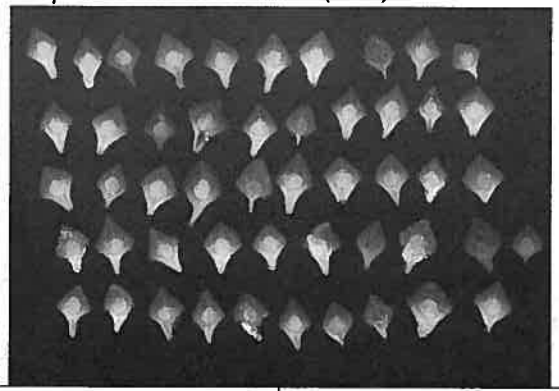
Aristida behriana EK87 (10%)



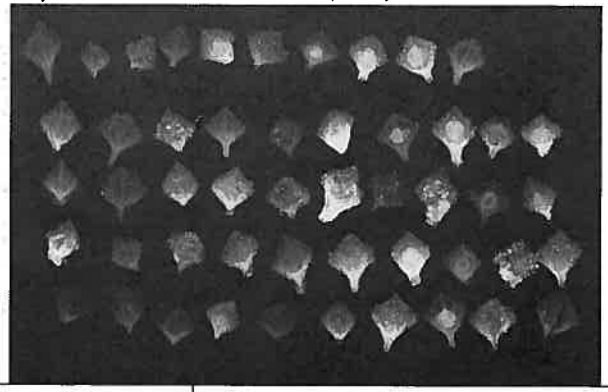
Arthropodium strictum EK50 (48%)



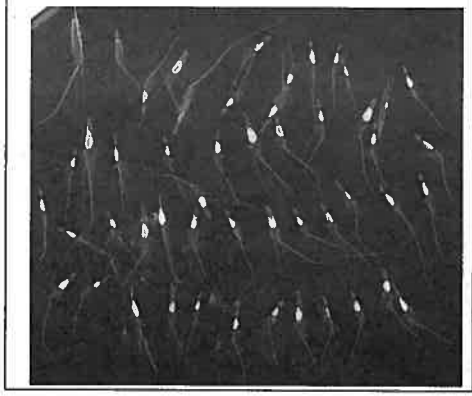
Atriplex semibaccata EK80 (82%)



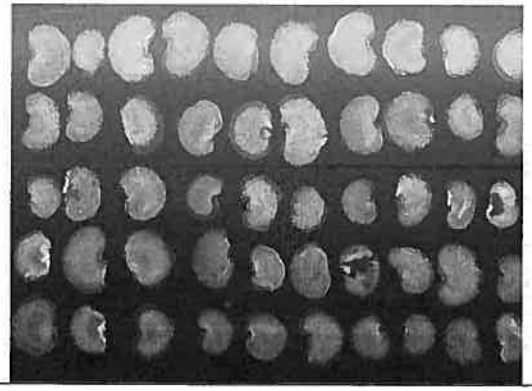
Atriplex semibaccata EK107 (14%)



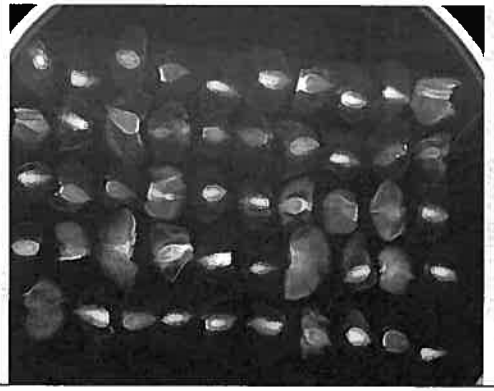
Austrodanthonia sp EK91 (94%)



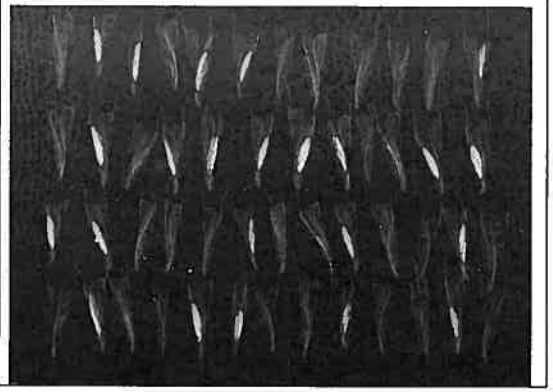
Bursaria spinosa EK105 (94%)



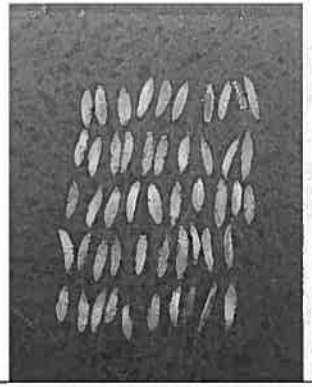
Callitris gracilis EK101 (44%)



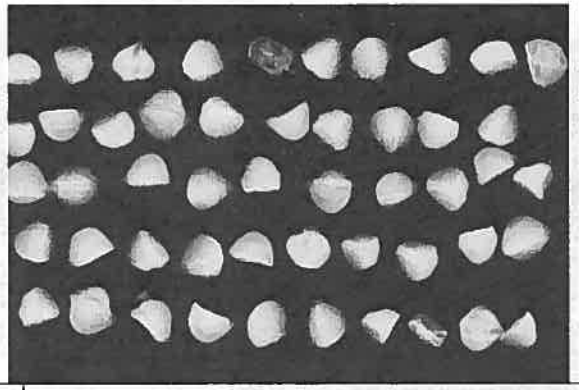
Chloris truncata EK104 (46%)



Chrysocephalum apiculatum EK 74 (92%)

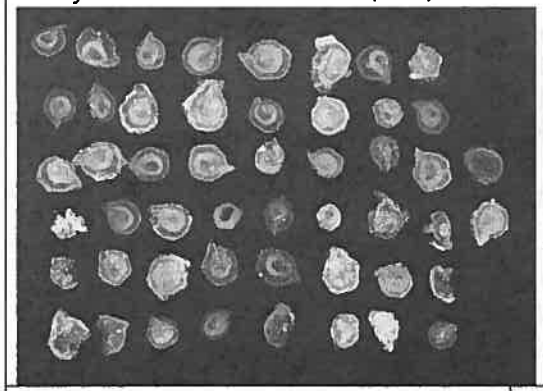


Convovulus remotus EK102 (94%)

