

12th - 19th May 2018

Gothenburg Botanic Garden Professional Development Week

Sarah Carlton (Merlin 724)



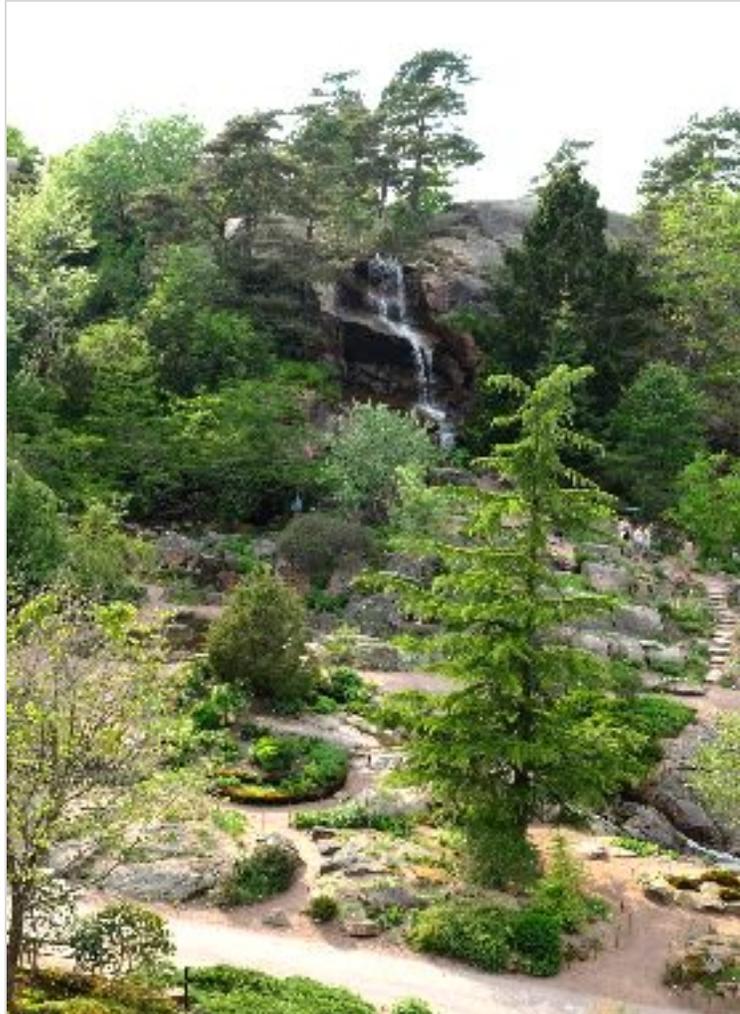
Introduction

Gothenburg Botanic Garden (Göteborgs Botaniska trädgård) was developed between 1912 when the land was donated to the state by a wealthy pharmacist, and 1923 when it opened to the public. Adjustments and improvements continue to be made each year, and as such the garden feels considered and purposeful. The current Director of the garden is Mari Kallersjö, a Professor of Botany and in post since 2008.

The garden is open all hours to be enjoyed by all free of charge. As with most active botanic gardens the collections are used for education, research, and inspiration. The Alpine Department in particular is a major focus of the garden, taking advantage of the sites impressive natural rock formations.

Alongside the Japanese and Rhododendron collections it is also the botanical focus of the garden and together hold the vast majority of the gardens wild collected plants.

The expertise of individuals (such as Henrik Zetterlund) involved in developing the alpine collections have given Gothenburg its deserved reputation as one of the top alpine botanical collections to visit in the world. It has been a privilege to spend a week here working with Marika Irvine, Johan Nilson, and the rest of the Alpine Team. The entire Rock Garden



was re-designed following the construction of the very impressive waterfall in the 1990's. The most recently completed area is the 'Caucasian' section, which was completed 3 years ago.

Working with Johan...

