Amazing Reticulata Iris Hybrids

Alan McMurtrie

In the 1994 *Year Book* I reported being successful in flowering *Iris sophenensis x Iris danfordiae* (sxd) hybrids[1]. In the 2000 *Year Book* I reported a total of eight second generation hybrids had bloomed, and that four were white (actually white with blue accents). There was even a clone from a backcross to the *I. danfordiae* pattern I refer to as "spotted light blue-green"[2]. Now in 2004 the number of second-generation hybrids from crosses involving *Ii. danfordiae*, *sophenensis*, and an unnamed species from Çat, Turkey had climbed to 225. Whites are easy. I now have more than 60. And there are now seven "spotted light blue-greens", though two are actually more "spotted light blue". Most amazing is the number of colour breaks that occurred in the last two years. There were hints of what was to come in 2002 when two clones from 98-NP bloomed a year earlier than expected. A further eight opened last year, followed by the final one this year. All are absolutely stunning. They cover a range from white, to plum, to pale yellow, to rosewood, and there's even one I can only describe as chameleon. In addition, all are a reasonable size (50 to 60mm tip-to-tip – from the tip of one fall to the tip of another); which is quite something when you consider the Çat parent is a small species, as is *I. danfordiae*. And on top of all that, they all appear to be good doers. I have to keep pinching myself to make sure I'm not dreaming!

(*danfordiae* Atilla x *sophenensis*) x (Çat ANM2175 x *danfordiae* ANM2325)
91-FC-7 x 88-AX-3
98-NP

Colour Breaks involving Çat

In the 2000 *Year Book* I wrote, "I would classify my second most promising line as involving Çat x *danfordiae*: 88-AX. I believe their biggest potential is in intercrossing with *I. sophenensis* x *I. danfordiae* hybrids". 98-NP is realisation of that potential, which is also embedded in a number of other crosses: 97-VS, 98-CB, 98-GZ, 98-OO, 98-OU, 98-PR, and 98-ND. In these cases the clones are on the small side (40 to 45mm tip-to-tip). Unlike the 98-NP hybrids, many have characteristic medium dotting around the fall ridge as well as a white area by the arch in the fall blade. I think of it as an opaque white flush since it seems to go over the top of the dots. Both characteristics are from the Çat parent.

1 That first year there were sixteen clones from four crosses made in 1989. They ranged in colour from light blue to dark blue, with one being violet. The clone with the most yellow influence, 89-AC-4, was pictured in the *Year Book*, but it was not very striking, in fact somewhat dirty looking. The only telltale sign of their parentage was very narrow standards, and in most cases, a hint of yellowed-green on the back of their style arms. The most amazing thing was they were fertile! Over the six years from 1989 to 1994, 56 clones from eight crosses have bloomed. 92-CI-2 is the clone with the most yellow influence. Surprisingly its yellow is blotchy. This effect hasn't yet shown up in other hybrids.

2 If you look carefully you will actually see its the 'Katharine Hodgkin' pattern in a smaller flower. The key difference is my flowers are fertile ... imagine the possibilities of being able to work with that pattern!

Of particular interest is the fact several of these hybrids are halfway between yellow and orange. According to the RHS colour chart they are 23A (Yellow-Orange group). In many cases the colour lightens toward yellow as the flowers age. The most steadfast is 98-ND-2, whose fall is unmarked other than by a few light dots near the fall ridge. It's quite striking, and especially so blooming alongside the bright yellow 98-ND-1. If you want something along that same line that is more than just a pure colour, then 98-00-4 fits the bill. Its falls are heavily marked with lots of dark brown dotting, as well as veining towards the outer edge. It, like most of the yellow-orange hybrids to bloom so far, has nicely complementing reddish-brown style rib-stripes. I personally quite like 98-00-6, which is less orange, but has lovely dark-green style ribs, and nearly black variable-sized spots on its otherwise evenly coloured fall blade.

