—4— Narcissus Species and Wild Hybrids

The following covers the wild species and wild hybrids. They are grouped in Div. 10 of the *Classified List and International Register of Daffodil Names* (1965).

Interest in growing *Narcissus* spans several hundred years and continues unabated to the present day. Despite the wide popularity and interest in this plant in gardens, no modern botanical treatment of the entire genus exists. Much more collecting to bring together new germ plasm for breeding purposes and to learn more about the plants in the wild is needed. With this in mind, I visited areas in Spain, Portugal, France, and Italy in 1957 in part to collect wild *Narcissus*. One of the interesting results of this trip was, for example, that *N. pseudo-narcissus* subsp. *tortuosus* was found in the wild for the first time.

In 1888 J. G. Baker published the last account to cover all of the species. In the present century, Pugsley published two fine pieces, one on *poeticus* (1915) and another on the *Ajax* subgenus (1933). Since the early 1930's Professor Abilio Fernandes of the University of Coimbra, Portugal has worked primarily on the cytology of *Narcissus* trying to interpret the relationships of the species. This fundamental work has resulted in the classification used by the Royal Horticultural Society of Great Britain and the system used throughout this Handbook.

The genus *Narcissus* of the family *Amaryllidaceae* comprises 25 species in the present listing. Some authors list 30 or more species. These plants are natives of the Mediterranean region, some extending into central Europe. *N. tazetta* reportedly extends to China and Japan. Assertions of the occurrence of *tazetta* in the Orient and the nebulous story of the origin of the Chinese Sacred Lilies need more concentrated study before acceptance.

Narcissus is of particular interest to gardeners because most of the species may be hybridized with relative ease. Allowing for polyploidy, the resulting hybrids will be at least partially fertile. It is possible to obtain an almost endless combination of characters. This possibility makes daffodil breeding a highly rewarding hobby for amateurs having no special knowledge of genetics or cytology. At one time it was believed that interfertility of the order found in *Narcissus* could not characterize genuinely distinct species. This, of course, is not the case at all. Indeed, *Narcissus* is a well-defined genus by any criterion and distinctness of species has been maintained despite the ability of most species to cross with any other member of the group.*

NARCISSUS LINNAEUS (1753)

Subgenus 1—Eunarcissus

Section 1—Jonquilleae

1. *Narcissus rupicola* Duf. (1830)
   (*rupicola,* inhabiting rocky places)
   Low-growing with smooth, slightly channelled grasslike leaves, 5 to 6 in. long; the

*A discussion of the cultivation by the gardener of the species and wild hybrids more commonly available to him will be found in Chapter 3.

flowering scapes are usually slightly longer. Differs from *N. juncifolius* chiefly in the solitary, bright yellow, fragrant, nearly sessile flowers, about 1 in. across, opening flat. In *juncifolius* the flowers vary from one to four per scape and the pedicels are ½ to 1½ in. long; chromosome number 2n = 14.

Distribution: On rocky declivities, particularly on decomposed granite, in New Castile and Terragona, Spain, and in central and northern Portugal. Wild bulbs collected in Portugal by me have multiplied profusely, although shy to flower. Currently available from bulb specialists.

1a. var. *marvieri* Jahand. & Maire (1925)
(*marvieri,* in honor of Marvier)

A larger *rupicola* having deeper yellow flowers than *rupicola*. Also thought of as a yellow-flowered *N. watieri,* which (according to Dr. Fernandes, the Portuguese specialist on *Narcissus*) has itself evolved by chromosomatic mutation from *N. rupicola* var. *marvieri.*

Distribution: Clearings in forests of Evergreen Oak, 6000-7000 ft. el., Grand Atlas Mts., Morocco.

Grown in Great Britain occasionally since being introduced in 1936, but scarce. Said to be as hardy as *N. rupicola* itself. Has been offered by Alec Gray*.

2. *Narcissus watieri* Maire (1921)
(*watieri,* in honor of Watier).

The only white-flowered species of the Jonquilleae section; leaves about 4 in. long, channelled, grayish; scape as long as the leaves, round, erect; flowers solitary, about 1 in. in diameter with a crystalline texture; tube about 1 in. long, greenish white; perianth segments pure white, opening flat; corona very shallow, nearly flat; chromosome number 2n = 14.

Distribution: Woodlands and pastures at 6000-7000 ft. el., Grand Atlas Mts. (Mt. Yagour near Mesfiona), Morocco.

Now more common in cultivation, which, however, is not easy except in rock gardens. First introduced into British gardens about 1931. Currently offered by specialist bulb growers. *N. watieri* is thought to have evolved by chromosomatic mutation from *N. rupicola* var. *marvieri.*

3. *Narcissus atlanticus* F. C. Stern (1950)
(*atlanticus,* of the Atlantic)

Leaves 3 to 6, up to 13¼ in. long and ⅜ in. wide, gray green, channelled; scape about 3 in. long, round; flowers fragrant, 1 per scape, about 1 in. in diameter, creamy white; chromosome number 2n = 14.

Distribution: "Growing under shade of shrubs and trees in soft moist loam." (E. K. Balls) 6500 ft. el., Amiziz in Grand Atlas Mts., Morocco.

First flowered in cultivation in garden of Sir F. C. Stern, Highdown, Goring-by-Sea, Sussex, England in 1948. Has been offered by Alec Gray in England.

This recently described species, still barely known, deserves more study in view of its alleged relationships with *N. watieri* and *N. rupicola. N. atlanticus* differs from *N. watieri* by the cup-shaped corona, the taller stature of the plant, larger perianth, and the fragrant flowers. It differs from *N. rupicola* in that it has creamy white flowers, wider leaves, and a larger bulb.

4. *Narcissus scaberulus* Henriq. (1888)
(*scaberulus,* a little rough, scurvy, scabrous)

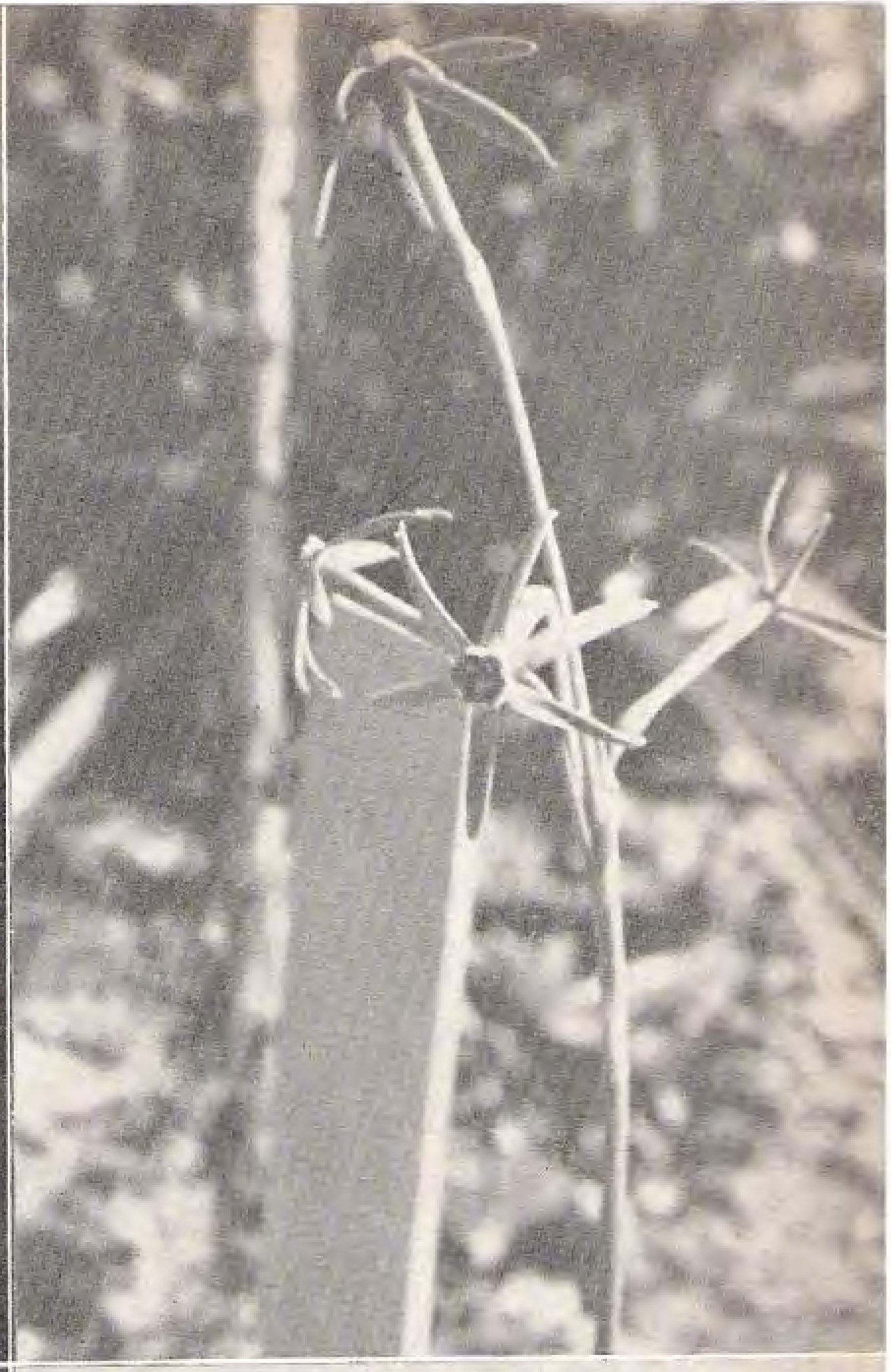
Leaves usually in pairs, 5 to 6 in. long, lax and often prostrate, with slightly roughened margins (scabridulous); scape as long as the leaves, erect, slightly roughened;

*Of Camborne, England. Has recently sold nursery to Broadleigh Gardens. See Appendix C.

PLATE 12 IVAN N. ANDERSON

VARIOUS SPECIES

Italicus (upper left); *viridiflorus* (upper right); *serotinus* (lower left); *triandrus* var. *albus* (lower right)



flowers 1 to 2, bicolored, about ½ in. across, the tube slightly curved; perianth segments opening flat, deep yellow; corona proportionately larger than the segments and nearly orange in color; chromosome number 2n = 14.

Distribution: Restricted to acid soils in well-drained open sites, or in pine (*Pinus pinaster*) woodland in a small area of central Portugal.

Cultivated shortly after 1888, only recently has this plant become well known in cultivation. Alec Gray offered it for several years. Garden hybrids have been produced.

5. *Narcissus calcicola* Mend. (1930)
(*calcicola,* inhabiting limestone)

Related to *N. juncifolius* and *N. scaberulus*; plant 5 to 6 in. tall when in flower, twice as tall when in fruit; leaves green, erect with smooth margins as contrasted with the roughened margins and lax gray leaves of *N. scaberulus*; flowers uniformly bright yellow; chromosome number 2n = 14.

Cultivated since 1930 and has been offered by Alec Gray.

Distribution: In pockets of limestone filled with humus, Serra de Sicó, 1200 ft. el., near Ramalhaes, west of Pombal, and on the peninsula directly south of Lisbon, Portugal.

5a. var. *grandiflorus* Fernd. (1953)
(*grandiflorus,* large flowered)

Flowers larger with longer and narrower perianth segments which do not overlap.
Distribution: Occurring with the species. Serra de Sicó, Portugal.

6. *Narcissus juncifolius* Lag. (1816)
(*juncifolius,* leaves resembling *Juncus,* the rush)

Leaves 3 or 4, round or nearly so, very slender and grasslike, erect; scape 3 to 8 in. long, round; flowers uniformly bright yellow, fragrant, 2 to 6, on pedicels ½ to 1½ in. long; perianth tube about ½ in. long, the segments spreading, about ½ in. long opening flat; corona perhaps a little darker shade of yellow, about ¼ in. long; chromosome number 2n = 14.

Distribution: Meadows in parts of the Pyrenees, near Gèdres; southern France in stony soil on limestone hills near St. Rémy; mountains of Andalusia to Catalonia, Spain. Some doubt exists whether the plant is wild in Corsica and Balearic Islands.

Cultivated since 1576. The natural hybrids *N.* × *dubius* and *N.* × *magnenii* (*N. juncifolius* × *N. tazetta*) are known. See later in this chapter under the heading "Wild Species Hybrids of Narcissus."

7. *Narcissus gaditanus* Boiss. & Reut. (1842)
(*gaditanus,* of Gades, a town in Roman Spain, now Cadiz)

Leaves 5-8 in. long, twisted; flowers 4 to 5, up to ¾ in. across, bright yellow, fragrant; perianth segments not over 1/6 in. long; corona cup shaped, nearly as long as the perianth segments; chromosome number 2n = 14.

Distribution: Brushy slopes in areas rainless in summer; in the Algarve, Portugal, and southern Andalusia near Jerez, and between Cichlana and Medina-Sidonia, Spain.

Closely related to *N. juncifolius,* but differing in that it has longer, twisted leaves, more flowers per scape, curved flower tube, and pedicels of unequal length.

8. *Narcissus minutiflorus* Willk. (1860)
(*minutiflorus* refers to the small size of the flowers)

Perhaps the smallest-flowered species and closely related to *N. gaditanus.* Leaves round, rushlike, 5-8 in. long; flowers 4 to 6, uniformly bright yellow, the tube about ⅓ in. long, the pedicels ½ to ¾ in. long; perianth segments very short, about 1/6 in. long, spreading; chromosome number 2n = 14.

Distribution: Brushy slopes in areas rainless in summer; Spain and Portugal (where it occurs with *N. gaditanus*).

Differs from *N. gaditanus*: smaller in every respect and the style is much shorter than the tube. In *N. gaditanus* the style extends beyond the throat.

9. *Narcissus jonquilla* L. (1753)

Leaves 12-18 in. long, 2 to 4 per bulb, dark green, rushlike, erect, strongly channelled on the upper surface, nearly round; scapes nearly as long as the leaves; flowers 2 to 6, about 1¼ to 1¾ in. wide, bright yellow, strongly fragrant; tube round, about 1 in. long, greenish; perianth segments obovate, opening flat; corona about as long as the segments; chromosome number 2n = 14.