It was Johan Nilson who motivated me to apply for this trip. After seeing him give two excellent talks at the Dunblane Scottish Rock Garden Club Show in Feb 2017, and the AGS AGM Conference in Nov 2017, he very kindly invited me to visit. This was confirmed in

February 2018 with Marika Irvine, Alpine Supervisor, and Mats Havström, Director of Collections and Research.



Johan is responsible for an area of the rock garden that holds an Asian, woodland collection. This consists of an intricate network of informal raised beds constructed from peat blocks, and planted with botanically rare and interesting species. I was keen to work with him in this area, as well as with

his alpine house potted collections, as I too have an area of peat terraces that I care for at St Andrews Botanic Garden (which need renovating).

I arrived on a weekend which happened to coincide with Johans weekend duty, and so he kindly spent some time walking me through the collections and the garden, and on to the wider landscape, discussing the history of the site, the different areas, and the projects underway. It was a scorching hot day (as were all the days that followed), and so I also assisted Johan with watering the bulb collections. The majority of these, such as the *Fritillarias*, *Crocus*, most of the *Iris*, etc were already on their way to, or in full dormancy. In full splendor were the *Alliums* and *Eremurus* species, and a few spectacular *Iris*.

The bulb collections here are extensive, and are being added to regularly with new wild collected material. Between 2015 - 2016 a huge bulb meadow was created in the garden to hold cc.210,000 bulbs. The predominant genera used were *Narcissus*, *Crocus* and *Fritillaria* spp. This year the *Fritillaria meleagris f. Alba* was flowering for the first time. There is also a smaller area that has been planted more recently with Autumn flowering species, such as *Colchicum* spp., and *Crocus* spp. The main meadow is cut once a year between mid July - mid August. The Autumn flowering section is cut twice a year, once in mid summer and once in the last week of August. The method of cutting is by Scythe (and Sickle on very

steep areas). The garden has one very experienced Scythe cutter and he trains other staff. Cuttings are left on the ground for a few days for seed to disperse, and nutrients to leach back into the ground, before being removed for composting.



Johan looks after a very varied collection of alpines in a small glasshouse beside the Dionysia collection. Alongside the regulars such as cushion forming *Eriogonum* spp. and *Helichrysum* spp., North American *Oxalis* spp., *Dianthus* spp., *Rhodohypoxis* spp., *Asperula* spp., *Petunia patagonica* (looking stunning I might add), there were many species growing in here that were far from common and a few I'd never heard of which is always very exciting!

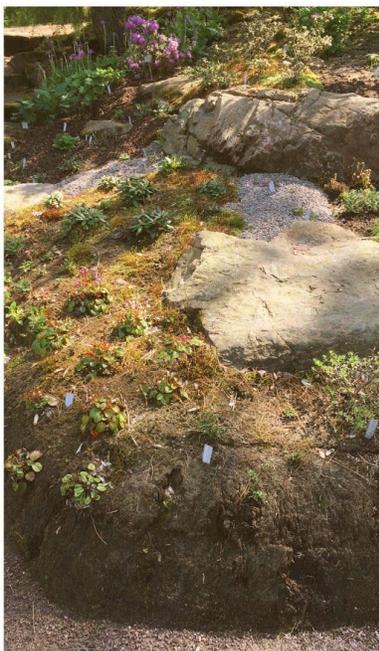


Some of those that stood out for me were:
Pterocephalus spathulatus,
Montegena novae-zelandiae (a New Zealand native and given to Johan by our mutual friend Cyril Lafong),
Sabaea thomasi (Johan and I both purchased this plant from Tim Lever at the AGS conference in November 2017 and I was happy to see Johan had kept his alive as mine had sadly died the week before),
Edrianthus owerinianus,
Dicentra X gothoborgensis,
Elmera racemosa var. *puberulenta*, and *Eryngium glaciale*. As well as *Primula reniformis* and *Tibetia tongolensis*.



Building and managing the Peat Beds

Johan showed me the way he secures the peat blocks to form curved walls. The first block is sunken into the ground by a third, and placed on an angle so that the front edge is only submerged by a couple of inches. The subsequent blocks are then built up in a brick formation, and leaning into the bed. When the desired height is reached the blocks can be sawn with a blunt wood saw (it is important NOT to use a sharp saw as it catches the fibres) to shape. The blocks are back filled with sand, and the bed is infilled with a mix of manure, peat and sharp sand.



