Pinaceae

On Friday 25 March a group of members gathered at Bicton Park for a study day on conifers. MONIQUE GUDGEON writes about the highlights and some of the knowledge she gained.

Any opportunity to visit a garden, especially a botanic garden, is never one to be missed, so it was with great excitement that I put my name down for the second IDS conifer study day at Bicton Park Botanic Garden in Devon. As a newcomer to all things coniferous and having attended the IDS Cupressaceae study day back in November, a day spent examining the Pinaceae was not to be neglected.

My anticipation was made all the more so because Bicton Park is one of the newest members of the Botanic Gardens Conservation International family (BGCI), having been awarded official accreditation by this most august group only very recently. With a worldwide membership of just over 700 it is a remarkable achievement for the garden team and especially for Curator, Neville Evans. It is also a process that I am halfway through applying for myself for my own garden at Sculpture by the Lakes in Dorset, so I was particularly anxious to meet Neville to congratulate him, but also seek his advice.

The weather could not have been better. After several days of benign warm spring weather, the gardens were looking spectacular and we were treated to wall-to-wall blue skies and glorious sunshine, the best that Devon could offer. The group met in the splendid Temple Orangery, described as a 'classic structure built around 1730, it offers commanding views across the Italian Garden to the distant Obelisk and rolling Devon countryside beyond.'

Bicton Park traces its history as far back as 670 AD and is entered in the Domesday Book of 1086. Much of the latter-day building and development took place in the mid-1700s with the magnificent Palm House added in 1830. This Bicton Park glasshouse pre-dates the famous Palm House at Kew with the elegant domed design inspired by eminent gardening writer John Claudius Loudon. It was he who invented the rolled wrought-iron glazing bar which made possible the construction of the curved glass roofs which are such a feature of both these celebrated buildings.

However, our reason for visiting was very much to admire, study and appreciate the trees, and particularly, the conifers of the garden. Work on the Arboretum began in 1830 through the foresight of Lord John and Lady Louisa Rolle, and both Ernest Wilson and William Lobb had close associations with Bicton Park, which includes many examples of specimens originating from their pioneering travels. Home to around 25 UK champion trees, Bicton Park has one of the finest collections in Britain and includes some of the world's rarest species.

But before we were allowed free rein to explore the Arboretum and Pinetum, we had work to do...

Neville Evans, Curator at Bicton, introducing the IDS group to the Study Day on conifers.

To set the scene for the day, Bedgebury National Pinetum Curator, Dan Luscombe, and Brian Robertshaw took us through a quick introduction to the world of conifers and their diversity, with Assistant Editor of IDS Trees and Shrubs *Online*, Tom Christian on hand with additional crucial information.

Some key facts and figures we learnt included:

- conifers represent an ancient group and are one of the rarest groups of plants with roughly one third currently under threat
- there are about 650 species of conifer, represented in 70 genera which, in turn, are held in six families;
- one third of conifer genera are monospecific;
- half the species occur in four genera: 120 *Pinus*; 105 *Podocarpus*; 60 *Juniperus*; 60 *Abies*
- conifers are dominant in higher latitudes of the northern hemisphere, but are most diverse in montane subtropical environments
- they are most scarce in tropical lowlands

We then looked at the different families:

- **Araucariaceae**, more or less restricted to the southern hemisphere and comprise, amongst others, the genera *Wollemia, Araucaria* and *Agathis*; the group with the most multi-veined leaves, large pollen cones and woody seed cones.
- **Cupressaceae**, present in both hemispheres in a wide habitat range and includes large genera such as *Juniperus* and *Cupressus*, but also monotypics such as *Sequoia* and *Fitzroya*.

- **Podocarpaceae**, after Pinaceae second largest family and mostly southern hemisphere distribution, with *Podocarpus* the largest genus. Interestingly this family contains the only parasitic conifer, *Parasitaxus usta*.
- **Sciadopityaceae**, only one species, *Sciadopitys verticillata*, that grows in Japan; the 'leaves' are actually modified shoots resembling fused needles.
- **Taxaceae**, mostly found in the northern hemisphere and most diverse in east Asia; includes our well-known common yew (*Taxus baccata*) and the Californian nutmeg (*Torreya californica*).

