Work Exchange to Berlin Botanic Garden and Botanic Museum (BGBM) and visiting to sites related to horticulture in Berlin

(13th August to 28th August 2016)

By RBG Kew Apprentice, Tomas Stehlik

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Acknowledgement

As part of RBG Kew apprenticeship, Jonathan Swain and I, experience the incredible opportunity for Foreign Work Experience. This chance encouraged us to participate in Kew's staff exchange programme. Our Practical Training Manager, Martin Staniforth, gave a number of options where to go and we decided to experience Berlin. Martin Staniforth organised contacting with Berlin's manager of horticultural training Thorsten Laute. Mr. Thorsten has been taking care of us while working in Berlin Botanic Gardens and Botanical Museum (BGBM).

We would like to offer our thanks to:

- RBG Kew, which bought us fly tickets to Berlin;
- RHS Coke Trust Bursary Fund, which partly funded our accommodation in Novum Hotel Ravenna, Berlin.
- The Merlin Trust, which funded our public transport costs.

Introduction

The Botanic Garden of German capital city Berlin was established between 1897 and 1910 and a major part during the redesigning originally farm land had botanist, taxonomist, phytogeography expert and architect Adolf Englar. The botanic garden stretches across 43 hectares of hilly topography and is divided into many departments including:

a) Plant Geographical Section;
b) Arboretum;
c) System of Herbaceous Plants (Plant Family Beds);
d) Medicinal plants;
e) Italian Garden (representing formal garden plantings);
f) Glasshouses.

The Free University of Berlin mainly funds the BGBM. The BGBM is visited approximately by 350,000 visitors a year.

As Jonathan Swain and I experienced, the local summers are hot; with midday temperatures reaching up to 35°C, and dry. Dry summers keep local gardeners busy with manual watering and setting up irrigation systems. The main water source is ground water from naturally occurring springs. This water is rich on iron so it is changing the nutrients contain in soil as well as leaving rusty brown residue on the leaves and tree trunks, as well as everything else it touches.

Also we could see, the current financial situation in BGBM is not ideal and there is money shortage for staff salaries. For this reason, there is no money for permanent position of gardener for department Systematic herbaceous beds (plant families beds) and this area is closed and bed covered with brown impermeable textile. Furthermore, only one member of stuff and number of volunteers are managing entire area of arboretum (14 ha).

However, I felt very inspired by BGBM; in particular by the local plant collection and the way gardens, arboretum and glasshouses are managed. Specifically, I was inspired by the brilliant way of sward management with leaving gloriously blooming meadow plants uncut for most of the year. This made me think of how native communities of insects, mushrooms and plants benefit from each other.

By the way, local meadows are being used for scientific research, are being cut only once a year by scythe lawn mower and visitors are not permitted to walk over them.

Meadows in August - lush green meadows were cut on the end of June
(Photo by author)

Main Aims and Objectives of the Project

- To visit and complete two weeks work experience BGBM;
- To work, gain and share knowledge and experience with horticulturists and experts in BGBM;
- To study how BGBM curates their plant collection throughout present and future plans. For example, if they prefer growing straight species or garden cultivars;
- To see and compare the approach to problems related to plant health, plant disorders and invasive species faced by BGBM;
- To find out information related to how many permanent members of staff they employ, and if they employ volunteers.
- To find out if students and apprentices are being trained in the same way as at RBG, Kew. Eventually, what training programmes they offer;
- To find out what is actually the use and purpose of BGBM;
- To find out if they are composting green litter, what they are composting and if they are composting in-situ;
- To represent RBG, Kew as and World leading botanical institution;
- To collect evidence in form of notes and photos and produce a report.

Itinerary

Day 1 (13th August): Flight from Gatwick to Berlin;
Day 2 (14th August): Day off and settling down
Visit to Berlin Botanic Garden;
Visit to Royal Parks, Palaces and Gardens in Potsdam;
Day 3 (15th August):
First day of work experience in BGBM - 8:30 meeting with Mr. Thorsten Laute;
Introduction into Plant Geographical Section (PG) and Alpine Nursery (AN);
Day 4(16th August):
Working in PG -Team work in beds dedicated to Dune Landscape;
Day 5(17th August):
Working in PG - Restoration of bed – clearance;
Wednesday section meeting at 9:30;
Day 6 (18th August):
Working in PG - Restoration of bed dedicated to Central Asia Mountains (foot hills) – Soil Topping up and planting;
Meeting with DR. Gerald Parolly;
Day 7 (19th August):
Working in PG - Maintenance of various beds within PG.