It's incredible that this has been accomplished in just two generations. The question is no longer "is orange possible?" It's "how soon will we have a large flowered orange?"

Other unusual things starting to show up are: very dark colours, such as solid dark violet with yellow in the areas around the fall ridge that would typically be white. There's also a grey, yellow, black combination that I refer to as "Evil" (98-GZ-3). You really need to see a picture of it to truly appreciate it and ensure you're not visualising something different. Also, there are several different patterns of fall dotting, as well as dotting and veining.

***Iris sophenensis* x *Iris danfordiae* Colour Breaks**

I have been looking forward to the day when I could say with certainty that *I. danfordiae*'s lemon yellow is actually made up a number of carotenes. Or to put it another way, when I could declare that more than just lemon yellow was possible. After all, the 25 yellow and 40 yellow-blue hybrids I have all involve *I. danfordiae*'s lemon yellow colour. In a sense we all knew pale yellow was possible because of *I. winogradowii*, but I want more. For this you first need the capability to produce the chemical compounds that give the other colours. Then you need the genes (switches) to turn those expressions on (or off). You can cross two blue or two purple Reticulatas until you are blue in the face but you'll never get a yellow. Reason: in all parents the yellow switches are off. Even though yellow is theoretically possible it never has the chance to express itself. This is why my goal has always been to shake up the genes as much as possible by working with wide clones from the wild (specifically ones that are distinctly different from each other). To truly shake everything up takes quite a few generations, not just two or three. Then it's a matter of working to open the secrets which are locked away to pull out the recessive characteristics.

Carotenes are fat-soluble pigments in cell walls that give the yellows, oranges and pinks we see. It seems that a number of my hybrids hinted more was possible, but it hadn't come out and hit me clearly until last year. One of the first to do so was the amoena 98-MN-1. Its styles and standards are white (with pale greeny-yellow style markings), and its fall is pale yellow. This isn't the rich colouring that will draw you all the way from one side of the garden to the other to see what it is, but it is lovely. There is only a limited number of colours that will do this; ones that are vibrant and vivid, like orange, or red. Yellow could also be included, but we already have *I. danfordiae*.

98-JI-2 bloomed this year and is similar. Its flowers have a slightly different shape, are smaller, and its falls have more dotting. I intercrossed the two and was rewarded with 54 seeds (an unusually high number).

97-CN-2 is pale yellow with blue accents: style-arm stripes and fall veining. It's small, 45mm tip-to-tip, but has reasonable size standards that narrow to a wisp. For a number of reasons it will probably just be for breeding purposes. It is striking and does increase well.

One other colour break that didn't involve the Çat Retic was 97-BG-1. Its overall colour is dark reddish-brown. This contrasts nicely with its lemon-yellow ground, which shows on the fall between veins of the overall colour. It's of typical size, with standards that are half the normal width (4mm). They are dull yellow, veined and shaded with the overall flower colour. This nicely accents the flower. The colouring and form are gorgeous, and it appears to be quite a good doer. I certainly hadn't been expecting anything like it.

Noteworthy

98-OK-1 (91-FC-1 x *I. danfordiae*) was the 6th "spotted light blue-green" to bloom. This pattern only occurs occasionally in back crosses to *I. danfordiae*. When my wife Lynda saw it she said it's "icy green". This leads me to giving it the name "Green Ice", which rolls off the tongue easier than either "Icy Green" or "Ice Green". Hopefully it conjures up ice cubes with pleasing green tones in them.

97-DZ-8 is a lovely white with green and blue accents, plus bits of yellow veining. It has a wide fall blade, but the flower doesn't open as much as it could; the falls and styles tend to be held upwards at high angle. As a result the flower only measured 47mm from tip to tip. If it was flatter, another 10mm could easily be added to its size. Of particular note, its flower had quite good substance. It remained fresh for quite a number of days; much longer it seemed than other Reticulatas starting at the same time. I do hope this characteristic continues. It would be valuable for both its commercial success and for use in hybridising.