The beds are mulched each year with a thin layer of garden compost. The whole area is irrigated every three nights (occasionally more) during hot weather, and so the blocks retain some moisture at all times. As a result of this the moss grows rapidly, and should be weeded out regularly. This is a slow process as pulling more than a strand or two at a time results in damage to the block. When sowing seed into the blocks it is important that there is no moss in growth as it will out-compete and the seeds will not germinate.

Following this method, the walls should last for around twenty years. Johan has been diligently reconstructing the

sections in need. He has found that the blocks can be reused by sawing off the outer edges (they start off quite a bit larger than ours so I'm not sure I will be able to do this at St Andrews).

Johan has had wonderful success cultivating stunning displays of *Shortia uniflora*, *Schizocodon soldanelloides f. alpinus*, *Berneuxia thibetica*, *Pleione limprichtii* and many more in the peat walls. Usually the *Shortias* and *Schizocodon* flower separately but this spring for the first time they are flowering simultaneously! I was impressed to see the *Pleione limprichtii* dotted around in the walls, and wondered how Johan established them.. But he said they just self-seeded and grow very well there!

This method of establishing selected species within the peat walls, especially those that spread and create good coverage, reduces the vigor of moss and other weed growth and therefore reduces maintenance time.

During the summer months the garden doubles their staff numbers with seasonal staff. This is essential as Sweden does not allow volunteering i.e. working without pay. The Alpine department has five permanent staff and a further five on six-month summer contracts. Currently the garden is fully funded by the government and there is no threat to this funding. This allows the garden to progress and develop its collections. Strong links with the Plant Sciences research centre adjacent to the garden means that the collections are actively used for research, and excellently maintained.





Other fantastic species growing here, from left to right, top to bottom: *Pteridophyllum*

racemosum, *Tollius altaicus*, *Ichtyoselmis macrantha*, *Paris polyphylla* var. *appendiculata*, *Podophyllum hexandrum*, *Epimedium brevicornu* f. *Rotundatum*.

Creating shade over these beds are several shrubs and trees, including *Rhododendron* spp., *Acer* spp. and a large *Pinus* sp. Johan uses the fallen Pine needles as a path covering. This both looks naturalistic and has the added bonus of saving time removing them. The other path surfaces are scraped back every year removing 2cm of the 0-5mm grit. This is discarded and a fresh layer is put down.

In Spring the beds are treated with a nematode to control the slugs and snails (we did this May 16th). I should add here that Gothenburg Botanic Garden is completely organic, no chemicals are used at all. The application of the nematodes is done via a water-tank holding dissolved nematodes at the rate stated on the packet, and a pump hooked up to a hose and lance. This is a two/three man job as one person needs to manage the tank and feed information regarding flow rate and quantity used to the person administering the dose. A third person is helpful to assist with the hose, preventing plant damage.

The garden compost used to mulch the beds is made on site and is always tested for weed seed germination before it is used. Samples of the compost taken from various places within the heap are left out for 2-3 weeks in seed trays. If germination during this time is high, the compost is deemed not ready and cooked for longer. The compost piles sit on hard standing, and are turned every week.



Woodland and Alpine Propagation

Johan and the rest of the permanent team are responsible for propagating the collections they care for. Most of the Alpine collection is propagated regularly to hold a back-up, however of the woody plants in the garden the majority are not backed-up.