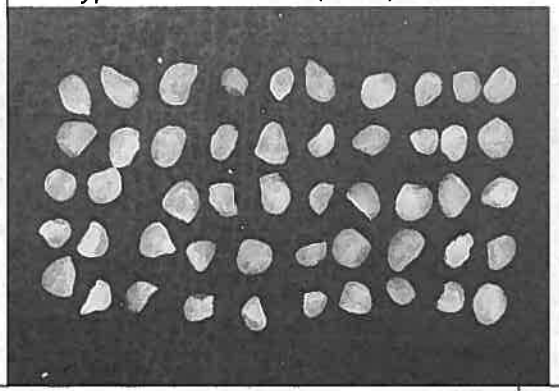


Dodonaea viscosa EK97 (100%)

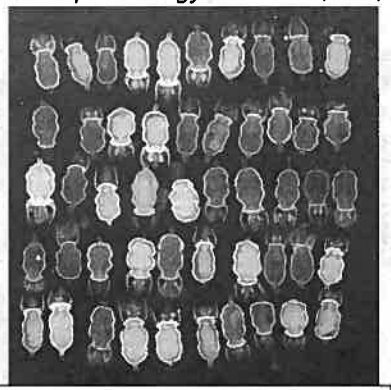
Enchylaena tomentosa EK103 (64%)



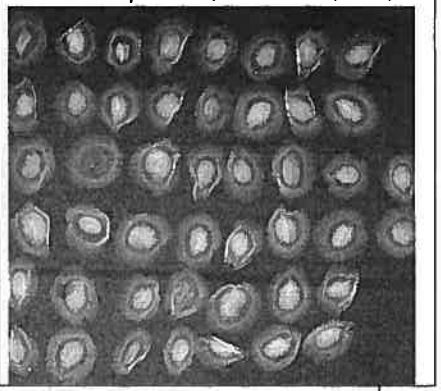
Eucalyptus odorata EK94 (100%)



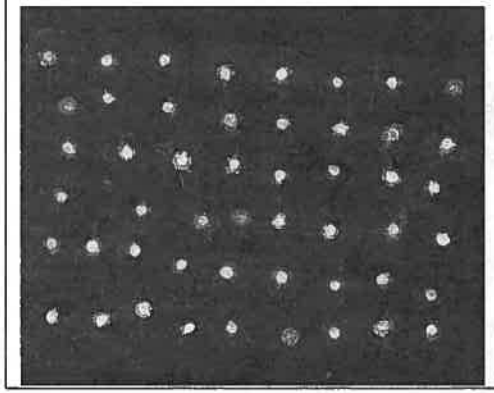
Gonocarpus tetragynus EK81 (40%)



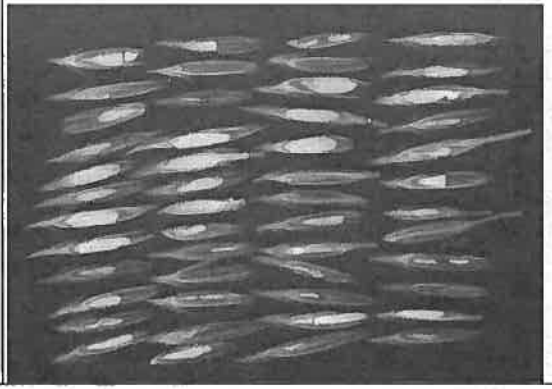
Goodenia pinnatifida EK83 (90%)



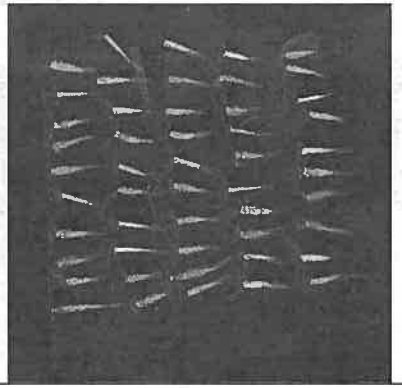
Maireana brevifolia EK71 (84%)



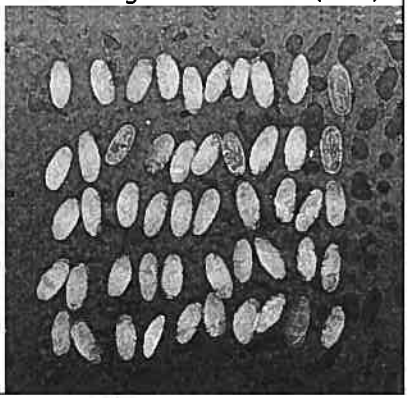
Themeda triandra EK90 (28%)



Vittadinnia mix EK106 (100%)



Wahlenbergia stricta EK86 (90%)



Appendix 2 Seedling Images

Austrodanthonia sp

Austrostipa blackii

Austrostipa elegantissima

Austrostipa nodosa

Bursaria spinosa

Callitris gracilis

Clematis microphylla

Einadia nutans

Enchylaena tomentosa

Appendix 2 Seedling Images (continued)

Goodenia pinnatifida

Ptilotus spathulatus

Velleia paradoxa

Vittadinia blackii

Vittadinia cuneata

Vitadinnia megacephala

Appendix 3

Information Pages from the website 'Seeds of South Australia' (http://saseedbank.com.au/) about some of the species that were investigated in this report.

Seeds of South Australia

South Australian Seed Conservation Centre

Atriplex semibaccata (CHENOPODIACEAE)

Creeping Saltbush




Seed collecting: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

collection times highlighted and underlined

Herbarium region: Lake Eyre, Flinders Ranges, Eastern, Eyre Peninsula, Northern Lofty, Murray, Yorke Peninsula, Southern Lofty, South Eastern

NRM region: Adelaide and Mount Lofty Ranges, Eyre Peninsula, Northern and Yorke, South Australian Arid Lands, South Australian Murray-Darling Basin, South East

Name derivation: *Atriplex* from the Latin '*atriplexum*' meaning an orach, a saltbush. *Semibaccata* from the Latin '*semi*' meaning half and '*baccate*' berry like in form, texure; or bearing berries.