Day 8 (20th August): Trip to Erfurt and visiting Kakteen – Haage, cacti nursery.
Day 9 (21st August): Day off and visit to Berlin city centre.

Day 10 (22nd August):
Working in Alpine Garden -Introduction; Topping up soil in to the apprentice's bed; Planting plants into the apprentice's bed.
Evening trip to Gardens of the World.
Day 11 (23rd August):
Working in Alpine Garden - Planting plants into the apprentice's bed; Potting up;
Meeting with Dr. Gerald Parolly for Museum and Herbarium Tour;
Meeting with Mr. Tomas Borovka for Glass Houses Tour;
Day 12 (24th August):
Working in Alpine Garden- Planting plants into the apprentice's bed; Potting up;
Meeting with Henrike Wilke;
Day 13 (25th August):
Working in Alpine Garden –Weeding in cold frames; Potting up;
Tour to Seed Bank;
Day 14 (26th August):
Working in Alpine Garden – Weeding in cold frames; Potting up;
Saying goodbye with Mr. Thorsten Laute.

Day 15 (27th August): Day off.
Day 16 (28th August): Travel from Berlin to Gatwick.

Jonathan and I were working 8.5 hours a day, with a flexible start time between 5:00 till 9:00 a.m. Along with all other members of staff, we had 30 min lunch breaks at midday.

From left: Tomas Stehlik, Thorsten Laute and Jonathan Swain
(Photo by BGBM member of staff)

Week 1: Working in Plant Geographical Section

The Plant Geography (PG) section is very unique setting designed by the former director, Adolf Engler in the early 1900s. This design spreads over a large area (12 ha), almost a third of the garden's area, and is divided into 3 sections: PG – 01 representing flora of Europe, PG – 02 the flora of Asia and PG – 03 the flora of North America. All plants in the PG sections are grouped together in to plant communities, as they have been observed growing in the wild. Each small bed represents a different geographical location.

The PG section displays the wild plants collected from nature, not garden cultivars that have been bought in a nursery. From this live plant collection the alpine garden (nursery) can propagate, plants then can be distributed further into other areas of the gardens. Also, seeds are banked within BMBG from here and from other sources in central Europe. Even the herbarium finds use from live plant collection for scientific research.

A current project that BGBM is working on was brought to my attention. It is the 'Caucasus – Plant Diversity between the Black and Caspian Seas ' ,which started in 2009 with the aim to develop a scientific way for conserving biodiversity and to make this information accessible. The considerable progress on the project was achieved through support of the Volkswagen Foundation within the programme "Between Europe and the Orient – A Focus on Research and Higher Education in/on Central Asia and the Caucasus'

Plant Geography section – alpine plant communities (Photo by author)

During my 5 days work experience I had a chance to work alongside the PG – 02 team of 2 permanent members of staff, 2 seasonal members of staff; hired for 8 months each year; and 2 part time members of staff and one volunteer. However, I was mainly working with section supervisor Klaus, who has been working in various departments of the gardens for longer then 20 years. Together we worked in many sections of the PG dedicated to flora of Caucasus. Our main tasks were weeding of self seeding plants and watering. I found this time really interesting and thanks to wisely situated interpretations I could broaden up my knowledge. This is an example of garden interpretation:

Honey madness in the Caucasus (Source: Garden interpretation)
Of five species of Rhododendron native to the Caucasus the yellow rhododendron (*R.luteum*) is only deciduous species, and is thus an azalea in everyday sense of word. They can frequently be found in the understorey of various mountain forest communities. Many rhododendron plants, including the yellow and the pontic rhododendron, are extremely poisonous. They contain the nerve toxin andromedotoxin, which is present in the plant's pollen and nectar and is thus transmitted by bees into the honey they produce. Eating this honey can lead to "madness", as the Greek historian Xenophon documented as early as 400 BC.