But the subject of our main focus for the day was **Pinaceae**, by far the largest family in the gymnosperms, they dominate most vegetation types including boreal forests, covering vast areas of Africa and the temperate world contributing significally to the ecology of the regions. They also make the largest economic contribution.

To coin a marketing phrase, the Pinaceae's unique selling points (USPs) are:

- of the 650 species of conifer, Pinaceae dominate with some 230, is the third largest genera group (11) and is relatively stable taxonomically
- they are more or less restricted to the northern hemisphere although one species, *Pinus merkusii*, occurs south of the equator in Sumatra
- Pinaceae are known from the Cretaceous fossil record (*ca.* 145 to 66 million years ago)
- most of the conifers grown as commercial timber crops belong in this family

Pinaceae genera

Abies, the 60 species are distributed across the temperate northern hemisphere and predominantly in mountains. Seed cones are erect and disintegrate on the tree. Leaves needle-like and generally not prickly to the touch. Shoots are smooth, leaves do not leave a peg as in *Picea* (see below). Widely grown in collections, but except for *P. koreana*, only suitable for large gardens or arboreta.

Cedrus, there are two, three or four species, depending on the taxonomy followed, with disjunct distribution in the Atlas Mountains in North Africa, in the eastern Mediterranean, and the western Himalaya where *Cedrus deodara* is a well-established accepted species. Similarly, *Cedrus libani* populations in Lebanon, Syria and Turkey are also well-established but some discussion as

to whether other cedars, namely *C. atlantica* in North Africa and *C. brevifolia* in Cyprus, should be sunk into *C. libani*. Important timber trees currently, and also in the past, but increasingly grown as ornamentals. Easily distinguished by their majestic shape and needle-like leaves held in whorls on short pegs. NB. *C. deodara* and *C. brevifolia* are easily identified, but telling Atlas and Lebanon is described as difficult and often impossible, and that's by the experts!

Keteleeria, the three species are restricted to warm-temperate to sub-tropical China, northern Laos, Vietnam and Taiwan. Rare in cultivation and doing poorly in the UK and Ireland compared with the warmer, longer summers experienced in the Mediterranean, continental Europe and New Zealand. Identified by erect seed cones on shoots which fall intact when mature. Leaves are needle-like and relatively long.

Larix, the ten *Larix* species are distributed in boreal forests and in high mountain ranges towards the south of the northern hemisphere. The best known of the deciduous conifers, larch leaves are borne in whorls on short pegs and the seed cones are small, oval and woody. Extremely valuable timber trees but equally important as ornamental specimens showing good strong growth, fresh spring colours as well as striking autumn tones.

Picea, an economically important group of approximately 35 species with vast ranges across the northern boreal forests, although some occur in smaller groups in southern mountain groups in the northern hemisphere. The handy reminder to identification, *Picea* = pendulous, pegs, refers to cones that hang downwards from shoots at maturity and fall whole, while leaves are attached to tiny pegs which leave a scratchy rough texture (unlike *Abies* where needles leave a smooth surface). Again, though widely grown they are mostly very large trees so not suitable for small spaces.

Pinus, with 120 species this is the largest group of conifers overall. Their distribution is exclusively in the northern hemisphere in boreal, montane, Mediterranean, sub-tropical and montane-tropical ecosystems. They are widely grown as ornamentals, but also as an important timber tree grown in both northern and southern hemispheres, which make them economically highly prized. Their distinctive bundles of 2, 3 or 5 needles make genus identification easy, seed cones are woody and mostly persistent on shoots.

Pseudotsuga, there are between four and nine species, two in western North America, one in Japan and one to six in China and adjacent countries, again depending on the taxonomy followed. *Pseudostuga menziesii* is the only one with a large distribution in North America, where it is an important forestry tree, as well as being commonly planted as an ornamental worldwide, whilst

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Pseudolarix amabilis (golden-larch), a deciduous member of the Pinaceae, endemic to China. The needle-like leaves are in false whorls.

all others are restricted to relatively small ranges. Seed cones are woody with a distinctive exposed, forked bract and leaves are irregularly placed and needle-like.