Distribution: A widespread species found throughout most of South Australia except for the very arid regions. Usually found on heavy soils, in woodland, saline flats and the edges of salt lakes.

Status: Common.

Plant description: Prostrate or decumbent perennial shrub with slender spreading branches, monoecious. Leaves narrow-elliptic to elliptic, 10-30 mm long, almost glabrous above, scaly beneath. Flowers axillary, solitary or in small clusters, cream to light green. Flowering all year round.

Fruit type: Fruiting bracteoles rhombic, 2–6 mm long and wide, acute, red and succulent when ripe.

Seed type: Seed light brown, circular, 20mm wide.

Embryo type: Peripheral.

Seed collecting: Collect fruits that are red, dried and papery. Fruits can be collected directly from the bush or from the ground underneath.

Seed cleaning: Place the fruits in a tray and leave to dry for one to two weeks. Then rub the fruit gently by hand to dislodge the seeds. Use a sieve to separate the unwanted material. Store the seeds with a desiccant such as dried silica beads or dry rice, in an air tight container in a cool and dry place.

Seed germination: Germination 100%, seed scarified (covering structure removed), on 1% w/v agar; 8/16 dark/light, 5°C (RBG Kew, Wakehurst Place) See http:data.kew.org/sid

Germination table:

Date	Result	T0	T50	Pre-treatment	Germination medium	Photoperiod	Thermoperiod
March 2014	100%	8d	29d	None	70mm glass petri dishes on 1% w/v agar	14/10 dark/light	5C (4hours); 15C (20hours)
March 2014	100%	8d	8d	Fruit removed	70mm glass petri dishes on 1% w/v agar	14/10 dark/light	5C (4hours); 15C (20hours)
March 2014	100%	8d	8d	Fruit removed	70mm glass petri dishes on 1% w/v agar	12/12 dark/light	10C/22C
March 2014	98%	8d	22d	None	70mm glass petri dishes on 1% w/v agar	12/12 dark/light	10C/22C

Result: Maximum percentage of germination observed.

T0: Number of days before first germinant observed.

T50: Number of days to achieve 50% germination.
Pre-treatment: The initial treatment that the seeds received prior to placement on germination media.
Germination medium: The substrate that seeds were placed on for the duration of the germination experiment.
Photoperiod: The duration of light exposure that the seeds were subject to during a 24 hour period.
Thermoperiod: The constant or diurnal temperatures that seeds were subject to during a 24hr period.

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Seeds of South Australia

South Australian Seed Conservation Centre

Acacia pycnantha (LEGUMINOSAE)

Golden wattle




Seed collecting: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

collection times highlighted and underlined

Herbarium region: Flinders Ranges, Eastern, Eyre Peninsula, Northern Lofty, Murray, Yorke Peninsula, Southern Lofty, Kangaroo Island, South Eastern

NRM region: Adelaide and Mount Lofty Ranges, Eyre Peninsula, Kangaroo Island, Northern and Yorke, South Australian Murray-Darling Basin, South East

Name derivation: *Acacia* from the Greek '*akakia*' and derived from '*ake*' or '*akis*' meaning a sharp point or thorn and '*akazo*' meaning to sharpen. Dioscorides the Greek physician and botanist, used the word in the 1st century AD for the Egyptian thorn tree, *Acacia arabica*. *Pycnantha* from the Greek '*pycn*' meaning thick, dense, compact and '*anthos*' meaning flowers.

Distribution: Found in the wetter part of South Australia, south of the Flinders Ranges. Also occurs in New South Wales and Victoria. Introduced to Tasmania and Western Australia.

Status: Native. Common.

Plant description: An erect small tree to 8m high usually with a rough dark brown to black bark or a smooth whitish-grey bark in the northern population. Leaves are large, lance-shaped and bright green. Flowers are contained within yellow rounded-balls appearing in winter and spring.

Fruit type: Long pods with a number of seeds inside.

Seed type: Black semi-flat ovoid seeds less than 10mm in length.

Embryo type: Investing.

Seed collecting: Collect pods that are turning brown with hard, dark seeds inside. For immediate propagation, the seeds can be collected prior to the seedcoat hardening.

Seed cleaning: Place the pods in a tray and leave to dry for 1-2 weeks or until the pods begin to split. Then rub the dried pods to dislodge the seeds. Use a sieve to separate any unwanted material. Store the seeds with a desiccant such as dried silica beads or dry rice, in an air tight container in a cool and dry place.

Germination table:

Date	Result	T0	T50	Pre-treatment	Germination medium	Photoperiod	Thermoperiod
August 2005	100%	9d	13d	Seed coat nicked.	Wet filter paper placed over wettex sponge.	12 hours.	20°C (24hrs).
August 2005	84%	9d	42d	Submerged in hot water (100°C) for 20secs.	Wet filter paper placed over wettex sponge.	12 hours.	20°C (24hrs).
August 2005	68%	11d	50d	Submerged in hot water (100°C) for 2mins.	Wet filter paper placed over wettex sponge.	12 hours.	20°C (24hrs).
August 2005	64%	11d	50d	Submerged in hot water (86°C) for 20secs.	Wet filter paper placed over wettex sponge.	12 hours.	20°C (24hrs).
August 2005	64%	11d	50d			12 hours.	20°C (24hrs).