A couple of my yellow-blue hybrids are particularly interesting. One I call "Tiger" (97-AG-6), since it has nice dark green stripes on a lemon-yellow background. Not quite the black stripes on orange ground you might have been thinking, but close enough. There are green dots around the fall ridge, and the arm portion of the style arm is wholly dark green. Another of interest is 94-AT-2. Its falls are a lovely dark brown on a rich yellow background. The yellow shows through mainly around the similarly coloured ridge in the middle of the fall. Its style arms are numerous shades of dark blue. Perhaps most interesting of all is "Sea Green" (97-CQ-1). I expect you are either going to love it, or hate it. It is an evenly coloured blue-green with yellow tones. The area beside the fall ridge is bright yellow with dark blue-green dots. Its style arms are much bluer. Just as the flower finishes it becomes bluer. Without question it's unique.

Bulblets, etc.

A common characteristic of *Irises danfordiae, sophenensis*, the Çat Reticulata and their hybrids, is they produce a reasonable number of bulblets. Each bloom-size bulb typically produces 8. If left alone many of these will simply die because they can't get their leaf above the soil surface – they use up all their energy trying. Some will make it, but the best thing is to replant the bulblets close to

the soil surface. In another four years they will bloom. Thus they can be used to increase a given clone faster than most other Reticulatas. The problem with the species themselves is their main bulbs don't regenerate large enough to bloom in subsequent years. This is why people say *I. danfordiae* "shatters": they find only bulblets and medium-sized bulbs (at best) when they dig up ones planted in previous years. What's needed of course is bulbs with hybrid vigour – ones that regenerate bloom-size bulbs year after year. The optimum situation is to plant several bulbs widely spaced, leave them, and have them form clumps. These would reach an equilibrium giving perhaps 5 or 6 blooms year after year. This is exactly what happened with one of my F1 sxd hybrids (i.e. first generation). A bulblet had been left behind in a replanted seedling patch. After a couple of years it consistently produced 5 to 6 flowers. I finally dug up the clump in 2001. It contained: 6 bloom-sized bulbs, 5 medium, 23 small and 163 bulblets.

Occasionally the number of bulblets produced by a bloom-size bulb can be as high as 25. The main difference between Holland and Toronto is Dutch bulblets get to bloom-size much faster. They will bloom in just three years, with some in just 2 years depending on the size of the bulblet. Rate of increase of a given hybrid is not really an issue in your and my garden – the clone just needs to give consistent bloom year after year. Before you know it, a couple of years have gone by and now you have a nice large display. Rate of increase is an issue for a new hybrid when you want to have enough bulbs to give some to a Dutch bulb grower for testing, and still have enough to use for hybridising, or want some for entry in a show. It is much more of an issue if you want to build up stock to be able to sell a variety commercially; especially on the scale of Dutch bulb sales where I hear 25,000 bloom-size bulbs are needed before starting sales.

Standards appear to be "missing" on some of the sxd hybrids because they've been reduced significantly in width: 0.3 to 3.0mm, versus typical *I. reticulata* standard width of 7 to 10mm. Two F2 hybrids have 8mm widths. In terms of length, most F1 standards are 30mm in length compared to a more typical 40mm. Some are only 20mm. F2 hybrids are much more variable: from 5mm to 35mm. This is of course due to *I. danfordiae*, which only has short bristles for standards. The tips of few F2 standards narrow to a wisp. Personally I don't really care whether a flower has standards or not; I'm more concerned with how it looks overall.

Other Hybrids

97-DG-1 is a unique purple with blue tones. What makes it so striking is a blue flush around its yellow fall ridge. The purple and blue contrast is quite distinct. This characteristic comes from a Reticulata I collected near Van, Turkey. On other hybrids the effect isn't nearly as intoxicating since the main flower colour is typically only a slightly different shade of blue or violet.

