Two Nepali Monocarps
(sub-titled – **Tales of the Unexpected**)

I introduced myself as someone who enjoys gardening with mountain flowers, and who travels to the mountains with the main purpose of seeing the scenery, but with a keen interest in the flowers to be seen along the way. So the images I showed were almost entirely taken in April, a good time of year to combine my interests, and providing unexpected insights into the ecology of meconopsis.

The first journey recounted, in April 2011, was the traditional trekking route into the Annapurna Sanctuary. This is fantastic walking for mountain scenery. Maybe the autumn season in October would be better for the views, but April allows some flowers to be seen as well as some views.

Images shown of flowers seen along the way included: *Zephyranthes* (a widespread non-native*)*, *Dactylicapnos scandens*, (at Holehird this flowers in August), the pink flowers of *Primula listeri, Primula nana in fruit*, *Primula erosa* - looking a little like *Primula denticulata,* but with no dead leaf remains under the new ones - *Arisaema griffithii*, *A.nepenthioides, Paris polyphylla*, *Piptanthus nepalensis* and the heart shaped leaves of *Cardiocrinum giganteum*. Also seen were tall tree-like rhododendrons in flower.

The route to the Annapurna Sanctuary is a very well-built stone trail, serving as the main link between villages. Vegetables were growing in the villages, including potatoes and maize, both well advanced in April, when they would only just be being planted in the UK. I also showed sweet corn that had been stored over the winter, hanging under eaves outdoors, indicating that the winter air has considerably less moisture content than we might expect.

At 3,000m the first rosettes of monocarpic meconopsis were seen. They proved very difficult to identify: the basal leaves seem to have an early stage or perhaps a winter form, that is much condensed lengthwise, only elongating later to enable the text-book descriptions to be applied. Coupled with the fact that these basal leaves often disappear altogether when the plants are in flower, leaving cauline leaves that can look very different, causes identification challenges!

It was unexpected that these plants were growing on a slope facing almost due south, in quite dry conditions exposed to full sunlight, and not in a moist, shady woodland setting.

Another image showed just how good the drainage was around a rosette, which was growing almost vertically.

The first monocarpic species discussed at length was grown from seed originating from the Annapurna Sanctuary, sown in May and flowering two years later.

The seedlings were very hairy, but surprisingly those hairs could be either golden or silver. The plants were over wintered outdoors, but in Cumbria it is wise to provide cover from winter wet.

Each plant produced over 100 flowers in an open inflorescence 8 feet tall. The top flower was solitary, immediately followed by multiple-flowered stems. By the tenth stem down there were 10 or more flowers on each branch. Photos compared to the one taken by Toshio Yoshida in a similar location, make it very likely the plant is that named in the monograph as *M. staintonii alba* – the rare white form.

The stigma of these plants was consistently red/purple, both before and after pollination.

Images were then shown to compare with the pink and red forms in the monograph. There are differences. These latter are more clustered and much more upright in their flower arrangement. Pictures of the stem leaves were also compared. The monograph states the stigma is green whereas the stigma of the white one is purple.

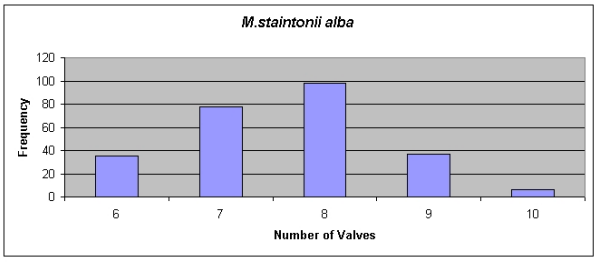
I then looked at whether this “big white” is the same as that described to the group by Ian Scott, grown from the CC3317 collection. This seed is supposed to have come from Khumbu some 250 miles from where *M. staintonii alba* is found. If they are not the same, what is the one described by Ian?

