

Australian plants – a warm home in Sweden

Astrid Fyhr, Horticulturist, Edvard Anderson Conservatory, Bergius Botanic Garden

All photos were taken at the Edvard Anderson Conservatory by Astrid Fyhr, unless otherwise specified.

Astrid has been an horticulturist at the Edvard Anderson Conservatory in the Bergius Botanic Garden, Stockholm, Sweden since 1994. She has always been interested in Australia and was very happy to have the opportunity to grow Australian plants. In 1995 Astrid went to Perth and collected seeds with the Kings Park Botanical Garden. She has been a member of ASGAP since 1998 and has attended two ASGAP Conferences, in Perth 2005 and in Geelong in 2009.

The Bergius Botanic Garden in Stockholm owes its existence to a donation to the Royal Swedish Academy of Sciences by the Bergius Brothers' Foundation, formed 1791. In 1885 the garden moved to its present site, where Professor Bergianus Veit Wittrock established a botanical garden on scientific principles. The Garden is currently run by Stockholm University and the Bergius Foundation at the Royal Swedish Academy of Sciences. At present the research is led by Professor Bergianus, the Director of the Bergius Foundation and the Bergius Botanical Garden, Birgitta Bremer, and is focused on biodiversity and the plant family Rubiaceae.

In the 9-hectare garden, you can find an arboretum, systematic areas, a herb garden, a very diverse vegetable garden and the park with its Japanese water feature. Within the garden there are more than 7,000 plant species of which 3,000 grow in our two glasshouses. The Victoria house opened in 1900 and is dedicated to tropical swamp and water plants like the giant water lilies, *Victoria cruziana* and *Victoria amazonica*. Here you can also find 16 species of Australian origin, like *Nymphaea gigantea*, *Marsilea hirsuta*, *Drynaria quercifolia* and *Austrobaileya scandens*.



Victoria greenhouse



Austrobaileya scandens. Flecker Botanic Garden, Cairns, donated this plant to the garden in 1998. Photo: Gunvor Larsson



Inside Victoria greenhouse, showing the amazing giant water lilies, *Victoria cruziana* and *Victoria amazonica*

Edvard Anderson Conservatory

The Edvard Anderson conservatory opened in 1995 and houses plants from areas with Mediterranean climate. Its erection was made possible thanks to a donation by the late Mr Edvard Anderson. He was a wholesale dealer in the glazing business and a keen traveller to southern Europe. He was also a frequent visitor of the Bergius Botanic Garden.

Edvard Anderson died in 1936 and left his fortune to the Bergius Foundation of the Royal Swedish Academy of Sciences. His will states that the money should be used for "a winter garden (orangery), where only trees, shrubs and herbs of the Mediterranean area, and of those areas having comparable climates, are to be cultivated."



The Edvard Anderson conservatory

It also states that in the glasshouse, it should be possible to enjoy a cup of tea, coffee or hot chocolate in a small café.

The main hall, measuring 23 by 27 metres and with a maximum height of 14 metres, is dedicated to the Mediterranean area proper. Here you can find attractive garden flowers, fruit trees cultivated in southern Europe, as well as the interesting indigenous flora of the region. The hall is surrounded by four satellite rooms, measuring 11 by 11 metres and with a height of 8 metres, presenting other areas with Mediterranean climate.

One satellite room presents the flora of the Cape Province of South Africa. There are terraces representing the fynbos vegetation of the Table Mountain with plants of the protea family and several representatives of the restio family. You can also find a miniature desert showing the succulent flora of the Karoo desert.

Parts of California also have Mediterranean climate. The type of vegetation here is called “Chaparral”, and this is where you find e.g. *Fremontodendron californicum* and *Simmondsia chinensis*. East of the Cascades Range, where deserts have developed, you are surrounded by high Cacti, Yuccas, Agaves and other succulents in a rocky dry landscape and it is the desert flora that dominates our California room.



