

THE MOST RECENT estimate (Kuethe 2010) of the total number of *Passiflora* species is 573. Most are climbing vines, but some are trees, and the genus exhibits a range of leaf shapes and spectacular flowers. The majority are native to South America, ranging from tropical jungle through high altitude cloud forest to the mountains of the Andes. There are also species native to North America, Asia, Australia and New Zealand.

The first hybrid, *P. x violacea* (*P. caerulea* x *P. racemosa*, syn. *P. x caerulea-racemosa*), was recorded in 1822. Since then more than 700 hybrids and cultivars have been recorded (King 2010); figures have been collected by Dr John Vanderplank who holds a National Plant Collection of *Passiflora*, and more recently by Dr Les King acting as *Passiflora* cultivar registrar on behalf of Passiflora Society International. Many of these selections have not been shared or are now extinct, few are widely available, and even fewer are near-hardy.

**Passiflora hardiness**

For *Passiflora* grown outdoors, 'hardy' is a relative term compared to, for example, the much tougher *Clematis*. All *Passiflora*, even those sold quite wrongly by nurseries as hardy perennials, are prone to die-back and defoliation over winter and their roots rot quickly in waterlogged soil. They are semi-hardy at best, although some are herbaceous but this cannot be relied upon. For this reason, Jane Lindsay of Tynings Climbers, Somerset, who holds a National Plant Collection of *Passiflora* cultivars, rightly always underestimates the hardiness of any

# Breeding hardy *Passiflora*



*Passiflora* 'Lambiekins' is an example of a new wave of breeding using tetraploids crossed with *P. loefgrenii*. The latter is a recently introduced species that has proved to be a highly effective pollen donor

All photographs by Myles Irvine unless stated

MYLES IRVINE surveys passion flowers at the hardier end of the spectrum and discusses his own breeding work in this area

*Passiflora* she sells by about 5°C. Grafting other less hardy *Passiflora* such as those of subgenus *Tacsonia* onto *P. caerulea* has been tried with some success in milder climates, but it is not of practical use in more severe UK conditions.

The hardiness figures I quote in this article are all as recorded in my garden in Surrey. However, I would suggest that readers assume that all these plants are only capable of coping with a light occasional frost, especially if planted in an exposed position. Parentages quoted give the female parent first.

The three most widely sold *Passiflora* for growing outdoors are:

■ *P. caerulea*, the common blue-and-white-flowered passion flower, which is quite vigorous and can tolerate a minimum of -8°C.

■ *P. caerulea* 'Constance Elliott', a white-flowered, slightly less hardy selection of *P. caerulea* with medium vigour and tolerating a minimum of -6°C. White-flowered cultivars such as this appear spontaneously from *P. caerulea* seed and as sports on typical plants. These have been selected by others since 'Constance Elliott' arose in 1879, but not renamed.

■ *P.* 'Amethyst' (*P. kermesina* × *P. caerulea*), with amethyst-coloured flowers and medium vigour, tolerating a minimum of -6°C. An early hybrid from 1888 named *P.* × *kewensis* is probably the same as this cross. 'Amethyst' has been backcrossed many times with *P. caerulea*.

All are best placed in south-facing, sheltered flowerbeds with free-draining soil with added rubble and sharp sand. They will also benefit from winter protection of a straw mulch and hessian wrapped around the bottom 1m of stem. Without



*Passiflora* 'Mini Lamb', a cultivar derived from *P. loefgrenii*

protection, even large vines will freeze in a sudden sharp frost and the stems will burst.

Many *Passiflora* species and hybrids are susceptible to viruses such as *Chrysanthemum B carlavirus*, *Passiflora latent carlavirus*, *Passiflora ringspot potyvirus*, *Passionfruit woodiness potyvirus* and *Purple granadilla mosaic virus*. These can give rise to leaf damage including distortions, weakened growth and in some cases the vine will become woody and die back. If well fed, however, with a slow-release high-potassium fertiliser with trace elements, many will outgrow the virus over the summer months and appear clean and flower well.

Other recommended hybrids are:

■ The cultivars 'Star of Bristol', 'Star of Clevedon' and 'Star of Kingston' (*P.* 'Amethyst' × *P. caerulea* 'Constance Elliott'), which were released by John

Vanderplank in 1987. *Passiflora* 'Star of Bristol', with a purple flower, is perhaps the best. It has medium vigour and tolerates a minimum of -6°C.