Seed propagation takes place throughout the year, as seed is ready. Seed is sown into the standard alpine department mix:

GENERAL ALPINE MIX:

1 bucket peat

1 bucket sand

1 bucket 2-5mm grit

1 bucket loam based kompost

150 ml dolomitic lime

600 ml bonmeal

2 litres Boralith (volcanic Rock Dust)

The mix is sieved and filled into 9cm square pots and flattened. Seed is sown, and sharp sand is sieved on top to the same depth as the seed. A thin layer of grit is then carefully applied. If the seed requires light to germinate then no grit is used. If the seed is of *Primula* sp. Then fine grit is used. The pots are then transferred to the cold frames outside if no heat is required. These have a wire lid and a perspex lid. During the day the perspex lids are raised to allow airflow. Watering is done by hand every friday (of all the collections), and checked again monday/tuesday. Germination is checked every friday. Around 3 frames per year are sown. Germination is allowed to take 4 years here, and some are allowed longer, but most will be thrown away after 4 years. There are some *Iris* sp. Seed pots that are 14 years old!

The cold-frames are additionally under a high shade net frame.

Bulb seedlings are not pricked out until flowering size. Other alpiners and woodland plants are pricked out when true leaves form. They are mostly pricked out into half seed trays filled with sieved alpine mix. While I was working with Johan I pricked out seed pots of *Primula blinii*, *Primula reidii* var. *williamsii*, and *Oreosolen wattii*. Seed pots kept in alpine are covered with glass discs (these are antiques!).



Primula seedlings are watered with cooled boiled water from a handheld sprayer on low pressure. This is to prevent moss forming on the surface. They are kept under lids until germination so humidity is quite high. After being pricked out into the half seed trays they are grown on a while and then planted out onto rock garden (peat area), not potted up again.



Henlik with his Rhododendron prop unit

Rhododendron propagation is done by Henlik. He uses both layering and air-layering (with eggs shaped capsules designed for air-layering) methods in the garden, and cuttings are taken in May-June. These are given bottom heat and mist, and housed in a closed unit similar to those used in the tropical nursery at Kew. He does not use any rooting hormone as this is illegal in Sweden. He has experimented with soilless rooting too, and pictured below is one of the cuttings boxes that uses water spray on the bases of cuttings. Rhododendron seedlings are kept inside in a closed unit with higher humidity.

Other cuttings are not given mist or bottom heat. They keep lids on propagators and clean every morning, shaking off condensation.

The benches are lined with a fleece type fabric matting that is made of recycled clothing. It is cheap and holds moisture without degrading.

Lances have very delicate control on trigger and very fine roses, they are always stored upright and with care not to damage rose.

Working with Marika...

Marika is the department supervisor, has been in post since 2004, and is responsible for the famous Dionysia collection, alongside overseeing all aspects of the departments management. It was great to work alongside her for a few days as I not only had a chance to gain an in-depth understanding of Dionysia cultivation, but also a general over-view of the glasshouse management practices in Gothenburg BG.

Nursery Management

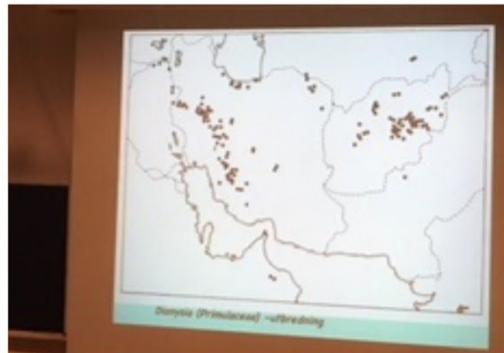
The Alpine Department consists of a large potting shed and several growing spaces under glass and under outdoor shade. The structure was built in the 80's and is soon to be re-built to accommodate green energy innovations and better house the growing collections. Marika has been involved with the planning of these structures to enable the departments needs to be met.

The glass is treated annually, externally, in Spring with a solution similar to white wash. The brand name is ReduHeat. It differs from traditional white-wash in that it reflects heat radiation but does not compromise the light intensity. This is perfect for alpine plants. It is used in Gothenburg in combination with ReduSol which also provides and diffused light in areas where lower light intensity is required. It is cleaned off every autumn with ReduClean which also acts as an algicide and removes algae and moss.

Gothenburg has very long daylight hours during summer, and very short daylight hours during winter. To help the Dionysia collection grow more consistently (and stronger) they have adopted a strategy using high grade supplementary lighting. These are LED based and have no heat output. They are on for 11 hours per day, all year round. The wavelengths of light have been designed specifically and also reduce pest problems.