One colour break outside sxd breeding was 98-YS-1. It's an amoena: white standards and styles, with coloured falls (in this case light blue with a medium blue halo). The YS row was 1998's catch-all for crosses with 3 or fewer seeds (which typically don't germinate), or ones orphaned while being counted. A number of other outstanding hybrids have bloomed over the past 3 years, and I would encourage you to take a look at www.reticulatas.com.

Direction

I really don't know where I'm going with all of my crosses. I just know the general direction (actually directions, since there are a number of lines I'm pursuing). It takes 5 years to go from a seed to a flowering bulb, which is like being the captain of a huge tanker or cargo ship. You need to make course corrections and start turns well in advance of when you want them to happen. If you wait, it will be too late. This is why I make the number of crosses that I do. Of course you could easily make thousands upon thousands of crosses and get absolutely nowhere. The key to is to know the theory behind what you are doing, then work in several directions at the same time; you never know exactly which is going to be the most important. As I mentioned above, starting with widely different clones from the wild is critical. Currently available commercial clones are too similar to one another genetically.

Had I known for example 98-NP would be so good, I would have repeated the cross as many times as possible. Five years ago I never could have guessed how spectacular its results would be. Hindsight is always 20/20. Yes, I did expect interesting results, but there are other parents I would have thought would be slightly better. This is where I can think that a particular cross will be good from the point-of-view of mixing things up, but exactly what it will give I can't say until the progeny bloom. It was sheer luck that I happened to repeat the original *I. sophenensis* x *I. danfordiae* (and reverse) cross several times prior to seeing it bloom. Interestingly the look of progeny from each of those crosses is slightly different. In contrast I only made the one Çat x *I. danfordiae* cross.

Reinforcing the idea of pursuing several lines at the same time, as I mentioned in the 2000 *Year Book*, I made hundreds of crosses with diploid *I. danfordiae* and produced thousands of seemingly good seeds. Most didn't germinate. As you might guess, I had speculated that perhaps *I. danfordiae* x *I. histrioides* would give interesting results, just as E. B. Anderson found using *I. winogradowii* to create 'Katharine Hodgkin'. I produced 200+ seeds from at least 15 successful crosses, but have nothing to show for it.

Working with two parents that are widely different is like opening up the potential expression of a 2-dimensional plane. If the two parents are species, then the first generation progeny will all be very similar because each parent's genes are essentially uniform. In the second and future generations, by intercrossing the children plus backcrossing to the parents, the possible range of expression is the whole plane. It's up to the skill of the hybridiser to bring out this full expression. For example, a recessive gene from one species and a dominant gene from the other will always give a dominant expression in the first generation. In the second generation there's a 1/4 chance the recessive characteristic will be expressed. In the case of *I. sophenensis* and *I. danfordiae*, the first generation hybrids are all "just blues". The second generation yielded whites, yellows, blues, yellow-blues[3], and "spotted light blue-greens". Now other expressions are starting to appear such as pale yellow and brown.

With three widely different species, the range of expression opens up tremendously. Comparatively speaking it is 3-dimensional, showing how much

3 Yellow-blues involve a variety of expressions with yellow and blue pigments. So far the yellow has tended to be lemon yellow, and generally the blues are medium to dark. In some cases the result is olive-green.

more is possible using three species. Now if I could find a fourth 2n = 18 species, that's distinct from the others.

Outcrosses to typical Reticulatas may yield interesting results, especially once I have even more unusual hybrids to use as parents. The progeny will of course be sterile dead ends (due to chromosome incompatibility). Well over 1,000 such seeds could have bloomed by now (I had been curious to see how unique they might be – you never know for sure until you see). With an overall germination success rate of 20% that should have yielded over 200 hybrids. Only a couple of clones from one cross in 1995 bloomed (95-D). The progeny were small (45mm tip to tip) due to the Çat parent. One is of interest with its unique purple and blue colouring, plus nice spotting (89-D-1). Unfortunately the others are similar to common Reticulatas.

