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CHROMOSOME NUMBERS IN *NARCISSUS* CULTIVARS AND THEIR SIGNIFICANCE TO THE PLANT BREEDER

P.E. Brandham

OF ALL THE STORIES of the development of modern ornamental cultivars, that of the genus *Narcissus* is one of great success, or maybe excess. This is because from the relatively few species and cultivars that were in our gardens 150 years ago many thousands of named cultivars have arisen, of which large numbers are now available to the horticultural trade and to specialist growers and breeders.

One of the main factors responsible for the establishment of so many *Narcissus* cultivars is their habit of growth and the way in which they are propagated. Deliberate or accidental cross-pollinations between species or cultivars differing in appearance gave (and continue to give) seeds which germinated to produce fine new forms. These forms are all of hybrid constitution, each carrying an individual combination of homozygous and heterozygous genes which determines its appearance and growth characteristics. Their hybridity prevents the obtaining of uniform offspring through self-pollination or the crossing of similar plants, because the heterozygous genes and gene combinations carried by the parent(s) are re-assorted during gamete formation to give further variation in the progeny. Vegetative propagation is thus the only way to perpetuate each entity in an unchanged state. This is easily achieved in bulbous perennials such as *Narcissus* through division of the bulb using traditional or more modern methods (micropropagation, etc). Consequently, any hybrid of sufficient merit can be described as a new cultivar very soon after its first flowering, without the necessity for the time-consuming processes of breeding and selection which delay the introduction of cultivars of annual species, sometimes by many years.

The best of these *Narcissus* hybrids have been introduced into cultivation as new cultivars. These have increased almost explosively in numbers since the mid-nineteenth century (Brandham, 1986), such that well over 22,000 cultivar names now exist in the genus (Kington, 1989). Many of these cultivars were inevitably short-lived and are now extinct, but there is a large and growing pool of named plants that narcissophiles can draw upon to introduce desirable characteristics into their breeding programmes.

Very important in the breeding of *Narcissus* is knowledge of the chromosome numbers of cultivars and the consequences of attempting to use plants with particular chromosome complements as parents, in terms of the viability of their gametes and the potential vigour and variability of their progeny. The chromosome numbers of *Narcissus* cultivars vary greatly, with 23 different ones being known, ranging from $2n = 14$ to $2n = 46$. Some of them confer high fertility on the plant and others almost total sterility. They are products of some or all of the following factors:

a. meiosis, which may be regular, irregular or disastrously unbalanced, depending on the chromosomal constitution of the plant in which it is taking place. It results in the eventual production of normal or aneuploid gametes, or in sterility if unbalanced;

b. polyploidy, where three or more basic sets of chromosomes are present in a plant instead of the usual two sets found in a diploid;

c. the presence of three basic chromosome numbers ($x = 7, 10, 11$) in the genus, combined with hybridization between plants with the same or different basic numbers at the same or different levels of polyploidy;

d. the production of viable non-reduced gametes via the by-passing of meiosis in fertile and in otherwise non-fertile plants.

Details of these four factors are as follows:

Meiosis in diploid species and hybrids

In every cell of a normal diploid plant the chromosomes are present as two almost identical sets (of seven in most *Narcissus* species), one of which is inherited from each of the plant's parents. During the first phase of meiosis (a key feature of ovule and pollen development), each member of one set pairs throughout its length with the corresponding chromosome from the other set to form a bivalent. In the bivalent the paired chromosomes exchange segments (together with the genes situated on them) and later separate again to give the haploid chromosome complement found in the gametes. The diploid number is restored when gametes fuse.

The pairing process in meiosis is crucial for high fertility. Fertility is often reduced in hybrid diploids because their two chromosome sets (inherited from the two dissimilar parental taxa) differ from each other in structure to a greater or lesser extent, even if the number of chromosomes in each set is the same. In the more extreme cases, in which the parents of a diploid hybrid are genetically and chromosomally very dissimilar, the chromosomes will not pair properly during meiosis in the hybrid. Consequently they will not separate properly, resulting in the production of at least some gametes with unbalanced chromosome complements which are non-viable, leading to a certain amount of sterility in the hybrid. In the most extreme cases of wide hybridity the only viable gametes that can be produced by the plant are those which are non-reduced (see below).

Polyploidy

Many *Narcissus* cultivars and some of the species are polyploid, having three, four or more basic sets of chromosomes instead of the two that are found in diploids. Tetraploids have four sets, and where each set comprises seven chromosomes (the most frequent number in *Narcissus*) they tend to form seven associations of four chromosomes (quadrivalents) during meiosis. Quadrivalents often separate 2–2 after their formation, and if this occurs in every quadrivalent in a meiotic cell the resulting gametes are diploid and viable, each with two sets of seven chromosomes. Sometimes the separation of a quadrivalent is an irregular 3–1, and if this occurs in one quadrivalent in a cell the resulting gametes have 15 or 13 chromosomes (two sets of seven plus or minus one). This genetic imbalance is often viable, since the deleterious effect of the lack of, for instance, one chromosome of a set of seven in a 13 chromosome gamete is buffered by the presence of another complete set in the gamete. The imbalance is nevertheless sometimes expressed as an irregularity in the appearance of the progeny, which would have 27 or 29 chromosomes if the defective ($n = 13$ or 15) gametes fuse with normal ones. If the irregular 3–1 chromosome separation occurs in two of the seven quadrivalents in a cell the gametes could contain 12 or 16 chromosomes, a greater genetic imbalance which is more likely to be expressed in the 26- or 30-chromosome progeny as a defect in growth or appearance. For instance, the statement that 'Weedy little . . . 'Falaise' . . . cannot be said to be outstandingly robust' (Jefferson-Brown, 1969: 115, 31) indicates that the loss of two chromosomes in the production of this aneuploid tetraploid ($2n = 4x - 2 = 26$) is a major degree of aneuploidy which has a severe adverse effect on the morphology and vigour of the plant.

Triploids and pentaploids have three or five sets of chromosomes and the trivalents and pentavalents produced during their meiosis cannot separate into equal groups. The resulting gametes are thus mostly unbalanced in their chromosomal constitution, and a low level of fertility would be expected in these plants. In autotriploids, where the three sets of chromosomes are very similar, regular trivalent formation occurs. Every trivalent segregrates 2–1 as meiosis progresses, and when all seven trivalents in a cell separate in this way *in the same direction* viable haploid and diploid gametes are formed by that cell (Brandham, 1982), although this would be expected to occur at a low frequency in the whole anther or ovary. In pentaploids the chromosomes tend to form fives (pentavalents) during meiosis; otherwise threes and twos (trivalents and bivalents). Either way, the result is usually a 2–3 separation of each group of five. Consequently, the gametes produced by a pentaploid range in chromosome number between diploid and triploid. Most are unbalanced, but the adverse effect of the imbalance is cushioned by the presence of two full sets of chromosomes in them and some viability is retained. Hexaploids are somewhat more fertile. Their six sets of chromosomes can segregate quite regularly during meiosis to form viable triploid gametes, although many aneuploid gametes can also be produced.

Basic number variation and hybridity

The genus *Narcissus* is divided into a number of sections among which there is variation in the basic number of chromosomes (x, which is the number in a normal gamete produced by a diploid). In Section Aurelia (*N. broussonetii* only) the basic number is x = 11; in Section Serotini (*N. serotinus* only) it is x = 10; in Section Hermione it is x = 10 and 11 in different species, and in the remainder, which constitute the majority (Sections Narcissus, Jonquilla, Apodanthe, Ganymedes, Bulbocodium and Pseudonarcissus), it is x = 7. Hybrids can be made between members of different sections, and in many cases diploid hybrids can thus contain two chromosome sets differing in number, such as 7 + 10 = 17, 7 + 11 = 18 or 10 + 11 = 21. In most of such plants the chromosome sets are so dissimilar that pairing fails almost completely during meiosis, as shown by Fernandes (1950) in the 17-chromosome cultivar 'Alsace'. Separation of chromosomes is chaotic and the developing gametes are grossly unbalanced genetically, resulting in sterility. The same applies in polyploid hybrids of this type, such as the allotriploids with 2n = 7 + 7 + 10 = 24 chromosomes, although an exception occurs in allotetraploids with, for instance, 2n = 7 + 7 + 10 + 10 = 34 chromosomes. These are fertile, because each chromosome has one and only one other with which to pair during meiosis. Meiosis is therefore regular, producing diploid gametes with n = 7 + 10 = 17 chromosomes. In this way, allotetraploids behave as diploids and thus are known as amphidiploids.

Non-reduction in gamete production

Because of many of the factors described above, irregularities of meiotic pairing and separation often result in the production of genetically unbalanced aneuploid gametes. In many cases these are of reduced viability or are totally non-viable, but all plants, whether hybrid, polyploid or not, can sometimes by-pass meiosis to produce non-reduced gametes which contain the same chromosome number as that of the plant which bears them. These are viable, and in some otherwise sterile cultivars they are the only viable gametes that the plant can produce. Fusion of a non-reduced gamete with a normal one in a diploid population can thus give rise to triploids, both in the wild (Brandham, 1982), and in cultivation, a process by which the old triploid *Narcissus* cultivars 'Emperor' and 'Empress' almost certainly arose from diploid parents. Similarly, a triploid × diploid cross can give rise to tetraploid progeny through the fusion of an unreduced triploid gamete with a normal haploid one from the diploid parent. The earliest tetraploid *Narcissus* cultivars probably arose in this way (Brandham, 1986).

The reduced fertility or almost complete sterility which occurs in a number of cultivars of *Narcissus* is a problem which has faced many breeders, the majority of whom were not familiar with the genetic or chromosomal principles involved. Some of the causes have been outlined above, but the main object of this article is to identify sterility etc. and patterns of potential variability by bringing together all the information on the chromosomal constitution of *Narcissus* cultivars that could be found in the literature and to supplement it with the results of an extensive survey of chromosome numbers carried out in the Jodrell Laboratory, Royal Botanic Gardens, Kew. Comment will be made on every chromosome number, which will be interpreted in terms of the origin of the cultivars, their expected degree of fertility and the probable chromosome numbers to be found in their gametes. This information will have a direct bearing on the probability of success or failure of crossing attempts and on the constitution and vigour of the progeny of such crosses. It is hoped that it will be used by breeders to distinguish more easily between plants of high potential and those of less use in their breeding programmes.

Material and Methods

For the survey carried out at Kew large numbers of cultivars were obtained as bulbs from a wide range of commercial and private sources (see Acknowledgements) and were cultivated in open frames in pots of compost. Vouchers were prepared from those that flowered and were deposited in the Kew Herbarium. The names of those which did not flower were given by the suppliers. Clearly there was a risk of misidentification in these cases, but this was minimised through collaboration only with the most reliable sources of supply.

Root tips were collected in mild spells between October and March, pretreated in saturated aqueous alpha-bromonaphthalene for 20 hours at 4°C and fixed in 1:3 acetic ethanol. They were stained in Feulgen after hydrolysis in 1 M HCl for 7 minutes at 60°C. Meristems were squashed on slides which were made permanent by freezing with liquid CO_2, separating slide and coverslip, dehydrating in absolute ethanol and mounting in Euparal. Permanent slides are retained in the collection of the Jodrell Laboratory, Royal Botanic Gardens, Kew. Chromosomes were counted in at least five well-spread cells for each cultivar.

Results

The chromosome counts are listed in Table 1. In the Kew survey 731 records were obtained, of which 61 agreed and 14 disagreed with those of at least one previous author. Also included are 301 more counts extracted from the literature, making a total of 1032 counts in 1005 cultivars, with 25 of the counts representing two or more different findings in a single cultivar, and two being records of somatic doubling of chromosome number. In the Kew survey 96 additional counts were made of duplicate material which confirmed the first finding, but there were five cultivars in which different chromosome numbers were found in duplicate accessions (in 'Barrett Browning', 'Great Warley', 'Lilac Charm', 'Queen of Bicolors' and 'Rip Van Winkle'). Since clonal propagation is only rarely a source of variation in chromosome number (except in cases of somatic chromosome doubling) at least one of the two identifications in each case must be in error. Both counts of each are included in Table 1, as it is not possible to say which of the alternative cytotypes was named correctly and which incorrectly. Similarly, different records for the same cultivar by different authors have been included in the table. Most of these are also probably due to misnaming rather than to inaccurate work, and it is again not possible to say which number is right and which is wrong for these cultivars, so the alternatives are given without comment. There is nevertheless a high level of agreement in cultivars examined by two or more authors, even when the number is an aneuploid or a complex polyploid, which suggests that the great majority of the counts in the table are accurate and can be relied upon.

Important features of cultivars listed in Table 1 are their classification and dates of origin. *Narcissus* cultivars are classified into twelve divisions (Kington, 1989) which can be summarised as follows:

Division 1. Trumpet daffodils of garden origin. Flowers solitary, corona length equalling or exceeding that of the perianth segments.

Division 2. Large-cupped daffodils of garden origin. Flowers solitary, corona shorter than perianth segments but more than one third of their length.

Division 3. Small-cupped daffodils of garden origin. Flowers solitary, corona one third the length of the perianth segments or less.