Some fynbos vegetation



Protea cynaroides



Two different perspectives of the Mediterranean garden



Two different views of the Cactus house



In the third satellite is the Fern room. Here you can walk under tall tree ferns, *Dicksonia antarctica* and *Alsophila australis*, and view the eight metre high epiphyte wall, covered with ferns, aroids and some orchids here and there. Have a seat and listen to the falling water and the sounds of the frogs.



The Fern room



Alsophila (Cyathia) australis

The last satellite room is the Australian one. Flowering scented Acacias, Eucalypts and scrubs, found in the Mediterranean areas of Australia, are here shown to the public.



The Australia room with Australian native plants being grown under a bank of daylight metal halide lights, which provide the necessary light during winter.



Drosera roseana



Drosera adelae

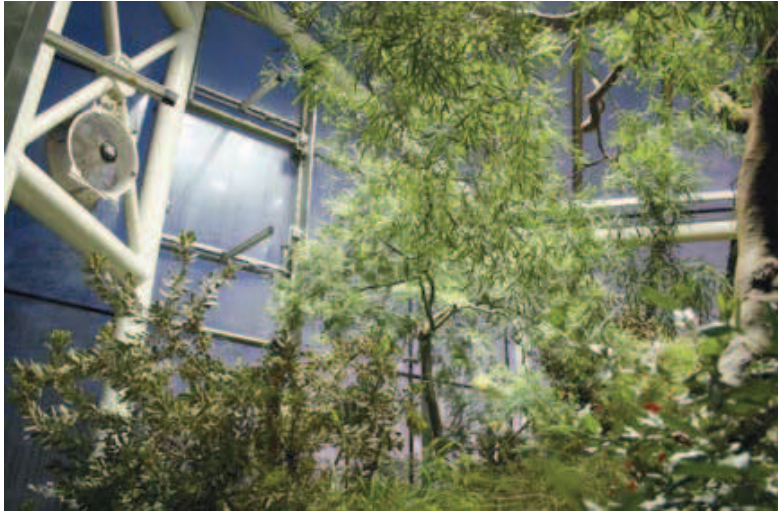


Cephalotus follicularis

Two sections of the Edvard Anderson Conservatory are rented by the Stockholm University. One section shows collections of tropical plants and Palm trees. In the other there are utility plants like Coffee, Cinnamon and Avocado, kept together with a large collection of Cycads. The children's favourite is the collection of carnivorous plants, among them some from Australia, like *Drosera roseana*, *Drosera adelae* and *Cephalotus follicularis*.

Heating and climate

The total area of the Edvard Anderson Conservatory, the nursery included, is 3,000 m². It is heated by two oil boilers of 350 kW each, and a new air/water heat exchanger of 90 kW, which helps us save 50 % of the earlier oil consumption of 45 m³ a year. With a price of \$AU1,236/m³ oil, we save \$23,175 a year with the new exchanger compared with the old one.



One of the fans used to help circulate the air in the Australia room.

The climate of the winter garden is Mediterranean in principle. However, in a glasshouse open to the public, additional facts have to be considered when regulating temperature and humidity. Our visitors expect to see flowering plants all year round. It is therefore not desirable to imitate the hot and very dry summer period characteristic of the Mediterranean climate, as the vegetation would dry out. Also, if the winters were cool and wet, you would be sure to have fungus diseases spreading. It is therefore necessary to keep the climate as dry as possible during that period. The temperature outside may drop as low as -25°C. That causes a lot of unwanted condensation of water on the inside of the glazing if the humidity is high. Making the air circulate by the use of fans helps a little.

Our visitors do not like to feel chilly while they watch the flowers or have a cup of tea or coffee in the glasshouse, but the plants would produce more buds and we would get a more impressive flowering if the temperature were held low during the winter months.

In order not to get the growth etiolated, it would be best to have that low temperature during daytime. To reach a compromise between plants and people, we keep the temperature at +15°C both day and night.