Tsuga, the ten or 11 species of hemlocks are found in temperate North America and Asia, in high rainfall areas where they are usually the dominant forest tree. Another economically important group but also grown as ornamentals, particularly *T. heterophylla* (which gets huge) and *T. canadensis*. The Asian species are seldom planted. Seed cones mostly ovoid, woody and usually fall after shedding seeds. Leaves are short, needle-like and irregularly arranged.

The three remaining monospecific genera are:
Cathaya argyrophylla, endemic to China and was only described in 1958. Highly ornamental but as yet limited in distribution appearing in a few collections or botanic gardens only.

Nothotsuga longibracteata, endemic to warm-temperate to montane sub-tropical regions of China. Exists in a handful of western collections only.

Pseudolarix amabilis, commonly known as the golden-larch, is also endemic to China. Better distributed amongst western gardens and arboreta than the other two, it is a beautiful deciduous tree to have in a collection and aptly named for its glorious autumn colour.

Recognising Pinaceae:
Pinaceae are typically large to very large trees, striking in appearance with mostly pyramidal or columnar crowns and largely evergreen.

Leaves are needle-like, not scaled as with *Cupressus*, borne individually on shoots (*Abies*, *Picea*, *Tsuga* etc.) or in clusters (*Pinus*) or in false whorls (*Cedrus* and *Larix*).

Pollen (male) and seed (female) cones are produced on the same tree. Male cones typically small, often tiny, and not helpful for identification, unlike female cones which are conspicuous, woody, some highly ornamental and most important in identification.

Depending on genus and species, some seed cones remain on the tree whereas others disintegrate and fall to the ground, in each case, seeds are always wind distributed.

Practical Pinaceae exercises...
Having absorbed a ton of facts, figures and Unique Selling Points of the mighty Pinaceae family we then turned to my least favourite exercise, keying out! I appreciate the reason for doing it, but it is such an individual and specific undertaking. As one well-known figure (whose name I have temporarily forgotten) said, 'Keys are written by people who do not use them for people who do not understand them.'

With that in mind, we split into small groups and were given a bundle of three different conifers, not necessarily to identify but merely to examine the distinct features, say what we had noticed and why we felt this separated them. The samples were all unnamed as our experts did not want to concern us with names at this stage; the purpose of the exercise was to study the material and identify the features that reliably separated them. Interestingly each group came up with very differing features but in the end we all agreed they had their merits. For example, needles prickly or not prickly as with *Picea* but not with *Abies*, obvious stomata on some but not on others, notched needle ends or not, differing needle lengths as with *Tsuga heterophylla*, or the appressed needles seen on *Picea orientalis*. We were then offered another bundle of four species, again the characteristics highlighted were extremely varied among the groups, which just goes to prove the quote above!

Tour of the Pinetum
After a strengthening and delicious lunch, we finally sallied forth into the garden proper and into the most glorious and warm Devon sunshine. Bicton Park Curator Neville Evans then took us on a fascinating tour, starting in the formal gardens surrounding the Temple Orangery, and with Dan, Tom and Brian on hand to field all of our endless questions.

The Italian Garden was laid out in 1735 by the famous designer of Versailles, André la Nôtre (1613–1700). Neville explained more of the history

The candle-like strobili of *Pinus patula*.

Young and mature cones on *Picea maximowiczii*.

of the development of the garden and then outlined their current collection policy. This involves a return to the high standards of the original nineteenth-century plan, whereby the emphasis is given to wild collected seed and specimens obtained and shared amongst other botanic gardens such as RBG Kew, Wakehurst, Missouri Botanical Gardens and Bedgebury National Pinetum, amongst others. Operating as a botanic garden for over 20 years, and now BGCI accredited, the focus of the Bicton Park collection is to tell a strong conservation story. As an example, they have laid out a small area planted with key threatened and rare species with clear interpretation boards so that visitors can easily see and read about each of them, an idea which I aim to copy in my own garden! Some of the specimens highlighted included *Picea omorika*, listed by the IUCN as Endangered and limited to a small area of Bosnia and Herzegovina, *Betula chichibuensis* (Critically Endangered), *Picea koyamae* (Critically Endangered) and *Cupressus chengiana* var. *jiangeensis*, also listed as Critically Endangered as there is only one tree known in north Sichuan.