Division 4. Double daffodils of garden origin and of any affinity. Flowers solitary or multiple, with doubling of perianth, corona or both.

Division 5. Triandrus daffodils of garden origin. Characteristics of *N. triandrus* evident; 2 or more pendent flowers per stem, perianth reflexed.

Division 6. Cyclamineus daffodils of garden origin. Characteristics of *N. cyclamineus* evident; flowers usually solitary, perianth reflexed, flower at acute angle to stem, pedicel short.

Division 7. Jonquilla daffodils of garden origin. Characteristics of *N. jonquilla* present; flowers fragrant, 1–3 on terete stem, perianth spreading, leaves narrow, dark green.

Division 8. Tazetta daffodils of garden origin. Characteristics of *N. tazetta* or its allies present; flowers fragrant, 3–20 on stout stem, perianth spreading, leaves broad.

Division 9. Poeticus daffodils of garden origin. Characteristics of *N. poeticus* dominating, with no evidence of hybridization with members of any other division. Flowers usually solitary, fragrant, corona very short, perianth white, spreading.

Division 10. Species, wild variants and wild hybrids, including double-flowered forms. (Only hybrids are included in Table 1, as the cytology of *Narcissus* species is a very large subject outside the chosen scope of this article).

Division 11. Split-corona daffodils of garden origin. Hybrids of any affinity, but with the corona split into lobes for at least half of its length.

Division 12. Miscellaneous daffodils, not falling into Divisions 1-11.

In addition to the division to which each cultivar belongs, the colour of its perianth, followed after a hyphen by that of the corona, is also given in Table 1, the codes for the colours being the initial letters of White, Green, Yellow, Pink, Orange and Red. Two or more letters, used frequently for the corona and very occasionally for the perianth, indicate a gradation in colour. This reads from the centre or base to the rim in the case of the corona, and from the outer zone to the base in that of the perianth. In Table 1 the classifications and colour codes follow those given by Kington (1989). In a very few cases these differ slightly from those in American Daffodil Society (1981).

The dates refer to the date of registration of the name of each cultivar, or the date when the name was first used, if earlier. They give only a rough approximation of each plant's actual date of origin, but are satisfactory guides for people interested in the ages of the material with which they are working.

Some of the original counts in Table 1 were published earlier (Brandham and Kirton, 1987), and in a very few cases they differ from those given here. The changes follow the re-checking of the identity or the chromosome preparations of the material, and the present version should be taken to be the correct one.

B chromosomes

In Table 1 are listed several cultivars containing a single B chromosome in addition to the quoted number, with 'Ultimus' having four. These chromosomes are clearly distinguishable from normal ones, usually being smaller. They are composed largely of non-coding or 'junk' DNA, and carry very few functional genes. Apart from delaying flowering by a short period in some plants and reducing fertility to some extent in others and a few other minor factors, 'effects due to B chromosomes on the growth and development of the external phenotype are slight and difficult to detect' (Jones and Rees, 1982; 69), and no study has yet been made of their effects in *Narcissus*, as far as I am aware. For practical purposes their presence or absence in *Narcissus* cultivars can therefore be ignored by breeders, although in some cases they can be used as interesting markers when pedigrees are being traced, since a plant carrying a B chromosome will transmit it via some of its gametes to some of its progeny.

Discussion

There follows an analysis of the probable fertility of each chromosome number, together with comments on its probable genetic origin and on the gamete types that will be produced by it. Where particular counts are said to be slightly or very fertile these are the highest degrees of fertility that can be forecast from the particular chromosomal constitution of each. Other factors such as wide hybridity, where very dissimilar species are involved in the ancestry of a plant, can lower fertility in cytotypes which might otherwise be expected to be fertile. This lowering is the result of irregular chromosome pairing during meiosis. Modifications of the floral parts of double flowers can result in partial or complete male sterility if anthers are modified in structure or absent, and even the female parts of double flowers (ovary, style, stigma) are sometimes altered to non-functioning structures.

2n = 14 (111 records). These are diploids derived directly or indirectly from diploid species with the same basic number (x = 7). They would normally be expected to produce bivalents during meiosis, which dissociate regularly to produce haploid gametes with n = 7 chromosomes. Fertility should be high, except where wide hybridity is involved.

2n = 17 (21 records). These are diploid hybrids between *N. tazetta* or one of its allies with 2n = 20 (x = 10) and a *Narcissus* species with 2n = 14 (x = 7). Most of these plants are *N. poeticus/tazetta* or *N. cyclamineus/tazetta* hybrids (= poetaz, cyclataz) in Division 8, or are double-flowered forms of them in Division 4 (e.g. 'Abba' and 'Sir Winston Churchill', which are double-flowered selections derived vegetatively from 'Cragford' and 'Geranium' respectively). One plant, *N.* × *biflorus* is a similar hybrid occurring in the wild and classified into Division 10. In these plants the 10 + 7 chromosomes are so dissimilar that they cannot pair during meiosis (Fernandes, 1950), which therefore fails to produce any fertile gametes. The only viable gametes that can be formed by these 2n = 17 plants are non-reduced, also with n = 17 chromosomes.

2n = 18 (2 records). 'Hiawassee', 'Minnow'. As above, but derived from a 2n = 14 (n = 7) *Narcissus* crossed with a 2n = 22 (n = 11) plant of the *N. tazetta* alliance. In the case of 'Hiawassee' this parentage is known to be 'Cassandra', a presumably diploid *poeticus* hybrid, crossed with 'Paper White' (from *N. papyraceus*, 2n = 22). These 2n = 7 + 11 = 18 plants are also sterile except in cases of non-reduction.

2n = 19 (1 record). 'Bethany'. This plant is a triploid based on x = 7, but lacking 2 chromosomes, i.e. 2n = (3 × 7)–2 = 19. One of its parents is known to be a tetraploid and the other is probably triploid, as tetraploid grand-parentage is known for the latter. 'Bethany' probably arose from the fusion of a) a gamete from the tetraploid lacking 2 chromosomes as a result of its meiotic irregularity, and b) a viable haploid gamete from the triploid parent. 'Bethany' is probably largely sterile because of its triploid nature compounded by its loss of two chromosomes, but it might produce a few viable haploid gametes (n = 7), or non-reduced ones (n = 19).

2n = 20 (7 records). 'Franklin', 'Gloriosus', 'Grand Soleil d'Or', 'Late Israeli Sol', 'Soleil d'Or' (Division 8) and 'Queen of Spain' (= *N.* × *johnstonii*, Division 10) are diploids based on x = 10. They should all be bivalent-formers and quite fertile. 'Piper's Barn' is an autotriploid (x = 7) jonquil (Division 7) formed probably from diploid ancestors with non-reduction in one of them. In this plant there is a Robertsonian fusion, in which two chromosomes fuse to give a larger one, with loss of a segment, resulting in reduction of the chromosome number by one. Robertsonian fusion has been noted previously in *Narcissus bulbocodium*, in which the process reduced the chromosome number of a x = 7 pentaploid from 2n = 35 to 34, with the formation of a single enlarged chromosome (Brandham and Kirton, 1987; Fig. 3D). It is unlikely that 'Piper's Barn' would be fertile, but it might produce some viable n = 7 or non-reduced n = 20 gametes.

2n = 21 (116 records). One of these, 'Sicily White' (Division 8), is a diploid hybrid between members of the *N. tazetta* alliance having 2n = 20 and 2n = 22 respectively (Kurita, 1954), i.e., its chromosomal constitution is 2n = 10 + 11 = 21. Fertility should be moderate to low in this plant due to difficulties of meiotic pairing between its dissimilar chromosome sets.

The remaining 115 plants are triploids based on x = 7. They could have been produced by either of two routes: a) from diploid parents with non-reduction in one of them, the very old mid-nineteenth century triploids such as 'Emperor' and 'Empress' almost certainly originating in this way; b) from hybridization between a diploid and a tetraploid parent with regular meiosis in each, which is the route by which the more recent triploids probably arose. Either way, these triploids have 2n = 7 + (7 + 7) = 21 chromosomes. When their three sets of chromosomes are very similar the plants are autotriploid, forming trivalents at meiosis. Their fertility is generally low, because of the inherent meiotic problems associated with the segregation of the three chromosomes in each trivalent, but small quantities of haploid and diploid gametes are produced, together with some non-reduced ones, as has been shown to occur in autotriploid *Aloe jucunda* (Brandham, 1982). Allotriploids have one set of seven chromosomes differing from the other two. Similar chromosomes pair during meiosis, but the third set remains unpaired and the seven univalents cause great disruption to the meiotic division, resulting in almost complete sterility. The non-reduced gametes produced occasionally by triploid *Narcissus* hybrids can give rise to tetraploid offspring when the plants are crossed with diploids. The oldest known tetraploid *Narcissus* cultivars, appearing at the end of the nineteenth century, probably arose in this manner.

2n = 22 (13 records). 'Paper White', 'Paper White Grandiflorus' and 'White Pearl' (Division 8) are diploids based on x = 11 chromosomes and should be as fertile as the diploids having x = 7 (2n = 14) and x = 10 (2n = 20). The remainder ('Bobbysoxer', 'Bunting', 'Buttonhole', 'Grandee', 'Grandis', 'Horsfieldii', 'Ice Chimes', 'Silver Bells', 'Skylon' and 'Victoria') are aneuploid triploids based on x = 7 (2n = 7 + 7 + 7 + 1 = 22). Because they are aneuploid they are unlikely to have arisen from diploid/diploid crosses with non-reduction in one parent, because these crosses involve only euploid gametes (n = 7, 14). It is more probable that most of the 2n = 22 plants arose from diploid/tetraploid crosses with meiotic irregularities in the tetraploid parent of each, resulting in the production of aneuploid gametes with n = 15 chromosomes. These fused with the n = 7 gametes from the diploid parents. In the formation of 'Ice Chimes' the n = 15 gamete came from its aneuploid (2n = 22) triploid parent, 'Silver Bells' (F. Galyon, *pers. comm.*)

Because of the probable origin of most 2n = 22 plants from diploid/tetraploid crosses, some doubt should be cast on the counts of 2n = 22 in 'Horsfieldii'. They were made by both Philp (1934) and Janaki Ammal and Wylie (1949) and are thus probably correct, but as the plant arose in 1845 (Kington, 1989), well before the earliest known tetraploid (Brandham, 1986) it is unlikely to have come from a diploid/tetraploid cross. It is more probable that it is a triploid plant originating from a diploid/diploid cross. It would not be expected to be aneuploid with this parentage (see above), so it is probably a triploid with 2n = 21, but carrying also an unusually large B chromosome that is so similar to one of the normal chromosomes that it was not identified as such by the people who examined the chromosomes of the plant.

Not included among the counts of 2n = 22 are those made of 'Empress' by Nagao (1929, 1933) and Philp (1934). These have been clearly shown by other workers to be 2n = 21 + 1B.

It is known that 'Buttonhole' is a split-corona sport of 'Victoria' derived from it by vegetative rather than sexual means (American Daffodil Society, 1981). The uncommon chromosome count of 2n = 22 in both confirms their close relationship.

Aneuploid triploids with 2n = 22 will have fertilities as low as those with 20 or 21 chromosomes, with a small incidence of viable haploid and diploid gametes, and some which are non-reduced.

2n = 24 (19 records). Most of these plants are in Division 8, or are double-flowered forms derived from them (Division 4). One is a Division 10 wild hybrid (× *biflorus*) and three are in Division 6 ('Jumblie', 'Quince' and 'Tête-a-Tête'). All are allotriploids with two basic numbers (2n = 7 + 7 + 10 = 24). They have arisen in two ways, both of which can be traced through their known pedigrees (American Daffodil Society, 1981).

The pedigrees of eleven of the plants are not known, but from one of these ('Elvira', originating in 1904) a vegetatively produced sport with double flowers was named 'White Cheerfulness' (1923), which in turn gave rise to 'Yellow Cheerfulness' (1938) through mutations of one or more of the genes for flower colour.

Two of the remaining six plants with 2n = 24, × *biflorus* and × *poetaz* are F_1 hybrids between *N. tazetta* and *N. poeticus*. They are products of a n = 10 gamete from *N. tazetta* fusing with a n = 14 gamete from *N. poeticus*. Interestingly, two different counts have been obtained for 'Biflorus', 2n = 17 (American Daffodil Society, 1981) and 2n = 24 (Stomps, 1919 and the present investigation). It is thus evident that this hybrid has arisen more than once, with the n = 10 gametes from *N. tazetta* fusing with either haploid or diploid gametes (n = 7, 14) from *N. poeticus*.

Three of the last four plants with 2n = 24 arose from non-reduced gametes (the only viable ones), produced by a 2n = 17-chromosome parent, fusing with a n = 7 gamete from a 2n = 14 diploid. These three, 'Jumblie', 'Quince' and 'Tête-a-Tête', were produced by a single breeder, Alec Gray, from an open-pollinated cyclataz hybrid having 2n = 17 (two of them were stated wrongly to be from *self*-pollinated cyclataz in American Daffodil Society, 1981).