Light

The lack of light is a main problem in the conservatory. Here, in latitude 59° north, Mediterranean plants that naturally grow in full sunshine have to adapt to 20 hours of daylight in summer and as few as 6 hours during the winter months. Though we have many hours of light in the summer, the intensity is not enough. During winter, the sun hardly rises above the top of the trees and in midwinter there are only a few hours of daylight. Winters without snow are exceptionally dark compared with when the snow reflects the light.

The artificial light amounts to 5,000 lux at ground level and 10,000 lux at the treetops. The lamps are 400 W, daylight, metal halides. All together we have 248 lamps of which 27 are situated in the Australian room. The total cost for electricity is more than \$AU154,340 yearly. Each lamp costs \$54 and they need to be replaced every third year. The cost for the electric fittings is \$264 AUD each. To add more lighting is not practical. So many electric fittings would shade a considerable part of the natural lighting, so the cost of installations and electricity would not pay off.



Edvard Anderson conservatory at night resembles a sparkling jewel.



Eucalyptus torquata under artificial lighting

The Australian Room

Beds

The Australian beds are raised, slightly sloped and one metre deep. These ground beds were made 15 years ago, and have not been redone since. The soil consisted of 3 parts clay soil, 1 part cow manure, 1 part peat, 1 part sand and 1 part baked clay pebbles. 1 kg dolomite/m² was added. The pH value is about 6. Before it was brought in, the soil was sterilized at +80°C for 20 minutes, to get rid of unwanted weeds and fungi.

The first plantings

There was not enough time to propagate all plants from seed, as the glasshouse was going to open to the public within a year. Mature plants had to be bought from garden centres in Holland, Italy and Portugal. Small tube plants were bought from Zanthorrea Nursery in Perth WA and cuttings and seeds were requested from Kings Park Botanic Garden. In spring 1995 the room was all planted and ready for opening in June.



The newly planted Australia room, 1995.

Propagation

To secure the stock of plants in the display, it is necessary to have a back up of new plants in the nursery. Cuttings are taken in spring and autumn. They are dipped in rooting powder, before they are put in the striking medium. They are placed in a tray, and then in a box with bottom heat. As soon as you can see the roots coming out of the peat pellets, they are transplanted into larger pots with potting mixture.



Above: Peat pellets with cuttings placed in a tray which provides bottom heat.

Left: A rooted cutting.

Seeds are collected continuously as they ripen and are stored in a refrigerator until they are to be used. Before sowing they are treated as recommended, e.g. treated with hot water, soaked in smoky water, rubbed with emery paper, stratified or even leached in running water to improve germination.

Seeds are sown two in each tube and covered with a layer of coarse sand. The sand makes it possible for light to come through and reach seeds which need light for germination. The pots are then placed in a tray with a cover.

To acquire new species, we send for seeds from the international seed exchange between botanical gardens and sometimes buy seeds from commercial seed companies. We also request seeds from the ASGAP seed bank, which is a great possibility for us to get an extraordinary wide range of seeds.

Propagation and potting mixture

As sowing medium, a mixture of one part of commercial soil (90% peat, 5% sand, 5% clay) with a pH of 6, is mixed with one part of coarse sand and one part of small baked clay pebbles. The mixture is watered and then sterilised in a microwave oven for about ten minutes.

For cuttings we use small peat pots called Jiffy 7. We have found that all cuttings root well in these peat pellets, which have low pH and are free of all pests and fungi. They also minimise the transplant shock and root damage when repotted.

To get good drainage in the pots, one part of the same commercial soil as used for propagation mixture is mixed with one part of coarse sand and gravel and one part of baked clay pebbles in different sizes. This makes a soil mixture that is poor in nutrients. The mixture is watered and sterilised the same way as the propagation mixture.