We were then led into the Pinetum itself where we were spoiled for choice at what to admire and study first. Some of the champion trees we marvelled at included a fine *Podocarpus salignus*, 13 m in height with a girth of 1.69 m, an evergreen conifer much threatened by logging in its native range in Chile; the national Champion *Abies cephalonica* at an extraordinary 42 m in height and a likely original introduction from 1834; *Pinus peuce* at 23 m a Devon Champion, a slow-growing but adaptable tree from the Balkans which will tolerate many

conditions including damp ground, and *Pinus taeda*, one of the lowland pines of the south-eastern United States, at 19 m high here at Bicton Park and a national Champion.

There were so many excellent specimens, sadly our time was limited so although we could have spent hours over each tree, we had a great deal of ground to cover. Other notables which I was particularly pleased to see included a fine example of *Pinus patula*, a native of eastern and southern Mexico and here wafting elegantly in the Devon breeze, plus another one of my favourites, the monotypic *Sciadopitys verticillata*, a native of the Honshu, Shikoku and Kyushu islands of Japan; the Critically Endangered *Abies numidica* from northern Algeria where it occurs in only two mountain locations, sadly it had no cones to show us as they are particularly handsome; and a newly discovered genus to me, *Pilgerodendron uviferum*, which I have just planted three of in my own garden as they are reliable where the water table is high. Listed by the IUCN as Vulnerable, it is one of the two southernmost conifers in the world, the other being *Lepidothamnus fonkii*. Together with *Podocarpus nubigenus*, it inhabits edges of bogs in the area of Los Lagos, with its most common range being the Valdivian and Antarctic rainforests in southern Chile, having said that, although protected, it is under pressure from increasing agricultural expansion in all these areas.

The Champion, *Abies cephalonica*.

The range of conifers at Bicton Park, and predominantly those of the Pinaceae group which we were studying, is extraordinary. There are so many with crucial conservation stories to tell such as the aforementioned *Picea koyamae*, Critically Endangered in its native range of Japan, where only a few hundred trees exist in largely unprotected mountain forests on Honshu Island; or the very beautiful *Picea maximowiczii*, only recently identified in the Pinetum and a magnificent and large example, but

Araucaria araucana avenue, two rows of 25 trees, planted in 1844.

also one of the rarest species of *Picea,* that is restricted to a small mountain area of Honshu.

An area of the Pinetum that tells a different story is the Wilson Grove. The specimens planted here were all from Ernest Wilson's collecting trip to Western China in 1912, all fine, large trees and include *Picea wilsonii, Picea brachytyla* and *Picea likiangensis.*

Most encouraging of all, and a point highlighted by Tom Christian at the end of the tour, Curator Neville Evans has implemented an extraordinary expansion and planting of young trees in the Pinetum which will take Bicton Park and its collection well into the next century, and beyond. Sadly for Bicton Park, Neville is leaving for pastures new at Dartington Hall, but we all wished him well on the next stage in his career, and thanked him for such an excellent and fascinating day. We also all took the opportunity to thank our kind hostess of the day, Valerie Lister, who together with her husband Simon took over the reins of this unique garden back in 1998 and have, together with Neville, overseen so much of the expansion and development of this beautiful spot.

Before our final farewell however, there was one more important feature we all wanted to see: the very famous and iconic Araucaria Avenue. Although now part of the neighbouring Bicton College (once part of the original estate), this magnificent avenue was planted in 1844, it contains some of the tallest monkey puzzle trees in Britain and is the longest avenue of *Araucaria araucana* in the northern hemisphere. A splendid sight to see and a fitting place to end our very fine day.