The last 2n = 24 plant, 'Golden Dawn', is derived from open-pollinated 'Admiration' (Division 8). 'Admiration''s chromosome number is unknown, but is probably 2n = 17 (see also below, under 2n = 34, the ancestry of 'Matador'), so 'Golden Dawn' arose from a non-reduced n = 17 gamete from 'Admiration' fused with n = 7 from an unknown 2n = 14 diploid.

Despite their vegetative vigour, ease of propagation and widespread popularity, especially of 'Cheerfulness' and 'Tête-a-Tête', all of the 2n = 24 plants are sterile unbalanced allotriploids. Their two sets of seven chromosomes can form bivalents during meiosis but the set of ten will not pair with them. Irregular segregation of the ten univalents will result in gross meiotic irregularity and almost total sterility. The plants can theoretically produce viable non-reduced gametes with n = 24 chromosomes, but these are too large to be of any practical value to the breeder.

2n = 26 (5 records). 'Charles I', 'Falaise', 'Orange Glow', 'Pink Glory' and 'Swansdown'. These are tetraploids based on x = 7, but lacking two chromosomes. Through meiotic irregularities in one or both of the tetraploid parents producing aneuploid gametes with n = 13 or 12 instead of 14, these plants could have arisen either from 13 + 13 or 14 + 12 gamete fusions.

As stated in the Introduction, 'Falaise' is not very sturdy, which is perhaps symptomatic of its chromosomal imbalance, and the other four cultivars could be similarly affected. Despite their weakness, these plants could produce viable gametes with n = 14, but also a larger number with n = 13 or 12, which are unbalanced and not so vigorous, so the plants' overall fertility should be only moderate or less. 'Falaise' and 'Swansdown' are double-flowered and possibly totally male-sterile, although it might be possible to use them as female parents.

2n = 27 (48 records). Tetraploids (x = 7) lacking one chromosome, these are products of tetraploid/tetraploid hybridization with one parent contributing 14 chromosomes and the other 13 through meiotic irregularities. As a result of their own meiotic irregularity compounded by aneuploidy, the 2n = 27 plants should be only moderately fertile. Approximately half of their gametes will contain 13 chromosomes and half 14, although small numbers with 12 or 15 will also occur. In consequence, large numbers of aneuploids lacking chromosomes from the tetraploid complement will occur in the progeny of any two of these 2n = 27 plants crossed with each other. Although some might be vigorous others will be less so and a great deal of progeny variability will ensue.

2n = 28 (601 records). The great majority of these plants are autotetraploids based on x = 7. Their quadrivalent frequency during meiosis is normally high, with regular 2–2 segregation, so many of their gametes are balanced with two sets of seven chromosomes (n = 14), although some less vigorous gametes with n = 12, 13, 15 or 16 might also arise. Fertility in these plants should therefore range from moderate to high, with low fertility in some resulting from doubleness. Other 2n = 28 cultivars are allotetraploids with two similar sets of seven and two other sets of seven which are also similar to each other (i.e. the four sets are derived from the chromosomes of two quite dissimilar diploid species). During meiosis these plants form bivalents which segregate regularly to form gametes with n = 14, resulting in high fertility. Still further tetraploids are auto-allotetraploids with three similar sets of seven and a fourth set of seven which differs in genetic structure from the other three. These plants form trivalents and univalents during meiosis, which is thus very disturbed, resulting in a high level of sterility.

The oldest tetraploids probably arose at the end of the nineteenth century from triploid/diploid crosses, in each case through the fusion of a non-reduced triploid gamete with a normal haploid one from the diploid parent. Later tetraploids almost certainly arose from tetraploid /tetraploid crosses.

Another route to tetraploid formation is via the doubling of the chromosome number of individual somatic cells of a diploid through mitotic misdivision. If the tetraploid cells are formed in a stem meristem they can continue to divide and grow normally to form a tetraploid sector. This has a chance of becoming a purely tetraploid offset that can be detached and propagated to make a new tetraploid cultivar. I have not yet found pedigree evidence of this process giving rise to new *Narcissus* cultivars, although its early stages (tetraploid sector production) were reported in the cultivars 'Fusilier' and 'Lucifer' by de Mol (1925).

Only one plant known to have 2n = 28 (+ 1B) is classified in Division 8. This is 'Silver Chimes', a tribasic allotriploid with three different sets of chromosomes, x = 10 and 11 from 'Grand Monarque' (Division 8) and x = 7 from *Narcissus triandrus loiseleurii*. It probably arose from a rare n = 11 + 10 gamete from the allotriploid 'Grand Monarque' (2n = 11 + 10 + 10 = 31) and a normal gamete from *N.t. loiseleurii*. The B chromosome was inherited from 'Grand Monarque'.

Because the three sets of chromosomes in 'Silver Chimes' are all different (2n = 11 + 10 + 7 = 28) its meiosis is expected to be very disturbed with a high incidence of univalent formation, leading to almost total sterility.

2n = 29 (44 records). These plants are tetraploids based on x = 7 with one additional chromosome. Their most probable origin is from tetraploid/tetraploid crosses with meiotic errors in one parent of each contributing 15 chromosomes to the gamete instead of 14. They are basically similar to tetraploids having 2n = 28 as far as their fertility is concerned. Approximately half of their gametes will contain 14 chromosomes and half 15. The genetic unbalancing effect of the extra chromosome in the n = 15 gametes is minimised by the presence of two full sets of chromosomes. As in other tetraploids some of the gametes will contain n = 12, 13 or 16 chromosomes, which will contribute to further progeny variation if they are viable.

2n = 30 (15 records). Eleven of these are Division 8 autotriploids derived from members of the *tazetta* alliance having x = 10 chromosomes ('Chastity', 'Chinese Sacred Lily', 'Cypri', 'Grand Emperor of China', 'Grand Primo Citroniere' (also recorded as 2n = 32), 'Grand Soleil d'Or', 'Kashmir Local', 'McKenzie Tazetta', 'Soleil d'Or', 'Suisen' and 'Yellow Prize'). They should form trivalents at meiosis, with some bivalents and univalents. Meiosis is thus quite irregular, resulting in low fertility, although a few viable haploid (n = 10) and diploid (n = 20) gametes would be produced, as in the autotriploids based on x = 7 (2n = 21). The triploid 'Soleil d'Or' (='Grand Soleil d'Or') is the true 'Sol' grown very widely, especially in the Scilly Isles. The diploid form (2n = 20) is probably an Israeli-grown relative similar to the old diploid cultivar 'Newton' (B. Welch, *pers. comm.*).

The four cultivars 'Gervo', 'Golden Spur' (also recorded to have 2n = 14 and 21), 'Modesta' and 'Pacific' are based on x = 7 chromosomes, being tetraploids with two additional chromosomes. They will have irregular meiosis, producing gametes with n = 13–17 chromosomes, with the extremes being of reduced viability. If crossed with normal tetraploids much variation in chromosome number will be found in the progeny, with corresponding variability in their appearance. Some of them will be genetically very unbalanced weak plants not worthy of selection.

2n = 31 (9 records). Seven of these are Division 8 plants ('Albany', 'Avalanche', 'Compressa', 'Chinita', 'Grand Monarque', 'Highfield Beauty' and 'Martha Washington'). Some (e.g. 'Albany', 'Chinita', 'Highfield Beauty' and 'Martha Washington') are auto-allotetraploids with three sets of seven chromosomes and one of ten, the latter from *N. tazetta*. Their origin is from a non-reduced n = 17 gamete from a 2n = 17 Division 8 hybrid fusing with a n = 14 gamete derived from a tetraploid with 2n = 28. Thus in these plants 2n = (10 + 7) + (7 + 7) = 31. One of them, 'Chinita', has documented evidence for this ancestry (American Daffodil Society, 1981), being derived from 'Chaucer' (presumably 2n = 28) crossed with 'Jaune a Merveille' (2n = 17, see Table 1). All of these 10 + 7 + 7 + 7 plants would be highly sterile, with triploid meiosis made more irregular by the presence of ten more univalents.

'Grand Monarque' is an allotriploid derived entirely from members of the *tazetta* alliance, as is 'Compressa' also, noted by F. Galyon (*pers. comm.*) to be almost entirely *tazetta*-like. They have 2n = 10 + 10 + 11 = 31. The plants would not be expected to be very fertile, since their chromosomes would tend to form ten bivalents and 11 univalents during meiosis, the latter causing disruption and lowering fertility. Nevertheless, 'Grand Monarque' has contributed a non-reduced n = 31 gamete to the production of 'Killara' (see below) and a n = 10 + 11 = 21 gamete to 'Silver Chimes' (see above).

'Avalanche' is a selection from 'Grand Monarque', derived vegetatively and differing from it by a gene mutation only, rather than by a re-assortment of the entire genome through hybridization. The chromosome count of 2n = 31 and more particularly the single B chromosome in each confirms their close relationship.

Another cultivar with 2n = 31 is 'Madame de Graaff'. This is a tetraploid based on x = 7 with three additional chromosomes derived from irregular meiosis in one or both of its parents. It is one of the earliest known tetraploids, dating from before 1887, so it is unlikely to have tetraploid parentage. It probably arose from a triploid/triploid cross with non-reduction in one parent (*N. pseudonarcissus albescens*) giving a n = 21 gamete, and irregular meiosis in the other ('Empress') giving an unusually viable n = 10 gamete, i.e. about midway between the viable n = 7 and n = 14 gametes that 'Empress' would be expected to produce. As in tetraploids with two additional chromosomes, 'Madame de Graaff' would have a very high incidence of gametes with more than 14 chromosomes, some of which would be non-viable. It should therefore have low fertility, but those of its progeny which survive should show considerable viability.

'Golden Perfection', listed as a jonquil (Division 7) by both the American Daffodil Society (1981) and Kington (1989), is also listed as such in Table 1. If this were so it would be thought to have arisen in a way similar to 'Madame de Graaff', and to have a similar chromosome constitution and behaviour, but it has been pointed out that it has no jonquil affinities (B. Welch, *pers. comm.*), so like 'Highfield Beauty', 'Martha Washington' and relations its chromosome complement is most probably 2n = (7 + 7) + (7 + 10) = 31, and its fertility would be similar to theirs.

2n = 32 (7 records). These are Division 8 plants, or their double-flowered derivatives in Division 4 ('Earlicheer', 'Early Pearl', 'Grand Primo Citroniere' (also recorded probably wrongly as 2n = 30—*see below*), 'Luna', 'New Zealand Tazetta', 'Polly's Pearl' and 'Scilly White'). They are allotriploids with 2n = 10 + 11 + 11. Each is possibly derived from a non-reduced n = 22 gamete from one of the *tazetta* alliance with 2n = 22 (perhaps *N. papyraceus* or similar) fusing with a normal n = 10 gamete from another of the same alliance but with 2n = 20. An equally possible origin for these plants is with the involvement of a non-reduced gamete with n = 21 (from a 2n = 21-chromosome hybrid between species with 2n = 20 and 22) and a normal n = 11 gamete from a 2n = 22 *tazetta* ally.

'Earlicheer' is a double-flowered form of 'Grand Primo Citroniere', derived vegetatively, their relationship being confirmed by their identical chromosome complements (two of the three recorded counts of the latter are 2n = 32, the other of 2n = 30 probably being a case of mis-identification). 'Earlicheer' is not derived from 'White Pearl', as widely believed, since the latter has 2n = 22 (B. Welch, *pers. comm.* see Table 1).

Meiosis in these 2n = 32 plants will be irregular. The two sets of eleven will form eleven bivalents, but the products of meiosis will be contaminated by univalents from the set of ten. The great majority of gametes will be unbalanced and non-viable, but a very few will be viable with n = 11 or n = 11 + 10 chromosomes.

2n = 33 (1 record). 'Rijnveld's Early Sensation' (Division 1). This plant is based on x = 7 and could be termed as a tetraploid plus five chromosomes or a pentaploid minus two. It is unlikely to have arisen from entirely tetraploid parents as its degree of aneuploidy is too high. It is more likely to have arisen via a non-reduced triploid gamete (n = 21) from a triploid plant (2n = 21) fusing with an aneuploid gamete (n = 12) from a triploid or a tetraploid. This plant would be expected to produce some viable gametes with n = 14 chromosomes but many more with up to five extra ones, with a lowering of the viability of the more unbalanced gametes. The plant's fertility should be low, but not impossibly so for breeding purposes, and the high frequency of aneuploidy in the progeny should confer extra variability.

2n = 34 (3 records). 'Matador', 'Spangles' and 'Yellow Butterfly' (Division 8). These are allotetraploids with 7 + 7 + 10 + 10 chromosomes. B. Welch (*pers. comm.*) has suggested that 'Matador' and 'Yellow Butterfly' arose directly from two 2n = 17 hybrids crossed with each other, with the involvement of non-reduced gametes on both the male and female sides. This is very probable, since non-reduced gametes are the only viable ones that these plants can produce (see above), and fusion of two of them is a distinct possibility when inter-crossing is attempted. This origin is supported by pedigree evidence

(American Daffodil Society, 1981) that 'Matador' was produced by open pollination (= self-pollination in this case?) of 'Admiration', a Division 8 plant presumably with 2n = 17.