Dutch bulb growers have told me a number of conflicting things. One of those was that they aren't interested in small Reticulatas unless they are unusual. To me white with blue accents is unusual; actually very unusual. Yet I was being told 96-DZ-1, whose white is pure white[4], was too small. Hearing that at the beginning of 2002 didn't bother me too much since I had 18 whites to choose from (now 60), and I was confident 94-HW-1 (my very first white) would be introduced. I still quite like 96-DZ-1 and think that being a lovely pure white, there would be a market for it (perhaps this year's 00-KV-2 will prove even better). If it were to fail testing it should do so on the basis of some other factor, not that it is too small.

I think a couple of the other whites could also be introduced: 98-DZ-8 has predominantly green accents (most whites have blue accents), and as mentioned above, it seems to have exceptional substance, which translates into extended bloom; 98-WB-1 also has green accents and is quite striking; 98-NP-7 is exquisite with a significant yellow flush on its fall; 98-LQ-1 has wide style arms and seems quite nice ... So many truly beautiful whites! How many can the market handle? And this year there were 5 with soft blue fall markings.

Until last year I hadn't ever paid attention to flower size when I was hybridising. It wasn't a characteristic I was concerned about. The highest priority has always been to work with clones I thought had the greatest potential (with one of the key characteristics being flower colour). After that I would look around to see what other crosses I should make. If the flowers were a bit smaller that wouldn't have stopped me from working with them. Last year I did specifically intercross some of the larger clones (85mm tip to tip). I don't really expect much from those crosses. They will likely give large hybrids looking similar to existing ones.

I did manage to measure about 100 of my hybrids last year. Normally I'm too busy taking pictures and hybridising to have time for something like that (I need to retire). One thing to keep in mind about flower size is that it does vary somewhat. The main factor is bulb size. Bulbs that are borderline as to whether they are large enough to bloom or not, understandably give the smallest flowers. Generally, bulbs that are of a reasonable size will produce flowers of that size.

4 I call 96-DZ-1 "Snow-White" since compared side-by-side, most of my other whites are clearly "off-whites" (e.g. creams). Having such a pure bright white is unusual, plus its blue and yellow accents seem to be the perfect pastel shades.

Genetic Switches

Now that I have a reasonable number of F2 sxd progeny, I can start to analyse the high level genetic switches that are at work. If I had tried this earlier, I would have come to the wrong conclusions (re: all of the whites in the second year, or the high number of yellow-blues in the third year). Fundamentally, flower colour is made up of anthocyans (blues and purples), which are water soluble pigments in each cell's vacuole, and carotenes (yellows, oranges and pinks), which are fat soluble pigments in the cell's walls. True red is also an anthocyan. Unfortunately it doesn't appear that iris have the capability to produce the chemical compounds that reflect fire-engine red back to our eyes (such as in geraniums, roses, etc.), specifically the compounds Paeonidin (crimson), Pelargonidin (scarlet) and Rosinidine (crimson). Reds of a sort are possible in bearded iris; these maroon or brownish reds come from combining the right shades of purple and yellow. To our eyes at the distance we are from the flower, they combine and give the illusion of red. This is what makes 94-AT-2's falls appear dark brown. It's interesting to look at a fall petal under a microscope to see this.

Another point to realise is that there are various shades of blues and purples contributing to the exact colouring we see. Each is controlled by one or more switches. Think of the flower as a chemical factory. The genetic switches control what compounds are produced, and hence what colours are reflected back to our eyes, from light to dark blue light waves, to violet, through various shades of purple. Similarly with yellows, there are a number of switches at work, though with *I. danfordiae*'s yellow being so dominant one might think there was only one. It's a nice colour, but I'm now starting to break its dominance so I can get at the others. A beautiful pink Reticulata or rich orange would certainly be nice (perhaps I'm dreaming, but it turned out to be possible in bearded iris). If these anthocyans and carotenes don't combine just right, all you end up with is a muddy mess.