■ *P.* 'Blue Bouquet' (*P. amethystina* × *P. caerulea*) × (*P. amethystina* × *P. caerulea*) × *P. caerulea*, raised by the *Begonia* hybridiser Patrick Worley in the USA in 1990. The pale lilac flowers have a dark centre, it is very vigorous (making it difficult to contain under glass) and survives a minimum of -8°C, i.e. it is as hardy as *P. caerulea*.

■ *P.* 'Purple Haze' (*P. caerulea* × *P. amethystina*), raised by Cor Laurens of the Netherlands in 1993. The purple flowers have a dark centre and it is vigorous. It is hardy to -8°C.

■ *P.* × *violacea*, of which there are number of selections, has a lovely ➤





*Passiflora* 'Flying V' (above), a tender and floriferous cultivar, and *Passiflora* 'Justine Lyons' (right), one of the author's early, hardier cultivars



purple and red flower, but it is prone to mosaic virus problems. It is of medium vigour and is hardy to  $-6^{\circ}\text{C}$ .

I have not included *Passiflora* Eden ('Hil Pas Eden') in the list above. Reputedly another *P.* 'Amethyst'  $\times$  *P. caerulea* hybrid, it has a pleasing purple flower but an untidy growth habit with variable leaf shape.

Another recent cultivar that has been promoted heavily is *P.* 'White Lightning'. It is simply *P. caerulea*  $\times$  *P. caerulea* 'Constance Elliott' which has given rise to an attractive paler version of *P. caerulea* similar to *P. caerulea* 'Chinenis'.

It is worth noting that some large European nurseries sometimes rename or incorrectly label *Passiflora* hybrids. For example, *P.* 'Perfume Passion', which has been widely distributed in the UK this year, and is sometimes described in error as hardy, appears to be the tender *P. x belotii* (*P. alata*  $\times$  *P. caerulea*). Also, it appears that *P.* 'Michael' (*P. vitifolia*  $\times$  *P. caerulea*) is being

widely sold as the hardier *P. x violacea* 'Victoria'. This 'Michael' should not be confused with two other cultivars called 'Michaela'.

#### Early hybrids

The first hybrid I raised was *P.* 'Flying V' (*P. penduliflora*  $\times$  *P. perfoliata*), a joint endeavour with Mark Cooper, USA, in 2002. It was the first cross of a day-flowering species and a night-flowering species in subgenus *Decaloba*. It has modest vigour, is hardy down to  $4^{\circ}\text{C}$ , and the pendent pink flowers are produced freely on a sunny windowsill. I named it in honour of the Gibson Flying V electric guitar because of its V-shaped leaves.

Following that I used existing, relatively hardy cultivars to raise more hybrids. Also in 2002, I released *P.* 'Justine Lyons' (*P.* 'Star of Bristol'  $\times$  *P.* 'Purple Haze'). It has large, lilac-coloured flowers with slightly reflexed sepals. It is of medium vigour and is hardy to  $-6^{\circ}\text{C}$ .

From the same cross came *P.* 'Star of Surbiton' (*P.* 'Star of Bristol'  $\times$  *P.* 'Purple Haze') which has large white flowers with pale blue and white filaments. It is of the same vigour and hardiness as its sister cultivar and I named it in honour of John Vanderplank's 'Star of' cultivars.

I subsequently became interested in identifying species that could be used to raise hardier hybrids. *Passiflora caerulea*, the hardiest species, seemed to be essential. One of the others I considered was *P. incarnata*, a North American species hardy to  $-15^{\circ}\text{C}$ . It is herbaceous and is known as Maypop – because it pops out of the ground in May. I have made repeated attempts to grow *P. incarnata* in Surrey and have given up. Its roots rot and it will die even in our mildest winters, and it is prone to mildew. If it does reappear, 'Jylopop' would more accurately describe it. That said, some great hybrids have been created with it, which do well, particularly in the USA.



*Passiflora loefgrenii* 'Iporanga' (left), one of the selections that can be crossed with tetraploid cultivars. It has given rise to *Passiflora* 'Betty Myles Young' (above), hardy to -8°C with flowers about 12cm in diameter

I also considered *P. actinia*, a Brazilian species hardy to -8°C. Rarely grown in the UK, it flowers in spring and autumn producing spectacular, sea-anemone-like, highly perfumed, pendent flowers which are quite hidden in the foliage. It is a short-day plant, so in spring it will fail to flower if it has been severely defoliated over winter. In autumn its flowers are usually aborted by frost. It has few named crosses, one being *P.* 'Anemone' (*P. actinia* x *P. caerulea* 'Constance Elliott') raised by Cor Laurens of the Netherlands in 1992. I have applied *P. actinia* pollen to several other *Passiflora* without any success, but it is known to cross with closely related species such as *P. elegans* and *P. sidifolia*.