Distribution: River banks in stony-sandy soil where the bulbs often are buried more than one foot by river sand. Also reported to grow in mountain meadows, Portugal and Spain, and to be naturalized in suitable places in southern Europe. Collected by me in 1957 in Portugal along the Douro River at Barca d'Alva while in flower March 25; also collected along the banks of the Rio Guardiana near Serpa on April 10. Cultivated since about 1565.

The best known of the Jonquilleae section; variable with several wild varieties known in cultivation. Widely grown in the southern United States. Queen Anne's Jonquil is the double-flowered form.

9a. var. *henriquesii* Henriq. ex Samp. (1901)

(*henriquesii,* in honor of Henriques, a 19th century Portuguese botanist)

Leaves 1-2 mm. wide; perianth uniformly orange yellow; corona about ⅓ or more as long as the tepals; tepals about 1 in. long; chromosome number 2n = 14.

Distribution: Castello de Vide and Tarrão, along the Tagus River, Portugal.

Distinguished from the typical form of the species by the relatively long corona. This plant was first noticed by Prof. J. A. Henriques who sent material to the Daffodil Committee, Royal Horticultural Society, London, for the April 27th meeting of 1886. The name *N. henriquesii* Hort. was suggested in the Gardeners' Chronicle article of May 8, 1886, but this does not constitute a valid description. Sampaio later described the plant in 1901. The plant apparently is still cultivated in Europe, and two bulbs of it were received in 1965 by B. Y. Morrison from a friend in Mentone, France.

9b. var. *minor* (Haw.) Bak. (syn. *N. minor* Haw. (1831); not to be confused with *N. minor* of Linnaeus).

(*minor,* smaller or lesser)

A shorter form, with very slender leaves; flowers about ½ in. in diameter.

Distribution: Occurs with the species. Bulbs of this variety have been offered by Alec Gray, but the authenticity of material grown under this name is questionable.

9c. var. *stellaris* Baker (1888)

(*stellaris* alludes to the starlike shape of the flowers)

Perianth segments narrower than in the species and reflexed; corona distinctly 6-lobed.

Distribution: Occurs with the species.

10. *Narcissus fernandesii* Pedro (1948)

(*fernandesii,* named for Professor Abilio Fernandes, of Portugal, well-known authority on *Narcissus*)

Allied to *N. juncifolius, N. gaditanus,* and *N. jonquilloides.* Leaves 2 to 3, erect or recurved, longer than the scape, grasslike, semiround with faint veins; scape round, about 4 in. long; flowers yellow, the pedicels unequal, the longest exceeding the flower tube; perianth segments about 3/8 in. long, obovate, ultimately a little reflexed, and overlapping; corona wavy margined, cup shaped, about half as long as the lobes.

Distribution: Grassy margins of ditches in sandy soil; Portugal, banks of the Tagus River near Zamora Correia. February—March. Has been introduced into cultivation.

Differs from *N. juncifolius,* having obsoletely veined leaves longer than the scape, a scape hollow above, a long-acuminate spathe, a lightly incurved perianth tube, and uniform color of the corona. It differs from *N. gaditanus,* having somewhat broader leaves, a less incurved perianth tube, and a shorter corona; from *N. jonquilla,* having a shorter and lightly incurved tube, distinctly overlapping lobes, and a longer corona; and from *N. jonquilloides,* having pedicels which before flowering are shorter than the spathe, and the lightly incurved perianth tube, the longer lobes, and the somewhat shorter corona.

PLATE 13 B. Y. MORRISON

JONQUIL SPECIES
1. *fernandesii* 2. *calcicola* 3. *scaberulus* 4. *rupicola*

PLATE 14 B. Y. MORRISON

BULBOCODIUM AND RELATED SPECIES

1. *bulbocodium* subsp. *albidus* var. *zaianicus f. lutescens* 2. *b.* subsp. *romieuxii* 3. *cantabricus* 4. *b.* subsp. *tananicus* 5. *b.* subsp. *praecox* 6. *b.* PI 239061 7. *b.* subsp. *obesus*

11. *Narcissus jonquilloides* Willk. (1860)
(*jonquilloides,* jonquilla-like)

Differs from *jonquilla,* having a smaller bulb, narrower leaves shorter than the scape, pedicels longer than the spathe, and smaller flowers; perianth tube ½ in. long; flowers about ¾ in. in diameter; corona more than half as long as the perianth segments; chromosome number 2n = 21.

Distribution: Marshy ground in Portugal, between Monchique and Lagos in the Algarve also in Spain along river courses between Seville and Cadiz, Spain. January—February.

The relatively long corona (nearly as long as the perianth segments) is an important distinguishing aspect of this plant.

Sometimes considered a variety of *N. jonquilla.* Professor Fernandes considered *jonquilloides* to be of hybrid origin between *N. jonquilla,* a naturally occurring tetraploid species, and *N. gaditanus,* a diploid. However, *jonquilloides* does not appear to be in any way a simple triploid derived from this parentage. Has been offered by Alec Gray.

12. *Narcissus viridiflorus* Schousboë (1800) Rush Daffodil
(*viridiflorus,* from *viridis* for the green-colored flowers)

Leaves 1 to several, nearly round, rushlike, up to 24 in. long, produced after the flowers; scapes 12 to 18 in. long, before the leaves, nearly round; flowers 2 to 4, dull green, fragrant; tube round, about ½ in. long, green; perianth segments strongly reflexed, recurved at the tip, resembling a crochet hook; corona insignificant, green, 6-lobed; chromosome number 2n = 28.

Distribution: Open sandy places and open slopes, Spain, in the vicinity of Gibraltar; Morocco, along the coast. November.

Distinct species from all others in the Jonquilleae section flowering in autumn with green flowers. Known in England since the days of Parkinson and figured in his *Paradisi in Sole* (1629), and probably cultivated since that time. Offered recently by Alec Gray.

Hybrids between *N. serotinus* and *N. viridiflorus* were found near Gibraltar in 1883 by G. Maw, and in 1886 more abundantly six miles from Tangier where the two species intermix.

Section 11—Ganymedes

13. *Narcissus triandrus* L. (1753) Angel's Tears
(*triandrus,* with three stamens)

Name coined by Linnaeus whose faulty observations overlooked the three stamens of the lower row, which sometimes remain hidden in the lower part of the tube.

Leaves 6-8 in. long, very slender, semiround, 2 to 4, channelled; scapes 6 to 12 in. long, 1-4 or 5-flowered flowers usually cernuous (drooping), uniformly creamy white the tube round, ½ to ¾ in. long; perianth segments reflexed; corona cup-shaped, truncate at the throat; chromosome number 2n = 14.

Distribution: Open grassy slopes and pine woods, on granite boulders, often in acid soils. Flowers in March and April. Occurs widely over the Iberian Peninsula, except in the southwestern part of Portugal and southwestern Spain. Common to granitic hills of northern Portugal near Coimbra and Oporto. A relic station for the plant (var. *loiseleurii*) exists on one of the islands of Glénan off the south coast of Brittany. An extremely variable species, with variants distinguished chiefly by the color and size of the flowers. Used as a parent of hybrids in cultivation mostly through the var. *loiseleurii.* Cultivated since 1579.

The following botanical varieties are recognized:

13a. var. *albus* (Haw) Bak. (syn. *Ganymedes albus* Haw. (1831))
(*albus,* white for the flowers)

Should be regarded as the typical form of the plant among the wild variants. Probably form described by Linnaeus with uniformly creamy-white flowers.

13b. var. *cernuus* (Salisb.) Bak. (syn. *Ganymedes cernuus* Salisb. (1812))
(*cernuus,* pendant, hanging)

Flowers bicolor, the corona deeper yellow than the perianth segments; perianth tube relatively long, up to about ¾ in. long; corona up to ¾ in. wide.

PLATE 15 DONALD F. MERRETT

SPECIES *asturiensis*

Distribution: Widespread in Portugal and Spain. Found by the author on moss-covered granite boulders along the main road west of León in northwestern Spain and near Madrid; introduced to English gardens in 1777 from Oporto, Portugal.

13c. var. *concolor* (Haw.) Bak. Yellow-flowered Angel's Tears. (syn. *Ganymedes concolor* Haw. (1831))
(*concolor* for the uniformly lemon-yellow color of flowers)

Plant short, 3 to 4 in. tall (shorter than in var. *albus*); flowers uniformly lemon yellow; perianth tube relatively short, about ½ in. long; corona about ¼ in. wide; styles of three lengths (trimorphic). Thought of by Prof. Fernandes as probably the ancestral form from which all other present day forms of *triandrus* have arisen.
Distribution: Widespread in Portugal and found by me on steep rocky slopes above the Mondego River near Coimbra; said to occur in the south and center of the Iberian Peninsula. Apparently known to Parkinson (1629) and probably cultivated since that period.

13d. var. *loiseleurii* Rouy (1908)
(*loiseleurii*, to honor Loiseleur, a Frenchman)

Flowers the largest of the wild varieties, half again to twice the size of var. *albus*, white or uniformly pale sulphur yellow; perianth tube up to ¾ in. long; corona about ¾ in. wide and nearly 1 in. long, nearly as long as the perianth segments; styles of two lengths (dimorphic).
Distribution: Found only in the Isles of Glénan, off the southwestern coast of Brittany, where it grows on short grassy patches constantly bathed by sea mist, and where frost is rare.

Less hardy than all other forms of *triandrus*. Introduced early in 19th century. Widely used in garden hybrids.

13e. var. *pulchellus* (Salisb.) Bak. (syn. *Ganymedes pulchellus* Salisb. (1812))
(*pulchellus*, derived from *pulcher* meaning beautiful, handsome)

The only form of the species with a creamy-white cup and yellow perianth segments.
Distribution: The literature distinctly lacks any reference to truly wild plants of this variety. Known in cultivation since Parkinson's time (1629).

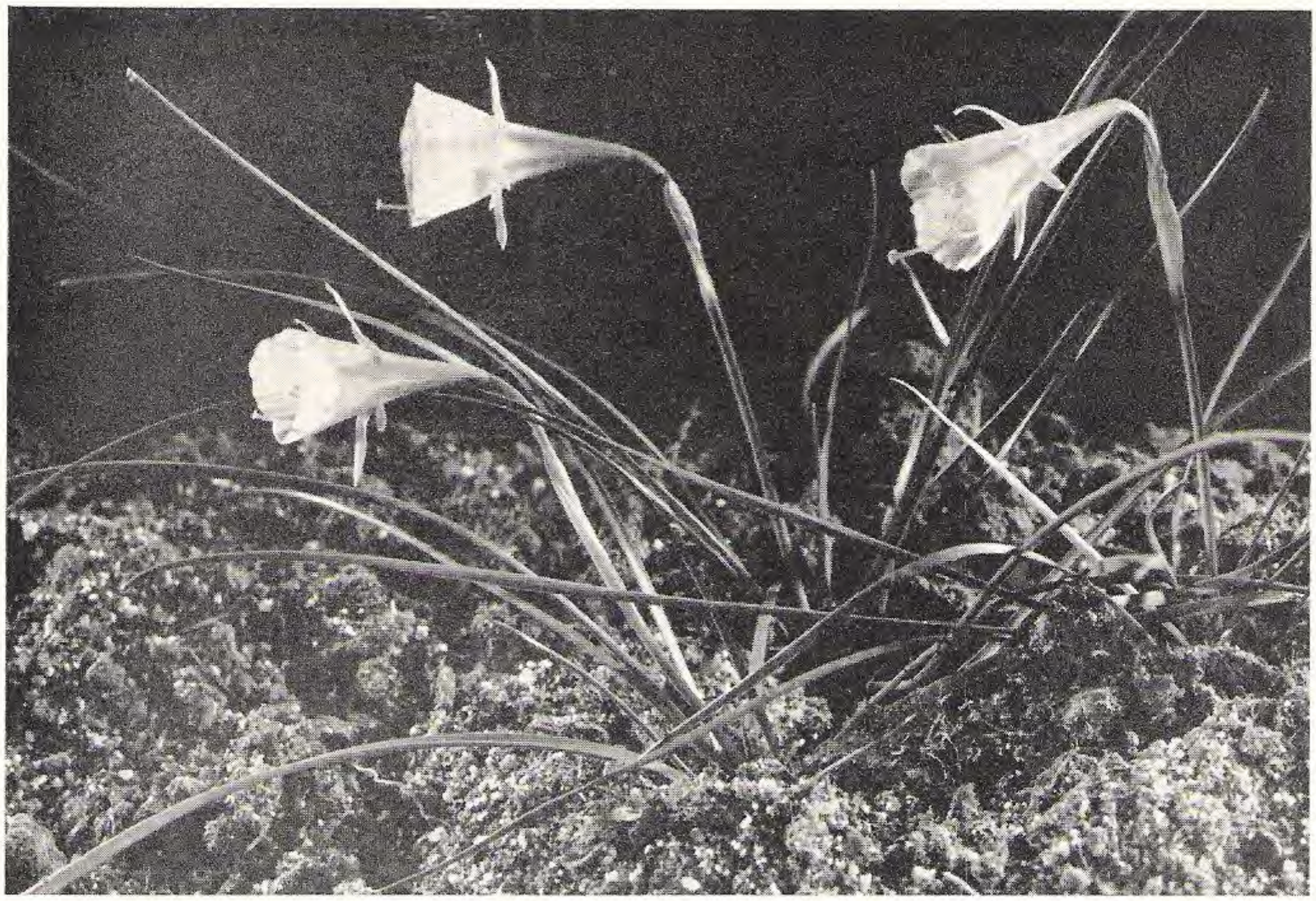


PLATE 16 LONGWOOD GARDENS, G. HAMPFLER

SPECIES *bulbocodium*
from a bog near Coimbra, Portugal; flowers deep orange yellow

Section III—Serotini

14. *Narcissus serotinus* L. (1753)
(*serotinus* from *sero,* late in reference to flowering of this plant in autumn)

Leaves 6 to 9 in. long, grasslike, deeply channelled, usually only one or absent, often leaves are not present on flowering bulbs; scapes resembling the leaves, about the same length; flowers solitary (rarely 2 or 3), about ¾ in. wide, fragrant; tube nearly round, greenish; perianth segments white; corona nearly rudimentary, lobed, yellow; chromosome number $2n = 30$.