				Submerged in hot water (93°C) for 20secs.	Wet filter paper placed over wettex sponge.		
August 2005	62%	25d	50d	Submerged in hot water (93°C) for 3secs.	Wet filter paper placed over wettex sponge.	12 hours.	20°C (24hrs).
August 2005	62%	25d	50d	Submerged in hot water (86°C) for 2mins.	Wet filter paper placed over wettex sponge.	12 hours.	20°C (24hrs).
August 2005	58%	21d	61d	Submerged in hot water (100°C) for 3secs.	Wet filter paper placed over wettex sponge.	12 hours.	20°C (24hrs).
August 2005	52%	25d	61d	Submerged in hot water (78°C) for 2mins.	Wet filter paper placed over wettex sponge.	12 hours.	20°C (24hrs).
August 2005	52%	16d	61d	Submerged in hot water (93°C) for 2mins.	Wet filter paper placed over wettex sponge.	12 hours.	20°C (24hrs).
August 2005	48%	25d	NA	Submerged in hot water (86°C) for 3secs.	Wet filter paper placed over wettex sponge.	12 hours.	20°C (24hrs).
August 2005	46%	25d	NA	Submerged in hot water (78°C) for 20secs.	Wet filter paper placed over wettex sponge.	12 hours.	20°C (24hrs).
August 2005	14%	21d	NA	Submerged in hot water (78°C) for 3secs.	Wet filter paper placed over wettex sponge.	12 hours.	20°C (24hrs).

Result: Maximum percentage of germination observed.
T0: Number of days before first germinant observed.
T50: Number of days to achieve 50% germination.
Pre-treatment: The initial treatment that the seeds received prior to placement on germination media.
Germination medium: The substrate that seeds were placed on for the duration of the germination experiment.
Photoperiod: The duration of light exposure that the seeds were subject to during a 24 hour period.
Thermoperiod: The constant or diurnal temperatures that seeds were subject to during a 24hr period.

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Seeds of South Australia
South Australian Seed Conservation Centre

Allocasuarina verticillata (CASUARINACEAE)

Drooping she-oak




Seed collecting: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

collection times highlighted and underlined

Herbarium region: Flinders Ranges, Eastern, Eyre Peninsula, Northern Lofty, Murray, Yorke Peninsula, Southern Lofty, Kangaroo Island, South Eastern

NRM region: Adelaide and Mount Lofty Ranges, Eyre Peninsula, Kangaroo Island, Northern and Yorke, South Australian Arid Lands, South Australian Murray-Darling Basin, South East

Name derivation: *Allocasuarina* from the Greek *allos* meaning other or different and Malay *kesuari*, from the resemblance of its twigs to the drooping feathers of the cassowary. *Verticillata* refer to the leaves arranged in whorls or seemingly so.

Distribution: Found across the lower part of South Australia in a wide range of habitats. Also occurs in Tasmania, Victoria and New South Wales.

Status: Common in South Australia. Common in other states.

Plant description: Tree to 9m tall with drooping branches and stems that look like needles. Leaves reduced to small teeth around the stems. Male and female flowers on different plants.

Fruit type: Large cylindrical and woody cone with numerous valves.

Seed type: Dark brown smooth and semi-flat seeds to 5mm long with a papery wing at one end.

Embryo type: Investing.

Seed collecting: Cones can be collected anytime as mature cones remain on the female plant. Collect cones from the lower part of the stem as these are more mature.

Seed cleaning: Place cones in a tray and leave to dry for 2-3 weeks. This will alow the valves to dry and open releasing the seeds. Place the dried cones in a bucket and shake gently to dislodge the seeds. Use a sieve to separate seeds from the unwanted material. Store the seeds with a desiccant such as dried silica beads or dry rice, in an air tight container in a cool and dry place.

Germination table:

Date	Result	T0	T50	Pre-treatment	Germination medium	Photoperiod	Thermoperiod
November 2006	80%	35d	63d	None.	Wet filter paper placed over wettex sponge.	12 hours.	10°C (12hrs); 22°C (12hrs).
March 2010	79%	17d	25d	None.	1% water agar.	12 hours.	10°C (12hrs); 22°C (12hrs).
November 2006	60%	28d	70d	None.	Wet filter paper placed over wettex sponge.	10 hours.	5°C (4hrs); 15°C (20hrs).

Result: Maximum percentage of germination observed.
T0: Number of days before first germinant observed.
T50: Number of days to achieve 50% germination.
Pre-treatment: The initial treatment that the seeds received prior to placement on germination media.
Germination medium: The substrate that seeds were placed on for the duration of the germination experiment.
Photoperiod: The duration of light exposure that the seeds were subject to during a 24 hour period.
Thermoperiod: The constant or diurnal temperatures that seeds were subject to during a 24hr period.

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Seeds of South Australia
South Australian Seed Conservation Centre

Bursaria spinosa ssp. spinosa (PITTOSPORACEAE)

Christmas bush




Seed collecting: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

collection times highlighted and underlined

Herbarium region: Flinders Ranges, Eastern, Eyre Peninsula, Northern Lofty, Murray, Yorke Peninsula, Southern Lofty, Kangaroo Island, South Eastern

NRM region: Adelaide and Mount Lofty Ranges, Eyre Peninsula, Kangaroo Island, Northern and Yorke, South Australian Arid Lands, South Australian Murray-Darling Basin, South East

Name derivation: *Bursaria* from the Latin *bursa* meaning a pouch, referring to the fruit. *Spinosa* from the Latin *spinosus* meaning thorny.

Distribution: Found across the southern regions of South Australia east of Ceduna and south of Arkaroola. Also occurs in Queensland, New South Wales, Victoria and Tasmania.

Status: Common in South Australia. Common in other states.

Plant description: Tall, low branching shrub or small tree to 10m with lance-shaped aromatic leaves. Branches sometimes with small thorns. Flowers are white in large clusters, appearing in Summer. Differs from the other subspecies *Bursaria spinosa ssp. lasiophyla* by having leaves that are glabrous on the underside.

Fruit type: Flattened capsules, brown when mature and containing two seeds.

Seed type: Flat orange-brown bean-shaped seeds to 5mm long.

Embryo type: Linear fully developed.

Seed collecting: Collect maturing capsules individually or break off whole stems. The capsules should be drying off and turning brown with orange seeds inside. Do not collect capsules that have split open as the seed has already been released.

Seed cleaning: Place the capsules/stems in a tray and cover with paper and leave to dry for 1-2 weeks or until the capsules split. Then place the capsules in a bucket with a lid if possible and shake gently to dislodge the seeds. Use a sieve to separate the unwanted material. Store the seeds with a desiccant such as dried silica beads or dry rice, in an air tight container in a cool and dry place.

