Theo Sanders February 2016

Narcissus cyclamineus crosses and their fertility

There is no doubt that the general public and all hybridizers love Narcissus cylamineus with its long trumpet, the swept-back petals, its little stature, and the early and durable flowers. If the bulbs multiply it would be perhaps the mostly grown daffodil in gardens and pots. The breeders try to give the interesting traits of N. cyclamineus to other daffodils, which admit vitality, best bulb multiplication, frost resistance, and perhaps other colours than yellow.

N. cyclamineus can be combined with nearly all diploid species. Crosses with members of the N. pseudonarcissus section (little trumpet daffodils) and N. poeticus are in most cases fertile. The difference of the chromosomes is so small that they seem to behave during the meiosis as if the homologous chromosomes were identical. All other crosses with diploid species are infertile with the exception that sometimes unreduced gametes are formed. The chosen pseudonarcissus species or varieties for the combination should have excellent bulb multiplication and vitality. The right partner seems to be the problem for all these crosses. I had seedlings with N. pseudonarcissus from the Eifel as seed parent, but they died after some years. Nevertheless, there exist many plants of these types. The breeding activity became greater in the last years. Perhaps Gipsy Queen is a good partner because it multiplies rapidly.

Crosses with N. jonquilla are Cupid, Flyaway, Golden Chimes, Pakotain, and Twinkle Boy. With N. jonquilla henriquesii you find Duffy Duck, Kava Kava, Little Becky, Little Emma, Parua, and Wowai; with N. fernandesii Cheek to Cheek, Cypher, Hy-Brasil, and Little Missus; with N. fernandesii cordubensis Sassy. As Delia Bankhead reported (1), Little Becky and Little Emma are very good growers. For the combination with N. rupicola Elfin, Ferdie, Gale Force, Mickey, Minnie, and Martie can be found in DaffSeek. For crosses with N. triandrus Billy, Andy Blanchard, Poppet, and Tricycle are mentioned. I have no experience with the last varieties, but suppose that bulb multiplication is low, because the species N. cyclamineus and N. triandrus have nearly no bulb multiplication. The variety Cyclataz is from Soleil d'Or x N. cyclamineus. I think the tazettas are good partners for N. cyclamineus, especially because of their rapid increase. Here more crosses with for example N. tazetta, N. papyraceus, N. bertolonii, and yellow-red tazettas should be tried. Coo is the combination of N. bulbocodium tenuifolius with N. cyclamineus, the only one in this group.

Petite and Stella Turk are combinations with N. calcicola. Crosses with N. assoanus and N. scaberulus cannot be found. Perhaps they have been made and did not stand the time. I have problems to cultivate the last three species in my greenhouse for a longer time, whereas N. jonquilla, N. fernandesii, N. henriquesii, and N. cordubensis grow very well. For all mixtures of two different diploid species is the rule that some plants develop unreduced diploid pollen (2). From some varieties this is known. Cyclataz for example is the parent of Tête- á- Tête. I think some others of the denominated varieties are also fertile. Their pollen should be examined for sprouting (3).

Most crosses of N. cyclamineus were made with tetraploid standard daffodils. Examples are the oldies February Gold, Peeping Tom, and Jenny and the newer ones Jetfire, Rapture, Articulate, and Trena. These varieties generally are infertile, because they have two chromosome sets (NN) of the standard daffodils and one of N. cyclamineus (C). However, sometimes you get viable pollen and/or egg cells. From crosses of N. cyclamineus with N. poeticus and members of the pseudonarcissus section we know that they possess good fertility. That means that the different chromosomes nearly react during meiosis as if they are from the same species. This reaction we should find in the fertile Jenny, Jetfire, and Articulate too. They form in the best case NC gametes in the worst- case NN gametes. The gametes consist in most cases of N(C) N(C) i.e.two chromosome sets of N(C); N chromosomes are mixed with C chromosomes and crossing over can take place. Little aberrations from the chromosome number 14 are possible. The fertility of the pollen often can be up to 10 or 20 %. In rare cases few unreduced gametes with NNC can be formed. If the N(C)N(C) gametes are combined with tetraploid standard daffodils you get tetraploid varieties for which the influence of N. cyclamineus is reduced.

More interesting is the combination of these cyclamineus hybrids with N. cyclamineus itself or with other diploid species for example with N. jonquilla. William G. Pannhill has generated in this way the triploid N(C)N(C)J plants Oz, Demitasse, Junior Miss, and Toto from Jenny with one chromosome set J for jonquilla. Until now, he seems to be the only hybridizer which followed this promising way. Many combinations are possible for example with N. assoanus, N. scaberulus and yellow- red tazettas. Moreover combinations of N(C)N(C) gametes with gametes which contain the chromosome sets of two different species are possible; for example from the new tetraploid Hawera or Fairy Chimes which generate JTr gametes with one chromosome set of N. jonquilla (J) and one of N. triandrus (Tr) (4). Here tetraploid N(C)N(C) JTr plants develop. For the last two groups of crosses also NNN(C)N(C) plants can be used as for

example Maria (probably Jetfire x tetraploid Y-R). Here the cyclamineus influence is reduced but a great many diploid gametes are generated by Maria.