Distribution: Open rocky slopes in areas with rainless summers near the sea around the perimeter of the Mediterranean basin from Portugal and North Africa to Italy, Greece, Lebanon, and Israel. *N. serotinus* and *N. tazetta* are the most widely distributed species of the genus. September—October.

Although known to Clusius in 1576, *N. serotinus* has never attained wide attention in cultivation owing to the difficulty of cultivating in northern gardens.

Section IV—Hermione

15. *Narcissus elegans* (Haw.) Spach (syn. *Hermione elegans* Haw. (1831))
(*elegans,* choice, fine, elegant)

Leaves 1 to 4, semiround, 4 to 6 in. long; flowers 2 to 6, pure white; pedicels erect, the tube greenish white, ½ to ⅝ in. long; perianth segments spreading, acute, ½ in. long; corona saucer shaped; chromosome number $2n = 20$.

Distribution: Morocco along the coast to Libya and Italy, Corsica, Sardinia, and Sicily. September—October.

N. serotinus and *N. elegans* are closely related and may be distinguished as follows:

Elegans	*Serotinus*
1. Leaves 2 or more, flat, before the flowers.	1. Leaf 1, round, with the flowers more often absent.
2. Corona generally conical and entire.	2. Corona 3-6 lobed.

In 1576 Clusius illustrated *N. elegans* in his *History of Spanish Plants,* and in the *Theatrum Florae* (1638). Difficult to cultivate in moist climates, because it requires a long rest period over a rainless summer and a mild moist winter, typical of the Mediterranean.

16. *Narcissus tazetta* L. (1753) Polyanthus Narcissus*

Leaves 4-6, flattish, bluntly keeled on the back, 1/2 to 5/8 in. wide; scapes 12-18 in. long, compressed; flowers 4 to 8, strongly fragrant; tube round, 3/4 in. long, greenish; perianth segments white, obovate; corona 1 to 1 1/4 in. across, cup shaped, 1/6 in. long, with an entire margin, lemon yellow; chromosome number $2n = 22$.
Distribution: Along streams and moist meadows near coast, Iberian Peninsula, Canary Islands, North Africa to Libya, southern France, Italy, Corsica, Sardinia, Balearic Islands, Sicily, Greece; coastal areas of Syria, Lebanon, and Israel; and island of Cyprus. China and Japan also are included in the distribution of this plant, according to some authors.

Next to the trumpet daffodil (*N. pseudo-narcissus*), *N. tazetta* is the most widely known species of the genus. By 1800 between 200-300 cultivars were offered by the Dutch growers. Still widely grown today, especially *papyraceus* the Paper White. *N. tazetta* is cultivated extensively outdoors in the milder parts of this country, especially in the Deep South and California. The Poetaz *narcissus* are hybrids of *N. tazetta* × *N. poeticus.*

Tazetta is characterized by earliness of growth which usually begins in late autumn or early winter, depending upon the area. Flowering usually occurs from the end of December into February or later in areas where the plants grow wild. Cultivated since 1557.

The wild varieties recognized by the *Classified List* (1965) are distinguished mostly by the color and size of the flowers, but the taxonomy is very imperfect and the plant definitely needs more study based on wild plants.

16a. subsp. *aureus* (Lois.) Bak. (syn. *N. aureus* Lois. (1827))
(*aureus,* yellow for the flower of this color)

Flowers 10 to 12, 1 to 1 1/2 in. across; perianth segments ovate; corona entire, about 1/3 as long as the segments, entire, deep orange yellow. Earlier authors suggested that the well-known garden plant Soleil d'Or is a form of this variety.
Distribution: Occurs with the species.

16b. subsp. *bertolonii* (Jord.) Bak. (syn. *N. bertolonii* Parl. (1848))
(*bertolonii,* in honor of Bertoloni)

Closely related to subsp. *aureus* but with oblong acute perianth segments and the flowers uniformly bright yellow.

Distribution: Italy and on rocky hillsides near Algiers in North Africa.

16c. var. *canariensis* (Herb.) Bak. (syn. *N. canariensis* Herb. (1837))
(*canariensis,* from the Canary Islands)

Distinct variety with flowers about 1/2 in. in diameter, the tube about 3/4 to 1 in. long, white throughout; perianth segments acute.

Distribution: Canary Islands. Not so attractive as some other varieties and rarely grown.

16d. subsp. *corcyrensis* (Herb.) Bak. (syn. *N. corcyrensis* Herb. (1837))
(*corcyrensis,* the Latinized form of Corfu)

Flowers the same color as *tazetta* but more star-shaped with narrower acute reflexed perianth segments and lobed coronas.

Distribution: Island of Corfu.

16e. subsp. *cupularis* (Salisb.) Bak. (syn. *Hermione cupularis* Salisb. (1812))
(*cupularis,* with the shape of a cupola)

Close to subsp. *aureus* but the corona and the segments lemon yellow. Salisbury in 1812, under the epithet *H. cupularis,* calls it the Soleil d'Or of Dutch florists.
Distribution: Locality undesignated.

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*A further discussion of the tazettas appears in Chapter 12.

PLATE 17 F. G. MEYER

SPECIES *pseudo-narcissus* SUBSP. *tortuosus*
(above) its home in the wild is grassy hillsides in the foothills of the Picos de Europa, Santander Province, northwestern Spain; (below) a close-up as it grows in the wild.

PLATE 18 F. G. MEYER

16f. subsp. *gussonei* Rouy (syn. *N. gussonei* Rouy (1912))
(*gussonei,* in honor of Gussone)

Related to subsp. *italicus;* perianth segments dull white, subequal, obliquely twisted; corona widely flaring, yellow, irregularly 3-lobed and wavy.

Distribution: Borders of fields near Mentone along the French Riviera and adjacent Italy.

16g. subsp. *italicus* (Sims) Bak. (syn. *N. italicus* Sims (1809))
(*italicus,* from Italy)

Flowers often 10 to 12; perianth segments nearly white, suggesting yellow, acute; corona lemon yellow, often distinctly 6-lobed.

Distribution: Italy. Known to naturalize freely in gardens on the French Riviera.

16h. subsp. *lacticolor* (Haw.) Bak. (syn. *Hermione lacticolor* (1831))
(*lacticolor,* combining form of *lac,* milk)

A plant with white perianth segments and a yellow corona, and closely allied to the typical form of *tazetta* itself.

Distribution: Unspecified but presumably with the species.

16i. subsp. *ochroleucus* (Lois.) Bak. (syn. *N. ochroleucus* Lois. (1806))
(*ochroleucus,* from the Greek *ochra* yellow earth and *leucos* white)

Flowers 1 to 1¼ in. across; perianth segments white; corona lemon yellow, the throat erect, entire. Perhaps the same as the plant called *N. orientalis* which no longer can be upheld as a valid name.

Distribution: Unspecified but presumably with the species.

16j. subsp. *pachybolbus* (Dur.) Bak. (syn. *N. pachybolbus* Dur. (1846))
(*pachybolbus,* from the Greek *pachy* thick and *bolba* bulb)

Bulbs very large, 2 in. or more in diameter; scapes 5-8 flowered, the flowers about ¾ in. wide; perianth segments obtuse, white; corona white.

Distribution: Oran, in Algeria.

16k. subsp. *panizzianus* (Parl.) Bak. (syn. *N. panizzianus* Parl. (1848))
(*panizzianus,* in honor of Panizzi)

Plant slender and relatively smaller than in subsp. *papyraceus;* flowers 4 to 6, about 4/5 in. wide; perianth segments acute, white; corona white, about half as long as the perianth segments.

Distribution: Collected originally near San Remo along the Italian Riviera.

16l. subsp. *papyraceus* (Ker-Gawl.) Bak. Paper White. (syn. *N. papyraceus* Ker-Gawl. (1806))
(*papyraceus,* after *papyrus* for the papery white nature of the flower)

Flowers often more than 8, about 1½ in. wide, strongly fragrant; perianth segments oblong, acute, white; corona white.

Distribution: Said to be naturalized in Portugal, Spain and through the French Riviera into Italy and interspersed with the smaller-flowered wild forms growing in these areas.

An old garden plant that should be treated as a cultivar and for this reason is reluctantly listed here. It may have been brought in from the wild originally. Cultivated in Italy for centuries, it is today the most widely known form of *tazetta,* especially for forcing. Distinguished by the perianth segments which are longer, as compared to the cup, than in all other known forms of *tazetta* except subsp. *italicus* and subsp. *bertolonii,* both of which may have been derived from the Paper White. The Paper White is well-known for the very strong fragrance considered by some to be sickly as compared to some other forms. The double form, called Double Roman, has been long grown in Italy.

16m. subsp. *patulus* (Lois.) Bak. (syn. *N. patulus* Lois. (1806))
(*patulus,* spreading, in relation to the flower)

Smaller and more slender than other forms of the species; flowers about 1 in. across; perianth segments white; corona lemon yellow.

Distribution: Range unknown, perhaps of garden origin.

16n. subsp. *polyanthos* (Lois.) Bak. (syn. *N. polyanthos* Lois. (1806))
(*polyanthos,* from Greek *poly,* many and *anthos,* flower)

Flowers 10-20 up to 1½ in. across, uniformly white; corona faintly tinged at first with sulphur yellow then white.

Distribution: Gibraltar and Malaga, Spain; and Portugal near Lisbon and the Algarve. In this region it grows with subsp. *papyraceus* which has smaller flowers.

16o. var. *chinensis* Roem.

In the *Flora of Japan,* J. Ohwi (English edition, 1965) lists this variety as a doubtfully naturalized plant in Japan. Described as a bicolor with white perianth segments and a yellow corona about ⅜ in. across.

Distribution: Naturalized (?) along seashores of Honshu (Kanto Distr.) and westward, Kyushu; presumably also in China, but truly wild plants in either Japan or China have not been adequately documented.

Single-and double-flowered forms of the Japanese plant, long cultivated in Japan, were formerly imported into Europe.

17. *Narcissus broussonetii* Lagasca (1816)
(*broussonetii,* to honor the French botanist Pierre Marie Auguste Broussonet, 1761-1801)

Leaves 4, linear, about 12 in. long; scapes as long as the leaves; flowers white, 4 to 8; tube about ¾ in. long, greenish below; perianth segments oblong, obtuse, ½ in. long; corona rudimentary; stamens exserted from the perianth tube; chromosome number 2n = 22.

Distribution: Mogador, a seacoast town, ca. 100 mi. west of Marrakech, Morocco. October.

Autumn-flowering species allied to *N. tazetta* but distinct by the almost complete absence of a corona and the strongly exserted stamens. Bowles states that the large white flowers with conspicuous yellow anthers look more like those of a small *Cooperia* (a *Narcissus* relative) than those of a *Narcissus.* Rarely grown except as a curiosity, partly on account of its tenderness and because it is not particularly handsome.

18. *Narcissus poeticus* L. (1753) Poet's Narcissus
(*poeticus,* narcissus of the poets)

Widespread from Spain across middle Europe to Greece, with much variability. Has contributed to the development of two major garden groups of narcissus, the *incomparabilis* (Divs. 2 and 3 by current *Classified List*) and the Poetaz covered by Div. 8 of the modern classification. The pink daffodils of modern origin involve the corona color of *poeticus.* The typical plant is characterized as follows:

Leaves about 4, flat, 12-18 in. long, ¼ to ⅓ in. wide; scape 12 in. or more long, compressed and two-edged; flowers 1 or 2, 1¾ to 2¾ in. across, horizontal or ascending, fragrant; tube round, white, 1 in. long; perianth segments spreading, white, yellowish at base; crown flat and disclike, about ⅝ in. wide, strongly wavy, with a bright scarlet edge; chromosome number 2n = 14.

Distribution: Moist meadows from near sea level, southern France to high mountains of central Europe, the Pyrenees, the Swiss alps, and the Balkan mountains south to Greece. Wild varieties as follows:

A. Poeticus Group. *Stamens unequal; perianth segments usually shortly narrowed and imbricate below; corona flat and discoid at maturity.*

18a. var. *hellenicus* (Pugsl.) Fernd. (1915)
(*hellenicus,* of Greece)

Plants large and robust, 12-18 in. tall; flowers 1½ to 1¾ in. across, at first opening round, later the perianth segments reflexed.

Distinguished by robust habit and relatively small flowers.

PLATE 19 F. G. MEYER

SPECIES *rupicola*

(above) Bulbs from wild growing in pot; (below) its home in the wild is the rocky hills of northern Portugal.

PLATE 20 F. G. MEYER

PLATE 21 F. G. MEYER

SPECIES *triandrus* VAR. *cernuus*
Growing in wild in pine woods of Orense Province, northwestern Spain.

Distribution: Greece, Mt. Pindus in northern Thrace. May—June.

18b. var. *majalis* (Curtis) Fernd. (syn. *N. majalis* Curtis (1793))
(*majalis,* refers to the large flowers)

A large robust phase, often 15 in. tall at flowering time, large flowers, often 2 in. across.

Distribution: The common phase of the species in southern France. Seen by me near Aix-en-Provence and at Levans above Mentone on the French Riviera.

18c. var. *recurvus* (Haw.) Fernd. Pheasant's Eye. (syn. *N. recurvus* Haw. (1831))
(*recurvus,* for the perianth segments which turn back)

Plants 12 to 18 in. long; flowers 2¼ to 2½ in. wide, very symmetrical; perianth segments recurved with inflexed margins; corona with a wavy-margined cup, green in middle then chrome yellow with a broad deep red rim.
Distribution: Switzerland, 4000-6000 ft. el. in the Valais.

18d. var. *verbanensis* Herb. (1837)
(*verbanensis,* from Verbania, a classic locality of northern Italy)

Flowers 1 to 1½ in. across, smaller than in var. *majalis,* leaves about 1 ft. long. A low-growing, small-flowered phase of the species.