Germination table:

Date	Result	T0	T50	Pre-treatment	Germination medium	Photoperiod	Thermoperiod
June 2005	60%	23d	41d	None.	Wet filter paper placed over wettex sponge.	12 hours.	10°C (12hrs); 22° C (12hrs).
May 2007	48%	35d	NA	Stored at -18° C for 1 year.	Wet filter paper placed over wettex sponge.	12 hours.	10°C (12hrs); 22° C (12hrs).

Result: Maximum percentage of germination observed.
T0: Number of days before first germinant observed.
T50: Number of days to achieve 50% germination.
Pre-treatment: The initial treatment that the seeds received prior to placement on germination media.
Germination medium: The substrate that seeds were placed on for the duration of the germination experiment.
Photoperiod: The duration of light exposure that the seeds were subject to during a 24 hour period.
Thermoperiod: The constant or diurnal temperatures that seeds were subject to during a 24hr period.

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Seeds of South Australia

South Australian Seed Conservation Centre

Callitris gracilis (CUPRESSACEAE)

Native Pine

Seed collecting: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

collection times highlighted and underlined

Herbarium region: Flinders Ranges, Eastern, Eyre Peninsula, Northern Lofty, Murray, Yorke Peninsula, Southern Lofty, Kangaroo Island, South Eastern

NRM region: Adelaide and Mount Lofty Ranges, Eyre Peninsula, Kangaroo Island, Northern and Yorke, South Australian Murray-Darling Basin, South East

Name derivation: *Callitris* from the Greek *kalos* meaning beautiful and *treis* meaning three, referring to the arrangement of the leaves in whorls of three. *Gracilis* Latin for graceful or slender.

Distribution: Found in the wetter regions of South Australia, across the Mount Lofty Ranges, Eyre and Yorke Peninsulas and Kangaroo Island. Also occurs in New South Wales and Victoria.

Status: Common in South Australia. Common in the other states.

Plant description: Erect pine-like tree to 15m tall with dark green leaves and seperate male and female plants.

Fruit type: Grey-brown round woody cones to 3cm long with wrinkled surface.

Seed type: Brown ovoid seeds to 6mm long with an orange papery wing on either side.

Embryo type: No information available

Seed collecting: Collect cones that are not open but large, hard and dark. These will contain maturing seeds.

Seed cleaning: Place the cones in a tray and leave to dry for 3-5 weeks to allow the cones to open naturally. Then shake the cones in a bucket to dislodge the seeds. Use a sieve to separate the seeds from the cones. Store the seeds with a desiccant such as dried silica beads or dry rice, in an air tight container in a cool and dry place.

Germination table:

Date	Result	T0	T50	Pre-treatment	Germination medium	Photoperiod	Thermoperiod
September 2004	75%	14d	21d	None.	Wet filter paper placed over wettex sponge.	10 hours.	10°C (12hrs); 22°C (12hrs).
September 2004	61%	14d	21d	Cold stratification (5°C for 3wks).	Wet filter paper placed over wettex sponge.	10 hours.	10°C (12hrs); 22°C (12hrs).

Result: Maximum percentage of germination observed.
T0: Number of days before first germinant observed.
T50: Number of days to achieve 50% germination.
Pre-treatment: The initial treatment that the seeds received prior to placement on germination media.
Germination medium: The substrate that seeds were placed on for the duration of the germination experiment.
Photoperiod: The duration of light exposure that the seeds were subject to during a 24 hour period.
Thermoperiod: The constant or diurnal temperatures that seeds were subject to during a 24hr period.

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Seeds of South Australia

South Australian Seed Conservation Centre

Clematis microphylla (RANUNCULACEAE)

Old man's beard




Seed collecting: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

collection times highlighted and underlined

Herbarium region: Flinders Ranges, Eyre Peninsula, Northern Lofty, Murray, Yorke Peninsula, Southern Lofty, Kangaroo Island, South Eastern

NRM region: Adelaide and Mount Lofty Ranges, Eyre Peninsula, Kangaroo Island, Northern and Yorke, South Australian Arid Lands, South Australian Murray-Darling Basin, South East

Name derivation: *Clematis* from the Greek *klematis* meaning a shoot, tendril. *Microphylla* meaning very small leaves.

Distribution: Found across the the southern regions of South Australia, south of Arkaroola. Also occurs in Western Australia, Queensland, New South Wales, Victoria and Tasmania.

Status: Common in South Australia. Common in other states.

Plant description: Perennial climbing plant with lance-shaped leaves in threes. Flowers are small in the centre of four large cream-white bracts, appearing in winter and spring.

Fruit type: White fluffy cluster of seeds each attached to a plumose style.

Seed type: Flat ovoid brown seeds about 6mm long with a long white plumose style.

Embryo type: No information available

Seed collecting: Pick the seeds from the cluster with your fingers. The seeds will come away easily. The seeds should be hard and brown when mature.

Seed cleaning: No further cleaning is required. Store the seeds with a desiccant such as dried silica beads or dry rice, in an air tight container in a cool and dry place.

Germination table:

Date	Result	T0	T50	Pre-treatment	Germination medium	Photoperiod	Thermoperiod
October 2004	66%	28d	42d	None.	Wet filter paper placed over wettex sponge.	12 hours.	10°C (12hrs); 22° C (12hrs).

Result: Maximum percentage of germination observed.
T0: Number of days before first germinant observed.
T50: Number of days to achieve 50% germination.
Pre-treatment: The initial treatment that the seeds received prior to placement on germination media.
Germination medium: The substrate that seeds were placed on for the duration of the germination experiment.
Photoperiod: The duration of light exposure that the seeds were subject to during a 24 hour period.
Thermoperiod: The constant or diurnal temperatures that seeds were subject to during a 24hr period.