Also, I learned from Mr. Klaus that rhododendron plants are being fed twice a year (spring and autumn) with organic fertilisers such as fish blood & bone and hoof & horn, and microrhizal products are being used with planting. Talking about rhododendron plants, I learned more about those growing in Europe, specifically the Alps. In the PG section representing European flora I found *Rhododendron ferrugineum* (growing on acidic soils) and *Rhododendron hirsutum* (growing on alkaline soils). Another interesting species represented in Berlin's collection since 1980s is *Rhododendron campanulatum* from natural source (mountains of East Asia). Unfortunately, the mature plants are not doing well due to Berlin's hot and dry summers, therefore, original plants are being propagated vegetatively (by cuttings), while the seeds are germinated in glasshouses in the Alpine Garden.

Team job in the Dune landscape

The team job, involving all members of PG – 02, was to weed through the dune landscape. We were mainly weeding self-seeders, *Circium vulgare, Calystegia sepium* and *Solidago canadensis*. The last named plant is considered as a dangerous and invasive weed in Europe. It is worth to mention that the dune landscape is topped up every 2 – 3 years with 5 m^3 of washed sand. The seasonal highlights are spring flowering bulbs including: white flowering *Tulipa turkestanica*, red flowering *T. schrenkii*, compact growing *T. polychroma*, yellow *Crocus karolkowii*, purple flowering *Allium stipitatum* and many more.

Dune landscape in high summer (Photo by author)

An interesting interpretation panel on dune landscape caught my attention. It is described here:

Living on salt and sand (Dune landscape with *Ephedra* sp. on Caspian Sea, Azerbaijan

I learned that lowlands surrounding the Caspian Sea lie partly below sea level. The vegetation consists overwhelmingly of semi-desert, wormwood steppe, salt steppe and salt marsh. Plants of the goosefoot family, sea lavenders and grasses characterize the landscape. Some locations close to the coast have maintained dune areas with their endemic psammophytes (plants growing on the sand). Unfortunately in the BGBM they learned through experience that they can only display a small section of this drought and salt-tolerant flora outdoors because of the overly damp Berlin summer (not the sub-zero winter temperatures) which add a restricting factor. More Aralo-Caspian species can be seen nearby in the Alpine Garden greenhouse.

To working in such a setting was very interesting to me, as I have never seen planting like this before. This just highlights the incredible value of BGBM as a scientific/botanical institution. I saw interesting gymnosperm shrubs of Ephedraceae plant family (*E. monosperma* and *E. equisetina*) used in a planting scheme. Another interesting plant seen in the dune landscape was *Amygdalus ledebouriana* (the wild almond), which creates amazing pink flowers in spring.

Dune landscape in high summer and garden interpretation (Photo by author)

Restoration of bed dedicated to Central Asia Mountains (foot hills)

For 3 days I was working alongside gardeners Henni and Kristen, both seasonal workers with many years of experience working around the World.

The bed restoration took place in a bed dedicated to plant communities of the Central Asian Mountains (foothills). Three of us were working in the bed with triangular shaped bed, with approximately 5 m long sides. Conditions were shady, achieved by a large tree, *Picea obovate*, under planted with woody plants such as *Acer tataricum*, *Salix gmelinii* and *Salix caprea*. These last mentioned woody plants are coppiced each year in spring to mimic a 'natural look' that would result from plants being eaten by herbivores in the wild. Other plants cultivated in this bed were: *Spiraea salicifolia, Lonicera caeurulea* (Honeyberry), *Ribes rubrum, Rhododendron ledebourii*. *Potentila fruticosa, Lactuca tatarica and Paeonia lactiflora.*

Our main job was to create space for new planting. We removed a large number of plants, such as *Filipendula kamtschatica, Iris sibirica* and *Matteuccia struthiopteris.* All green waste was collected and sent for composting
(Photo by author)

Picture showing author planting new plants in the freshly cleared bed (Photo by Kristen)

Once we removed and discarded all undesirable plants we brought new topsoil from the composting area. The soil was dark and well structured. Then we went to the Alpine Garden (plant nursery) and we brought different accessions of plants in 6 cm and 9 cm clay pots, always leaving 3 healthy plants back in the nursery for 'Mother plants'. Into the restored bed we planted plants like:

- 7x *Caragana frutex* – yellow flowering shrub in Fabaceae family;
- 3x *Astragalus dahuricus* – purple flowering herbaceous plant, Fabaceae ;
- 23x *Bupleurum longifolium* subs. *aureum* – green -yellow flowering perennial plant in Apiaceae family,
- 70x Geum aleppicum – yellow flowering up to 1 m tall perennial plant in Rosacea family;
- 20x *Sibbaldianthe bifurca* synonym *Potentilla bifurca* – yellow flowering perennial plant in Rosaceae family.