Distribution: Restricted to the Italian Lake district. Abundant in rocky meadows and open woods on mountain slopes above Lake Maggiore, near Pallanza. May.

B. RADIIFLORUS GROUP. *Stamens subequal; perianth segments usually cuneately-narrowed below; corona small, cup shaped.*

18e. subsp. *radiiflorus* (Salisb.) Bak. (syn. *N. radiiflorus* Salisb. (1796))
(*radiiflorus,* from *radi* provided with rays or spokes and *florus,* flower)

Scape 12 to 16 in. tall; flowers 2¼ to 2¾ in. wide; perianth segments radiate and starlike, not imbricate, oblanceolate, spreading, greenish white; corona cup shaped, about ⅓ in. wide, bright yellow, edged red.

Distribution: Switzerland, Austria, and northern Yugoslavia.

18f. var. *exertus* Haw. (1831)
(*exertus,* thrust forth, projecting, for the exserted stamens)

Flowers 2 to 2½ in. wide; perianth segments imbricate below, often twisted, spreading or recurved, snow white tinged yellow at base; corona flat and discoid; stamens exserted.

Distribution: Switzerland.

18g. var. *poetarum* Burb. & Bak. (1875)
(*poetarum,* resembling *poeticus*)

Phase with larger flowers than *poeticus* with imbricate perianth segments; corona red throughout.

Distribution: Not known in the wild, but has contributed as a source of red color in some present-day garden hybrids.

18h. var. *stellaris* (Haw.) Fernd. (syn. *N. stellaris* Haw. (1831))
(*stellaris,* for the star-shaped flowers)

Flowers starlike, about 2½ in. in diameter. Allied to subsp. *radiiflorus* but the corona 2/5 in. wide, cup shaped, yellow with a narrow white zone within the narrow scarlet rim.

Distribution: Mountainous regions of Austria from the Tyrol to Transylvania.

SUBGENUS 2—AJAX

19. *Narcissus asturiensis* (Jard.) Pugsley Asturian Daffodil. (syn. *Ajax asturiensis* Jord. (1903); *N. minimus* of hort. not *N. minimus* of Haworth)
(*asturiensis,* from Asturias province and former kingdom in n.w. Spain)

Smallest of the trumpet daffodils, 3-7 in. tall; leaves 2-4 in. long, shorter than the scapes; flowers 1, about 1 in. long, inclined or drooping, uniformly soft yellow throughout or nearly so and very slightly scented; corona inflated at base, contracted about the middle, then rather abruptly spreading at the margin; stamens attached close to base of the flower tube; chromosome number $2n = 14$ or 15.

Distribution:Grassy slopes and open woodland; Spain from Asturias to Castile and Portugal in the central mountains. Seen growing by me in the thousands in Asturias along the mountain roads from Santandar near the summit of Puerto de San Gloria, 4827 ft. el. In Portugal, the plant is abundant in the Serra da Estrella and on mountain slopes near Bragança, in the northern part of the country.

N. asturiensis is often confused with *N. minor,* from which it clearly differs, having a constricted corona and basal insertion of the stamens. Cytologically *asturiensis* is also distinct. A species not well documented until Jordan pinned it down, although illustrated first in Besler's *Hortus Eystettensis* (1613).

19a. var. *brevicoronatus* Pugsley (1933)
(*brevicoronatus,* with a short corona)

Usually differs from the species in that it may have only 2 leaves and a slenderer scape; flowers ½ to ¾ in. long, the tube longer than in the plant usually grown; corona with the margin less lobed and more serrate.

Distribution: Found with the species.

19b. var. *lagoi* (Merino) Fernd. (syn. *N. lagoi* Merino (1909))
(*lagoi,* perhaps with reference to Lugo on the banks of the Minho in Galicia)

A large growing form of the species with scapes 16 to 20 in. tall, as compared with 3 to 7 in. for the species itself. Although originally described as *N. lagoi*, the relationship is clearly with *N. asturiensis*.
Distribution: Galicia in northwestern Spain.

20. *Narcissus cyclamineus* DC. (1816)
(*cyclamineus,* in reference to the poised cyclamen-like aspect of the flowers)
Bulbs small, round, about ½ in. wide; leaves up to 8 in. long, about 3/16 in. wide; scapes about 6 in. long, sometimes taller, erect, nearly round; flowers drooping, 1 to 1¾ in. long from edge of corona to tip of perianth segments, uniformly deep yellow, unscented; perianth segments linear-oblong, about ¾ in. long, strongly reflexed upwards over the capsule; corona as long as the perianth segments, the margin irregularly notched; chromosome number 2n = 14.
Distribution: Portugal near Oporto, and northwestern Spain (Galicia) near Coruña and Pontevedra. Now extremely rare in nature due to thoughtless digging by bulb hunters.

PLATE 22 F. G. MEYER

SPECIES *poeticus* SUBSP. *poeticus* VAR. *majalis*
Growing in natural habitat near St. Cannat, Aix-en-Provence in southern France.

A highly distinct and local species. Of interest is the following quotation from Pugsley (*Jour. Roy. Hort. Soc.* p. 37, 1933); "Its [*N. cyclamineus*] rediscovery in 1885, by Messrs. Tait and Schmitz after being lost to cultivation for about 250 years . . . [is remarkable] it is so well figured by Vallet in *Jardin du Roi Henry IV* (1608) and in the *Theatrum Florae* (1633) that its identity cannot be questioned." The species was formally described by De Candolle in 1816 in Redouté's *Liliaceae* based on the plant figured in 1633.
N. cyclamineus has been cultivated for certainty only since its rediscovery in 1885; recently it has contributed to fine garden hybrids, such as Beryl, Charity May, Cyclataz, February Gold, Peeping Tom, and a host of others.

21. *Narcissus minor* L. (1762)
(*minor,* smaller, lesser) Known in gardens as *N. nanus*.
Plant 6 to 8 in. tall; leaves 3 to 4 in. long, about ¼ in. wide; flowers up to 1¼ in.

long, horizontal or nodding, faintly scented; tube about ½ in. long; perianth segments ovate-lanceolate, acute, wavy, erect to spreading, uniformly yellow; corona 6-lobed, the lobes incised, overlapping and transversely roughened; chromosome number 2n = 14 or 15.

Distribution: Although represented in the herbarium of Linnaeus, nothing exactly like the plant he described has since turned up in the wild.

Of questionable standing as a wild plant, although distinct as a horticultural subject. Usually kept separate as a species closely related to *N. asturiensis,* and the ordinary trumpet daffodil, *N. pseudo-narcissus.* Cultivated in European gardens since about 1600.

In the classification by Prof. Fernandes and in the *Classified List* (1965) four variants of *minor* are listed, namely vars. *pumilus, conspicuus, parviflorus,* and *provincialis,* all of garden origin.

22. *Narcissus pseudo-narcissus* L. (1753) The name daffodil was originally applied to this species.

(*pseudo-narcissus,* from pseudo, false or bastard narcissus); name selected by Linnaeus to distinguish the daffodil from other plants so-called by the ancients, some not narcissus at all.

The wild daffodil is still abundant in many parts of western Europe and throughout its distribution shows a remarkable degree of variability. A generalized description of the wild plant follows:

Bulbs 1 to 1¼ in. long, nearly round; leaves erect, up to 14 in. long, glaucous, usually somewhat channelled, up to about ½ in. long, obtuse; scapes as long as the leaves in flower, elongate after flowering, 2-edged; flowers drooping to nearly horizontal up to 2½ in. long in var. *tortuosus* or half this long in the variety of the species known as the Lent Lily common in English cemeteries, uniformly sulphur yellow or cream colored or bicolored with the perianth segments darker yellow than the lighter perianth tube; corona straight, without distinct lobes but irregularly cut and dentate; chromosome number 2n = 14.

Distribution: A plant of meadows and fields, France, Portugal, and Spain. Some authorities include England where it has naturalized.

Trumpet daffodils in the wild are divided into two principal groups: (1) those with uniformly yellow, small flowers produced on a small plant with small bulbs, typified by the Lent Lily of northern France and England, and (2) those with bicolored flowers, produced on a larger, more robust plant with larger bulbs and broader leaves, typified by subsp. *nobilis* of Spain.

Subspecies and varieties of *pseudo-narcissus* listed in the *Classified List* are:

22a. subsp. *abscissus* (Schultes f.) Pugsl. (syn. *N. abscissus* Schultes f. (1830))

(*abscissus,* to tear off, for the abrupt straight edge of the corona, called "clipt-trunk" by Parkinson)

Flowers bicolor, the perianth segments pale or sulphur yellow, the perianth tube orange yellow, the corona golden yellow.

Distribution: Pyrenees.

Known in English gardens of the 17th century and figured by Parkinson (1629), formerly common but now rare.

22b. var. *graciliflorus* Pugsl. (1933)

(*graciliflorus,* from *gracilis,* for the narrow flowers)

Flowers drooping, up to 2 in. long; perianth segments narrow; corona narrow with suberect subtruncate margin.

Distribution: Gavarnie in the French Pyrenees.

A narrow-flowered variety of subsp. *abscissus.*

22c. var. *serotinus* (Jord.) Pugsl. (syn. *Ajax serotinus* Jordan (1903))

(*serotinus,* late)

Scape much shorter than the leaves; perianth segments wavy, spreading. Flowers later than the type.

Distribution: Gèdres, in the French Pyrenees.

22d. var. *tubulosus* (Jord.) Pugsl. (syn. *Ajax tubulosus* Jord. (1903))
(*tubulosus,* formed like a pipe, tubular)

Perianth tube very short, only ¼ in. long; perianth segments narrowly lanceolate, acute, conspicuously exceeding the narrow, slightly lobed and wavy corona.
Distribution: Gèdres, in the French Pyrenees.

22e. subsp. *albescens* (Pugsl.) Fernd. (syn. *N. albescens* Pugls. (1933))
(*albescens,* to become white, whitish)

Not known in the wild, according to Pugsley (1933). Sulphur-white flowered phase, closely allied to subsp. *moschatus.*

22f. subsp. *alpestris* (Pugsl.) Fernd. (syn. *N. alpestris* Pugsl. (1933))
(*alpestris,* of the mountains)

Leaves up to about 6 in. long, rarely 10 in., glaucous; scapes as long as the leaves; flowers drooping or inverted, 1½ to 1¾ in. long, pure white, except the bright green stripes or suffusion on the perianth tube, almost odorless.
Distribution: Known only from the Central Spanish Pyrenees at about 7000 ft. el.
Closely related to subsp. *moschatus* but differs in its lower and more slender habit, narrower and more channelled leaves, white flowers with a more truncate corona and broader, more triangular capsules. Not easily maintained in cultivation.

22g. subsp. *bicolor* (L.) Bak. (syn. *N. bicolor* L. (1762))
(*bicolor,* for the flowers of two colors)

Bulb large, up to about 2 in. long; plant more robust than in any of the forms of *pseudo-narcissus* except subsp. *leonensis*; leaves nearly flat and not twisted, up to ¾ in. wide; flowers bicolored; perianth segments whitish or cream colored; perianth tube yellow; corona golden yellow.
Distribution: May occur in the Pyrenees, but wild plants not known for certain.
Cultivated since about 1613.

22h. var. *lorifolius* Herb. (1837)
(*lorifolius,* for the strap-shaped leaves)

A derivative of *bicolor* and unknown in the wild.

22i. subsp. *confusus* (Pugsl.) Fernd. Spanish Daffodil. (syn. *N. confusus* Pugsl. (1933))
(*confusus,* confused)

Plant robust; leaves erect, 12 to 14 in. long, flat; scape a little shorter than the leaves; flowers uniformly yellow or nearly so; perianth segments a little twisted.
Distribution: Central Spain.
Cultivated since 1601.

22j. subsp. *gayi* (Henon) Fernd. (syn. *N. gayi* Henon (1903))
(*gayi,* after the French botanist, J. Gay)

Not known in the wild.

22k. var. *praelongus* (Jord.) Pugsl. (syn. *Ajax praelongus* Jord. (1903))
(*praelongus,* very long)

Not known in the wild. A garden form perhaps most closely allied to *gayi.*

22l. subsp. *leonensis* (Pugsl.) Fernd. (syn. *N. leonensis* Pugsl. (1933))
(*leonensis,* from León, a province in northwestern Spain)

Flowers very large, ascending, about 2¾ in. long to edge of corona, about 3 in. long to tip of perianth segments, bicolored; perianth segments cream colored, the perianth tube yellow.
Distribution: Spain, in the northern part of the province of León.
Known only from a single gathering made in 1896, it has the largest flower of any known wild daffodil. Probably not in cultivation.

22m. subsp. *longispathus* (Pugsl.) Fernd. (syn. *N. longispathus* Pugsl. (1933))
(*longispathus,* with a long spathe)

Spathes variable, sometimes up to 4 in. long, never as short as in *pseudo-narcissus;* pedicels slender, erect, 1½ to 3½ in. long.