These allotetraploids are remarkably fertile. Because they have two of each of two different chromosome sets each chromosome has one other similar one with which to pair during meiosis. Seventeen bivalents are usually formed, which dissociate regularly to produce a majority of n = 17 gametes which are viable, giving a moderate to high level of fertility to the plant. I have observed the expected number of 2n = 31 in an unnamed hybrid obtained by B. Welch from crossing 'Matador' with a tetraploid (2n = 28) Division 3 hybrid. It appears that 'Matador' is self-fertile, because 'Spangles', a new variety named by S. Du Bose, is a self-pollination product of it with the same chromosome number.

These allotetraploids represent a new departure in the breeding of Division 8 plants, and should form the starting points to a new range of interesting fertile *tazetta* hybrids.

2n = 35 (2 records). 'February Silver' (Division 6) and 'White Owl' (Division 5). 'February Silver' is a pentaploid with five sets of seven chromosomes. Its probable origin is from the fusion of an unreduced gamete (n = 21) from a triploid (2n = 3x = 21) and a normal gamete (n = 14) from a tetraploid (2n = 4x = 28). In this plant the chromosomes will tend to form trivalents and bivalents during meiosis, less commonly quadrivalents and pentavalents. Gametes will be formed ranging mostly between diploid and triploid (n = 14 - 21) with a high incidence of aneuploidy which will tend to lower the fertility of the plant quite considerably. There should nevertheless be a sufficient level of fertility to make the plant of use to the breeder, and the variation brought about by the aneuploidy of some of its gametes could be exploited.

The count of 2n = 35 in 'White Owl' is more interesting, since although it is placed in Division 5 it has clear affinities with *N. tazetta* and should more probably be in Division 8. Its chromosome complement confirms this suggestion, since it closely resembles that of 'Matador' (2n = 34). Furthermore, F. Galyon (*pers. comm.*) has reported success in crossing it with a seedling from a selfed 'Matador'. It is thus very probable that 'White Owl' is a complex allotetraploid with 2n = 11 + 10 + 7 + 7 chromosomes. Its claimed origin ('Scilly White' × 'Minnie Hume'), given by the American Daffodil Society (1981) can be interpreted as a normal n = 14 gamete from presumably tetraploid 'Minnie Hume' (2n =? 28) fusing with a non-reduced gamete (n = 21) from the *tazetta* ally 'Scilly White'. The latter is recorded as having 2n = 32 chromosomes (Fernandes & de Almeida, 1971), but the one used as a parent of 'White Owl' could have been the 'Sicily White' (2n = 21) counted by Kurita (1954), because it is quite possible that Kurita's 'Sicily White' represents a misprint or a misunderstanding of the name 'Scilly White' in the original reference. This confusion over names is confirmed by the absence of 'Sicily White' from the International Daffodil Checklist (Kington, 1989).

In crosses, 'White Owl' should behave similarly to the 2n = 34 allotetraploids but it will not be nearly so fertile. Its 7 + 7 chromosomes will form seven bivalents during meiosis, but the 10 + 11 chromosomes will not pair or separate so well. Some univalents will be formed which will give rise to unbalanced gametes and reduce fertility to a moderate or low level.

2n = 36 (2 records). 'Great Warley' (Division 2) and 'Larkelly' (Division 6). These are pentaploids based on x = 7, with origins, chromosome behaviour and fertility similar to 'February Silver' (2n = 35), but with an extra chromosome. In the case of 'Great Warley' this would have been derived from the aneuploid triploid parent 'Horsfieldii' (2n = 22) via non-reduction. In that of 'Larkelly' the extra chromosome probably arose via an aneuploid gamete with n = 15 inherited from its tetraploid parent.

2n = 37 (1 record). 'Roger' (Division 6). Again as 'February Silver' (2n = 35), but with two additional chromosomes. The parents of 'Roger' are 'Beryl' and 'Nor-Nor' (American Daffodil Society, 1981). 'Beryl' is triploid, contributing a non-reduced triploid gamete (n = 21). The other parent is probably tetraploid, contributing an aneuploid gamete (n = 14 + 2) through an irregular meiotic division.

2n = 43 (1 record). 'Queen of Bicolors' (Division 1). This is an aneuploid hexaploid with six sets of seven chromosomes plus one extra. It probably arose from tetraploid parents with a non-reduced gamete from one (n = 28) fusing with an aneuploid gamete from the other (n = 14 + 1). This plant should have irregular meiosis because of the presence of so many sets of chromosomes, but at least some gametes should be approximately triploid (n = 21 or 22) and viable, conferring some viability to the plant.

2n = 45 (2 records). 'Killara' (Division 8) and 'Sanda' (Division 1). The pedigree of 'Killara' is given by the American Daffodil Society (1981) as 'Grand Monarque' × 'Empress'. These are known to have 2n = 31 + 1B and 21 + 1B chromosomes respectively (Table 1). It is pointed out above that 'Grand Monarque' has irregular meiosis and low fertility, but similarly to all other *Narcissus* hybrids it can produce viable non-reduced gametes. 'Empress' is not totally sterile, but in common with other triploids it can produce a low frequency of viable haploid and diploid gametes. 'Killara' thus has the chromosomal constitution 2n = 10 + 10 + 11 + 1B from non-reduced 'Grand Monarque' added to a diploid 7+7 gamete from 'Empress'. It is thus a complex allopentaploid (2n = 7 + 7 + 10 + 10 + 11 + 1B). Its two sets of seven and two of ten should produce 17 bivalents during meiosis, but the single set of eleven will disrupt the meiosis, partly by pairing with some members of the sets of ten and partly by forming univalents. The plant would thus be expected to form n = 17-chromosome gametes contaminated with various numbers of chromosomes from the set of eleven, of which the more unbalanced ones will not be viable. Fertility would be very low in this plant, but it would be worth attempting to cross it with the 2n = 34 allotetraploids, or with 'White Owl' (2n = 35). As the latter also have viable gametes with n = 7 + 10 = 17 chromosomes the progeny should include some highly fertile 2n = 34 allotetraploids.

'Sanda' is chromosomally indistinguishable from 'Killara', even containing the same B chromosome. The two plants are also alike and there is now good evidence for the opinion of F. Galyon (*pers. comm.*) that 'Sanda' as is widely available is the same clone as 'Killara' that has been mis-named.

2n = 46 (1 record). 'Jamage' (Division 8). This plant, bred by George Tarry (B. Welch, *pers. comm.*) is known to be derived from a tetraploid Division 3 cultivar crossed with 'Grand Primo Citroniere' (2n = 32). The latter is of very low fertility (see under 2n = 32 above), but can produce some viable non-reduced gametes in common with many *Narcissus* cultivars that are otherwise sterile. The chromosome constitution of 'Jamage' is thus 2n = 7 + 7 from the tetraploid, united with 10 + 11 + 11 from 'Grand Primo Citroniere'. The plant is a complex allopentaploid, and its two sets of seven and two sets of eleven will produce 18 bivalents during meiosis, but the last set will form ten univalents which will disrupt meiosis somewhat. Fertility will be low at best, with gametes carrying n = 7 + 11 = 18 chromosomes plus a variable number from the set of ten, the latter causing non-viability if too many are present.

Future Developments

In those *Narcissus* cultivars having x = 7 as the only basic chromosome number this study has shown an increase in chromosome number which started in the middle of the nineteenth century with the origin of triploid cultivars from the diploid species and cultivars grown at the time, with formation of non-reduced gametes being instrumental in triploid formation. Typically of triploids these were larger, more vigorous and more showy than the diploids and were naturally seized upon by breeders, but initially there was little success in obtaining further progeny from them. Their triploid meiosis was irregular, their fertility was low, and when attempts were made to cross them with each other the problem was exacerbated because of low fertility in both parents. Indeed the only extant cultivars that can be reasonably confidently assigned to a triploid/triploid origin are 'Madame de Graaff' (2n = 31) and perhaps also 'Rijnveld's Early Sensation' (2n = 33).

It was not until triploids were crossed with diploids at the end of the nineteenth century that tetraploids (2n = 28) arose in any numbers, again through meiotic non-reduction on the triploid side (n = 21). Their origin constituted a major break-through in *Narcissus* breeding, since they are mostly vigorous, their fertility is adequately high for breeding purposes, and their progeny show considerable variability. They have been so successful that they now comprise the great majority of cultivars, with nearly 700 of the about 1000 chromosomally-known ones being tetraploid or approximately so.

An obvious question which must now be addressed is whether meiotic non-reduction can also occur in the tetraploids to give rise to a new race of hexaploid cultivars (2n = 6x = 42) that are even larger and more vigorous. The answer to this is most certainly no. Tetraploids have existed for nearly 100 years and have been widely interbred, but the number of plants exceeding the tetraploid level of polyploidy is very low indeed, with only one ('Queen of Bicolors', 2n = 43) probably arising from a tetraploid/tetraploid cross with meiotic non-reduction in one parent.

The process of non-reduction in tetraploids leading to the formation of hexaploid progeny certainly does occur, since in addition to the origin of 'Queen of Bicolors' it has also been noted by Wylie (1952), who found a spontaneously-produced hexaploid seedling growing among tetraploid cultivars, but the hexaploids so formed are not normally selected by breeders. It is clear that they exceed the level of polyploidy (and the amount of DNA per nucleus) that is optimal for plant size and vigour. They are evidently less vigorous than tetraploids and hence will not normally be selected from the progeny of a tetraploid/tetraploid cross. It is thus unlikely that such high polyploids will ever appear widely among newly-described x = 7 *Narcissus* cultivars.

The probability that high polyploids would be horticulturally successful is even lower in the *tazetta* alliance (x = 10,11), since not even the tetraploid derived solely from these basic numbers has yet been detected. It seems probable that vigorous plants exceeding the triploid level do not occur. The group is nevertheless fascinating as far as the breeder is concerned, since when tazettas are crossed with x = 7 plants their multiple-flowered habit is added to the normally larger flowers of the x = 7 group to give very desirable products. The lack of fertility in these hybrids, particularly in the ones with 2n = 17, 18, 24 etc., makes them difficult to breed further, but use can be made of meiotic non-reduction in them to produce a few viable gametes. Ideally this process should be utilised on the male side of a cross, because many more meiotic cells are present on the male (pollen) side of a plant than on the female (ovule) side, and if the frequency of non-reduced meiosis is constant there is thus a higher incidence of fertile non-reduced pollen than of fertile non-reduced ovules per flower in these otherwise sterile plants. In some cases, however, non-reduction can also be involved on the female side, as in the ancestry of 'Jumblie', 'Quince', 'Tête-a-

Tête', 'Matador' and 'Yellow Butterfly' (see above under 2n = 24 and 34).

As with the tetraploids in the x = 7 group, the break-through in the breeding of the genetically complex plants with mixtures of x = 7 and 10 has now occurred. Allotetraploids with 2n = 7 + 7 + 10 + 10 = 34 have recently arisen ('Matador', 'Spangles' and 'Yellow Butterfly') which are bivalent-formers and should be adequately fertile for further breeding with each other and possibly with 'White Owl', which is genetically similar and has already been shown to be compatible with them. It is also quite feasible to use colchicine to double the chromosome numbers of sterile plants with 2n = 7 + 10 = 17 to restore fertility and produce new races of allotetraploids combining the best features of the x = 7 complex and the *tazetta* alliance. These allotetraploids, together with those already known, should form the basis for a fascinating new series of 'multiflorus grandiflorus' cultivars in *Narcissus*, a genus which will surely continue to be one of the most successful of the decorative bulbous plants.

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Those appearing in Table 1 are numbered in brackets.