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Seeds of South Australia
South Australian Seed Conservation Centre

Enchylaena tomentosa var. tomentosa (CHENOPODIACEAE)

Barrier Saltbush



Seed collecting: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

collection times highlighted and underlined

Herbarium region: North Western, Lake Eyre, Nullarbor, Gairdner-Torrens, Flinders Ranges, Eastern, Eyre Peninsula, Northern Lofty, Murray, Yorke Peninsula, Southern Lofty, Kangaroo Island, South Eastern

NRM region: Adelaide and Mount Lofty Ranges, Alinytjara Wilurara, Eyre Peninsula, Kangaroo Island, Northern and Yorke, South Australian Arid Lands, South Australian Murray-Darling Basin, South East

Name derivation: *Enchylaena* from the Greek '*egchlos*' meaning fleshy, succulent and '*laina*' meaning lined cloak, alluding to the succulent fruiting perianth. *Tomentosa* from the Latin '*tomentum*' meaning wool, hair, referring to the hairs on the plant.

Distribution: A widespread species found across South Australia in a variety of habitats. Occurs principally in slightly saline soil.

Status: Common.

Plant description: Shrubby perennial to 1m high, branches decumbent to erect, tomentose. Leaves semiterete, succulent to approximately 15mm long, villous. Inconspicous small flowers, solitary, emerging from the axis of the leaf and stem. Flowering May-November.

Fruit type: Fruiting perianth depressed-globular, flat to deeply sunken in the centre; wing absent or crown-like and incurved; lobes glabrous (but ciliolate) to pubescent. Approximately 5mm in diameter, green, yellow or red (drying brown to black).

Seed type: Seeds are black/brown and disc shaped, up to 1.5 mm diameter with overlapping embryo tip sometimes forming a small beak.

Embryo type: Peripheral.

Seed collecting: Collect the fruits by running gloved fingers through branches to remove mature or drying fruits. Collect when fruit is red and seed inside is brown and firm.

Seed cleaning: Soak the fruit in 1% pectinase and water solution for at least 4 hours. Then gently rub the soaked fruits through a sieve to remove the fleshy and leave the remaining seeds to dry. Store the dried fruit heads with a desiccant such as dried silica beads or dry rice, in an air tight container in a cool and dry place.

Seed germination: Germination 100%, seed scarified (covering structure removed) on 1% w/v agar, 12/12 dark/light, 23°C/9°C. See http://data.kew.org/sid

Germination table:

Date	Result	T0	T50	Pre-treatment	Germination medium	Photoperiod	Thermoperiod
January 2013	63%	7d	30d	None	Glass petri dish on 0.7% w/v agar	14/10 dark/light	5C (4 hours); 15C (20hours)
January 2013	56%	7d	30d	None	Glass petri dish on 0.7% w/v agar	12/12 dark/light	10C/22C
January 2013	51%	7d	37d	None	Glass petri dish on 0.7% w/v agar supplemented with 250 mg/L Gibberellic acid (pH adjusted to 6.5)	14/10 dark/light	5C (4 hours); 15C (20hours)

January 2013	45%	7d	NA	None	Glass petri dish on 0.7% w/v agar supplemented with 250 mg/L Gibberellic acid (pH adjusted to 6.5)	12/12 dark/light	10C/22C
January 2013	12%	7d	NA	None	Glass petri dish on 0.7% w/v agar supplemented with 250 mg/L Gibberellic acid (pH adjusted to 6.5)	10/14 dark/light	15C/30C
January 2013	9%	16d	NA	None	Glass petri dish on 0.7% w/v agar	10/14 dark/light	15C/30C

Result: Maximum percentage of germination observed.
T0: Number of days before first germinant observed.
T50: Number of days to achieve 50% germination.
Pre-treatment: The initial treatment that the seeds received prior to placement on germination media.
Germination medium: The substrate that seeds were placed on for the duration of the germination experiment.
Photoperiod: The duration of light exposure that the seeds were subject to during a 24 hour period.
Thermoperiod: The constant or diurnal temperatures that seeds were subject to during a 24hr period.

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Department of Environment, Water and Natural Resources

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Seeds of South Australia
South Australian Seed Conservation Centre

Eucalyptus odorata (MYRTACEAE)

Mallee Box




Seed collecting: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

collection times highlighted and underlined

Herbarium region: Eyre Peninsula, Northern Lofty, Murray, Yorke Peninsula, Southern Lofty, Kangaroo Island, South Eastern

NRM region: Adelaide and Mount Lofty Ranges, Kangaroo Island, Northern and Yorke, South Australian Murray-Darling Basin, South East

Name derivation: *Eucalyptus* from the Greek '*eu*' meaning well and '*calyptos*' meaning covered, alluding to the cap or lid which covers the stamens in the bud. *Odorata* from the Latin '*odoratus*' meaning having a smell, referring to the scent of the leaves when crushed.

Distribution: Typically on sandy-loam to clay-loam soils.

Status: Peppermint Box Grassy Woodlands are unique to South Australia and is nationally listed as a critically endangered ecological community. The species it self is considered common.

Plant description: Multi- or single-stemmed trees to 20 m high; bark rough, coarse, dark-grey on at least the lower half, smooth and brownish above, shedding in long strips. Juvenile leaves opposite to alternate, petiolate, narrow-elliptic to ovate; adult leaves on petioles 5-15 mm long, lanceolate, glossy, dark-olive-green, 5-14 x 0.6-2 cm. Inflorescences axillary, in umbels of 7-11. Operculum conical to hemispherical, equal to or shorter than the obconical hypanthium; flowers white. Flowering March-October.

Fruit type: Fruits obconical or cylindrical to hemispherical, with a narrow rim and descending disk, 5-8 x 4-6 mm; valves enclosed.

Seed type: Seeds reddish-brown or dark-grey, irregularly shaped, not winged, conspicuously reticulate.

Embryo type: Folded.

Seed collecting: Collect mature fruits that are dark and hard (difficult to break with a finger nail) with the valves un-open any time of year but preferably during summer. Leave the fruits in a breathable container in a dry room for at least a week. This allows the valves on the fruit to open and release the seeds.

Seed cleaning: Separate the seeds by placing all the materials into a bucket and shaking it to dislodge the seeds. Pass the material through a sieve to separate the unwanted material. The finer material will contain both seeds (soft)and frass (hard) usually distinguishable from each other but can be very similar in shape and colour. With finer sieves, the seeds can be separated from the frass but this is not essential for storage or propagation.