Watering and Feeding

As the plants grow, they are repotted in larger pots and one teaspoon of fertiliser for Australian natives is added to each pot. The plants remain in the nursery for about two years or until they are large enough to be planted out in the display. During this period, the plants are watered individually by hand when dry and when they



The nursery at the Bergius Botanic Garden.



Banksia blechnifolia growing over a layer of sand and orange gravel.

start to wilt. Some need to be watered every day and some once a week, depending on the weather and the size of the plant and pot. Once a month they get fed with a very low concentration of a liquid fertiliser, Walco, (N51-P10-K43). Plants from the protea family are only given the special fertiliser for Australian natives, added to the potting mixture.

In the display, we now have installed a trickle watering system. This makes it easier to water the raised beds; before the water always flowed off. We still need to use the sprinklers during the warmest period. Once or twice a year the beds are watered with the same fertiliser, Walco, as the pot plants in the nursery.

To make the Australian display room look like real Australian bush land, we cover some parts of the beds with yellow sand and pebbles, and some parts with crushed orange bricks, to get the right feeling. The fallen leaves are not removed, but kept as mulch and to help hide the trickle watering system.

The plants

Most of the specimens planted in 1995 are still alive and growing well. Unfortunately, some of them grow too well and will soon have to be replaced. Some trees reached the roof years ago and need so much heavy pruning that they do not look attractive any longer. It is not easy to keep a 28 year-old *Acacia retinodes* in an eight metre high glasshouse. However, it pleases us with flowers the whole year round.



Above: *Acacia retinodes*, which flowers all year round in the Conservatory.

Left: *A. retrinoides* is clearly outgrowing its space in the glass house.

Our *Banksia ericifolia* is also one of the reliable oldies as some flowers are always coming out. Another favourite is the *Melaleuca cuticularis*, with its smooth bark and abundant flowering. Many of our Australian plants flower during our late autumn and winter, like our *Hakea laurina* which starts to flower in November, one of the darkest months of the year.



Banksia ericifolia



Hakea laurina

One of the more spectacular plants is the *Banksia grandis*, a beautiful specimen with several flowers every year. Our *Banksia blechnifolia* was bought at Zanthorrea Nursery in Perth 1996. It took ten years until it flowered for the first time.



Banksia grandis

When our visitors recollect our Australian room, they often think of the Grass trees. We have two old *Xanthorrhoea preisii*, as well as a young one, propagated from seed in 1994. Sadly an old Grass tree died a couple of years after being planted in 1994, but it is pedagogic to be able



Old and young *Xanthorrhoea preisii*

to show the old trunk and what it looks like inside. It still stands where it once was planted.

Different species of Kangaroo paws are also associated with Australia. A large *Anigozanthos flavidus* is always in flower. The Mangles Kangaroo paws, *Anigozanthos manglesii*, are difficult to grow and are usually short lived. They always get attacks from the ink spot disease.

As undergrowth we use different species and change them during the year. Some are bedded out and treated as annuals. The first years, we only had everlastings, *Helipterum roseum* and *Rhodanthe chlorocephala*, but the varieties increased after we managed to get seeds from the ASGAP seed bank.

Stylidium adnatum is the of the best established and spreads rapidly.



Anigozanthos manglesii



Banksia blechnifolia growing on a carpet of *Stylidium adnatum*

To get the right bushy feeling we allow *Kennedia coccinea*, *Kennedia macrophylla*, *Sollya heterophylla* and *Hardenbergia comptoniana* to climb in trees and bushes.



Everlasting daisies



Ptilotus macrocephalus with *Ptilotus exaltatus* in the background.



Kennedia macrophylla

Quite a lot of plants are kept in pots all the time, and are moved in and out of the nursery. They are used for decoration when in flower, like this enormous *Scaevola ariculata*. A *Grevillea lanigera* has been sold in Sweden as a “flowering Christmas tree” and we use them as Christmas decorations in the conservatory.