Bench/staging sizes in Sweden are legally determined to limit over-stretching etc. All benches are 90cm deep.

Sand plunges are not sterilised and sand is never changed. Occasionally they removed all pots and re-mix the sand. They are left to dry out when empty.



Water is sourced from the mains, and is run through a fixed system that adds feed.

Basically a fixed dosatron. This supplies all water points with a very weak balanced feed. When bulbs and alpines are requiring stronger or more specific feed such as a high potash feed during flowering, a watering can of the additional feed is made up and the filter tube is submerged. All other staff are alerted whilst this is carried out to avoid over feeding of other plants.

Dionysia sp. are only ever fed with

the very weak feed.

Terracotta pots are used for all plants growing permanently in pots. These are washed by hand in hot water only (with a scourer). They are dried and stored indoors. Pots with cracks

and chips are continued to be used until they are unusable. All plastic pots are brushed out and stored outdoors, they are not washed. The winter is so cold in Sweden that all pests are killed off.

When new propagations are labelled they initially get a hand-written (using a marker pen) plastic label. These are then upgraded to a printed sticker attached to the label as the plant grows on. After this a metal stick label with sticker is used when planted out (growing as part of permanent collection), and after 2 years an engraved label is made.

Plants records are kept on Iris databasing system (the same as St Andrews Botanic Garden).

Pest and Disease management

Gothenburg BG does not use any chemicals on their plants.

During the growing season, for 6 months, new lacewings are added every week. These deal with many of the regular pest problems you might expect to see. They have an issue with large spider mite (*Bryobia* sp.) in the past. They treated this with a flora-mite spray applied three times during the growing season, two years in a row. This knocked out the infestation.

In the Tufa house liverwort is removed with citric acid, painted on at a dilution of 12%.

Magpies and Squirrels like to bury peanuts and sunflower seeds in the plunges. This mostly causes damage to plants when sand is piled up on top of *Dionysia* cushions. No control measure is in place apart from being visualent.

Growing *Dionysia* sp.

Gothenburg's *Dionysia* collection was started in the 1960's, and today they hold around 40 of the 50 known species. Two collection trips to Iran have resulted in 4 new species to science being discovered. Marika took part in the third *Dionysia* collection trip to Iran that took place in April 2018 (she was just back!). She went with leading botanist Magnus Liden who is currently writing a new monograph on *Dionysia*.

The morning or south facing sun can burn Dionysias and so the house is always treated with ReduHeat AND ReduSol. It also has some shade mesh panels above the staging. In the wild Dionysias are found growing predominantly on North facing walls, occasionally East facing. And always on limestone.

The collection is propagated mostly by cuttings, other than the new seed collected in Iran. These are taken in mid summer (just before the plant's natural rest) and rooted in pure



pumice (and 50/50 mix of fine and coarse). Half seed trays are filled with the pumice mix and soaked from below to moisten, but not too wet. It is vital that the water is clean (trays are scrubbed clean). The cuttings are then inserted in rows and kept with lids on the seed trays. They are placed on the sand plunges

and shaded. They will usually require re-soaking every ten days or so. They have found that the pumice is the very best thing for rooting Dionysia (and other cushion species).

Individual plants are re-potted only when they have outgrown their pots. This is not necessarily every year. It is always done during the growing season, and after flowering. After flowering the remnants of flowers are removed very carefully with tweezers to prevent botrytis. And if not repotting, the old grit is removed and refreshed. Any dead material in cushion is removed and rocks (local stone) are used to fill holes/prop up.

The collection is watered every week in Summer, and every 2-3 weeks during Autumn and Spring. During Winter the collection is watered even less. Lacewings are released every two weeks, and no sticky traps are used as they trap the biocontrol. Feeding is via the watering at a rate of 0.4% (straight tap water is 0.2%).