Some years ago I pollinated Hillstar (NNJJ) with N. cyclamineus pollen and got some interesting seedlings (Fig. 1,2 and 3).

Figure 1. Hillstar x N. cyclamineus 1

Figure 2. Hillstar x N. cyclamineus 2

Figure 3. Hillstar x N. cyclamineus 3 (fertile)

They have with the formula NCJ, one chromosome set N of the standard daffodils, one set of N. cyclamineus C and one of N. jonquilla J. The N. cyclamineus part is guaranteed with one third whereas this part is for the N(C)N(C)J plants of William G. Pannhill between zero and one third. Most of

the seedlings increase rapidly. It is the question whether we can exchange the N. jonquilla chromosomes against the chromosome of some other species. It has been done already with the N. tazetta chromosomes (T) for Cornish Chuckles, Eaton Song, Bittern, and Dovekie. They were developed by crossing Matador (NNTT) with N. cyclamineus. I have some NCV seedlings from Emerald Sea x N. cyclamineus with one- third of the standard daffodil Sea Dream, one-third of N. cyclamineus, and one- third of N. viridiflorus (Fig. 4 and 5).

Figure 4. N. cyclamineus x Emerald Sea 1

Figure 5. N. cyclamineus x Emerald Sea 2 (fertile)

Another example may be El Camino. I suppose it is one-third standard daffodil, one- third N. cyclamineus, and one- third N. triandrus (Tr). Honey Bells (NNTr) was crossed with N. cyclamineus. Probably NTr egg cells reacted with C pollen to an NCTr plant. From these examples, we learn how to generate these NCX varieties. X is for the chromosome set of the species. The first method is to choose NNXX varieties and combine them with N. cyclamineus. There exist the jonquilla hybrids like Hillstar and some more (NNJJ),the viridiflorus hybrids (NNVV) like Emerald Sea, the tazetta hybrid Matador (NNTT), the triandrus hybrids Lapwing and Mission Bells (NNTrTr). If other species shall be used within NCX plants we have to look for fertile NNX plants (crosses of diploid species with standard daffodils) which develop NX gametes (5). This do perhaps 15 % of these varieties often with up to 10 or 20 % sprouting pollen. One chromosome set of every standard daffodil can be combined in this way with N. cyclamineus and for example with N. jonquilla, N. tazetta, N. triandrus, N. scaberulus , N. calcicola, or N. assoanus. N. viridiflorus and N. triandrus have the effect to strengthen the trait for reflexed petals.

In 2015 I saw that one clone of the NCJ seedlings (Fig.3) formed three seed pots with 12 seed grains by open pollination. This means, when the maximal number of viable egg cells is 40 for one flower, that the viability of the egg cells from the clone is 10 %. For optimal pollination it may proof higher. Meanwhile

on January 28, 2016 seven from the twelve seed grains already sprouted. The seed fertility of the clone was the incentive to write the present text. In 2016 I looked at the pollen with a microscope and found about 10 % sprouting in a sugar solution with a little part of Murashige and Scoog basal salt mixture . The mean pollen volume of 56 µmm³ indicates that N(C)J pollen are generated which should contain from 0 to 50 % N. cyclamineus chromosomes. The egg cells are probably composed in the same manner. One of the NCV seedlings (Fig.5) also generated about 10 % sprouting N(C)V pollen with a mean volume of 50 µmm³ . The assumption that some NCX seedlings behave in the same manner as some NNX seedlings seems to be justified. The homologous chromosomes of N and C are very similar. That means some plants are fertile with N(C)X – gametes as the NNX seedlings with NX – gametes.

The N(C)X gametes can be used for the same crosses which function with NX gametes:

- The plants can be crossed with diploid species to get for example the triploids N(C)JTr or N(C)JC. The principle is: the chromosome sets of two diploid species can be combined with N(C).
- Tetraploid plants can be generated by taking the gametes from NNXX plants to get for example N(C)JNTr , N(C)JNV or N(C)TNT. The first example is similar to the N(C)N(C)JTr plants from crosses of NNC x Hawera (tetraploid).
- Another type of tetraploid plants can be developed by taking the allotetraploid N. x xanthochlorus or the new allotetraploid Hawera or Fairy Chime as parents. With Hawera and the NJC seedling you get N(C)JJTr descendants.

The difference for combining the N(C)X gametes instead of NX gametes with other varieties or species is that the seedlings will have in many cases some traits of N. cyclamineus as for example the reflexed petals.

I hope that this article is of interest for some other hybridizers. For me it was useful to write it: I understand the many different and exciting possibilities for crosses with N. cyclamineus better.

Literature

(1) Bankhead, D: The Miniature Cyclamineus Hybrids, Daffodil and Tulip Yearbook 1999 – 2000
(2) Sanders, T: Hybrids of different narcissus species can be fertile by generating unreduced pollen (October2014), www.theo-sanders-daffodils.de
(3) Sanders, T: Looking at Pollen, The Daffodil Journal, Dec, 1990

(4) Sanders, T: The generation of fertile allotetraploid hybrids of narcissus species by chromosome doubling, www.theo-sanders-daffodils.de
(5) Sanders, T: Pollen Volume and Chromosome Content of Daffodils – Possibilities for hybridizing 2 (January 2013), www.theo-sanders-daffodils.de