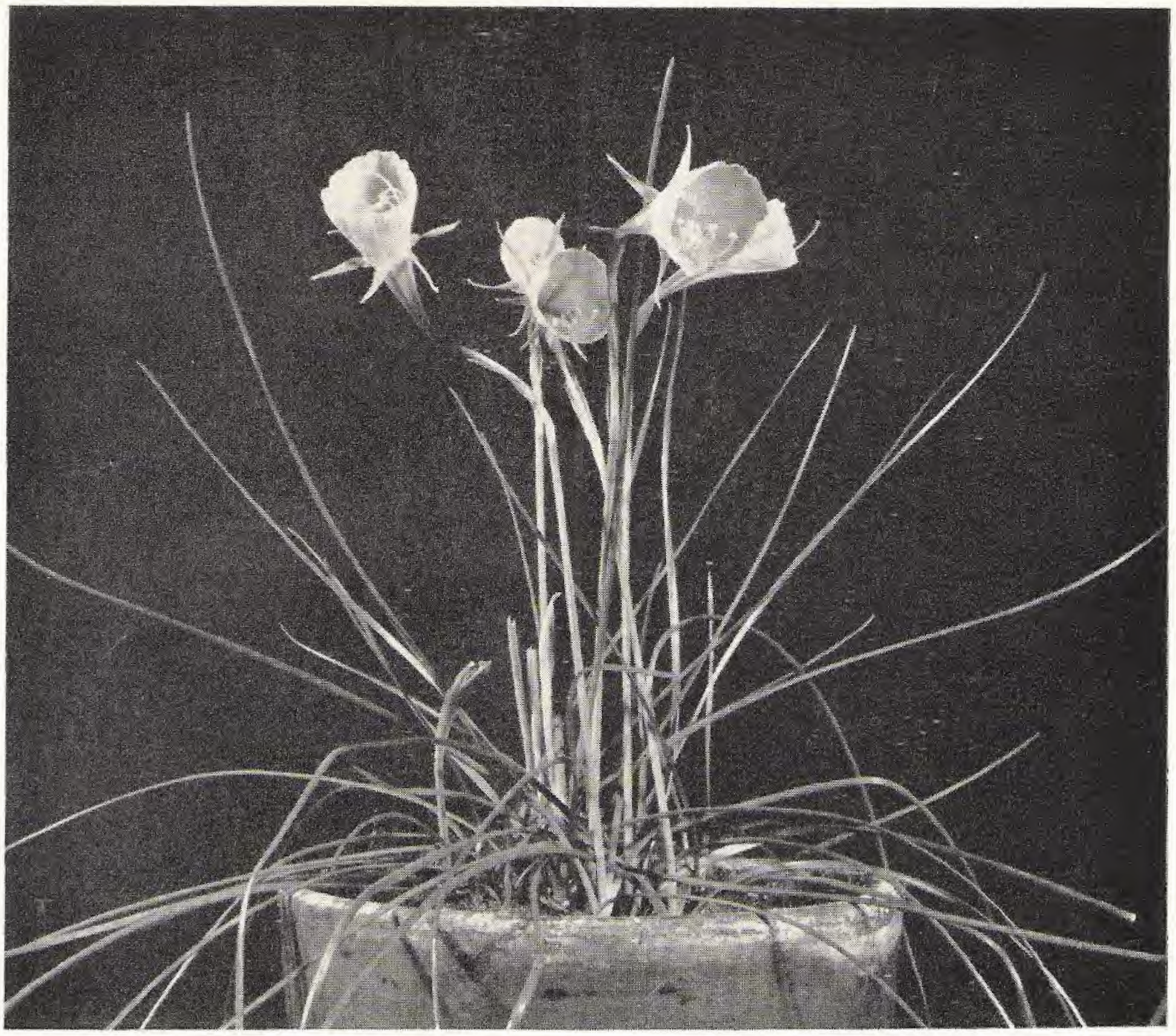

PLATE 23 F. G. MEYER

SPECIES *bulbocodium* SUBSP. *vulgaris* VAR. *citrinus*
Grown from bulbs from natural habitat in grassy slopes above the sea near San Sebastian, northeastern Spain.

Distribution: Spain, 5500 ft. el. on Sierra de Cabrilla, province of Jaén.

Distinguished from all other trumpet daffodil species of subgenus *Ajax* by the long spathes and pedicels.

The notes accompanying the figure of this plant in *Curtis's Botanical Magazine,* 170: t. 246 (1955) are interesting with respect to the size of the plant in the wild. V. H. Heywood and P. H. Davis found this plant in the middle zone of the Sierra de Cazorla in Spain where "plants were often up to 1.5 m. tall and sometimes actually rooted in water." This may be a record for height of a wild daffodil.

22n. subsp. *macrolobus* (Jord.) Fernd. (syn. *Ajax macrolobus* Jord. (1903))
(*macrolobus,* large lobed with reference to the perianth segments)

Leaves 6 to 10 in. long, glaucous, nearly flat, up to ½ in. wide; flowers cream white with a yellowish tube, with a sulphur- or lemon-yellow corona; perianth tube ½ to ¾ in. long, scarcely half as long as the corona; perianth segments larger than in typical *pseudo-narcissus,* more or less twisted; corona broadened and expanded with a spreading margin cut into shallow overlapping lobes.

Distribution: Eastern and central Pyrenees.

Differs from typical *pseudo-narcissus* in the broader foliage, more uniformly dwarf habit, usually lighter-colored flowers, much shorter perianth tube and larger perianth segments, and in the broader and more expanded corona. Flowers handsomer than *pseudo-narcissus.*

PLATE 24 F. G. MEYER

SPECIES *cyclamineus*
Grown from bulbs from wild in northern Portugal.

22o. var. *pallescens* Pugsl. (1933)
(*pallescens,* to grow pale, to lose color)

Perianth segments straw colored, with rather deeper tube and corona.

Distribution: Central Pyrenees (Mont Louis).

A color form of subsp. *macrolobus.* Has been cultivated in England.

22p. subsp. *major* (Curtis) Baker. (syn. *N. major* Curtis (1788), *N. hispanicus* Gouan of authors (1733), *N. maximus* Hort.)
(*major,* larger, greater)

Leaves somewhat spirally twisted; pedicels erect but curved above, 1 to 1¼ in. long; flowers 2 to 2⅜ in. long, deep golden yellow throughout, sweet scented; perianth segments regularly spirally twisted; corona about 1¾ in. across, obscurely lobed.

Distribution: Southwestern France, and the Pyrenees to northern Spain and Galicia, but not a well documented plant in the wild.

The plant known as *N. hispanicus* and *N. maximus* may be recognized by its erect pedicels, its deep golden-yellow large flowers, with twisted perianth segments and widely expanded corona. Grown in Europe since the latter part of the 16th century.

22q. var. *concolor* (Jord.) Pugsl. (syn. *Ajax concolor* Jord. (1903))
(*concolor,* of the same color)

Leaves not spirally twisted; pedicels about 7/8 in. long; flowers uniformly golden yellow; perianth segments shorter than the corona.

Distribution: Southern France: Le Luc (Var).

Resembles Golden Spur, differing in its slenderer flowers with the lobes of corona distinct and handsomely crenulated. Has been cultivated in England.

22r. var. *propinquus* (Salisb.) Herb. (syn. *N. propinquus* Salisb. (1796))

Leaves less twisted than in *N. major;* flowers golden yellow, the perianth tube and base of segments flushed with green; perianth segments slightly twisted.

Distribution: Southern France: Agen (Lot-et-Garonne), and near Bayonne.

Resembles Golden Spur which has larger flowers than var. *propinquus.* Cultivated since 1712 in England.

22s. var. *spurius* (Haw.) Pugsl. (syn. *Ajax spurius* Haw. (1812))
(*spurius,* illegitimate)

Smaller than the var. *propinquus,* about 12 in. tall; pedicels about 5/8 in. long; flowers golden yellow.

Distribution: Specimens closely resembling this variety are known from northwestern Spain in Asturias.

22t. subsp. *moschatus* (L.) Baker (syn. *N. moschatus* L. (1762), *N. cernuus* of gardens)
(*moschatus,* musk scented)

One of the most distinct daffodils for the handsome, drooping, white flowers with a narrow, slightly cut corona.

Distribution: Pyrenees.

Cultivated at least since the 18th century when it was grown by Linnaeus at Uppsala; perhaps the parent of some of the early white daffodils of gardens. Considerable confusion still exists in distinguishing between subsp. *alpestris, moschatus,* and *tortuosus,* all white flowered.

22u. subsp. *nevadensis* (Pugsl.) Fernd. (syn. *N. nevadensis* Pugsl. (1933))
(*nevadensis,* of the Sierra Nevada in southern Spain)

Plant low growing; leaves up to 6 in. long, about 3/16 in. wide, scape a little longer than the leaves; pedicels very long (1 in.); flowers small, about 2¼ in. long, yellow with a golden corona.

Distribution: In stony ground, Sierra Nevada, Spain. Discovered in 1931.

Distinct in the long pedicels which recall those of subsp. *longispathus* and in the dwarf habit and long perianth tube. May not be in cultivation, unless re-collected in recent years. The author was unsuccessful in locating the plant on his visit to the Sierra Nevada in April, 1957.

22v. subsp. *nobilis* (Schultes f.) Fernd. (syn. *N. nobilis* Schultes f.)
(*nobilis,* noble, celebrated)

Leaves 6 to 10 in. long, about ¾ in. wide, glaucous; pedicels short, about ½ in. long, suberect to curved; flowers rather large yellow, with a golden-yellow corona; perianth segments spreading, twisted, a little shorter than the corona; corona with spreading margin.

Distribution: Central Pyrenees and the provinces of León and Old Castile in Spain.

Closely related to typical *pseudo-narcissus,* but a larger plant with suberect pedicels and spreading perianth segments and corona.

Figured by Parkinson (1629) as *N. variformis* and cultivated since the early 19th century.

22w. subsp. *obvallaris* (Salisb.) Fernd. Tenby Daffodil. (syn. *N. obvallaris* Salisb. (1796), *N. lobularis* Haworth (1830))

Distinct, dwarf plant, up to about 12 in. tall, with flat leaves; flowers uniformly deep golden yellow; corona distinctly 6-lobed.

Distribution: Unknown in the wild, but naturalized in England. Described from plants found at Tenby.

Offered in the trade sometimes as *N. lobularis.* Cultivated 1613.

Three varieties of *obvallaris,* namely, *concolor, toscanus,* and *maximus* are strictly garden plants.

22x. subsp. *pallidiflorus* (Pugsl.) Fernd. (syn. *N. pallidiflorus* Pugsl. (1933))
(*pallidiflorus,* for the pallid or pale flowers)

Flowers drooping or horizontal, 1¾ to 2¼ in. long, cream or straw colored with a slightly deeper-colored corona, nearly scentless; perianth segments broadly oval; corona about 1¼ in. across, 6-lobed.

Distribution: Western Pyrenees, especially near Bayonne.

Differs from subsp. *moschatus* and typical *N. pseudo-narcissus* in its broader perianth and corona and in the very short, abruptly deflexed pedicel. Known to Parkinson (1629); reintroduced into cultivation, 1882.

22y. var. *intermedius* Pugsley (1933)
(*intermedius,* intermediate)

Leaves narrower than *pseudo-narcissus;* pedicels nearly obsolete; flowers uniformly primrose yellow or nearly so; corona sometimes a little deeper yellow, not spreading.

Distribution: Central Pyrenees, (Haute-Garonne) France, and in the eastern Pyrenees. Cultivated,1889.

22z. subsp. *pisanus* (Pugsl.) Fernd. (syn. *N. pisanus* Pugsl. (1933))
(*pisanus,* from Mount Pisano (Tuscany) Italy)

Flowers uniformly clear yellow with slightly deeper-colored corona; pedicels short, about 3/16 in. long.

Distribution: Monte Pisano (Tuscany) and Lugano and other parts of northern Italy.

Allied to subsp. *major* (*N. hispanicus*) and subsp. *obvallaris* differing from both in the shorter pedicels and relatively longer perianth tube; plant shorter, with leaves not twisted and smaller lighter-colored flowers than in *major.* Introduced by Peter Barr in the 19th century.

22aa. subsp. *portensis* (Pugsl.) Fernd. (syn. *N. portensis* Pugsl. (1933))
(*portensis,* from Oporto, Portugal)

Perianth segments narrow, linear-lanceolate, acute, distinctly shorter than the corona; corona large, straight, gradually expanding toward the top, becoming somewhat funnel-shaped.

Distribution: Portugal near Oporto and Lisbon (Serra da Sintra), thence across Spain to Madrid and Galicia.

Differs from other forms of the trumpet daffodil in its narrow perianth segments and its large, funnel-shaped corona; somewhat the aspect of a Hoop Petticoat (*N. bulbocodium*).

22bb. subsp. *pseudo-narcissus*

Under *N. pseudo-narcissus* the *Classified List* names the following varieties: *festinus, humilis, insignis, montinus, platylobus,* and *porrigens.* Most of these originally proposed by Jordan in his *Icones ad Floram Europeae* (1903), constitute what might now be called cultivars. Whether they have been in cultivation is unknown.

Subgenus III—Corbularia

23. *Narcissus bulbocodium* L. (1753) Hoop Petticoat.

The ridiculous name *bulbocodium* was proposed by Linnaeus through a remark by Clusius, in his *Historia* (1601), that some believe it is Bulbocodium of Theophrastus. Actually, the genus *Bulbocodium* of the Lily Family is distinct and occurs with species of *Narcissus* in Spain and Portugal.

N. bulbocodium is an extremely variable species with a rather large number of wild variants. The following brief description typifies the species in the broad sense:

Leaves 2 or 3, nearly round and grasslike, 4 to 8 in. long, usually shorter than the scape; flowers single, ascending or horizontal, not drooping, yellow to white with pedicels about ¾ in. long, the tube as long as the corona; perianth segments small, linear, ½ to ¾ in. long, not more than ⅛ in. wide at base; corona funnel shaped, ½ to ¾ in. deep and as wide at the entire or wavy mouth; chromosome number 2n = 14, 21, 26, 28, 35, 39, 42, 49, 56.

Distribution: Southwestern France from Bordeaux to Toulouse; Portugal and Spain; Morocco and Algeria.

Called *Corbularia* by Haworth and others because the flower differed drastically from all the other species. The plant has been extensively studied by Prof. Fernandes in Portugal with the conclusion that *N. bulbocodium* is the youngest species of the genus and is now undergoing a fast rate of change in nature. Two geographic centers of diversity exist, namely the European center north of Gibraltar in Spain and Portugal and another in North Africa. Among the North African forms in Morocco and Algeria are found white-flowered plants and others which are not reliably hardy in northern gardens. The following wild variants are listed in the *Classified List* after the work of Fernandes:

23a. subsp. *albidus* (Emberger & Maire) Fernd. (1929)
(*albidus,* whitish)

Flowers whitish yellow or white with a slight greenish yellow shade; perianth segments about ⅛ in. wide at base.
Distribution: Morocco, east and west Riff (from Moulouya to Oued Laou, including the Riffian Atlas).

23b. var. *zaianicus* (Maire, Weiller & Wilczek) Fernd. (1938)

Flower white to slightly greenish yellow; perianth segments less than 1/16 in. wide, shorter than the corona.
Distribution: Zaian mountains, Morocco.