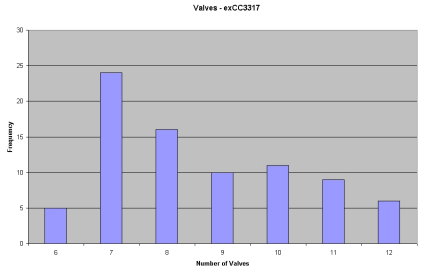
I also included a comparison with a tall white meconopsis grown by Jeanie Jones. It had striking and sizeable bracts over emerging flower buds, and inspection of the exCC3317 growing at Holehird showed that these plants shared this feature. Thinking that monocarpics from Khumbu needed to be either *M.wallichii* or *M.paniculata*, as no others grow there, I had ruled out the former for a variety of reasons. Re-reading the monograph on the latter, I noticed that Margaret Thorne’s image of *M. paniculata var. rubra* showed bracts shielding the flower bud.

I had not observed this feature on *M.staintonii alba*, although I will obviously study next year’s crop with great care!

Plants of exCC3317 also exhibited a stigma that could be either yellow or red. I found this variation completely unexpected, but others observed this as well, and it was evident as soon as flowers opened.

I then described work I have done on the number of valves in the fruit capsules. As a group, we are often exhorted to measure everything. But it is a scientist telling us that, whereas I am a mathematician – I only do counting, not measuring! The number of valves in the capsule is a character that is easy to study, and the range of values can provide valuable insight.





The graphs show that within a sample size for *M staintonii alba* of 250+, the number of valves is from 6 to 10, whereas in exCC3317 the upper limit is 12. It is highly unlikely that *M.staintonii alba* could produce a capsule with 12 or more valves. (Jeanie Jones’ plants had up to 14 valves). Further, *M. staintonii alba* has fewer lobes on the leaves, and these lobes are rounded at the apex - but pointed in CC3317. I conclude they have to be different taxa.

Based on current understanding, the leaf lobing, capsule shape and valve count, and because of its collection location, I believe that CC3317 is a white *M. paniculata*. DNA studies indicate that *M.staintonii* and *M.paniculata* are indeed very close: further study would be useful to clarify the differences. Live examples of both species were displayed.

M.staintonii alba, left, and CC3317, right.

My second Nepali monocarp is *M*. *dhwojii*

The Group is looking at what is in cultivation, and how to avoid losing the species we do have. I know I'm not alone in having struggled with *M. dhwojii*. I don't struggle to germinate it or to grow it on to a reasonable size, just to get it into flower. Yet it used to be considered easy to grow. By the end of the summer of 1914 I had grown a good number of quite sizeable plants, enough to give away to people, yet they nearly all died that autumn. I was left with one. This survivor, kept in a pot in my cool and shady greenhouse, won a red sticker on the bench at the Kendal Show in March 2015. I went away for a few weeks and when I came back it was dead, as were two sizeable *M. superba* plants. After a fairly benign April there had been a very sharp frost of -3ºC for three hours in the morning on April 27th which could have been to blame.

No point in guessing, I decided to do some research into where it was known to grow to see what I could learn. I looked at herbariums on line and started by trying to track down the Type specimen found by Dhwoj himself. There are three samples from a place called Sangmo. Searching for Sangmo suggests that there is nowhere in Nepal by that name. They do have a relaxed approach to spelling, which made me consider that there is a place called Zhangmu in the area where *M. dhwojii* is known. The only problem being that Zhangmu is in Tibet! I realised that when Dhwoj was collecting in the 1930s the border wasn't in the same place. In fact, the border changed in the 1960s, so Zhangmu was in Nepal when Dhwoj collected, and could be where the Type specimen was collected.

It is in the right area. I know it grows a little bit further north in Tibet, because I saw it. In another tale of the unexpected, a landslide on the road delayed a tour led by David and Margaret Thorne. We were forced to wait, so we did some botanising and found some *M. dhwojii* growing at the side of the road, identified by its distinct leaf.

Other herbarium specimens were studied and a 2011 sheet from a RBGE team at Bharaiv Kund stated that it was found in a consolidated boulder field: this proved particularly helpful when searching for the plant.