Seed germination: No information available

Germination table:

Date	Result	T0	T50	Pre-treatment	Germination medium	Photoperiod	Thermoperiod
March 2014	100%	8d	8d	None	70mm glass petri dishes on 1% w/v agar	12/12 dark/light	10C/22C
March 2014	88%	8d	17d	None	70mm glass petri dishes on 1% w/v agar	14/10 dark/light	5C (4hours); 15C (20hours)

Result: Maximum percentage of germination observed.
T0: Number of days before first germinant observed.
T50: Number of days to achieve 50% germination.
Pre-treatment: The initial treatment that the seeds received prior to placement on germination media.
Germination medium: The substrate that seeds were placed on for the duration of the germination experiment.
Photoperiod: The duration of light exposure that the seeds were subject to during a 24 hour period.
Thermoperiod: The constant or diurnal temperatures that seeds were subject to during a 24hr period.

Government of South Australia
Department of Environment, Water and Natural Resources

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Seeds of South Australia

South Australian Seed Conservation Centre

Lomandra densiflora (LILIACEAE)

Pointed Mat-rush



Seed collecting:	Jan Feb Mar Apr May Jun Jul Aug Sep Oct **Nov** **Dec** collection times highlighted and underlined
Herbarium region:	Flinders Ranges, Eyre Peninsula, Northern Lofty, Murray, Yorke Peninsula, Southern Lofty
NRM region:	Adelaide and Mount Lofty Ranges, Eyre Peninsula, Northern and Yorke, South Australian Arid Lands, South Australian Murray-Darling Basin
Name derivation:	Greek '*loma*' edge, border, fringe and '*andros*' man, referring to the fringed, circular anthers of some species and '*juncea*' rush-like
Distribution:	Found in open woodlands in Mount Lofty Ranges and Flinders ranges.
Status:	Locally common in SA
Plant description:	Dioecious perennial tussocked herb with bright green rigid leaves 20 to 60 cm long, basal sheaths becoming fibrous. White flower spikes appearing late winter to spring.
Fruit type:	Capsule ovoid to globular approx 6 mm long.
Seed type:	Rounded wedge shaped dark yellow-grey seed.
Embryo type:	Linear underdeveloped.
Seed collecting:	Collect ripe fruits when they are starting to split.
Seed cleaning:	Leave fruits in a dry place to dehisce, sieve and aspirate seed to remove other plant material.
Seed germination:	This species has morphophysiological dormancy and will germinate slowly over weeks to months.

Germination table:

Date	Result	T0	T50	Pre-treatment	Germination medium	Photoperiod	Thermoperiod

Result: Maximum percentage of germination observed.
T0: Number of days before first germinant observed.
T50: Number of days to achieve 50% germination.
Pre-treatment: The initial treatment that the seeds received prior to placement on germination media.
Germination medium: The substrate that seeds were placed on for the duration of the germination experiment.
Photoperiod: The duration of light exposure that the seeds were subject to during a 24 hour period.
Thermoperiod: The constant or diurnal temperatures that seeds were subject to during a 24hr period.

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Seeds of South Australia
South Australian Seed Conservation Centre

Lomandra effusa (LILIACEAE)

Scented Iron-grass

Seed collecting: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov **Dec**

collection times highlighted and underlined

Herbarium region: Nullarbor, Flinders Ranges, Eastern, Eyre Peninsula, Northern Lofty, Murray, Yorke Peninsula, Southern Lofty, South Eastern

NRM region: Adelaide and Mount Lofty Ranges, Alinytjara Wilurara, Eyre Peninsula, Northern and Yorke, South Australian Arid Lands, South Australian Murray-Darling Basin, South East

Name derivation: Greek 'loma' edge, border, fringe and 'andros' man, referring to the fringed, circular anthers of some species and 'juncea' rush-like

Distribution: Grows on sandy to clay loam in grassland or open woodland. A dominant species in the EPBC listed Peppermint Box grassy woodland and Iron Grass natural temperate grassland.

Status: Common in SA

Plant description: Rigid iron grass leaves 10-80 cm long and 2 toothed at the tip. Dioecious perennial with scented white/pale pink flower spikes appearing in winter to early spring.

Fruit type: Ovoid capsule 7-9 mm long

Seed type: Wedge shaped dark yellow-grey seed

Embryo type: Linear underdeveloped.

Seed collecting: Collect fruits when they are dark and starting to split.

Seed cleaning: Leave fruits in a dry place to dehisce, sieve and aspirate the seed to remove other plant material

Seed germination: This species has morphophysiological dormancy and will germinate slowly over weeks to months.

Germination table:

Date	Result	T0	T50	Pre-treatment	Germination medium	Photoperiod	Thermoperiod
December 2012	72%	28d	49d	Soaked in water for 24 hours then soaked in gibberellic acid (1000 mg/L) for 16 hours.	1% agar	12 hours	15°C constant temperature
December 2012	65%	35d	77d	Soaked in smoked water (10% (v/v) 24 h	1% agar supplemented with gibberellic acid (250 mg/L)	12 hours	10°C (12 h) 22°C (12 h)
December 2012	50%	35d	77d	Soaked in smoked water (10% (v/v) 24 h	1% agar supplemented with gibberellic acid (250 mg/L)	10 hours	5°C (4 h) 15°C (20 h)
December 2012	48%	28d	NA	None	1% agar supplemented	10 hours	5°C (4 h) 15°C (20 h)

					with gibberellic acid (250 mg/L)		
December 2012	18%	49d	NA	None	1% agar	10 hours	5°C (4 h) 15°C (20 h)
December 2012	3%	77d	NA	Heat shock 90° C for 15 min then soaked in smoked water (10% (v/v) 24 h	1% agar supplemented with gibberellic acid (250 mg/L)	12 hours	10°C (12 h) 22°C (12 h)
December 2012	3%	77d	NA	None	1% agar	12 hours	10°C (12 h) 22°C (12 h)
December 2012	0%	NA	NA	None	1% agar supplemented with gibberellic acid (250 mg/L)	12 hours	10°C (12 h) 22°C (12 h)
December 2012	0%	NA	NA	Heat shock 90° C for 15 min then soaked in smoked water (10% (v/v) 24 h	1% agar supplemented with gibberellic acid (250 mg/L)	10 hours	5°C (4 h) 15°C (20 h)

Result: Maximum percentage of germination observed.
T0: Number of days before first germinant observed.
T50: Number of days to achieve 50% germination.
Pre-treatment: The initial treatment that the seeds received prior to placement on germination media.
Germination medium: The substrate that seeds were placed on for the duration of the germination experiment.
Photoperiod: The duration of light exposure that the seeds were subject to during a 24 hour period.
Thermoperiod: The constant or diurnal temperatures that seeds were subject to during a 24hr period.