Marika was very kind to let me pot up some of her 2 yr old babies. When repotting it is absolutely vital that the root ball is not disturbed at all. In order to achieve this the old pot

must be broken off with a hammer, applying the perfect amount of pressure to crack open the pot without causing any collapse in the root ball. This was quite tricky at first and Marika was brave to let me have a go.

Dionysias also don't like to be touched and so the least amount of handling the better. Where roots have grown long through the drainage hole they can be trimmed by 1-2 mm. This encourages branching.

ALPINE MIX for DIONYSIA

20 litres lergranulat (Clay granules)

20 litres fine pummicite

20 litres coarse pummicite

20 litres sharp sand

20 litres vermiculite

20 litres perlite

0.5 litres Boralith (volcanic rock dust)

300 ml bonemeal

100 ml bjorkaska (Betula Ash)



When placing into new pot, fill a little initially so that the plant can sit on this bed of fresh compost without the need to be held tightly, while the side spaces are infilled. Always ensure the crown of the plant sits at the correct level before infilling (it is best to get this right before placing the plant in the new pot. Using a pot the same size as the old one is a helpful way to judge the space needed. Once the plant is placed in the new pot, always fill slowly a little on each side moving round the pot evenly. When the compost level is at the same level as the root ball gently tap evenly around the pot and remove the loose particles from the surface. Then add grit, gradually and evenly all the way round. Replace labels.

Soak from the bottom in very clean water. Wait until the label makes the wet scratchy sound when gently moved up and down in pot (it is a specific sound).

Visiting Peter Korn...

Peter Korn is to Sweden what James Hitchmough is to the UK.. maybe ten years ago. He is innovative and inspired. He is pushing the boundaries of what we consider the correct ways to cultivate plants and experimenting with growing species suitable for a changing climate. He has taught classes from his new workshop alongside Noel Kingsbury, and has space to take international students as interns.

I went to meet him in the south of Sweden at his new residence near Lund. Here he has set up a large nursery area of stock beds, these are 100% sand filled. He is growing plants here which he will use in his designs. He is focused on Central Asian and Steppe habitat species. Dry growing. Along with Sweden's general views, he uses no chemicals.

He has created a small designed garden area showcasing his planting ideas. Here he has naturalistic soft shaped raised beds with mixed species that perform at intervals and overlap to create a constant ebb and flow of interest throughout a long growing season. To name a few genera that caught my eye here: *Salvia*, *Goniolimon*, *Erisimum*, *Phlox*, *Opuntia*, *Carmichaelia*, *Eriogonum*, *Linum*, *Rumex*, *Onobrychis*... *Tulipa*, *Iris*, and so many more bulbs. The beds are planted on a gradient from driest to semi-dry. In the driest bed I saw *Allium libanotica*, *Bellavalia longistela*, *Ornithogalum* sp., *Iris nusar*, *Paeonie bersowski*, *Narcissus*



assoanus (one of my favourites in the St Andrews Botanic Garden Alpine House), *Verbascum atroviolaceum*.

He is currently working on a government funded project to plant a bank alongside a motorway. He has decided to plant this as a Steppe habitat as the bank creates a natural rain shadow. He will plant more than half native species. He will sow every September and burn every three years. No supplementary water will be applied. No fertiliser. The area will be prepared with 1 foot of pure sand before sowing.

In other areas of the dry garden he is growing some of my favourites: *Orostachys spinosa*, *Bulbinella hookeri*, *Dodocatheon sp.*, *Lewisia rediviva*, *Baptisia sericea/australis* and *sphaerocarpa*, and *Corydalis calycosa*.

In conclusion..

I have gained valuable insights into very specialist growing techniques and since my return I have already adopted several of these methods and had much better results. I have come into contact with several species I hadn't known before too!

I would love to go back to Gothenburg Botanic Garden again, perhaps for longer next time. It is one of the most inspiring gardens I've ever been to. I felt this trip has given me a huge amount of motivation to push forward the collections, both potted and outdoor, at St Andrews Botanic Garden.

I want to thank Johan and Marika and all the staff who welcomed me and gave their time to teach me about their work. And also huge thanks to The Merlin Trust who helped fund this trip and so made it possible.