Then in April 2015 another unexpected turn when I was invited to join a trek along the Rolwaling valley, where both Adam Stainton and Toshio Yoshida had found the species. Sadly this trip ended unexpectedly quickly due to the massive earthquake. The Nepalese rescued all our possessions that were buried in the collapsed lodge. Next day, after an aftershock, there was a massive landslide down the valley which was to be our escape route. We were then deluged by dust and dirt for the next forty minutes, carried on the strong up-valley winds that are a daily occurrence – of which more later. We stayed five days to let the aftershocks settle down a bit, but we didn't get high enough to see any *M. dhwojii* on that trip.

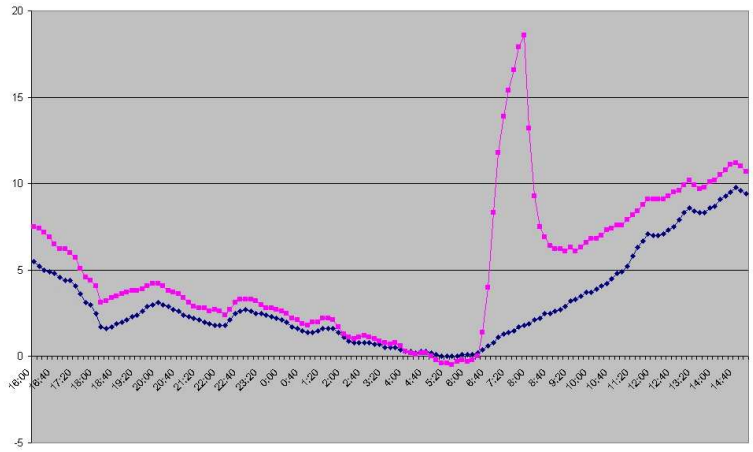
In the monograph and in Curtis' magazine there is a good image taken by Toshio Yoshida in August 1985 at Jata Pokhari. This April, we returned to Nepal and were able to visit this site. We had decided to walk the 'Numbur Cheese Circuit'. Numbur is a striking peak seen on the route, and there is small-scale cheese production taking place in villages at either end of the trek. Summer grazing pastures are encountered along the way. The village with the Cheese factory also hosted a plantation of *Edgeworthia chrysantha,* grown to produce paper under contract with the Japanese Mint to produce paper for Japanese currency.

We climbed 2,000m over two days. This is not recommended but there were few places to pitch the tent. Lots of *Primula gracilipes* were growing on a south facing slope, in surprisingly dry conditions. On the ridge at the top, the first *M. dhwojii* were found under

large rocks. Baskets were found alongside, which are used as muzzles on the animals to stop them eating poisonous plants – or indeed, anything other than grass since the Nepalese use many of the plants themselves.

We had a day to acclimatise in this area, which gave ample time to study populations of *M.dhwojii*, and the conditions in which they grow. At two sites, I checked the soil temperature and pH:

M.dhwojii	Altitude	Soil Temperature	pH
Sample 1	3650m	10℃	5.5
Sample 2	4000m	7.5℃	5.5



Altogether, more than 250 individuals were found, almost exclusively growing under the shelter of large boulders.
But they only grew on one side of the ridge, the south side. I had taken dataloggers to study the scale of the difference between the two habitats:
The southern slope had shade temperatures significantly higher than the north slope just 200m away. The “blip” in the graph was caused by the early morning sun being further round than expected, but it does show the major effect of insolation, even at 7am, at 13000ft, in April!

Relative Humidity figures were also informative, reaching as low as 50% by evening – a figure rarely reached in my garden!

M dhwojii grows in consolidated boulder fields, sheltered from wind, rain and sun. Its leaves are cut right to the rachis, as can be seen clearly in this image (left). Its fruit capsules retain many sharp prickles, even after the winter.(below)