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Table 1. Chromosome numbers in Narcissus *cultivars. Those referred to as 0 are original results obtained in the author's laboratory.*

Cultivar	Classification and date of origin	2n	Ref.
Ababa	2W-O, 1929	27	0
Abba	4W-WOO, 1984	17	0
Abel Tasman	11W-WYO, 1970	28	0
Accolade	3W-R, 1956	28	1
Ace of Diamonds	9W-O, 1923	14	1
Acropolis	4W-R, 1955	28	0
Actaea	9W-GWO, 1927	28	0, 5, 6
Aflame	3W-YOO, 1938	28	0
Agnes Montefiore	2W-WWY, 1928	28	6
Agora	2W-O, 1959	28	0
Ahoy	11W-Y, 1960	28	5
Air Marshal	2Y-O, 1953	28	0
Alabaster	4W-W, 1972	14	0
Alayne	2W-YYO, 1947	28	0
Albany	8W-YOO, 1931	31	0
Albatross	3W-YYO, 1891	28	0, 17
Albicans	1W-W, 1884	14	12, 13
Albion	3W-Y, 1877	c.14	16
Albus Plenus Odoratus	4W-W, 1629	14	0
Aldergrove	2W-Y, 1953	28	0
Aleppo	3W-R, 1928	28	0
Alison Johnstone	2W-W, 1941	28	6
Allurement	2W-P, 1959	28	0
Alsace	8W-YYO, 1907	17	4
Amber Castle	2YW-WPP, 1976	28	0
Ambulle	2Y-YYO, 1921	28	6
Amor	3W-YYO, 1971	28	0
Anacapri	3W-YYR, 1960	28	0
Angel	3W-W, 1960	28	0
Ann Abbott	2W-P, 1947	28	0
Anzio	2W-O, 1945	28	6
Apricot	1W-Y, 1897	14	0
April Tears	5Y-Y, 1939	14	0
Aranjuez	2Y-YYO, 1933	28	5
Arcadia	2W-O, 1910	28	6
Arctic Gold	1Y-Y, 1951	28	0
Ardelinis	1W-W, 1934	28	6
Ardour	3Y-R, 1952	28	0
Ard Righ	1Y-Y, 1885	14	0
Arish Mell	5W-W, 1961	21	0
Armada	2Y-O, 1938	28	0
Array	9W-GYR, 1982	14	0
Ascot	4Y-YOO, 1962	28	0
Aspasia	8W-Y, 1908	24	0
Auburn	5Y-Y, 1951	21	0
Aurelia	7Y-Y, 1913	21	6
Avalanche	8W-Y, 1906	31 + 1B	0
Avenger	2W-O, 1957	28	0
Baby Moon	7Y-Y, 1958	14	0
Baby Star	7Y-Y, 1949	14	1
Baccarat	11Y-Y, 1950	28	5
Bahram	2Y-O, 1935	28	6
Balamara	2Y-Y, 1973	28	0
Balvenie	2W-GPP, 1976	28	0
Bambi	1W-Y, 1948	14	0
Bantam	2Y-OOR, 1950	27	0
Barnby Moor	3W-Y, 1979	28	0
Barrett Browning	3W-O, 1945	27	0
Barrett Browning	3W-O, 1945	28	0
Barrii Conspicuus	3Y-Y, 1869	21	0
Bartley	6Y-Y, 1934	21	0, 6, 17
Bath's Flame	3Y-O, 1914	21	0
Bawnboy	1Y-Y, 1960	28	0
Beacon	3W-YOR, 1897	28	6
Bealita	3Y-O, 1968	28	0
Beersheba	1W-W, 1923	28	0, 5, 6, 17
Beersheba	1W-W, 1923	29	10
Beirut	2W-YYR, 1944	28	6

Cultivar	Classification and date of origin	2n	Ref.
Belisana	2W-O, 1946	28	0
Bell Song	7W-P, 1971	21	0
Benediction	3W-W, 1958	28	0
Ben Hee	2W-GWW, 1964	28	0
Benvarden	3W-W, 1969	28	0
Benvoy	3W-GWW, 1977	28	0
Bernardino	2W-YYO, 1907	28	0
Beryl	6Y-O, 1907	21	6
Beryl	6Y-O, 1907	21 + 1B	17
Bethany	2Y-W, 1958	19	1
Biflorus	10W-Y, ?	17	1
Biflorus	10W-Y, ?	24	0, 16
Big Chief	1Y-Y, 1977	28	0
Big Wig	4W-Y, 1964	27	0
Binkie	2Y-W, 1938	28	0, 6
Bird of Dawning	1Y-Y, 1960	28	0
Birma	3Y-O, 1938	28	0
Biscayne	1Y-Y, 1966	28	0
Blanc de Blancs	11W-W, 1986	28	0
Blaris	2W-P, 1960	28	0
Blarney	3W-OOY, 1935	28	6
Bobbysoxer	7Y-O, 1949	22	0
Bodilly	2W-Y, 1925	28	6, 17
Bokhara	2Y-O, 1927	28	6
Bolton	7Y-Y, 1935	21	0
Bon Bon	9W-R, 1976	14	0
Bonfire	3Y-O, 1910	21	0
Border Chief	2Y-O, 1953	28	0
Border Legend	2Y-O, 1963	28	0
Boswin	1W-Y, 1927	28	6
Bowles Bounty	1Y-Y, 1957	28	1
Brabazon	1Y-Y, 1950	28	0
Brahms	2W-O, 1957	28	0
Brandon	1Y-Y, 1931	28	6
Brave Adventure	2W-O, 1979	28	0
Bravoure	1W-Y, 1974	29	0
Bridal Crown	4W-Y, 1953	17	0
Bright Flame	2W-P, 1986	28	0
Broomgrove	2Y-Y, 1965	28	0
Broomhill	2W-W, 1965	28	0
Broughshane	1W-W, 1938	28	6
Brunswick	2W-Y, 1931	28	0, 6
Brussels	1W-W, 1945	28	0
Bryher	3W-W, 1939	28	0
Buncrana	2W-O, 1938	28	0
Bunting	7Y-O, 1965	22	0
Burgemeester Gouverneur	1Y-Y, 1930	28	6
Burntollet	1W-W, 1974	28	0
Bushmills	3W-YYO, 1961	28	0
Bushtit	6Y-Y, 1960	21	0
Buttercup	7Y-Y, 1890	21	0
Butter King	1Y-Y, 1941	28	0
Buttermilk	4W-Y, 1936	28	6
Butterscotch	2Y-Y, 1962	28	0
Buttonhole	11W-Y, 1923	22	2
Caedmon	9W-YYR, 1913	14	1
Caledonia	2W-YYO, 1931	28	5
California	2Y-YOO, 1945	28	0
Camellia	4Y-Y, 1930	21	0
Camowen	1Y-Y, 1974	28	0
Campernelli	10Y-Y, 1837	14	14
Campion	9W-GYR, 1980	14	0
Canarybird	8Y-GOO, 1959	17	0
Canasta	11W-Y, 1957	27	0, 5
Candida	4W-Y, 1956	27	0
Canisp	2W-W, 1960	28	0
Cantabile	9W-GYR, 1932	14	0
Cantatrice	1W-W, 1936	28 + 1B	0
Cape Kennedy	11W-O, 1968	27	0
Capisco	3W-GYO, 1969	28	0
Capitol Hill	2Y-YYO, 1979	28	0
Capparoe	3W-R, 1951	27	0
Caragh	2W-GYO, 1941	28	6

Cultivar	Classification and date of origin	2n	Ref.
Caramel	9W-O, 1913	28	0
Caravelle	1Y-Y, 1959	27	0
Carbineer	2Y-O, 1927	28	0, 5, 6
Carlton	2Y-Y, 1927	28	5
Carnmoon	3W-WWY, 1953	28	0
Cassata	11W-W, 1963	28	0
Catawba	9W-GYO, 1948	28	0
Cathay	2Y-R, 1962	29	0
Cawsand	2W-Y, 1978	28	0
Celestial	5Y-Y, 1950	21	0
Ceylon	2Y-O, 1943	27	0
Ceylon	2Y-O, 1943	28	1
Chania	1W-W, 1984	28	0
Chantain	2W-Y, 1963	28	0
Charity May	6Y-Y, 1948	21	0
Charles First	1Y-Y, 1908	26	6
Charter	2Y-W, 1964	28	0
Chastity	8W-W, ?	30	15
Chatsworth	1W-Y, 1939	28	6
Cheerfulness	4W-WYY, 1923	24	0, 6, 15
Cheerio	2Y-O, 1932	28	6
Chelsho	1Y-Y, 1929	28	6
Cherie	7W-P, 1935	21	6
Chesterton	9W-GYR, 1979	14	0
Chevalier	1Y-Y, 1956	28	0
Chinese Sacred Lily	8-?, ?	30	7, 13
Chinese White	3W-W, 1937	28	0
Chinita	8Y-YRR, 1922	31	0
Chinook	2W-Y, 1952	28	0
Cibola	2Y-Y, 1952	28	0
Cicely	2W-W, 1927	28	0, 6
Citrix	1Y-Y, 1953	28	5
C.J. Backhouse	2Y-YOO, 1869	14	0
Cleena	2W-OOY, 1939	28	6
Cloncarrig	1Y-Y, 1952	28	0
Clumber	3W-Y, 1975	28	0
Codlings and Cream	4W-Y, 1820	14	0
Colley Gate	3W-YOR, 1972	28	0
Colorange	11Y-O, 1950	28	0
Coloratura	3W-WWO, 1956	27	0
Como	9W-GYR, 1973	14	0
Compressa	8W-Y, ?	31	0
Concolor	5Y-Y, 1877	14	0
Conspicuous	3Y-YYO, 1869	21	12
Constantine	1Y-Y, 1930	28	0
Content	1W-WWY, 1927	28	0
Contrapunt	2Y-O, 1962	27	0
Convair	1Y-Y, 1938	27	0
Cora Ann	7W-Y, 1939	21	0
Coral Ribbon	2W-WWP, 1964	28	0
Cornet	6Y-Y, 1953	21	0
Cotopaxi	2Y-O, 1943	28	6
Court Martial	2Y-O, 1956	28	0
Cove	2Y-Y, 1939	28	0
Coverack Glory	2Y-Y, 1927	28	6
Coylum	3W-GWW, 1967	14	0
Cragford	8W-O, 1930	17	1
Craigdun	2W-OOY, 1979	28	0
Cramer	? ?	21	5
Crepello	3W-GWY, 1957	28	0
Crescendo	2Y-YYO, 1945	28	0
Crocus	2Y-Y, 1927	28	0, 6
Croesus	2Y-YYO, 1912	21	0
Cromarty	1Y-Y, 1933	28	6
Culmination	2W-P, 1982	28	0
Curly	2Y-Y, 1968	28	0
Cushendall	3W-GWW, 1931	14	0
Cushendun	3W-Y, 1980	14	0
Cushlake	3W-W, 1934	14	6
Cyclataz	8Y-O, 1922	17	17
Cyclone	6Y-Y, 1960	28	0
Cyclops	1Y-Y, 1974	28	0
Cypri	8-? ?	30	7
Dactyl	9W-GYR, 1923	14	0

Cultivar	Classification and date of origin	2n	Ref.
Dalboyne	2Y-O, 1947	28	0
Dalhuaine	3W-R, 1971	28	0
Dallas	3W-W, 1948	14	0
Dandy Boy	1Y-Y, 1931	28	6
Daphne	4W-W, 1914	14	5
Dava	2W-W, 1931	28	6
Daydream	2Y-W, 1960	28	0
Deanna Durbin	2W-O, 1939	28	5
Decency	1Y-Y, 1930	28	6
Delibes	2Y-O, 1950	29	0
Delightful	3W-GYY, 1969	14	0
Delta Wings	6W-P, 1977	28	0
Denys Meyer	2W-WY, 1927	28	6
Deodora	2W-WWY, 1951	28	0
Descanso	1W-Y, 1965	28	0
Desdemona	2W-W, 1964	28	0
Dickcissel	7Y-W, 1963	21	0
Dick Wellband	2W-O, 1921	28	5
Dinkie	3Y-OOR, 1927	21	6
Diversion	3W-GYR, 1970	28	0
Divertimento	7W-WPP, 1967	21	0
Doctor Alex Fleming	2W-R, 1948	28	0
Doe Ross	1Y-Y, 1979	28	0
Dolly Mollinger	11W-OWO, 1958	28	0
Dominator	1Y-Y, 1948	28	1
Double Campernelle	4-?, 1900	14	0
Doubledale	4W-Y, 1953	28	0
Double Eagle	4W-O, 1959	27	0
Double Event	4W-Y, 1952	29	0
Double Ice Follies	4W-W, ?	28	0
Doublet	4W-Y, 1961	14	0
Dove Wings	6W-Y, 1949	21	0
Downhill	3W-W, 1960	28	0
Downpatrick	1W-Y, 1959	28	0
Dream Castle	3W-W, 1963	28	0
Dreamlight	3W-GWR, 1934	14	0
Dromona	2W-Y, 1973	28	0
Duke of Windsor	2W-YYO, 1936	28	0
Dulcimer	9W-GYR, 1913	28	1
Dunkeld	2Y-O, 1935	28	0
Dunlewey	2W-W, 1934	28	0
Dutch Master	1Y-Y, 1948	28	5
Earlicheer	4W-Y, 1934	32	0
Early Bird	3Y-Y, 1955	28	0
Early Bride	2W-O, 1943	28	0
Early Pearl	8W-GWW, 1984	32	0
Early Prince	1W-Y, 1956	28	0
Early Sensation	1Y-Y, 1954	28	0
Early Splendour	8W-O, 1938	17	0
Easter Moon	2W-GWW, 1954	28	0
Eastern Dawn	2W-P, 1964	28	0
Eddy Canzony	2W-YOO, 1938	28	0
Edward Buxton	3Y-OOR, 1932	27	5
Edward Buxton	3Y-OOR, 1932	28	0
Egg Nog	4W-Y, 1975	28	0
Eland	7W-Y, 1968	21	0
Elrond	6W-W, 1981	28	0
Elvira	8W-YYO, 1902	24	0, 6, 13
Emperor	1Y-Y, 1869	21	0, 6, 10, 12, 13
Empire	2W-WYY, 1908	28	0
Empress	1W-Y, 1869	21 + 1B	0, 10, 17
Empress	1W-Y, 1869	22	12, 13, 14
Empress of Ireland	1W-W, 1952	28	0
Enniskillen	3W-R, 1952	28	0
Enterprise	4Y-O, 1958	28	0
Entrancement	1Y-W, 1958	28	0
Estrella	3W-Y, 1956	28	0
Eva	2W-YYO, 1930	28	6
Evangeline	3W-Y, 1908	21	0
Evening	2W-W, 1935	28	0, 6
Evolution	11Y-Y, 1957	28	5
Extol	4Y-R, 1959	27	0
Fairgreen	3W-GYO, 1965	28	0
Fair Head	9W-GYP, 1982	14	0