Detailed analysis of my hybrids has shown that 2 dominant genes are required to turn blue on, and a recessive gene is required to turn yellow on:

sophenensis $B_1B_1B_2B_2$~~YY~~
danfordiae $b_1b_1b_2b_2$yy

My analysis doesn't explain why three of the 56 F1s had a reasonable amount of yellow on their falls. Is there a second path for synthesising yellow involving several genes? At some future point hopefully I'll be better able to understand what's behind the 'spotted light blue-green' pattern, as well as the yellow streaking or blotching effect seen in some clones. Of course by that time there will be other mysteries. Somewhere hidden in the genes is *I. sophenensis'* veining that I had expected would be extremely hard to get rid of. The only F2 hybrids it's shown up in directly are wholly blue and purple clones that you could possibly mistake for F1 hybrids.

One of the pictures published with my 1994 Year Book article was labelled "Caucasus Alba". It has taken a while, but I'm pleased to announce it was registered last year as 'White Caucasus'. It will still be a number of years before there is enough stock to introduce it commercially, but I am working proactively with a Dutch Bulb grower to make that a reality.

Dr. Rodionenko feels strongly that I should be working with *I. winogradowii* rather than *I. danfordiae*. I don't believe he appreciates the genetic incompatibility that presents. The only way round this would be to first raise all of the parents up to the tetraploid level. However that doesn't fully solve everything. It would seem that I'm now poised to achieve success with *I. danfordiae*, *I. sophenensis*, and the Çat Retic.

One of *I. winogradowii*'s advantages is that, like *I. histrioides*, its flowers are large: 70mm tip-to-tip. I could for example raise some of my "mcmurtriei" hybrids to the tetraploid level. In theory that would make them at least 20% bigger. Thus a 55 to 60mm clone could be made 70mm. It would need to be treated like developing a separate line, with many years needed to see how successfully it turns out. At least 3 clones would need to be raised to the tetraploid level for hybridising purposes. The main drawback to this is the cost. Ideally it should be pursued now rather than later.

Cultivation Suggestions

- Well-drained soil (e.g. sandy loam) with lots of moisture in the early spring (e.g. snow melt)
- To prevent ink spot soil should be fairly dry around the time the leaves are starting to turn brown
- Should have at least half a day of sun
- Replant every two years or so
- Best if planted in a new spot in the garden
- In Holland they are treated as crops and only planted in the same area every 7 years
- Remember, the bulbs need to regenerate, so the last thing you want to do is disturb them while they're in growth
- Wait until the leaves start to turn brown, then do what you will. Otherwise you're only ruining next year's bloom!
- A little bit of low nitrogen fertiliser at the beginning of the bloom season is good for bulb regeneration

Conclusion

A whole new world has opened up for Reticulata Irises.

Ideally we'd all like to create the 'pièce de resistance' right away. It's taken awhile (20 years), but I'm quite pleased with what I've achieved so far, and the potential for realising other great treasures is almost assured, not just a dream.

The words "success is a combination of good luck, knowing what you're doing, and a lot of hard work", are just as true today as they were when I wrote them in 2000.

To find out more visit www.reticulatas.com. *Ed.*

Amazing Reticulata Hybrids

See page 90

Photos: Alan McMurtrie

▲ Seedling 97-unknown-2

▲ Seedling 97-CQ-2

▲ Seedling 00-KN-1

▲ Seedling 98-BL-2

▲ Seedling 98-CB-1

▲ Seedling 98-FN-1

▲ Seedling 98-PR-5

▲ Seedling 98-NP-10

▲ Seedling 00-JF-1

▲ Seedling 98-NP-12

▲ Seedling 98-00-5

▲ Seedling 98-00-4

▲ Seedling 98-00-6

This is a small selection from the many seedlings that can be viewed on Alan McMurtrie's website www.reticulatas.com

▲ Seedling 98-DZ-8

▲ Seedling 97-DG-4