Grevillea lanigera Red Salento, sold in Sweden as “the only flowering Christmas tree”.

We were surprised to find a truffle in a pot with a *Calothamnus* from Zanthorrea nursery, Perth. The truffle, *Hymenangium album*, (det. Lars Kers) must have been in the soil when the plant was bought.



Truffles, *Hymenangium album*, which hitched a free ride to Sweden in a pot plant purchased from Zanthorrea Nursery, Perth, Western Australia.

Pests and Natural Enemies

The Australian plants are generally very healthy. However, with the plants bought from southern Europe, we had some pests coming in. Giant citrus aphids *Ecerua purchace*, caused us a lot of problem and we had to spray several times before we got rid of them.

We also got six different species of Vine weevils *Otiorynchus armadillo*, *O. armatus* var. *romanus*, *O. salicicola*, *O. sulcatus*, *O. dieckmanni* and *Pantomorus cervinus*, coming in with plants, and they breed two or three generations within a year. Vine weevils are fought with nematodes, when they are larvae and live in the ground. Snails, slugs, centipedes, aphids, spider mites, thrips, moths, sciarid flies, mealy bugs and white flies sometimes occur, but are generally easy to control. At present the most difficult pest to fight is the long tailed mealy bug *Pseudococcus longispinus*.



Vine weevils, *Otiorynchus armatus* var. *romanus*



The Giant citrus aphid, *Ecerua purchace*

We do not use pesticides or fungicides any longer. They have been replaced by a large amount of biological pest control and several insecticidal soaps. Toads and frogs eat slugs and weevils very efficiently and our Chinese dwarf quails *Excalfactoria chinensis* do a great job catching grubs and snails and whatever is moving. Great tits *Parus major* stay in the glass house during the winter and feed on aphids and larvae.



A Chinese dwarf quail, *Excalfactoria chinensis*

Outdoors

Australian plants are also used outdoors in pots during the summer period. A large *Callistemon citrinus* is kept in a plastic greenhouse during winter and moved out as soon as the weather allows. Stockholm has a cold temperate climate and only the months of June, July and August are frost free. Most Australian plants used outdoors are grown as annuals and planted out in spring, like *Chloris barbata*, *Brachyscome iberdifolia*, *Isotoma axillaris*, *Trachymene caerulea*, *Shoemia cassiniana*, *Rhodanthe chlorocephala* and *Helipterum humboldianum*. Australian plants are also used in mixed borders and flower beds, together with other Mediterranean plants. In a summer with extremely warm and dry weather, even the *Swansonia formosa* will flower in a sunny position.



Callistemon citrinus bush growing happily in a tub.



Trachymene caerulea and *Shoemia cassiniana*



Isotoma axillaries, *Shoemia cassiana* and *Helipterum humboldianum*



Sturt's Desert Pea, *Swansonia formosa*, in the garden



Flowers of *Callistemon citrinus*

Education

We regularly organise guided walks for children, students and adults. One of the major tasks is to teach school children about plant diversity, ecology and botany. During school holidays, children can come with their parents and learn how to sow, take cuttings and plant. They may also take their pot with seed back home with them.



Children being shown how to sow seeds and take cuttings.

School classes and university students can get guided tours by request. They study, e.g. the difference between rainforest and sclerophyllous plants, and the convergence between plants from different continents.

Every January 26th we pay attention to Australia Day and hoist the Australian flag in the Australian room. A view of the Australia room on Australia Day can be seen on the back cover of this journal. In June 2007 the Hon. Greg Hunt MP presented us with a Wollemi pine and in 2008 we were honoured by a visit by Mrs Tamie Fraser, President of the Australian Open Garden Scheme.

The Edvard Anderson conservatory has been a great success. In here, flowering specimens of Australian plants can be seen all the year round. More than 160 Australian species are now in cultivation. The main flowering is in our late winter and early spring when the snow is sparkling outside and makes a fantastic contrast to the colourful flora inside.