23c. subsp. *obesus* (Salisb.) Maire. (syn. *N. obesus* Salisb. (1796))
(*obesus,* fat, stout with reference to the flower shape)

Leaves spread out nearly flat over the ground; perianth segments very short; corona ½ to ¾ in. long and 1 in. wide slightly constricted around the mouth; chromosome number 2n = 26.
Distribution: Spain and Portugal.

23d. subsp. *praecox* Gatt. Weiller (1937)
(*praecox,* precocious, early)

Leaves 1-3, narrow; flowers pale yellow; stamens included.
Distribution: Maquis covered hills in acid soil on south and west exposures; Yauem, Cherrat, Nefifik, Morocco. November to January.

23e. subsp. *romieuxii* (Br.-Bl. & Maire) Maire (syn. *N. romieuxii* Br.-Bl. & Maire (1922))
(*romieux,* in honor of Romieux)

Flowers sulphur yellow; spathe whitish, papery; pedicels about ⅛ in. long; perianth segments nearly as long as the corona; anthers light yellow.
Distribution: Northern zone of central Morocco, Middle Atlas (including Mt. Tazzeka), and the Great Atlas.

23f. var. *rifanus* Emberger & Maire (1931)

Flowers sulphur yellow; spathe violet brown; pedicels a little longer than ⅛ in.; perianth segments longer than the corona; anthers golden yellow.
Distribution: Morocco, east and west Riff (from Moulouya to Oued Laou, including the Riffian Atlas) and central Middle Atlas.

23g. subsp. *tananicus* Maire (1932)

Leaves 3 to 5 to a bulb; flowers nearly white, nearly vertical.
Distribution: Morocco.

23h. subsp. *vulgaris* var. *citrinus* Baker (1880)
(*citrinus,* of a citron yellow)

Leaves up to 10 in. long, pale lemon yellow; corona 1 in. in diameter at the throat.
Distribution: Seen by me in Spain on grassy slopes and open woodland above the sea beyond Pesajes de San Juan, near San Sebastian, where it is abundant in March; also on screes of eastern Gibraltar.

The var. *citrinus,* one of the largest-flowered forms of *bulbocodium,* is often cultivated.

23i. var. *conspicuus* (Haw.) Burbidge. (syn. *Corbularia conspicua* Haw. (1831))
(*conspicuus,* striking, remarkable)

Leaves and scapes about 4 in. long; flowers buttercup yellow.
Distribution: Spain and Portugal.

Illustrated in Parkinson (1629); now the most common phase of the plant in cultivation.

23j. var. *nivalis* (Graells) Maire
(*nivalis,* of the snowy)

Scape 2 to 4 in. long; flowers orange yellow, small; diploid.
Distribution: Spain, on decidedly acid soils.

23k. var. *genuinus* Cout.
(*genuinus,* authentic, genuine)

The same as the typical form of *bulbocodium;* diploid.
Distribution: Spain and Portugal.

23l. var. *graellsii* (Webb) Baker. (syn. *N. gratellsii* Webb ex Graells (1859))
(*graellsii,* in honor of Graells)

Leaves usually 2; scapes 4 to 6 in. long; flowers primrose yellow, ½ in. long and broad with very short pedicels; perianth segments with a brown keel.
Distribution: Spain, mountains of Castile.

24. *Narcissus cantabricus* DC. (1816)
(*cantabricus,* from the Cantabrian Mountains)

Formerly known as *N. bulbocodium* var. *monophyllus.* Prof. Abilio Fernandes (1957) has shown that *cantabricus* is distinct from *bulbocodium* in several basic respects as follows:

N. bulbocodium	*N. cantabricus*
1. Flowers yellow	1. Flowers white
2. External scales of bulb varying from whitish to dark brown	2. External scales of bulb always dark brown (almost black)
3. Flowers with pedicels	3. Flowers nearly sessile
4. Flowers slightly fragrant	4. Flowers very fragrant
5. Corona usually not expanded	5. Corona expanded at the throat
6. Grows in open situations	6. Grows in the shade of bushes

Hybrids between *bulbocodium* and *cantabricus* are highly sterile. The latter species is thought to have originated through *bulbocodium* by structural changes of the chromosomes.

Synopsis of the wild variants of *cantabricus*:

A. *Bulbs with more than one leaf.*

1. var. *cantabricus* (syn. *N. clusii* Dunal (1847))
Leaves spread over the ground.
Distribution: South Spain at Almeria and at Oran in Algeria.

2. var. *foliosus* Maire (1929)
(*foliosus,* leafy)

Leaves erect or recurved, 3 to 8 to each bulb; perianth segments white 1½ to 2¼ in. long; chromosome number $2n = 28$.

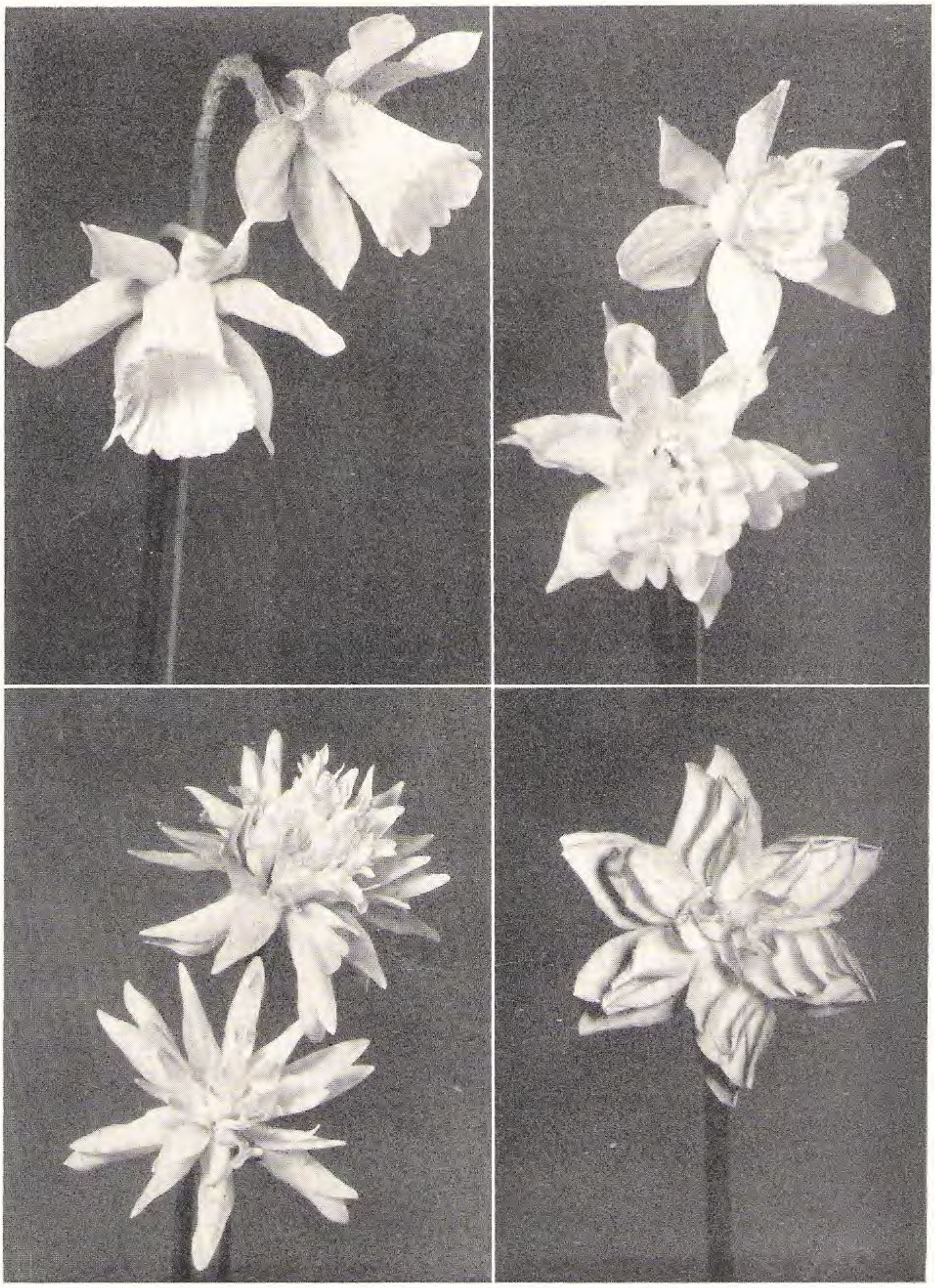

PLATE 25

DOUBLE FORMS

Pseudo-narcissus subsp. *moschatus* and Plenus, a garden derivative of it (upper row); *minor* var. *pumilis* Plenus (syn. Rip Van Winkle) and Eystettensis (syn. *capax plenus*) (lower row)

Distribution: Northwestern Morocco at Oued Nefifik and southwest Morocco at Sokrat-en-Nemra, prov. Boulhaut.

3. var. *kesticus* Maire & Wilczek (1936)
(*kesticus*, from Mount Kest)

Leaves erect or recurved, 2 to each bulb; perianth segments greenish white, about 1¼ in. long.

Distribution: Mount Kest, southwestern Morocco.

4. var. *petunioides* Fernd. (1957)
(*petunioides,* petunia-like in reference to the corona)

Leaves erect or recurved, 3 to 4 to each bulb; corona widely expanded, simulating the corolla of *Petunia;* pedicels up to 3/16 in. long.

Distribution: Algeria (?) Authentic material from the wild is unknown. This plant may have been imported by C. G. Van Tubergen, bulb growers in Holland. A highly distinctive plant not yet widely available.

B. *Bulbs usually with one leaf.*

5. subsp. *monophyllus* (Dur.) Maire. (syn. *Corbularia monophylla* Dur. (1847))
(*monophyllus,* one-leaved)

Bulbs usually one-leaved; flowers white.

Distribution: Along the south coast of Spain from Gibraltar to Almeria and in Morocco and Algeria; also in the Balearic Islands.

Known to Clusius (1601) and figured in his *Historia,* and probably cultivated since that time.

25. *Narcissus hedraeanthus* (Webb & Heldr.) Colmeiro (syn. *Corbularia hedraeanthus* Webb & Heldreich (1850))
(*hedraeanthus,* alluding to the sedentary and sessile flowers)

Closely related to *N. bulbocodium* and perhaps only a variety of it. Differs at once from all other components of the *bulbocodium* complex by its sessile, not pedicellate flowers. The pale yellow flower color resembles *N. cantabricus.* The following brief description is based upon the most recent account of the plant in *Curtis's Botanical Magazine,* 175: t. 248 (1955):

Leaves 1 per bulb, linear, 2½ to 3½ in. long, about 1/16 in. wide; scape erect or oblique, usually emerging almost horizontally and continuing this aspect throughout flowering; flowers sessile, 1 per scape, horizontal or ascending, ¾ to 1¼ in. long, sulphur or pale sulphur yellow, uniformly so throughout; tepals more or less equaling the corona in length; corona straight, gradually broadened above with the margin undulate, obscurely 6-lobed; style and stamens strongly exserted and ascending during flowering; chromosome number 2n = 14?

Distribution: Southeast Spain; Sierra de Segura and Sierra de Cazorla (Prov. Jaén), about 5200 ft. el. and Ciudad Real in the limestone zone.

Although discovered in 1849 at Era de Fustal (Prov. Jaén), the species has never been in general cultivation, having been introduced as recently as 1948 to British gardens.

Wild Species Hybrids of *Narcissus*

Natural hybridization may be expected between any of the species wherever they occur together in the wild. A high degree of interfertility exists between the various species. In fact, some of the difficulty in understanding the wild species may well be the result of incipient hybridization. The following list of hybrids, admittedly, is incomplete, but does show some of the best known natural crosses.

1. *N.* × *dubius* Gouan (*N. juncifolius* × *N. tazetta*)
Leaves narrow; flowers cream color or nearly white. 2n = 50.

Distribution: France; near Toulon, Hyères, Avignon, and Montpellier, *N.* × *magnenii* Rouy is another form of the hybrid.

2. *N.* × *intermedius* Lois. (*N. jonquilla* × *N. tazetta*)
Intermediate between the species; nearly round leaves 12 in. long; flowers 3 to 10, yellow, but paler than in *jonquilla.*

Distribution: France; near Bayonne, Dax in the Pyrenees foothills.

3. *N.* × *biflorus* Curtis. (*N. poeticus* × *N. tazetta*)

Flowers usually 2, rarely 1 or 3, 1¼ to 1½ in. wide (thus intermediate between the species); segments milky white; corona orange yellow; scape 12 to 18 in. tall; leaves about ½ in. wide.

Distribution: Southern France in places where *poeticus* and *tazetta* grow together.

This hybrid was known in English gardens of the 16th century according to Gerard who published an herbal (1597). It is accurately figured by Parkinson in his herbal (1629). The garden form is reputedly always sterile. The *biflorus* cross gave rise to the highly successful Poetaz narcissus originated by the Dutch in 1885.

4. *N. poeticus* × *N. pseudo-narcissus*

Plants produced by this cross are:

N. × *incomparabilis* (1768)	*N.* × *juratensis*	*N.* × *macleayi*
N. × *bernardii*	*N.* × *abscissus*	*N.* × *sabinii*
N. × *incomparabiliformis*	*N.* × *boutignyanus*	*N.* × *leedsii*

N. × *incomparabilis* as the oldest name in the above list is the only valid collective epithet for the cross. Under this name the plant was figured in de Pas's *Hortus Floridus* (1614) and by Parkinson (1629). The innumerable cultivars of *incomparabilis* produced over past years are among the best known of cultivated narcissus.

5. *N. pseudo-narcissus* × *N. cyclamineus*

6. *N. pseudo-narcissus* × *N. juncifolius*

7. *N.* × *odorus* L. (1762) Campernelle Jonquil
(*N. pseudo-narcissus* × *N. jonquilla*)

Although recorded by Clusius in 1595, the wild plant has not been observed.