In 2001 Brazilian botanist Mauro Peixoto was instrumental in the rediscovery of *P. kermesina* in the Atlantic Forest of Brazil. I contacted him with a view to trying crosses with *P. kermesina*. He instead advised me that *P. loefgrenii* had much more

spectacular purple and red flowers and kindly sent seed of two selections: *P. loefgrenii* 'Iporanga' and *P. loefgrenii* 'Corupa'. *Passiflora loefgrenii* was originally discovered by the Swedish naturalist Alfred Loefgren in 1894 on the banks of the Ribeira de Iguape river in São Paulo State, Brazil. Subsequently it was rediscovered by Fabio Vitta in 1991, in the area now known as the Intervalas State Park.

I successfully germinated seed of both the *P. loefgrenii* selections. Germination rates were poor and since then I have learnt that, at least for some of the series *Lobatae*, germination rates are much higher using wet seed fresh from the fruit. These plants quickly flowered. Seizing the opportunity, I applied the pollen of *P. loefgrenii* 'Iporanga' to *P. actinia*. At the same time I also applied the pollen of 'Purple Haze' to *P. actinia*. The plants were variable in vigour and none ever flowered.

I later made some successful

crosses using *P. loefgrenii* pollen and in 2005 I released *P.* 'Mini Lamb' (*P.* 'Purple Haze' x *P. loefgrenii* 'Corupa'). It has small but striking, deep purple flowers with a dark amethyst centre and blue and white filaments. It is of medium vigour and is hardy to -4°C. The name is from the nickname of a friend, Leanne Bassett.

### Exploiting polyploidy

Polyploid plants, those with extra sets of chromosomes, are of interest to hybridisers because they often have greater vigour, hardiness and bigger and better flowers. Out of all the *Passiflora* species only some wild *P. incarnata* (Bruner 1998) and *P. suberosa* clones are known to be naturally polyploid, but polyploidy is present in the ancestry of *Passiflora* and over half of all flowering plants.

In 1998 German breeder Dr Roland Fischer made a significant advance in *Passiflora* hybridising by reintroducing polyploids (Fischer ►





A comparison of *Passiflora* 'Lambiekins' (left) and *Passiflora* 'Betty Myles Young' (right) with *P. caerulea* (centre)

2000). The only previous artificial polyploids were *P.* 'Byron Beauty', a tetraploid derivative of *P. incarnata* × *P. edulis* raised by Robert Knight of the USA in 1979, and *P.* × *aponii* 'John Innes', a triploid raised in the UK in 1953.

Fischer used colchicine to produce tetraploids. The chemical does this by disrupting cell division during meiosis. Almost all plants so treated will die or be deformed, but a few will go on to greater things. In 1998 Fischer released his first tetraploid hybrid, *P.* 'Jara' (*P.* 'Purple Haze' × *P. caerulea*). It has large pale purple flowers with blue and white corona filaments and a dark centre. It is vigorous and hardy to -8°C. In 2000 he produced *P. caerulea* 'Emil Kugler', another tetraploid. It is as hardy as typical *P. caerulea* but is prone to slight colour variations and its growth habit is quite untidy, making it unappealing commercially.

Fischer crossed both these tetraploids to produce *P.* 'Clear Sky' in 2001. It is a fantastic plant with large 11cm flowers that holds its dark green leaves well in winter. Very vigorous, it is hardy to -8°C and is now on sale worldwide.

Fischer kindly sent me *P. caerulea* 'Emil Kugler' and *P.* 'Clear Sky' to trial and to see if I could set fruit on them. The two barriers to success were that there were no other tetraploids to hand and that *P. caerulea*, while a good pollen donor, is extremely reluctant to accept pollen from other *Passiflora* and is not self-fertile.

I managed to successfully pollinate both Fischer's tetraploids with *P. loefgrenii* 'Iporanga' – the more spectacular of the *P. loefgrenii* selections. Germination rates in spring 2004 were good with both crosses producing vigorous seedlings. I named and released two cultivars from these crosses.