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Seeds of South Australia

South Australian Seed Conservation Centre

Maireana brevifolia (CHENOPODIACEAE)

Small-leaf Bluebush



Seed collecting: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

collection times highlighted and underlined

Herbarium region: Flinders Ranges, Eastern, Eyre Peninsula, Northern Lofty, Murray, Yorke Peninsula, Southern Lofty

NRM region: Adelaide and Mount Lofty Ranges, Northern and Yorke, South Australian Arid Lands, South Australian Murray-Darling Basin, South East

Name derivation: '*Maireana*' after the 19th certury belgium botanist Adolphe Lemaire and Latin '*brevis*' short, '*folia*' leaves

Distribution: Usually found on slightly saline soil.

Status: No information available

Plant description: Erect, short-lived perennial shrub to 1.5 m high. Leaves alternate, fleshy, obovoid to narrow-fusiform, 2-5 mm long, glabrous. Flowers solitary, glabrous apart from the woolly ciliate lobes. Flowering January - October.

Fruit type: Fruiting perianth glabrous; tube shallowly hemisperhical, thin-walled, 2 mm in diameter; wings 5, horizontal, thin, fan-shaped, 2-3 mm long, with delicate brown venation when dry; perianth lobes thick and fleshy, sharply demarcated from the wings

Seed type: Seeds are brown and disc shaped, up to 1.5 mm diameter with overlapping embryo tip forming a small beak.

Embryo type: Peripheral

Seed collecting: Collect seeds when fruits are brown and papery. Check inside several fruits for the presence of well developed seed before making a collection. Strip or shake fruiting branches into a container.

Seed cleaning: Remove twigs and other plant material.

Seed germination: Germination 100% on 1% w/v agar, 8/16 dark/light, 25°C. See http://data.kew.org/sid

Germination table:

Date	Result	T0	T50	Pre-treatment	Germination medium	Photoperiod	Thermoperiod
June 2005	86%	7d	14d	None	Glass petri dishes on wettex sponges overlaid with filter paper. Seeds irrigated once a week with RO water.	12/12 dark/light	10C/22C

Result: Maximum percentage of germination observed.
T0: Number of days before first germinant observed.
T50: Number of days to achieve 50% germination.
Pre-treatment: The initial treatment that the seeds received prior to placement on germination media.
Germination medium: The substrate that seeds were placed on for the duration of the germination experiment.
Photoperiod: The duration of light exposure that the seeds were subject to during a 24 hour period.
Thermoperiod: The constant or diurnal temperatures that seeds were subject to during a 24hr period.

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Seeds of South Australia

South Australian Seed Conservation Centre

Ptilotus spathulatus (AMARANTHACEAE)

Cats Paws




Seed collecting: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

collection times highlighted and underlined

Herbarium region: Flinders Ranges, Eastern, Eyre Peninsula, Northern Lofty, Murray, Yorke Peninsula, Southern Lofty, Kangaroo Island, South Eastern

NRM region: Adelaide and Mount Lofty Ranges, Eyre Peninsula, Kangaroo Island, Northern and Yorke, South Australian Arid Lands, South Australian Murray-Darling Basin, South East

Name derivation: Greek '*ptilotos*' feathered or winged, referring to the hairy flowers, and '*spathulata*' meaning shaped like a spatula (spoon-shape), referring to the spoon-shaped leaves.

Distribution: Found in the southern regions of South Australia. Also occurs in Western Australia, New South Wales, Victoria and Tasmania.

Status: Common.

Plant description: A procumbent perennial herb spreading from a rosette to 40cm across. Leaves slightly fleshy. Flowers are yellow with pink tips, cone-shaped heads appearing in spring and summer.

Fruit type: A cone-shaped head containing numerous, long papery and hairy fruits. Each fruit contains one seed.

Seed type: Brown reniform seeds to 2mm long.

Embryo type: Bent

Seed collecting: Be very careful when collecting this species as the fruits contain fine hairs that may cause an allergic reaction for some people. Collect the fruit heads when dried to a pale straw colour. Each fruit should come off the head easily when fingers are rubbed up the stem. Collect more fruits than required as not all fruits contain viable seed.

Seed cleaning: Be very careful when cleaning this species as the fruits contain fine hairs that may cause an allergic reaction for some people. To clean, rub the fruit heads gently to dislodge the seed at the base of each fruit. Use a sieve to separate the unwanted material. Store the seeds with a desiccant such as dried silica beads or dry rice, in an air tight container in a cool and dry place.

Germination table:

Date	Result	T0	T50	Pre-treatment	Germination medium	Photoperiod	Thermoperiod
March 2014	100%	8d	8d	None	70mm glass petri dishes on 1% w/v agar	14/10 dark/light	5C (4hours); 15C (20hours)
March 2014	100%	8d	8d	None	70mm glass petri dishes on 1% w/v agar	12/12 dark/light	10C/22C

Result: Maximum percentage of germination observed.

T0: Number of days before first germinant observed.

T50: Number of days to achieve 50% germination.

Pre-treatment: The initial treatment that the seeds received prior to placement on germination media.

Germination medium: The substrate that seeds were placed on for the duration of the germination experiment.

Photoperiod: The duration of light exposure that the seeds were subject to during a 24 hour period.

Thermoperiod: The constant or diurnal temperatures that seeds were subject to during a 24hr period.

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