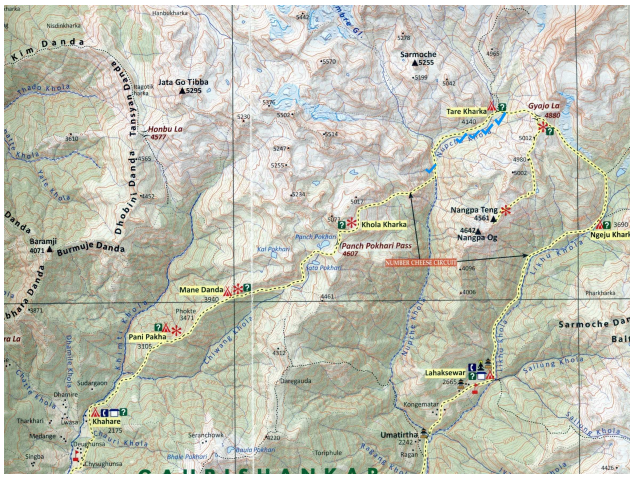
M.gracilipes and *M.dhwojii* have been confused. The upper image (left) shows the former, photographed by Margaret Thorne. *M.dhwojii.*(left, below) has long bristly hairs, the easiest character difference to describe. Both are basically pinnate, with the leaflets having variable dissection.

Other meconopsis seen during this trek and illustrated during the talk were the polycarpics *M.simplicifolia ssp. simplicifolia* and *M.grandis ssp. grandis*, both only newly emerging but with their location often disclosed by the previous year's flowering stems. Two further monocarpics were seen, *M. paniculata* and *M.wallichii*; and perhaps most surprisingly, probable hybrids between the latter and M*.dhwojii*.

In most cases, the identifications are secure, and the capsule valve counts match those in the Flora of Nepal and in the monograph. In the case of what we took to be *M.paniculata*, there were unexpected variations, and it may be that the area could well be worth studying in the monsoon season. What did appear clear was the impact of the wind on the location of the plants of this species, which seem to thrive on open, south-facing positions. Plants were exclusively distributed in shallow stream hollows where there was shelter, or against rocks that have interrupted the travels of the wind-distributed seed. (below, left)

I also studied the sunny side of this valley, but found no plants there.
Our sherpa saw me photographing this species and its fruit capsules, and promptly started breaking these off and eating the seeds!

For each species, I showed a distribution map. The blue "ticks" on the map below show the locations of *M.grandis ssp.grandis*, found only at the foot of the north-facing slopes adjoining the Nupche Khola.



M.wallichii was found in considerable quantity in the woodland further down the same valley, and at its lower limit, one plant was seen with its flowering stem developing well. It would have been in flower by the middle of May – not at all the late flowering species normally expected, but matching my experience that individuals that take a year longer to reach flowering size can then flower much earlier in the season.

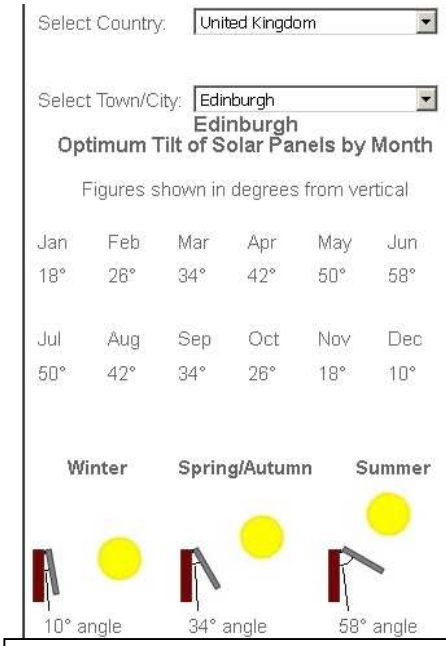
Other flowering finds illustrated were *Primula deuteronana* and *P.atrodentata, Trillidium govanianum, Arisaema propinquum, A. erubescens, A.costatum,* (again with the observation that this is in April, whereas the species flowers in Cumbria in July or August) and *A.jacquemontii.* The final images from the trek showed the "edgeworthia" paper being dried in the hot sunshine at 2000m.