The lay out of the new planting was decided by PG – 02 supervisor Mr. Klaus and individual accessions were distributed across the bed in groups in the aim to create natural looking chaos. After planting we got the sets of labels and we placed them beside the representing groups. Talking about plant labelling in BGBM, it is worth to mention that BGBM labels are not taxonomically up to date according to APG (mostly molecular-based, system of plant taxonomy being developed by the Angiosperm Phylogeny Group). BGBM labels are still in the Engler system of plant taxonomy. BGBM labels are created from durable materials and the cost of updating the labels is something that BGBM currently cannot afford. This made me think about the luxury we have at RBG Kew of using our own label-printing machine at roughly £1.00 per label.

Crataegus tenacetifolia – each year the young growth is being removed to create the habit similar to the one seen in the wilt; where herbivorous animals eating off the thornless growth.

Quercus castaneifolia – the oldest tree in the BGBM.

Ruta graveolens - Garden interpretation for summer festival dedicated to poisonous plants

Group of 3 mature *Abies. nordmanniana* subsp. *equi-trojani* trees

(Pictures by author)

Week 2: Working in the Alpine Garden

The alpine garden – Nursery and safe site for plant geographical section

The traditional term “Alpine Garden” refers to a particularly important section of the Botanic Garden. Hidden by a wall, biennial and perennial herbaceous species for the plant geographical section are produced here, while the woody species for the whole garden are grown in our tree nursery. Year in and year out, the Alpine Garden staff cultivates 800 – 900 accessions, pricking out approximately 12,000- 15,000 seedlings, planting 10,000 in pots and meticulously recording their data of cultivation. In addition, we keep extensive stock plants quarters under glass, in shade halls and on rock garden beds. Seventy percent of the c. 1,900 species of the Alpine Garden are so-called “stock plants”, producing the seeds and vegetative plant material necessary for reproducing and maintaining the species inventory of the public display. Excessive seeds are exchanged with other botanical gardens worldwide by way of our Index Seminum. (Source: Garden Interpretation)

Cold frame and recently build glasshouses in Alpine Garden (Photo by author)

I spent 5 days working in the Alpine Garden. The team included 3 permanent members of staff, 2 part time members of staff and 2 apprentices and one volunteer. The temperature this week was very hot, with midday temperatures about 35 °C. The high temperatures were almost unbearable, so our working days were divided into morning jobs outside and afternoon jobs of working inside the potting shed.

In the beginning of my second week in Berlin I was working alongside apprentice Jenny, an apprentice whose is specializing in nurseries and herbaceous plant propagation. Jenny and I were carrying on the job which my fellow apprentice from RBG Kew, Jonathan Swain, started in the previous week. Together, we created new beds by topping up topsoil (topsoil from BGBM's own production in nursery from old used potting compost) in the area beside newly built glasshouses. We marked up the path and rectangular beds, 1.3m wide. Then we replanted a number of plants from trays into new beds dedicated to apprentices training.

Pictures showing the area of newly created beds dedicated for practical training (Photo by author)

Working alongside Jenny was interesting in the way that we were talking about things we are learning at RBG Kew and on RHS level 2 in England compered to her studying in the local horticultural collage, Peter Lenne School. For example, during planting Jenny pointed out the differences between fibrous root system and tap root in respect to watering. According to her training, the plants with shallow fibrous roots are being watered once, although the plants with deep rooted tap roots need to be watered in 2 intervals to insure that water soaks deep into the ground.

I am glad that Jonathan and I, as RBG Kew apprentices, got involved into the creation of beds used for future education.

Another interesting fact apprentice Jenny mentioned was the name of German plantsman Karl Foerster. Karl Foerster (1874 – 1970) was born in Berlin and was interested in breading new garden cultivars. His plant nursery was and is still based near by Berlin, in Potsdam, where he transformed 5000 square metre agricultural land into a famous gardening paradise, and employment at his nursery was considered prestigious. He introduced number of garden cultivars into the cultivation, to name few: *Delphinium elatum* 'Berghimmel', *Rudbeckia sullivantii* 'Goldsturm' and *Calamagrostis* x *acutiflora* 'Karl Foerster'.