Cultivar	Classification and date of origin	2n	Ref.
Fair Lady	9W-YYR, 1923	14	6
Fairmaid	3W-GYY, 1970	28	0
Fairy Circle	3W-WWP, 1913	14	6
Fairy Footsteps	3W-GWW, 1982	14	0
Fairy Wings	6W-Y, 1938	14	6
Falaise	4W-O, 1945	26	0
Farewell	2W-Y, 1938	28	6
Favell Lee	2W-Y, 1944	28	6
February Gold	6Y-Y, 1923	21	0, 17
February Silver	6W-W, 1949	35	0
Felindre	9W-GYR, 1930	14	1
Fermoy	2W-YOO, 1938	28	0
Feu de Joie	4W-O, 1927	21	6
Filly	2W-W, 1984	28	0
Film Queen	2Y-YYO, 1955	27	0
Finland	2W-Y, 1940	28	0
Fiorella	3W-YYO, 1963	28	0
Firebrand	3WY-R, 1903	14	0, 6
Fire Chief	2Y-R, 1954	28	0
Firetail	3W-O, 1910	21	5
Flamenco	2W-O, 1935	28	0, 6
Flaneur	11Y-Y, 1948	28	5
Floore	9W-WWO, 1939	28	6
Flower Drift	4W-OYO, 1966	28	0
Flower Record	2W-WWO, 1943	28	0, 5
Flowersong	2Y-YYO, 1960	28	0
Folly	2W-O, 1926	28	6
Foresight	1W-Y, 1944	28	0
Forte	2W-P, 1986	28	0
Fortune	2Y-O, 1917	28	5, 6, 17
Fortwilliam	1Y-Y, 1960	28	0
Foundling	6W-P, 1969	27	0
Foxfire	2W-GWP, 1968	28	0
Fragrant Rose	2W-GPP, 1978	28	0
Franklin	8?, ?	20	13
Frigid	3W-W, 1935	14	0
Frost in May	9W-GGY, 1981	14	0
Frou-frou	4W-W, 1984	14	0
Fuego	2Y-R, 1976	29	0
Furbelow	4Y-O, 1961	27	0
Fusilier	3Y-?, 1907	14	3
Fusilier	3Y-?, 1907	28	3
Galway	2Y-Y, 1942	28	0
Gamay	1W-Y, 1984	28	0
Garden Princess	6Y-Y, 1938	28	5
Garibaldi	2Y-O, 1933	28	6
Garron	1Y-Y, 1934	28	0, 6
Gaucho	2Y-O, 1953	29	0
Gaylord	2Y-YOO, 1979	28	0
Gay Record	4W-O, 1964	28	0
Gay Song	4W-W, 1968	28	0
Gay Symphony	4W-Y, 1973	28	0
Gay Time	4W-R, 1952	28	0
Gem of Antrim	2W-P, 1964	28	0
Gem of Ulster	2W-P, 1964	28	0
George Leak	2W-O, 1960	28	0
Geranium	8W-O, 1930	17	0, 6, 17
Gervo	2W-W, 1944	30	5
Gimli	6W-P, 1981	27	0
Gin and Lime	1Y-GWW, 1973	28	0
Gipsy Moth	2W-W, 1967	29	0
Glenravel	1W-Y, 1934	28	6
Gloria Mundi	2Y-YOR, 1869	21	12, 13
Gloriosus	8W-Y, 1850	20	0
Glorious	8W-O, 1923	24	0,6
Glory of Lisse	9W-YYR, 1901	14	0
Glowing Red	4W-R, 1968	28	0
Glynver	3W-O, 1921	28	0
Godolphin	1Y-Y, 1925	28	6
Gold Collar	11Y-Y, 1956	28	5
Golden Amber	2Y-ORR, 1975	28	0
Golden Aura	2Y-Y, 1964	28	0
Golden Cycle	6Y-Y, 1916	21	0
Golden Dawn	8Y-O, 1958	24	0

Cultivar	Classification and date of origin	2n	Ref.
Golden Ducat	4Y-Y, 1947	28	0
Golden Empire	1Y-Y, 1967	28	0
Golden Harvest	1Y-Y, 1920	27	0
Golden Harvest	1Y-Y, 1920	28	5
Golden Horn	1Y-Y, 1958	28	0
Golden Incense	7Y-Y, 1957	21	0
Golden Jewel	2Y-GYY, 1973	29	0
Golden Joy	2Y-Y, 1973	28	0
Golden Lacquer	6Y-Y, 1949	28	0
Golden Perfection	7Y-Y, 1925	31	6,17
Golden Princeps	1Y-Y, 1885	14	6
Golden Ranger	2Y-Y, 1976	29+1B	0
Golden Ray	1Y-Y, 1927	28	6
Golden Robin	1Y-Y, 1960	28	0
Golden Sceptre	7Y-Y, 1914	21	0,6
Golden Spur	1Y-Y, 1885	14	0,6
Golden Spur	1Y-Y, 1885	21	2,10
Golden Spur	1Y-Y, 1885	30	12
Golden Star	1Y-Y, 1970	28	0
Golden Torch	2Y-Y, 1942	27	0
Golden Vale	1Y-Y, 1976	28	0
Gold Medal	1Y-Y, 1938	28	0
Gold Strike	1Y-Y, 1984	28	0
Goring	2Y-YYO, 1947	28	6
Grandee	1W-Y, 1877	22	12,13
Grand Emperor of China	8W-O, ?	30	1
Grandis	1W-Y, 1877	22	6,12
Grand Monarque	8W-Y, 1798	31+1B	0
Grand Primo Citroniere	8W-Y, 1780	30	1
Grand Primo Citroniere	8W-Y, 1780	32	0,5
Grand Soleil d'Or	8Y-O, 1890	20	11
Grand Soleil d'Or	8Y-O, 1890	30	0,7
Grayling	2W-YYW, 1927	28	6
Great Leap	4Y-Y, 1923	21	0
Great Warley	2W-Y, 1904	29	0
Great Warley	2W-Y, 1904	36	0
Greenmount	3W-Y, 1957	28	0
Green Peace	3W-GGY, 1984	14	0
Green Woodpecker	2W-GYO, 1954	28	0
Greeting	2W-Y, 1934	28	6
Grenoble	2W-OOY, 1960	29	0
Gripshover	7-?, ?	14	0
Gulliver	3Y-YYO, 1927	28	0,6,
Hannibal	11Y-O, 1968	28	0
Happy Easter	5-?, 1936	21	6
Harbinger of Spring	1Y-Y, 1979	27	0
Havelock	2Y-Y, 1927	28	5,6
Hawaii	4Y-O, 1956	27	0
Hawera	5Y-Y, 1938	14	6,17
Haye	2Y-O, 1977	28	0
Helios	2Y-Y, 1912	21	0,6
Henry Irving	1Y-Y, 1885	14	0,6,14
Hera	2W-WWY, 1943	28	6
Hesla	7Y-Y, 1908	21	6
Hexameter	9W-GYR, 1927	14	1
Hexworthy	3W-WYY, 1985	28	0
Hiawassee	8W-W, 1956	18	0
Highfield Beauty	8Y-GYO, 1964	31	0
High Tower	3W-GWY, 1982	28	0
Hillstar	7YW-YWW, 1979	28	0
Hillston	1Y-Y, 1955	28	0
His Excellency	1Y-Y, 1931	28	6
Hollywood	2Y-O, 1939	28	0
Home Fires	2Y-O, 1950	28	0
Homer	9W-OOR, 1898	14	17
Horace	9W-GOR, 1906	14	0,5,17
Horn of Plenty	5W-W, 1947	21	0
Hors d'Oeuvre	8Y-Y, 1959	17	0
Horsfieldii	1W-Y, 1845	22	6,14
Hospodar	2Y-O, 1914	28	0
Hozozo	7W-P, ?	28	0
Ice Chimes	5Y-Y, 1970	22	0
Ice Follies	2W-W, 1953	14	1

Cultivar	Classification and date of origin	2n	Ref.
Ice Follies	2W-W, 1953	28	0
Ideal	8W-O, 1906	17 + 1B	0
Inglescombe	4Y-Y, 1912	14	5,6
Inishkeen	1W-Y, 1951	28	0
Initiation	1W-W, 1969	28	0
Inniswood	1W-W, 1978	28	0
Insulinde	4W-O, 1921	21	6
Interim	2W-YYP, 1944	28	6
Intermedius	8Y-O, ?	17	1
Investment	1Y-Y, 1945	28	0
Irene	8Y-Y, 1906	17	4
Irene Copeland	4W-Y, 1923	14	0,5
Irish Legend	2W-O, 1964	28	0
Irish Light	2Y-O, 1972	28	0
Irish Luck	1Y-Y, 1948	28	0
Irish Minstrel	2W-Y, 1958	28	0
Irish Mist	2W-Y, 1972	28	0
Itzim	6Y-R, 1982	21	0
Jackpot	2Y-R, 1964	28	0
Jack Snipe	6W-Y, 1951	21	0
Jamage	8-?, ?	46	0
Jana	6Y-Y, 1949	21	0
Jaune à Merveille	8Y-YYO, 1906	17	4
Jenny	6W-W, 1943	21	0
Jessamy	12W-W, 1952	28	1
Jetfire	6Y-O, 1966	21	0
Jezebel	3Y-R, 1948	28	0
Jindalee	2W-Y, 1973	28	0
Johanna	5Y-Y, 1950	21	0
John Evelyn	2W-O, 1920	28	5,6
Johnstonii	10Y-Y, 1886	21	1
Jonquilloides	10Y-Y, ?	21	1
Joseph MacLeod	1Y-Y, 1946	28	0
Jubilant	2Y-Y, 1925	28	6
Juliet	9W-YYR, 1907	14	1
Jumblie	6Y-O, 1952	24 + 1B	0
Junco	1W-W, 1944	28	0
Kanchenjunga	1W-W, 1934	28	0
Kandahar	1Y-Y, 1927	28	6
Kashmir Local	8W-Y, ?	30	8
Keats	9W-GYY, 1958	14	0
Kilbride	2Y-Y, 1938	28	6
Killaloe	2W-W, 1937	28	6
Killara	8W-Y, 1910	45 + 1B	0
Killigrew	2Y-O, 1907	28	0,6
Kilmorack	2Y-O, 1950	28	0
Kilmore	3W-O, 1962	28	0
Kilrea	2W-W, 1952	28 + 1B	0
Kilworth	2W-YOO, 1938	28	6
Kimi	2W-P, 1956	28	0
King Albert	1Y-Y, 1938	28	6
King Alfred	1Y-Y, 1899	28	0, 2, 5, 6, 12, 13
King Cardinal	2W-R, 1951	28	0
Kingcraft	8W-O, 1915	24	0
Kingscourt	1Y-Y, 1938	28	0
Knowehead	2W-W, 1954	28	0
Krakatoa	2Y-O, 1937	27	6
Lady Bee	2W-P, 1929	14	6
Lady Betty	2W-W, 1933	28	6
Ladybird	2Y-YOO, 1910	14	6
Lady Margaret Boscawen	2W-Y, 1898	29	0
Lady Serena	9W-GYR, 1976	28	0
La Fiancee	8W-Y, 1937	24	0
Lanarth	7Y-O, 1907	21	6
Lancaster	3W-GYO, 1977	28	0
Langford Grove	3W-YYO, 1977	29	0
Langlo	1Y-Y, 1973	28	0
Lapine	3Y-YYO, 1982	28	0
La Riante	3W-YOO, 1933	28	0
Larkelly	6Y-O, 1930	36	0
Larkwhistle	6Y-Y, 1960	21	0
Late Israeli Sol	8-?, ?	20	0
Laurens Koster	8W-Y, 1906	17	5,6