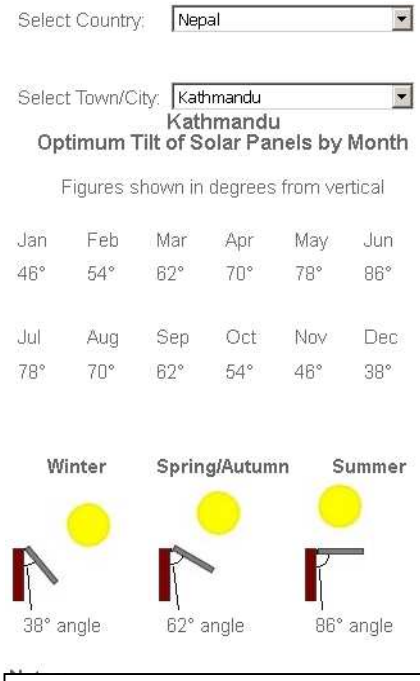
In the final part of the talk I discussed aspects of the Nepali climate, which is described in the monograph:

> "most species have a regime of cold winters, often blanketed under snow,
> dry springs and autumns,
> with most of the precipitation occurring during the summer months"

I think we fully understand the winters and the monsoons, but tend to overlook the bit in the middle, and just how dry the springs and autumns can be.

There can be long dry autumns, and I showed an image taken on Christmas Eve, with no snow at all on the major peak of Gauri Sankar. Autumn is a whole growing season. Their spring is more like our summer, and produces a full harvest. It is nothing like our spring!





Day length:	
December 21	7 hours
March 21	12 hours

Day length:	
December 21	10.5 hours
March 21	12 hours

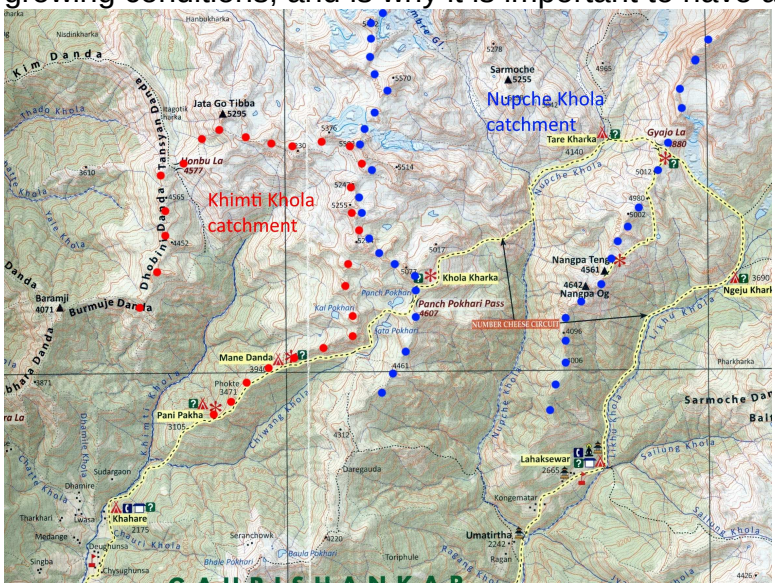
The two diagrams above were shown to compare the effect of the sun – due of course to the different latitudes of Edinburgh and Kathmandu. In Nepal, the sun is higher in the sky in December than it is in Edinburgh by the end of March. And in April, higher than it ever gets in Scotland! Further, the day length in December in Kathmandu is a full 10.5 hours – much better for growing than the paltry 7 hours enjoyed here.
So maybe a reason we can't grow some of these plants is because we can't do what the sun does in the Himalayas.

I now return to the up-valley wind, mentioned a few times earlier. The morning sun strikes first on the snows at the tops of the mountains. The air there is warmed, expands, gets less dense and floats away upwards. This leaves a space to be filled, sucking the air up from below. As the sun rises, this air itself gets warmed, and also moves up….. The net result is warm air moving up over the south-facing slopes all day. Research has shown that the average wind speed exceeds 10m/sec (36Km/hr). So hot air from the dry Indian plains reaches the Nepal mountains everyday, causing the low humidity. [But if you are in Sikkim, that hot air has come from the Bangladeshi delta areas, where it picks up plenty of moisture, hence the "Cloud Kingdom"]. This warm adiabatic air-flow has a major effect on the growth of plants in the spring and autumn seasons.