In the second half of the week I was weeding cold frames with plants potted into clay pots sunken into the sand. In the Alpine Garden the sunken clay pots are used for 3 main reasons:

- Individual plants are kept in order;
- Root system in clay pot is under control (easy lifting);
- Clay pot is permeable and while sunken in send the roots are kept moist.

BGBM is mainly interested in straight species rather then in garden cultivars. These plants are mainly propagated from seeds legally collected in the wild. The main sowing season starts on 1st of March and finishes on the end of April. The second sowing season is carried out from 1st of November until end of December. The sowing is carried out in heated glasshouses and all information such as the date of sowing, the date of germination, the number of seedlings before pricking out, and so on are carefully recorder into BGBM plant database called BOGARD (provided by Microsoft).

Young plants in sunken clay pots (Photo by author)

Seedlings of various plants in sunken clay pots (Photo by author)

Each day after lunch break I had chance to work with young seedlings, large enough to prick out. This was interesting job because I had to mix different growing media for each individual plant type and looking at the plant database BOGARD and how to use it. For example: one afternoon I was pricking out seedlings of *Gentiana asclepiadea.* Seeds sown in November 2015, germinated in growing media 50% washed sand and 50% peat (peat from natural sources is still used in European gardens). Another time I produced a number of pots with individual seedlings that I was potting up. They needed a mix containing nutrient rich mix from public glasshouses:

- 6 parts of old compost from *Victoria amazonica* and mycorrhizal products;
- 2 parts of peat;
- 2 parts of pumice;
- 1 part of sand;
- 1 part of lava.

Once I finished potting on the whole accession I was explained how to sink the pots into a sand bench and the cold frames within the Alpine Garden. The selection where to put each accession has been decided according to vigour, needs of the plant and hardiness of each plant. I was impressed that some of the plant accessions are so brand new in cultivation that even local experts weren't sure which place to chose for the plant. I would say, that this all is part of the project "Caucasus – Plant Diversity between the Black and Caspian Seas", which is in some way the introduction of new plant species into the cultivation.

Hidden from the eyes of public, the half way down sunken glasshouses in Alpine Garden are used for various purposes such as seed germination and rooting up the cuttings. Each glasshouse has slightly different microclimatic conditions. (Photo by author

Composting in BGMB

The composting in BGMB takes place in large area hidden from eyes of public. It starts by collecting of woody waste material and all green plant material from the gardens, glasshouses and arboretum on separate piles. The woody material is shredded and processed in aim to produce bio charcoal. The machine named 'Karbonisierungsanlage' (carbonisation plant) is used for process of pyrolysis. The produced charcoal is then mixed up with well-rotted compost.

Composting area in BGBM
(Photo by author)

Compost aerator (Picture by author)

The green waste plant material is composted on hard concrete surface in long winrows. The number of heavy machinery is used for mixing and aerating, which takes approximately 7 – 10 days, depending on season. The winrows of composting mass are then watered, enriched by products containing 'effective microorganisms' and covered with impermeable membrane, which helps with keeping temperature above 50 °C. The well-rotted compost is produced after 3 weeks. The final stage of composting is mixing with charcoal.

Carbonisation System in BGBM (Picture by author)

Guided tours throughout BGBM

I must say that 10 days of working experience in BGBM were remarkably interesting and my fellow apprentice Jonathan Swain and I had really nice time. The jobs we were carrying out helped to make a difference in the gardens and all our hard work was recognised by local gardeners and supervisors. While working we had a chance to discus differences in approaches and share the knowledge between both Berlin gardeners and ourselves. Only the language barrier was leaving restricting us, however, the value of using Latin plant names was recognised and kept us all understanding to a decent level.

The curator Dr. Gerald Parolly treated us very well and he organised many guided tours around the gardens and glasshouses. Jonathan and I enjoyed guided tours of various themes such as:

Botanical museum, Herbarium Library and Archives and Seed Bank

Tours led by Dr Gerald Parolly, who informed us about dramatic history of the BGBM during and after the Second World War, the process of recovering and building underground bunger for current herbarium collection and the importance of digitalisation and reorganisation of current herbarium collection, which is in stages of planning as a future huge investment. Dr. Gerald Parolly informed us also about ongoing project of Seed bank and field collecting trips.