8. *N.* × *laetus,* DC.
(*N. minor* × *N. jonquilla*)

9. *N.* × *johnstonii* (Baker) Pugsley 'Johnstonii' (syn. *N. pseudo-narcissus* var. *johnstonii* Baker (1886))

(*N. pseudo-narcissus* × *N. triandrus* var. *cernuus*)

Distinguished by its clear yellow flowers and long, narrow perianth tube and more or less reflexed segments. According to Prof. Fernandes, × *johnstonii* is derived from a tetraploid form of *N. pseudo-narcissus* and a diploid form of *N. triandrus* var. *cernuus;* chromosome number 2n = 21 and the plants are sterile. The plants resemble the *N. pseudo-narcissus* parent.

Distribution: Margins of Rio de Avintes, Portugal.

Two plants with the same parentage are known, namely *N.* × *johnstonii* (1886) and *N.* × *taitii* (1887). Both plants were discovered simultaneously by A. W. Tait and Edwin J. Johnston in Portugal growing together along the Rio de Avintes in March, 1886. Part of the material reached the Daffodil Committee of the Royal Horticultural Society for their meeting on April 27th of the same year, and less than two weeks later, on May 8th, the name *N. pseudo-narcissus* var. *johnstonii* Baker appeared in the Gardeners' Chronicle (N.S.) 25: 590 (1886). On May 20 of the same year (1886), the name appears again in a little known work, *Notes on the Narcissi of Portugal* by A. W. Tait. A more amplified description of *Johnstonii* appeared in Curtis's Botanical Magazine 114: t. 7012 (1888). Another portion of the same collection by Tait and Johnston reached Prof. J. A. Henriques at the University of Coimbra. This material was described as *N.* × *taitii* Henriques in 1887.

The Portuguese plant apparently has not been cultivated to any extent, although form called 'Queen of Spain' has been grown in gardens for at least 65 years from Peter Barr's introduction from northern Spain in 1887 and 1888.

9a. *N.* × *johnstonii* (Baker) Pugsley 'Taitii' (syn. *N.* × *taitii* Henriq. (1877)
(*N. pseudo-narcissus* × *N. triandrus* var. *cernuus*)

Leaves shorter than the scape; fls. clear yellow, 1 to 2 per scape, resembling the triandrus parentage. Derived from a diploid phase of each parental species and sterile.

Distribution: Margins of Rio de Avintes, Portugal.

Perhaps not in cultivation, although again found in the wild by A. Roziera in Portugal a few years ago and studied by Prof. Fernandes in a special work. This plant should be treated as a cultivar of *N.* × *johnstonii,* as cited above.

10. *N. bulbocodium* × *N. triandrus*

I have collected plants of this hybrid in Portugal in 1957 on one or two occasions. While not common, occasional plants do occur wherever the parents grow together, which is frequent. The plants seen resembled triandrus and have orange-yellow flowers.

11. *N.* × *carringtonii* Rozeira (1962)
(*N. scaberulus* × *N. triandrus* var. *cernuus*)
(*carringtonii,* in honor of J. Carrington Simões da Costa of Portugal)

The first reported natural hybrid involving *N. scaberulus;* intermediate between the parents with flowers ¾ to 1 in. long and with subreflexed perianth segments ⅜ in. long; tube up to ¾ in. long; corona about ¼ in. long, and ⅜ in. wide. The original description does not mention flower color.

Distribution: Ervedal da Beira, Portugal.

12. *N.* × *tenuoir* Curtis "Tenuior' (syn. *N. tenuoir* Curtis (1797))
(*N. jonquilla* × *N. poeticus*)

An old garden plant of unknown origin, long grown in Europe and brought to England from Holland in the 18th Century and described in *Curtis's Botanical Magazine* 11: t. 379 (1797). The plant still exists in old gardens. This hybrid may be looked for in the wild where the parental species meet in northeastern Spain. Flowers very late.

13. *N.* × *tenuoir* Curtis 'Gracilis' (syn. *N. gracilis* Sabine (1824))
(*N. jonquilla* × *N. poeticus*)

Although of the same parentage, the hybrid name *N.* × *tenuior* (1797) is the older name and therefore takes priority over *N.* × *gracilis* (1824). For this reason, the name *gracilis* should be treated as a cultivar. Differs from *N.* × *tenuior* 'Tenuior' in being taller, with a rounded, not compressed, and nearly 2-edged scape, and pale yellow, unequally spreading tepals. A plant first recognized in England, more than 140 years ago, but still occasionally cultivated in this country and in Europe. Not known in the wild state.

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—5— Anatomy and Physiology of the Daffodil

The daffodil is a monocotyledonous plant which is a member of the family *Amaryllidaceae* and the genus *Narcissus.* Based on anatomical differences, the genus is divided into species and the species into subspecies and botanical varieties. The term "variety" is applied to both botanical varieties of the subspecies and by the gardener also to forms produced by man through cross pollination. The man-made forms or hybrids commonly called varieties are now sometimes referred to as "cultivars."

The plant is a bulbous perennial. The part above ground dies down in summer, leaving the bulb beneath the soil where it remains dormant, or partially so, for a period of time, depending on the species. Following the resting period, the plant, consisting of a subterranean bulb, forms roots and sends up leaves followed by the scape and flower. If two plants which differ from one another in one or more traits are crossed, and if pollination and fertilization take place, the ovary of the seed parent may set seeds. These, when planted and permitted to grow for several years, will produce bulbs, leaves, scapes, and flowers. Due to genetic differences of the parents, the offspring are hybrids brought about by sexual reproduction. Certain characteristics may be either dominant or recessive in the offspring, depending on the random gene combinations received from the parents; thus new varieties with some outstanding quality may result.

Another method of reproduction is asexual, or by vegetative means. When a bulb becomes mature, a lateral bulb may form which, in time, will separate from the parent bulb; characteristics of both plants will be identical, and any further lateral bulbs produced will exhibit the same characteristics as the parent plant.

ANATOMY OF THE DAFFODIL PLANT

The Seed. Mature daffodil seeds vary in size with the parentage. Most seeds obtained from miniature parentage are smaller than those from large varieties. The seeds may vary in size from 1.5 to 3 mm. wide by 2 to 4 mm. in length and are oval in shape. The outside coat, or testa, of the seed is black, shiny, and smooth. A ridge, called the raphe (formed by a part of the stalk of the ovule), runs along one side of the seed from end to end. A longitudinal section of the seed made at right angles to the raphe shows the testa thickened or wing-like at both ends (Pl. 28C). The lower end is known as the micropylar end and is the place where the seed was attached to the seed stalk of the ovule. The upper end is called the chalazal end. Beneath the testa and integument (inner seed coat) lies the endosperm, or food supply, upon which the new plant lives until it has sufficient roots and leaves to manufacture its own food. The stored food in the endosperm consists of protein and oil globules. Near the micropylar end lies the embryo, or the potential new plant, which is about one-third the length of the seed (Pl. 28C). Most of the embryo consists of the cotyledon (seed leaf) which surrounds the plumule, or leaf bud. At the lower end of the cotyledon is the root cap from which arises the primary root of the new seedling.

By cell division the embryo begins to develop, and a leaf forms which pushes downward from the micropylar end of the seed. In doing so, a connection is retained with the endosperm, so that food may be absorbed. The roots develop af-

ter the seed leaf. The vascular system which carries food and water throughout the plant develops first in the roots from special cells which are termed meristematic (capable of actual division). The vascular system sends branches to the cotyledon and upward to the first leaf; thus the leaf and roots become connected.

By the time germination is complete and the seedling is anchored in the soil —about six months—the reserve food supply, or endosperm, becomes depleted, and the shriveled cotyledon falls away and decays in the soil. The plant now must produce its own food through the process of photosynthesis which will be discussed later.

THE SEEDLING. Germination of the seed usually starts in the fall, and emergence of the first leaf may occur in either late fall or early spring depending upon the parentage. Some species start growth earlier than others. *N. elegans, N. serotinus* and *N. viridiflorus* are fall bloomers.

During the first growing season the new plant forms roots, two or three in number. Food reserves in the form of starch are stored in the basal portion of the tiny bulb which is composed of the first leaf and the apical meristem—commonly called the growing point—(a group of meristematic cells which by division produce the precursors of the tissues of root and shoot). At the end of the growing period, an abscission layer (separation layer) forms at the bulbous base of the foliage leaf, and the leaf falls away. By the end of the summer, another abscission layer forms around the basal portion, or plate, of the bulb, and the entire root system falls away and decays in the soil. The tiny bulb, without roots and leaves, passes its first dormant period in the soil. The bulb is oval in shape, covered by a thin brown scale which is the remains of the sheath which covered the cotyledon in the seed. Inside the brown sheath are the fleshy base of the foliage leaf of the first year and a group of cells capable of division in all directions: the apical meristem or growing point. From this group of cells, future growth will originate.

The second year of growth of the seedling may start as early as November or December, depending on climate and temperature of the soil. The roots develop, usually three to five in number, around the edge of the basal plate. They are slender and delicate and vary in diameter from 0.7 to 1 mm. and in length from 5 to 30 mm.

The foliage leaf of the second year is encircled by a sheathing base composed of cells containing starch. The sheathing base extends slightly above the neck of the bulb (Pl. 29B). The new leaf contains a number of vascular bundles which form a network; however, the main bundle is located near the center of the leaf. At the base of the leaves are rows of elongated cells which contain calcium oxalate crystals (raphides); as a result animals do not relish the plants as food (Pl. 30). By the end of the second year, the bulb has stored much starch, and the leaf and roots fall away in the same manner as at the end of the first year.

The growth of the plant in the third and fourth years is about the same as in the second year; however, by the third year the above ground portion consists of two leaves which take on the appearance of the ribbon-like structures of the mature plant, instead of the cylindrical appearance as in the first two years. Some species retain the rushlike foliage throughout the life of the plant, e.g., *N. jonquilla*.

Before the plant reaches maturity, each new sequence of growth is produced by the entire apical meristem, but when the plant reaches flowering stage the apical meristem divides into two parts, one smaller than the other (Pl. 31A). The larger portion of the meristem produces the scape, and the smaller portion continues to function as the growing point.

PLATE 26 IVAN N. ANDERSON

TRIANDRUS HYBRIDS

Ivory Gate (upper left), Sidhe (upper right), Silver Chimes (lower left), April Tears (lower right)—All Div. 5b except Silver Chimes (half triandrus and half tazetta) transferred in 1965 to Div. 8.

PLATE 27 LILIAN A. GUERNSEY

FORTUNE
Large-cup (Div. 2a)

THE FLOWERING PLANT. Usually by the fifth year the bulb is mature and will send up a scape and inflorescence. Some seedlings will flower in four years, while others may take as long as seven. At the flowering stage, the underground portion of the plant consists of the following parts, the number depending on the age of the bulb; one brown scale on the outside, scale leaves, sheathing bases of foliage leaves from previous years' growth, foliage leaves, sheathing base which subtends the scape, and the apical bud (Pl. 31A). The scale leaf is a com-

plete sheathing structure which extends slightly above the neck of the bulb. It is similar to the sheathing base of the foliage leaf, but does not develop a leaf. Its function is protection to underlying tissues and starch storage. (Pl. 31B). The foliage leaves completely encircle the scape and apical meristem with the exception of the innermost foliage leaf which is semi-sheathing and partially encloses only the scape. The sheathing bases of the foliage leaves also store starch.

The scale leaves which surround the scape are the longest and extend above the neck of the bulb, a condition which furnishes support to the scape as it emerges from the bulb. By the time the scape is mature, the scale leaves have become dry and withered around the neck of the bulb. The scape enclosed in a sheath is produced within the bulb near the end of the previous year's growth; although it is very short it contains a tiny flower bud. As growth begins in the spring, the sheath and scape grow simultaneously. The flower bud is covered by the sheath (spathe) until the flower begins to open, then the sheath splits and becomes brown and papery, but remains attached to the stem at the neck for a time after the bloom has withered.

According to some botanists, the perianth segments, composed of the sepals and petals, are formed within the spathe in a clockwise manner. Formation is said to begin with the posterior right-hand segment of the outer whorl (sepals) of the perianth. The next segment formed is one of the inner whorl (petals), then another sepal and so on, until three sepals and three petals have been formed. The anthers and filaments are formed in the same manner as the perianth segments: one member of the outer whorl series alternating with a member of the inner whorl series. The six filaments which carry the anthers are attached to the perianth tube at the base of the perianth segments. The ovary is formed from the central part of the apical meristem and is the last floral part to appear. The female parts of the flower compose the pistil and consist of the style, stigma, and ovary which contains the ovules (Pl. 32A). The stigma is tri-lobular, the the ovary has three seed locules or compartments; characteristics typical of the monocotyledonous plants.

The scape is supplied by six vascular bundles which branch at various levels and thus supply the ovary and other floral parts with a vascular system. The bundles fuse together in the outer ovary wall as do the bases of all the flower appendages. This formation produces a condition known as an inferior ovary, i.e., the floral parts are above the ovary.

During the late summer and autumn, the scape remains very short within the bulb; about December or January it begins to lengthen and slowly pushes its way through the neck of the bulb. In spring the growth of the scape is quite rapid.

The scape may terminate in one or more flowers depending upon the species. The longitudinal growth of the scape takes place by division of meristematic cells located at internodes deep within the bulb, but later, as these cells mature, the meristematic cells at the base of the bulb take over responsibility for the final lengthening of the scape.

The structure of the basal portion of the scape is similar to that of the foliage. The outer, or peripheral cells, contain chlorophyll and are photosynthetic. The vascular bundles of the scape are arranged in a circle around the hollow center, a distribution which is typical of a monocotyledonous stem. The basal portion of the scape inside the bulb is composed of storage tissue which is packed with starch. Calcium oxalate crystals are abundant in the scape as well as in the leaves.

After the bulb becomes mature and the foliage dies down, a lateral shoot usually begins to develop at the base of the outermost foliage leaf or, in varieties with three or four leaves, in the axil of the second leaf. It resembles the spathe sheath of the flower bud at first, but later takes on the characteristics of a lateral growth. After two years of leaf growth, the lateral shoot will probably

produce a scape and an inflorescence. By this time the lateral growth has developed a stem plate and root system of its own and will break away from the parent bulb, thus producing an independent growth identical with that of the parent.