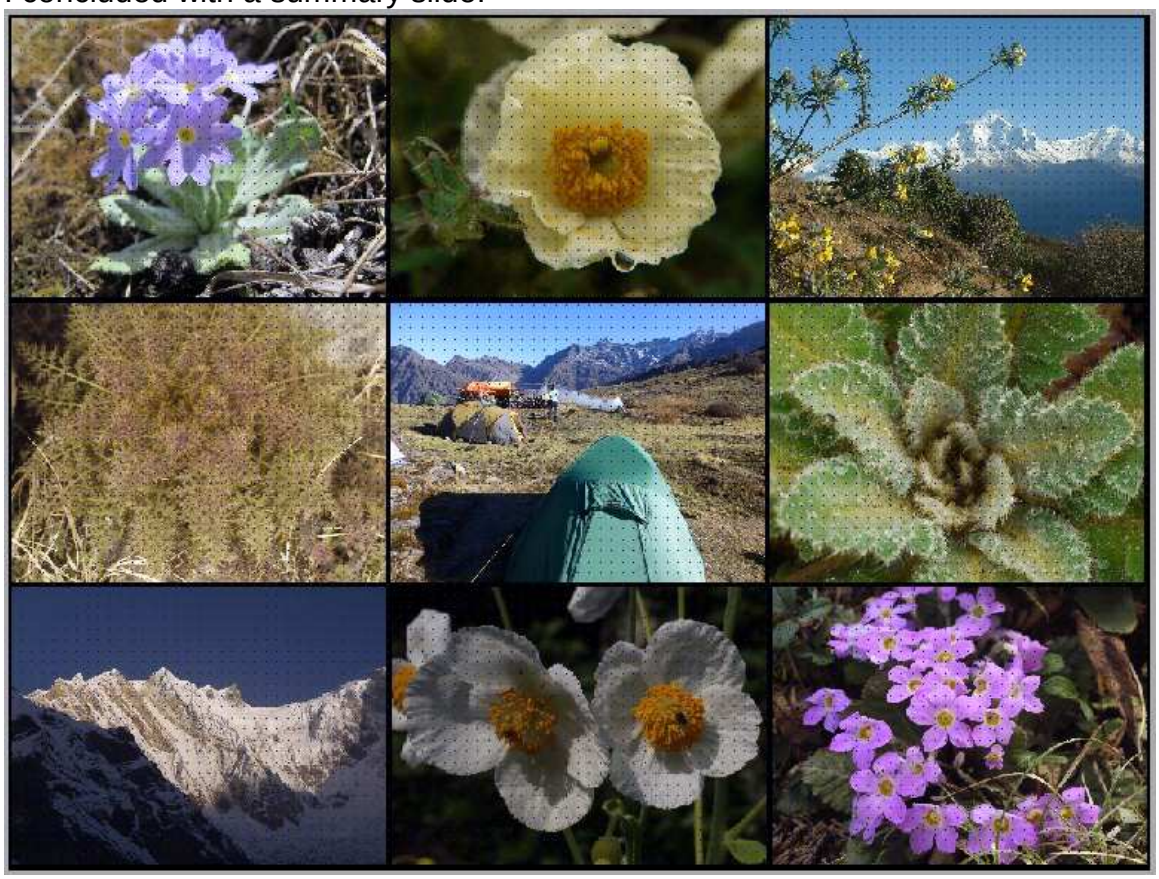
What goes up doesn't have to come down. There is no equivalent source of cooling to match the daytime supply of warm air. Both pre and post monsoon, everyday the heating effect of warm air passing uphill far exceeds the cooling effect of the reverse.

There is one factor that creates a cooler night effect, which is the location of glaciers. If slopes have no glaciers above them, then the night-time cooling is significantly less than in valleys with glaciers at the head. I compared the catchments of Khimti Khola on the map

with Nupche Khola, the latter having several glaciers feeding into it – including several more off the map to the north. The Khimti has none. Such difference has a big impact on growing conditions, and is why it is important to have accurate distribution maps.



I concluded with a summary slide:



Clockwise from top left:
Primula atrodentata, *Meconopsis dhwojii*, Piptanthus nepalensis and Dhaulagiri, *Meconopsis staintonii alba*, *Primula gracilipes*, *Meconopsis staintonii alba,* Annapurna Sanctuary – early morning sun, *Meconopsis dhwojii.*
Centre image: Camp at Mane Danda.

Alan Oatway October 2106