*Passiflora* 'Star of Surbiton' is hardy to -6°C and is from the same cross as *P.* Justine Lyons'



The first was *P.* 'Betty Myles Young' (*P.* 'Clear Sky' × *P. loefgrenii* 'Iporanga'), a free-flowering plant with flowers to 12cm in diameter. It has strongly reflexed lilac petals and sepals, a deep maroon corona and filaments banded white and blue. I can see the influence of *P. amethystina* in it with its deeper purple sepals and petals (*P. amethystina* is in the parentage of *P.* 'Clear Sky'). Very vigorous, it is hardy to -8°C. In mild conditions in the USA it will flower all year round and sets large yellow to orange fruit readily if there is *P. caerulea* nearby. I named it for my mother using her maiden name.

The second was *P.* 'Lambiekins' (*P. caerulea* 'Emil Kugler' × *P. loefgrenii* 'Iporanga') which has large 3–5-lobed leaves that are somewhat twisted, adding to the plant's character. The flowers, to 11.5cm in diameter, have white petals and pale lilac sepals that are slightly reflexed, and a dark centre. It is vigorous, hardy to -8°C and occasionally produces large, yellow to orange fruit. The name is from the nickname of a friend, Claire Batten.

In 2011 my latest hybrid should be available, *P.* 'Poppet'. It is a cross between *P.* 'White Wedding' and



*Passiflora* 'Poppet' is the latest of the author's hybrids. It has four species in its parental background

*P. 'Mini Lamb'* and therefore contains the genes of four species: *P. amethystina*, *P. caerulea*, *P. eichleriana* and *P. loefgrenii*. The beautiful flowers are 10cm in diameter, white and pastel-lilac, and it is free-flowering. The leaves are 3–5 lobed, it shows medium vigour and is hardy to -4°C. The name is from the nickname of a friend, Linda Grover.

The ploidy of many recent *Passiflora* hybrids, including 'Betty Myles Young', 'Lambiekens', 'Mini Lamb' and 'Poppet', was not known until Dr Les King and I used flow cytometry to answer these questions (2010, in press). There are quite complex reasons why they could be triploid or tetraploid. The 12cm-flowered *P. loefgrenii* selections 'Corupa' and 'Iporanga', used in the parentage of my recent cultivars, could be natural tetraploids, or they could be diploids producing some unreduced diploid pollen. Both situations would lead to tetraploid offspring when crossed with *P. 'Clear*

Sky' or other tetraploids. Equally, if they were diploids producing normal haploid pollen you would expect the offspring to be triploid. Triploids are often, but not always, sterile.

### Trialling and availability

I trial my hybrids before release using a number of quite different microclimates in my garden. For example, in the severe 2009–10 winter three *P. 'Betty Myles Young'* plants, depending on their location, varied from coming through fairly unscathed with little foliage loss to dying right back to the ground.

All my hybrids are easy to care for, root readily from cuttings and are free-flowering from at least June to October. They are, to date, shared freely. A number have been shown by Jane Lindsay of Tynings Climbers nursery, Somerset, at various flower shows, including the RHS's Chelsea and Hampton Court Palace Flower Shows, and some are now on sale in Europe and USA.

### Conclusion

I would have expected more similar crosses to have been done worldwide, but it has not happened yet. There are some other great tetraploid crosses such as *P. 'White Wedding'* (*P. caerulea* 'Constance Elliott' x *P. eichleriana*), raised by Fischer and Wouters in 2004, with spectacular white flowers.

Only two other crosses have been done with *P. 'Emil Kugler'* and *P. 'Clear Sky'* as maternal parents. These are *P. 'Sonja'* (*P. 'Clear Sky'* x *P. caerulea* 'Constance Elliott') raised by Fischer and Diez in 2003, and the unreleased *P. 'Francesco III d'Este'* (*P. 'Clear Sky'* x *P. amethystina* 'Santa Tereza') raised by Maurizio Vecchia in Italy in 2007.

*Passiflora loefgrenii* 'Iporanga' has been found by others to be an effective pollen donor, like *P. caerulea*. It has produced a number of less vigorous diploid *P. caerulea* hybrids with flowers that are similar to, but smaller, than *P. 'Betty Myles Young'*. My hybridising continues, particularly with four-species tetraploid crosses, which I think are the way forward.

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