Cultivar	Classification and date of origin	2n	Ref.
Lawali	4W-P, 1966	28	0
Lebanon	2W-Y, 1956	28	0
Lemon Doric	2Y-W, 1955	27	0
Lemon Heart	5W-W, 1952	21	0
Leonora	3W-OOY, 1963	28	0
Leslie Hulbert	2W-Y, 1927	28	6
Liberty Bells	5Y-Y, 1950	21	0
Light Yellow	11Y-Y, ?	28	0
Lilac Charm	6W-GPP, 1973	21	0
Lilac Charm	6W-GPP, 1973	27	0
Limelight	1Y-Y, 1958	28	0
Limequilla	7W-W, 1990	28	0
Limone	1Y-Y, 1949	28	5
Limpkin	2W-WWY, 1975	28	0
L'Innocence	8W-Y, 1930	17	5
Lintie	7Y-O, 1937	21	0
Lisbreen	2W-GOO, 1940	28	6
Little Beauty	1W-Y, 1953	14	0
Little Dancer	1W-Y, 1960	14	0
Little Gem	1Y-Y, 1938	14	0
Little Witch	6Y-Y, 1921	21	0
Liverpool Festival	2Y-O, 1974	28	0
Lizard Light	2Y-O, 1947	27	0
Loch Hope	2Y-R, 1970	28	0
Loch Maree	2W-P, 1946	28	1
Lod	1W-Y, 1966	28	0
Lord Kitchener	2W-Y, 1905	28	0
Lord Nelson	1Y-Y, 1936	28	6
Lorenzo	2W-O, 1959	28	0
Lough Maree	2W-P, 1946	28	6
Love in Idleness	2W-P, 1974	28	0
Love Song	2W-OOY, 1957	28	0
Luccombe	2Y-O, 1933	28	6
Lucienne	2W-YOO, 1930	28	6
Lucifer	2W-YOO, 1890	14	3
Lucifer	2W-YOO, 1890	28	3
Luna	8W-W, 1798	32	11, 12, 13
Lunar Sea	1Y-W, 1954	28	0
Lunar Spell	2Y-WWY, 1968	29	0
Lurgain	1Y-Y, 1957	28	0
Lusky Mills	3W-GYO, 1978	29	0
Macaw	2Y-O, 1969	27	0
Madame de Graaff	1W-W, 1887	31	6
Magic Flute	2W-GWP, 1984	28	0
Magnet	1W-Y, 1931	27	5
Magnificence	1Y-Y, 1914	21	1
Maiden's Blush	2W-P, 1945	29	0
Malta	2Y-O, 1938	29	6
Malvern City	1Y-Y, 1951	28	0
Malvern Gold	2Y-Y, 1933	28	1
Mara	9W-YYO, 1950	28	1
March Madness	2Y-R, 1976	28	0
March Sunshine	6Y-Y, 1923	21	0
Margaret Mitchell	3W-YYR, 1943	28	0
Marion Cran	2Y-O, 1931	28	6
Market Merry	3Y-O, 1932	28	6
Marksman	2Y-O, 1930	28	6
Marmora	2W-W, 1923	28	6
Mars	2Y-R, 1968	28	0
Marshal Tsjoekof	2W-OOR, 1945	28	6
Martha Washington	8W-O, 1948	31	0
Mary Copeland	4W-O, 1914	21	6
Mary Kate	6W-GWP, 1983	27	0
Masterpiece	3W-OOR, 1906	28	0
Matador	8Y-O, 1958	34	0
Maximus	1Y-Y, 1576	21	2
Maximus Superbus	1Y-Y, 1851	21	0
May Muriel	2W-Y, 1957	28	0
McKenzie Tazetta	8-?, ?	30	0
Medaillon	2Y-O, 1960	28	5
Medusa	8W-O, 1907	24	0
Merlin	3W-YYR, 1956	28	0
Milan	9W-GYR, 1932	14	0
Milkmaid	2W-W, 1907	28	6

Cultivar	Classification and date of origin	2n	Ref.
Millennium	1Y-Y, 1972	28	0
Ming	3W-Y, 1930	28	6
Mini Cycla	6Y-Y, 1912	14	17
Minnow	8Y-Y, 1962	18	0
Minster Lodge	3Y-Y, 1977	27	0
Minuet	9W-R, 1923	21	0
Mistral	11W-Y, 1965	28	0
Misty Moon	3W-WOO, 1936	14	0
Mitylene	2W-Y, 1923	28	0, 6
M.J. Berkeley	1Y-Y, 1869	14	0
Mockingbird	7Y-W, 1971	21	0
Modesta	11Y-Y, 1951	30	5
Moina	3W-WWO, 1938	28	0
Montclair	2W-YYP, 1967	28	0
Monterrico	4W-O, 1962	28	0
Moongold	1Y-Y, 1929	28	0
Moonshine	5W-W, 1927	21	6
Mount Angel	3W-YYR, 1978	28	0
Mount Hood	1W-W, 1938	28	5
Mount Hood	1W-W, 1938	29	0
Mountnorris	2W-Y, 1968	28	0
Mountpleasant	2W-Y, 1968	28	0
Mr Jinks	3W-YOO, 1930	29	0
Mrs David Calvert	3W-GRR, 1968	28	0
Mrs E.C. Mudge	1W-Y, 1921	28	6
Mrs Ernst H. Krelage	1W-W, 1912	28	0, 6, 17
Mrs Langtry	3W-W, 1869	14	0, 6
Mrs R.O. Backhouse	2W-P, 1921	28	5, 6
Mrs W. Copeland	4W-W, 1930	21	6
Muirfield	1W-GWW, 1981	28	0
Mulatto	1Y-WWY, 1931	29	0
Muscadet	2W-Y, 1960	28	0, 5
Musketeer	1Y-Y, 1937	28	6
My Love	2W-WWY, 1948	28	0
Mystic	3W-GWO, 1923	14	0
My Word	2W-P, 1962	29	0
Nampa	1Y-W, 1958	28	0
Nanny Nunn	3Y-OOR, 1921	21	6
Narvik	2Y-O, 1940	28	0
Nazareth	2Y-W, 1958	28	0
Nelly	3W-Y, 1927	28	0
Nelsonii Major	2W-Y, 1877	14	12
Nemo	3W-YYO, 1953	28	0
Nero	1W-Y, 1924	28	6
New Zealand Tazetta	8-?, ?	32	6
Niantic	9W-GYO, 1946	28	0
Nimrod	2Y-Y, 1927	28	6
Ninth Lancer	2Y-O, 1959	28	0
Niphetos	2W-W, 1927	28	6
Nissa	2W-Y, 1923	28	6
Niveth	5W-W, 1931	21	0, 6
Nuage	2W-W, 1949	28	0
Nylon	12W-W, 1949	28	1
Nymphette	6W-P, 1978	27	0
Oadby	1Y-Y, 1972	28	0
Ocarino	4Y-O, 1964	29	0
Ocean Spray	7W-W, 1966	21	0
Odense	2W-YYO, 1960	28	0
Odorus	10Y-Y, ?	14	1
Ohio	2W-ORR, 1966	28	0
Old Pheasant's Eye	9W-O, ?	21	0
Olivet	2W-W, 1958	28	0
Oloron	11W-OOY, 1986	28	0
Olympia	1Y-Y, 1900	28	6, 12, 13
Oran	3W-YYO, 1944	28	6
Orange Bird	2Y-R, 1939	28	6
Orange Crinoline	2W-O, 1949	28	6
Orange Glory	6Y-O, 1920	28	6
Orange Glow	2Y-O, 1922	26	5
Orange Queen	7Y-Y, 1908	14	5, 6
Orangery	11W-POY, 1957	28	0
Oratorio	2W-Y, 1959	28	0
Orion	2W-O, 1959	28	0
Ormeau	2Y-Y, 1949	28	0

Cultivar	Classification and date of origin	2n	Ref.
Ornatus	9W-Y, 1884	14	0
Ortona	3W-GOO, 1945	28	6
Osiris	1Y-Y, 1974	28	0
Pacific	1W-W, 1930	30	6
Palaverer	1W-Y, 1959	28	0
Pale Sunlight	2Y-Y, 1982	28	0
Panache	1W-W, 1962	28	0
Paper White	8W-W, 1576	22	13
Paper White Grandiflorus	8W-W, 1887	22	0
Papillon Blanc	11W-W, 1940	29	0
Papua	4Y-Y, 1961	27	0
Parcpat	7Y-O, 1931	21	0
Parisienne	11W-O, 1961	28	5
Park Springs	3W-WWY, 1972	29	0
Passionale	2W-P, 1956	28	0
Patagonia	2Y-O, 1956	28	0
Peep-Bo	3W-?, 1944	14	6
Peeping Tom	6Y-Y, 1948	21	0
Pencrebar	4Y-Y, 1929	14	0
Penpol	7Y-Y, 1935	21	0
Penvose	2Y-Y, 1926	28	0
Pepper	2Y-O, 1933	14	0, 6
Perdita	9W-GYR, 1963	28	1
Perfect Spring	6Y-Y, ?	21	0
Petit Four	4Y-P, 1961	28	0
Pheasant's Eye	9W-O, ?	21	0
Phebe	9W-GYO, 1975	14	0
Pick Up	11Y-O, 1968	28	0
Pickwick	2W-YYO, 1964	28	0
Pink Chiffon	4W-P, 1963	27	0
Pink Fancy	2W-P, 1943	28	5
Pink Glory	2W-P, 1948	26	5
Pink Pacer	2W-P, 1973	28	0
Pink Pageant	4W-P, 1973	27	0
Pink Panther	2W-P, 1974	28	0
Pink Paradise	4W-P, 1976	28	0
Pink Rim	2W-YYP, 1939	21	5
Pink Select	2W-OOP, 1947	27 + 1B	5
Pink Smiles	2W-P, 1953	28	0
Pink Step	7W-P, 1972	28	0
Pinza	2Y-YOR, 1962	28	0
Pioneer	1W-Y, 1930	28	0
Pipe Major	2Y-O, 1965	28	0
Pipers Barn	7Y-Y, 1947	20	0
Pipit	7Y-W, 1963	21	0
Pirate King	2W-O, 1956	28	0
Pismo Beach	2W-WWP, 1978	28	0
Pixies Pool	3W-GGY, 1979	14	0
Planet	4Y-Y, 1978	28	0
Playboy	2Y-O, 1944	28	0
Poetarum	9W-O, 1913	c.14	16
Poetarum	9W-O, 1913	21	12
Poetaz	8-?, 1933	24	13
Poeticus Flore Pleno	4W-O, ?	14	0
Polar Ice	3W-W, 1936	29	0
Polglase	8W-R, 1927	24	0
Polindra	2W-Y, 1927	28	0, 6
Polly's Pearl	8W-W, 1979	32	0
Polnesk	7Y-Y, 1927	21	0
Ponderosa	1Y-Y, 1964	28	0
Pontresina	2W-Y, 1958	28	0
Poplin	12Y-Y, 1960	28	1
Portadown	1Y-Y, 1961	28	0
Porthchapel	7Y-Y, 1953	21	0
Porthilly	2Y-O, 1927	28	6
Portrush	3W-W, 1947	28	0
Postmistress	2W-R, 1950	28	0
Preamble	1W-Y, 1946	28	0
Premiere	2W-GPP, 1973	28	0
Pride of Cornwall	8W-YRR, 1933	24	0
Primrose Beauty	4Y-YOO, 1955	24	0
Prince	3W-YYR, 1934	28	6
Princeps	1W-Y, 1878	14	0, 6

Cultivar	Classification and date of origin	2n	Ref.
Princeps Maximus	1W-Y, 1884	14	13
Principal	1Y-Y, 1931	28	6
Professor Einstein	2W-R, 1946	28	0
Profile	2W-Y, 1970	28	0
Prologue	1W-Y, 1952	28	0
Queen of Bicolors	1W-Y, 1925	28	0
Queen of Bicolors	1W-Y, 1925	43	0
Queen of Narcissi	3W-YYR, 1939	14	5
Queen of Spain	10Y-Y, 1888	20	2, 12
Queen of Spain	10Y-Y, 1888	21	14
Queen of the North	3W-Y, 1908	21	0
Quick Step	7W-Y, 1955	28	0
Quiet Day	2W-GPP, 1983	28	0
Quince	6Y-Y, 1953	24	0
Quirinus	2Y-O, 1939	28	0
Raeburn	9W-GYR, 1913	14	1
Rainbow	2W-WWP, 1961	28	0
Rameses	2W-R, 1960	28	0
Rashee	1W-W, 1952	28	0
Rathkenny	1W-Y, 1938	28 + 1B	0
Red Cottage	2W-YYR, 1967	28	0
Red Defiance	2Y-O, 1932	28	6
Red Devon	2Y-O, 1943	28	0
Red Goblet	2Y-O, 1937	28	0
Redhill	2W-R, 1978	28	0
Red Rascal	2Y-R, 1950	28	0
Red Rim	9W-YYR, 1923	14	5
Rembrandt	1Y-Y, 1926	28	0
Replete	4W-P, 1975	28	0
Reprieve	3W-GWY, 1947	28	0
Reynoldstown	2Y-O, 1937	28	6
Rijnveld's Early Sensation	1Y-Y, 1943	33	0
Rima	1W-P, 1954	28	0
Riotous	4Y-Y, 1946	28	0
Rippling Waters	5W-W, 1932	21	0, 6
Rip Van Winkle	4Y-Y, 1885	14	0
Rip Van Winkle	4Y-Y, 1885	21	0
Roberta	1W-?, 1954	28	0
Roberta Watrous	7Y-GYP, 1979	21	0
Robey	1Y-Y, 1937	28	0
Rockery Beauty	1W-Y, 1925	14	6
Roger	6Y-O, 1952	37	0
Romantica	2O-O, 1960	29	5
Romeo	8Y-O, 1946	17	0
Rosaline Murphy	2Y-Y, 1958	14	1
Roselene	2W-P, 1949	28	6
Rose of Tralee	2W-P, 1937	27	0, 6
Rose Royale	2W-P, 1958	28	0
Rossini	2W-O, 1968	28	0
Rosy Trumpet	1W-P, 1928	14	0
Rowallane	1Y-Y, 1960	28	0
Roxane	1W-W, 1927	28	6
Royal Armour	1Y-Y, 1967	28	0
Royal Charm	2Y-ORR, 1964	28	0
Royal Coachman	2W-GYO, 1969	28	0
Royal Gold	1Y-Y, 1956	29	0
Royal Mail	2Y-O, 1937	28	6
Royal Orange	2W-O, 1953	28	0
Royal Regiment	2W-O, 1961	28	0
Royal Revel	2Y-O, 1967	28	0
Royal Wedding	2W-GWY, 1982	29	0
Rushlight	2Y-O, 1957	28	0
Rustom Pasha	2Y-O, 1930	28	0, 6, 17
Sacajawea	2Y-YYO, 1954	28	0
Sacramento	3W-W, 1949	28	0
Safrano	?, ?	28	0
Saint Agnes	8W-O, 1926	17	0
Saint Ives	2Y-Y, 1927	28	6
Saint Keverne	2Y-Y, 1934	28	1
Saint Keyne	8W-O, 1927	24	0
Saint Olaf	3W-W, 1913	28	0
Saint Patrick's Day	2Y-Y, 1964	28	0
Salerno	2W-O, 1944	27	6