The world of glasshouses of BGBM

Tours led by Ing. Thomas Borowka, who took us into the non-public nursery glasshouses and public display glasshouses. The interesting part of the tour was when we could see newly restored Victoria House being tested by turning heating in to the maximum working performance and water tanks being tested for leeks before the actual plants could be brought in. Also, Mr. Borowka mentioned the modern computer technologies of monitoring individual glasshouses zones by using operation software by company called http://www.ram-group.com/.

Plant health and quarantine

The introduction and tour led by Mrs. Henrike Wilke, who explained us that BGBM is currently focusing on using biocontrol in large scale with positive results. She mentioned that BGBM is spending up to 9000 Euros per year for 8000 m2 of glasshouses. The biocontrol is manly supplied by local company called KATZ BIOTEC.

The tour around the gardens of BGBM

The apprentices exchange has been organised as unique opportunity for us, RBG Kew apprentices, to learn from colleagues abroad. It was Ing. Thorsten Laute, manager of local apprentices, who introduced us to the gardens at BGBM and communicated with us while staying in Berlin.

Visiting to sites related to horticulture in Berlin and Erfurt

Kakteen –Haage, Erfurt

On Saturday morning I took train from Berlin, Hauptbahnhof to Erfurt, to visit the oldest cacti nursery in the World. The Kakteen – Haage is family run business established in 1685. The current owner and director Ulrich Haage kindly provided me guided tour and explained me the way of cacti and xerophytic plants cultivation on the commercial mass production scale. The current size of nursery and commercial grounds is 6000m2, the team is made of 13 cacti specialists and the 80% of plants are sold through out the online internet sells. This visit was remarkably interesting for me as I saw huge number of different cacti species and very old specimens on one place. It is worth to mention that Ulrich Haage has been trained in 1990's at RBG Kew.

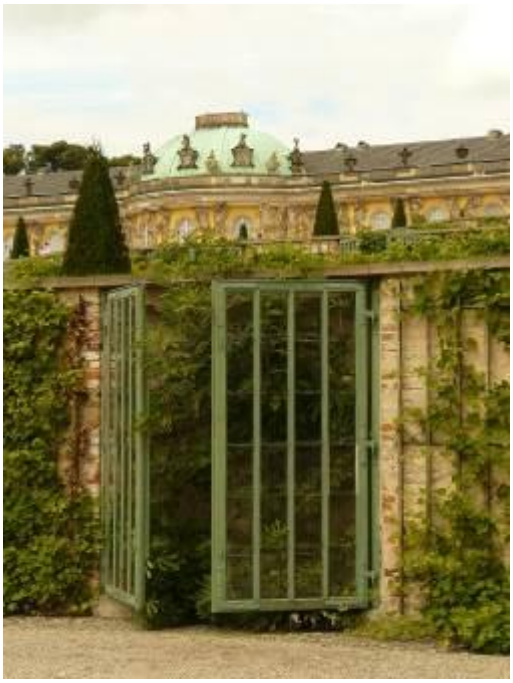
Glasshouse with 'mother plants' of *Astorphytum* spp. (Picture by author)

Glasshouse with 1-year-old cacti seedlings grown in trays compatible with potting machine (Photo by author)

Royal parks, Palaces and Gardens in Potsdam

Jonathan and I set off to Potsdam by public transport on Sunday 14th August. We spent entire day of enjoying was landscape with many ornamental garden settings, park tree plantings with superb palaces in background. As we could see, the Sanssouci Park is an ensemble of palaces and garden complexes, which were build under Frederick the Great during the 18th century and were expanded under Frederick William IV in the 19th century.

Decorative bedding planting (Picture by author)



Winter protection (window frames) for *Ficus* sp. grown on south facing terraces (Picture by author)

The Gardens of the World

On Monday 22nd August evening, I set off by public transport to area of East Berlin, Marzahn. This visit was great experience as I have seen the 'Oriental Garden'; the setting, which I have never seen before. The first garden of The gardens of the World have been opened for public in 2000 and since then the number of different gardens styles and settings were build. On 21acres / 8.5ha I saw a themed Chinese garden, the Japanese garden, as well as Balinese, Oriental, Korean, Italian Renaissance and the Christian garden. Unfortunately, I didn't seen the English garden, which is currently under construction and is expected to open soon.

Christian Garden (Picture by author)

Oriental Garden (Picture by author)