

Chromosome doubling of Narcissus varieties and species

In (1) I described the method for chromosome doubling of the daffodil varieties 'Hawera' and 'Fairy Chimes'. The storage time of the chips was seven days and the processing time two days. Meanwhile solid allotetraploid plants have been generated by selfing that already flower. With the same method and times one *N. jonquilla henriquesii* has been transformed and three *N. jonquilla cordubensis*. Two of the latter turned out to be mixoploids and regressed to diploids. Pixie's Sister was converted by the new oryzalin process (1) with a processing time of five days. The success of the transformation for the two methods is not as good as I expected. Therefore in 2019 the chips have not been stored but at once treated with oryzalin. The result was terrible: 61 bulbils only were formed from 880 chips. The cutting without storage time and the harmful influence of the herbicide 'oryzalin' seem to be too much stress to the chips. A storage time of 7 days and a processing time of five days is obviously the better combination. I hope that some further transformations of the years from 2015 upwards can be detected. They are found by pollen analysis: The pollen volume of the transformed species is about twice the value of the originals. The transduced varieties become fertile.

The plants flower from two up to five years after the treatment. Most of them grow in the greenhouse or in cold frames and need temperatures above the freezing point. They require much space and maintenance. In the future, I intend to prove the transformations when the first leaflets have developed. Then the stomata can be seen under the microscope. The transformed plants have for most species bigger and fewer stomata than the originals (2). The plants that have not been transformed can be given to other growers or discharged.

You see from the table which species or varieties I selected for chromosome doubling. The converted daffodils can have great potential not only for hybridizing but also in their own right as polyploids. The transformed diploid species like *N. jonquilla* become autotetraploid. They can for example be crossed with other autotetraploids like most standard daffodils.

Oryzalin treatment of Narcissus

Date	Storage Time in days	Processing Time in days	Variety or Species	Chips	Bulbils
11/9/2009	1	2	Sun Disc	80	164
			Hawera	96	159
			Kidling	84	46
			Geranium	160	126
			N. cordubensis	64	108
18/9/2010	1	2	Sundial	52	25
			Hawera	80	70
			N. cordubensis	120	100
			Baby Boomer	180	0
			Sun Disc	86	61
			Geranium	78	64
30/7/2011	7	2	N. cordubensis	184	160
			Hawera	100	90
			N. tazetta	128	6
			N. jonquilla henriquesii	100	63
1/9/2012	7	2	Hawera	80	29
			N. cordubensis	40	0
			Sun Disc	64	3
			Angel's Whisper	60	41
			Fairy Chimes	80	82
24/8/2013	7	2	Sun Disc	316	127
			Hawera	73	51
			Fairy Chimes	93	64
			Angel's Whisper	50	31
			N. rupicola	60	24
24/8/2014	7	5	N. poeticus hellenicus	100	10
			Sundial	80	45
			Sun Disc	36	21
			Fairy Chimes	33	32
			N. assoanus	56	25
27/9/2015	7	5	Kidling	118	87
			April Tears	142	500
			Pixie's Sister	129	100
			Woodstar	139	182
			N. panizzianus	94	0
			N. tazetta	109	95

4/9/2016	7	5	Cyclataz	130	59
			Geranium	127	0
			Angel's Breath	160	99
			Sun Disc	160	51
			N. jonquilla henriquesii	160	0
16/8/2017	7	5	Little Rusky	160	125
			Requienii improoved	120	25
			Sundial	150	60
			Angel's Breath	90	137
			Sun Disc	140	0
			Pixie's Sister	100	132
			Cyclataz	58	50
3/9/2018	7	5	Chappie	88	115
			N. scaberulus	104	64
			Sabrosa	100	146
			N. x incurvicervicus	100	84
			Cyclataz	80	73
			More and More	70	70
			N. x tenuior	50	45
			Little Rusky	60	97
12/9/2019	0	5	Chappie	104	0
			More and More	102	13
			Actaea x N. tazetta	130	0
			Altruist x N. jonquilla minor	110	13
			N. assoanus (Vinisky)	55	22
			Little Oliver	28	13
			Hillstar x N. cyclamineus	124	0
			Heart to Heart	116	0
			Little Sunrise	111	0

Varieties similar to Hawera or Pixie's Sister are infertile diploid daffodils, which were generated by combining two diploid species. They become allotetraploid and fertile by chromosome doubling. Hints for interesting crosses you find in (1).

Allotriploid plants as for example Actaea x N. tazetta or Altruist x N. jonquilla minor become allohexaploid and fertile by the conversion. This high polyploidy can be found only for N. dubius and some bulbocodiums. Perhaps the level of polyploidy for optimal plant size and vigour in most cases is exceeded but the plants can be useful for crosses. If the allohexaploid form of 'Altruist x N. jonquilla minor' is combined with N. jonquilla minor, a fertile allotetraploid can be generated. Many other crosses of these hexaploids are imaginable.

Literature

- (1) T. Sanders. The generation of fertile allotetraploid hybrids of narcissus species by chromosome doubling. June 2015. Theo-sanders-daffodils.de
- (2) C. North. Artificial chromosome doubling in Narcissus and its implication for breeding *N. tazetta* hybrids. Acta Hort. 1976