Cultivar	Classification and date of origin	2n	Ref.
Salmon Trout	2W-P, 1948	27	0
Salome	2W-PPY, 1958	28	0
Samba	5Y-O, 1952	21	0
Sanda	1W-W, 1954	45+1B	0
Sandringham	3W-Y, 1933	21	6
Sarchedon	9W-GYR, 1913	14	6, 17
Sateen	2W-YYP, 1968	27	0
Scapa	1W-W, 1933	28	6
Scarlet Gem	8Y-O, 1910	17	0, 6
Scarlet Leader	2Y-O, 1921	28	5
Scarlet Perfection	2Y-O, 1921	28	1
Scarlett O'Hara	2Y-R, 1950	28	0
Scilly White	8W-Y, 1885	32	5
Scorcher	2Y-O, 1952	28	0
Scotch Rose	2W-P, 1942	28	6
Sea Green	9W-GWR, 1930	14	0
Sealing Wax	2Y-R, 1957	28	0
Sea Shell	2W-Y, 1908	28	6
Sea Urchin	2W-Y, 1935	28	0
Sebastopol	2W-Y, 1945	29	0
Sedate	2W-P, 1967	28	0
Sempre Avanti	2W-O, 1938	28	5
Sentinel	2W-P, 1972	28	0
Sextant	6W-GWW, 1981	28	0
Shah	7Y-Y, 1949	28	0
Shandon	2W-GOO, 1979	28	0
Shantallow	3W-GGY, 1956	14	0
Shot Silk	5W-W, 1933	21	0
Show Countess	2W-W, 1946	28	0
Shriner	2W-Y, 1972	28	0
Shy Face	2W-GWP, 1965	29	0
Sicily White	8W-Y, ?	21	11
Sidney Torch	2Y-YOO, 1951	28	0
Silent Morn	3W-YYO, 1964	28	0
Silent Valley	1W-W, 1964	28	0
Silver Bells	5W-W, 1962	22	0
Silver Chimes	8W-W, 1914	28+1B	0, 17
Silver Circle	3W-W, 1941	28	6
Silver Convention	1W-W, 1978	28	0
Silver Leopard	3W-WWY, 1972	28	0
Silver Moon	2W-W, 1959	28	0
Silver Sand	2W-GWW, 1963	28	0
Silver Spell	3W-GWW, 1975	14	0
Silver Standard	2W-W, 1944	28	0
Silver Surf	2W-W, 1978	28	0
Silvretta	1Y-Y, 1949	29	5
Sioux	2Y-O, 1966	28	0
Sir Samuel	2W-P, 1973	28	0
Sir Watkin	2Y-Y, 1884	21	0, 6, 12, 17
Sir Winston Churchill	4W-O, 1966	17	0
Skylon	7Y-YRR, 1951	22	0
Sligo	2Y-Y, 1943	28	6
Sneeuwprinses	3W-YYO, 1944	27	1
Snoopie	6W-GPP, 1979	28	0
Snow Bunting	7W-Y, 1935	21	0
Snowcrest	3W-GWW, 1972	28	0
Snowdean	2W-W, 1950	28	0
Snow Gem	3W-O, 1957	28	0
Snow Gleam	1W-GWW, 1977	28	0
Snow Princess	2W-W, 1949	27	5
Snow Queen	2W-W, 1931	28	6
Snowshill	2W-W, 1949	28	0
Solario	2W-Y, 1927	28	6
Soleil d'Or	8Y-O, 1807	20	17
Soleil d'Or	8Y-O, 1807	30	5, 6, 13, 17
Solferino	1Y-Y, 1930	29	6
Sonata	9W-GYR, 1910	14	0
Sonia Sloan	2W-OOY, 1971	29	0
Sorbet	11W-YYO, 1966	28	0
Southern Gem	2W-W, 1913	21	0
Spangles	8Y-O, ?	34	0
Sparkling Eye	8W-GOO, 1931	17	0
Spellbinder	1Y-W, 1944	28	5
Spellbinder	1Y-W, 1944	29	0

Cultivar	Classification and date of origin	2n	Ref.
Spitzbergen	1W-Y, 1943	28	0
Spring Glory	1W-Y, 1914	29	5
Squire	1Y-Y, 1969	28	0
Stadium	2W-Y, 1948	28	6
Stainless	2W-W, 1960	28	0
Standard Value	1Y-Y, 1949	28	0
Standfast	1Y-Y, 1982	29 + 1B	0
Stilton	9W-YYR, 1909	28	1
Stocken	3W-?, 1950	21	0
Straight	1W-Y, 1938	28	0
Strines	2Y-Y, 1965	28	0
Stromboli	2W-O, 1959	28	0
Sudan	2Y-R, 1938	28	6
Sugarbush	7W-YYW, 1954	21	0
Suisen	8-?, ?	30	11
Sulphur Crown	4Y-Y, 1821	14	5
Sulphur Phoenix	4Y-Y, 1820	14	0
Sulphur Prince	1Y-Y, 1931	28	6
Sunburst	4Y-Y, 1955	28	0
Sundial	7Y-O, 1955	14	0
Sun Fire	3Y-R, 1962	28	0
Sunproof Orange	2Y-O, 1935	28	6
Sunrise	3W-YYO, 1901	14	0
Sunstar	3W-R, 1921	28	6
Suzy	7Y-O, 1954	21	0
Swansdown	4W-W, 1939	26	0
Sweet Memory	2W-P, 1963	27	0
Sweetness	7Y-Y, 1939	21	0
Sweet Pepper	7Y-O, 1939	21	0
Sydling	5W-GWW, 1977	21	0
Taffeta	12W-W, 1952	28	1
Tahiti	4Y-R, 1956	28	0
Takoradi	4W-W, 1963	28	0
Talland	2Y-?, 1965	28	0
Tamar Fire	4Y-R, 1976	28	0
Tarlatan	12W-W, 1952	28	1
Tawny Lad	2Y-O, 1976	28	0
Tebourba	3W-R, 1944	28	6
Tecoma	2Y-O, 1932	28	0
Telamonius Plenus	4Y-Y, ?	14	2, 6, 10
Telamonius Plenus	4Y-Y, ?	27	5
Telamonius Plenus	4Y-Y, ?	28	10
Tête-a-Tête	6Y-Y, 1949	24 + 1B	0
Texas	4Y-O, 1921	21	5
Thalia	5W-W, 1916	21	5
Thoughtful	5Y-Y, 1951	21	0
Tibet	2W-W, 1942	28	0
Tinker	2Y-O, 1937	28	0
Titch	1Y-Y, 1946	29	0
Tittle Tattle	7Y-O, 1953	21	0
Toorak Gold	2Y-Y, 1945	28	0
Topolino	1Y-Y, 1965	14	0
Toreador	3W-R, 1961	28	0
Tranquil Morn	3W-W, 1962	28	0
Tredore	3Y-O, 1927	28	6
Trena	6W-Y, 1971	21	0
Trenithon	1Y-Y, 1950	28	0
Tresamble	5W-W, 1930	21	0, 5
Trevithian	7Y-Y, 1927	21	0, 5, 6, 17
Trewithen	1Y-Y, 1949	28	0
Tricollet	11W-O, 1969	29	0
Trifine	2Y-O, 1970	28	0
Tristram	2Y-Y, 1976	29	0
Trostan	1W-Y, 1938	28	6
Trousseau	1W-Y, 1934	28	6
Trumpeter	1Y-Y, 1975	28	0
Trumpet Major	1Y-Y, ?	14	14
Tuesday's Child	5W-Y, 1964	21	0
Tullyroe	2W-R, 1960	28	0
Tunis	2W-WWY, 1927	28	6
Turin	3W-GOO, 1927	28	6
Tutankhamun	2W-GWW, 1972	28	0
Twink	4W-O, 1927	21	5
Ucluluet Gem	5-?, 1949	21	6

Cultivar	Classification and date of origin	2n	Ref.
Ultimus	2Y-O, 1947	28+4B	0
Unique	4W-Y, 1961	28	0
Unsurpassable	1Y-Y, 1923	27+1B	0, 5
Urchin	6W-P, 1981	28	0
Valiant Spark	2Y-O, 1959	28	0
Valinore	2W-P, 1978	28	0
Van Sion	4Y-Y, 1620	14	0
Van Waveren's Giant	1Y-Y, 1900	28	2, 6, 17
Van Wereld's Favourite	1W-Y, 1936	28	5
Verdin	7Y-W, 1965	21	0
Verger	3W-R, 1930	28	0
Verona	3W-W, 1958	28	0
Victoria	1W-Y, 1897	14	12, 13
Victoria	1W-Y, 1897	22	0, 2, 6, 14
Victoria	1W-Y, 1897	28	5
Victorious	2W-Y, 1954	28	0
Viennese Rose	4W-P, 1976	29	0
Vigil	1W-W, 1947	28	0
Vigilante	1W-W, 1977	28	0
Viking	1Y-Y, 1956	28	0
Violetta	2W-GPP, 1975	28	0
Volturno	2W-YYO, 1945	28	6
Vulcan	2Y-O, 1956	28	0
Wahkeena	2W-Y, 1955	28	0
Warlock	2W-YYO, 1927	28	6, 17
Waterperry	7W-Y, 1953	21	0
Welcome Inn	?, 1979	28	0
Wetherby	3W-YYR, 1983	28	0
White Apricot	11W-P, ?	28	0
White Chief	1W-W, 1975	28	0
White Diamond	1W-W, 1982	28	0
White Emperor	1W-W, 1913	28	0
White Empress	1W-W, 1970	28	0
White Fairy	9W-O, 1927	14	0
White Gold	2W-Y, 1973	28	0
Whitehead	2W-W, 1953	28	0
White Knight	1W-W, 1907	14	1
White Lady	3W-Y, 1898	21	0
Whiteley Gem	2Y-O, 1928	28	6, 17
White Lion	4W-WYY, 1949	28	0
White Majesty	1W-W, 1970	28	0
White Marvel	4W-W, 1950	21	0
White Nile	2W-W, 1922	29	0
White Orange	11W-O, ?	28	0
White Owl	5W-W, 1950	35	0
White Pearl	8W-Y, 1861	22	11
White Pink	11W-P, ?	28	0
White Sail	4W-W, 1946	14	0
White Sentinel	2W-Y, 1926	28	6
White's Hybrid	8-?, 1930	24	6
White Spire	2W-W, 1958	28	0
White Star	1W-W, 1970	28	0
White Triumphator	1W-W, 1938	28	6
Whitewell	2W-Y, 1910	21	0, 9
White Yellopink	11W-YPP, ?	28	0
Wild Rose	2W-P, 1939	28	6
William Farmer	2Y-Y, 1978	28	0
William the Silent	1Y-Y, 1933	28	5
Will Scarlet	2W-O, 1898	14	0
Winchester	2Y-YOO, 1954	28	0
Windblown	4W-Y, 1946	29	0
Wingadee	2W-OOY, 1967	28	0
Winifred Van Graven	3W-YYR, 1954	28	0
Woodcock	6Y-Y, 1949	29	0
Woodgreen	2W-Y, 1956	28	0
Woodland Prince	3W-Y, 1964	28	0
Woodland Star	3W-R, 1962	28	0
Worlington	1Y-Y, 1930	28	6
W.P. Milner	1W-W, 1869	14	6
Wrestler	1Y-Y, 1930	28	6
Wybalena	4W-W, 1968	27	0
Yankee Clipper	2Y-YYO, 1939	28	0
Yellow Beauty	1Y-Y, 1929	28	6
Yellow Butterfly	8Y-O, 1981	34	0

Cultivar	Classification and date of origin	2n	Ref.
Yellow Cheerfulness	4Y-Y, 1937	24	0
Yellow Dazzler	1Y-Y, 1958	28	0
Yellow Poppy	2Y-YYO, 1914	21	6
Yellow Prince	8Y-O, 1872	30	13
Yellow Prize	7Y-Y, 1931	28	6,17
Yornup	2Y-Y, 1939	27	0
Ypsilante	9W-YYO, 1927	14	6
Zeeland	2W-Y, 1930	28	6