Contractile Roots. It has been noted that daffodil bulbs have a tendency to pull themselves down in the soil to a depth which seems most suitable for their growth. This is accomplished by contractile roots, which usually function during the growing season. Roots measured in early spring and again about six weeks later were found to have shortened several millimeters. The contraction takes place near the base of the bulb in the region of the older portion of the root. As the roots begin to contract, they become shorter in length and larger in diameter. The cortex, or outer covering, becomes wrinkled transversely which gives the root a curly appearance (Pl. 29C). Microscopic study of the cells in the contractile region shows the inner cells broader and shorter than in ordinary roots. It is thought that the cells become compressed by the longitudinal shortening of the roots, thus causing a wrinkling of the outer cells which are less elastic than those of the vascular system in which the cells have a tendency to flatten out.

Leaf Structure. Daffodil leaves may be straplike or rushlike depending upon the species; however, the structure of both is similar. The leaves have their origin in the primary meristem. They emerge as a protuberance on the side of the apical meristem. As the leaf sheath grows, it extends laterally around the apical meristem and vertically until it reaches the neck of the bulb where a limb elongates on one side the bulb. The limb portion is what we consider the true leaf; it contains vascular bundles and chloroplasts and is capable of carrying on photosynthesis.

The leaf is covered with cutin, a waxlike, complex, fatty substance which makes the walls more or less impervious to water (Pl. 30). Stomata, or pores, open into a chamber beneath the epidermis on both sides of the leaves. The substomatal chamber connects with the intercellular spaces beneath and acts as a communication route between inner cells and outside air.

In the species with tubular leaves, the center is hollow. The vascular bundles develop around the hollow core; however, in the species with straplike leaves there is a central bundle which is larger and better developed than the secondary bundles which are found near the edges of the leaf. The bundles run longitudinally along the leaf and are connected by short transverse veins which form a network system.

The Flower. The mature floral parts of the daffodil are borne atop the stem which gradually tapers into the neck. At

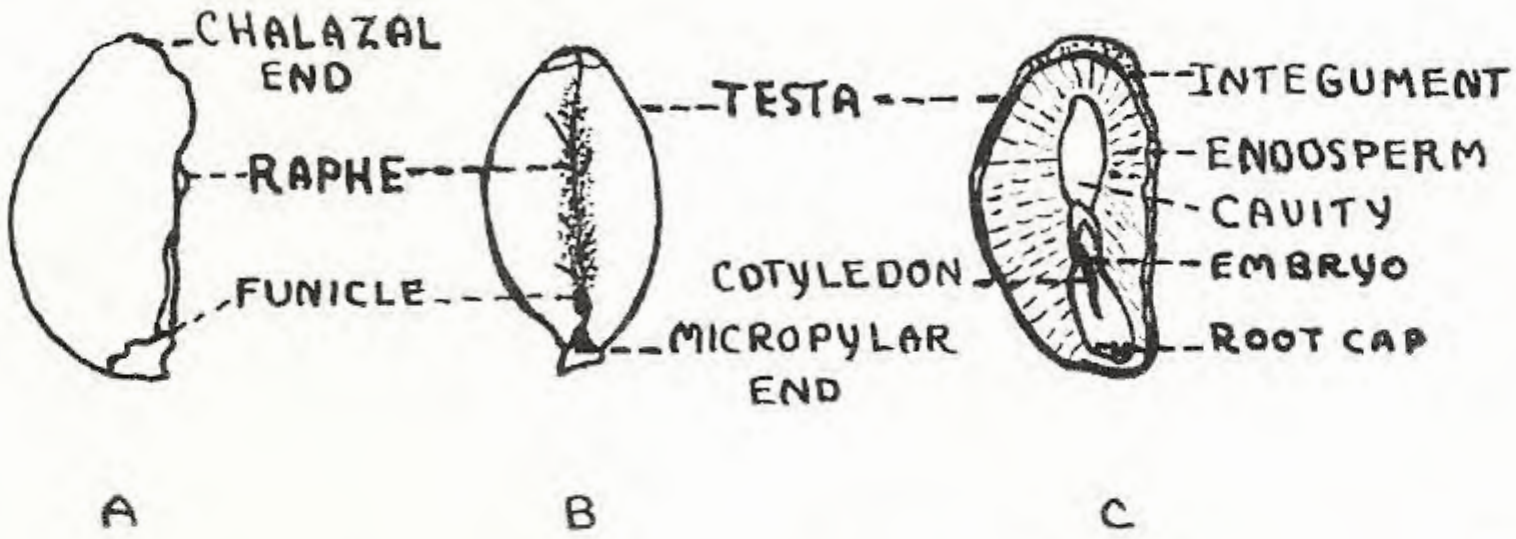

Plate 28 — Helen K. Link

Daffodil Seed × 30

A. External side view. B. External view of raphe. C. Longitudinal section showing endosperm and embryo.

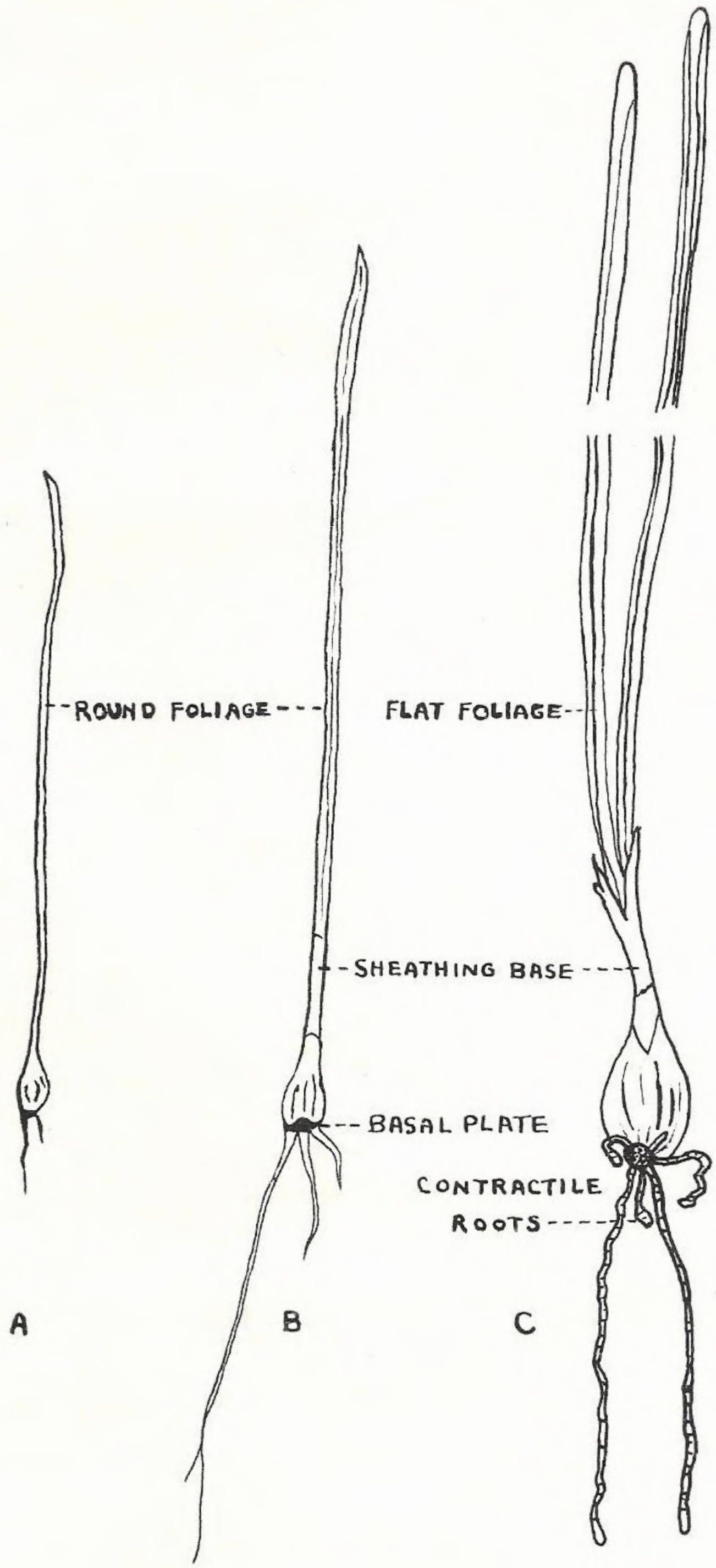

PLATE 29 HELEN K. LINK

DAFFODIL SEEDLINGS × 1

A. One year old. B. Two years old. C. Three years old, showing flat foliage and contractile roots.

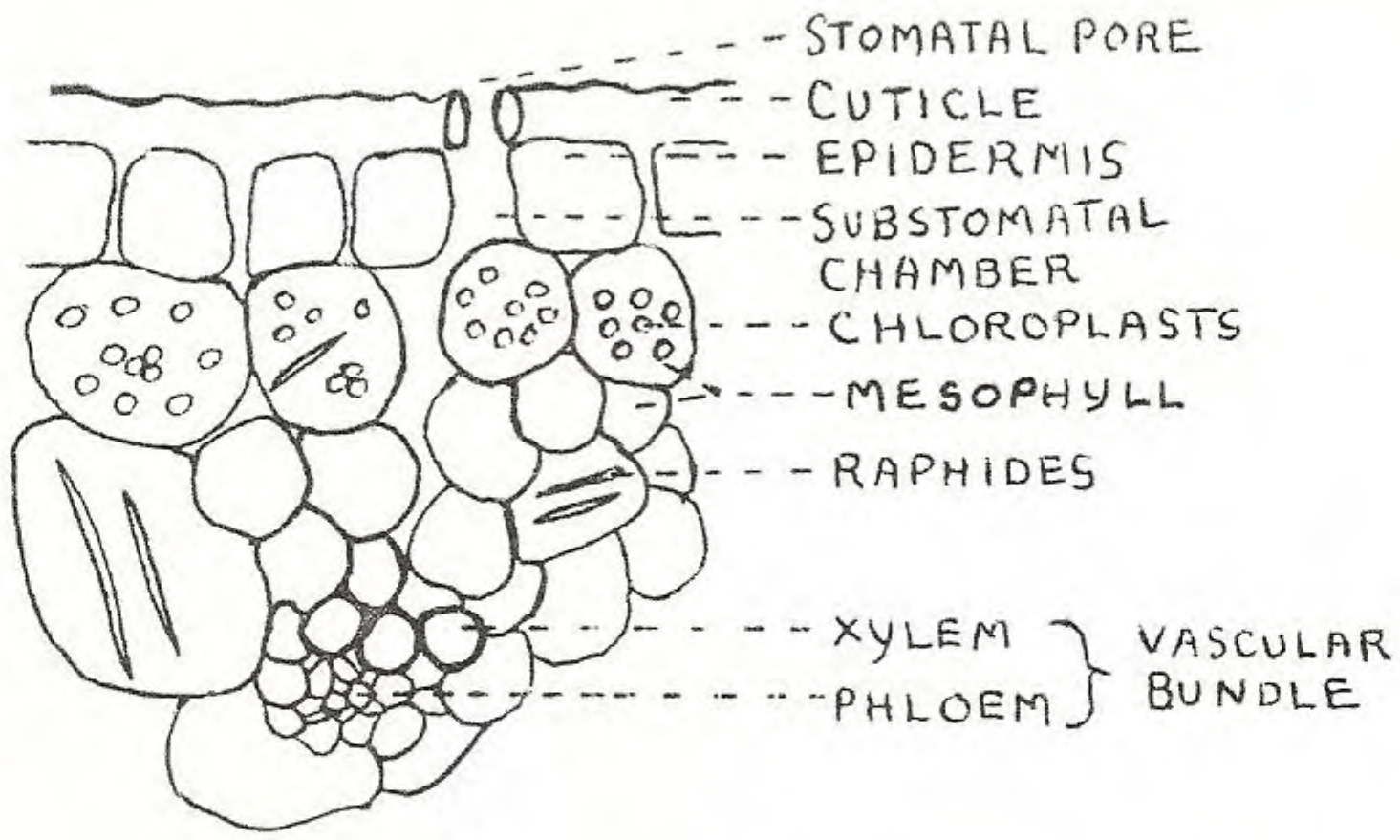

PLATE 30 HELEN K. LINK

DAFFODIL LEAF

Cross section of a portion of a daffodil leaf showing epidermis, stomatal pore and chamber, raphides (calcium oxalate crystals), and vascular bundle structure × 600.

the neck is a joint where the brown sheath which once enclosed the flower hangs ruptured after the emergence of the flower (Pl. 32A). Above the neck rests the ovary which contains the ovules or eggs (Pl. 32B). The ovary has three compartments or locules, each containing two rows of seeds. A tripartite tube (pistil) protrudes from the ovary and flares at the end into a three-lobed stigma. The cup, or corona, fuses with the sepals and petals at various distances from the ovary, depending on the species. Some species, such as *N. poeticus,* have a long perianth tube connecting the ovary to the corona and perianth segments; other species have a short tube which is more or less expanded. The trumpets and large cups are examples of the latter type of structure.

The male reproductive organs, the anthers, are six in number and attached by filaments to the perianth tube. In some species the filaments are attached to the tube just above the ovary and in others midway between the ovary and junction of the perianth tube with the corona and perianth segments. In a few species the filaments are of two different lengths.

The position of the anthers with regard to the stigma also varies with the species. In the trumpet division, the stigma is well above the anthers, while in the poeticus, the opposite relation prevails.

The anthers are oval, long, and slender. A furrow runs down the side of the anther on the side opposite the point of attachment to the filament. Along this furrow the anther ruptures for dispersal of the pollen grains.

The outer whorl of the perianth segments is composed of three sepals and the inner whorl of three petals. These segments are often referred to as floral leaves.

The tips of the perianth segments are mucronate, or end in a sharp point. Upon close observation one may note that the mucros are more pronounced at the tips of the sepals than on the petals. These projections are somewhat concave and hook-shaped and serve the purpose of locking the outer segments over the inner segments until the entire flower is mature and ready to burst open. Occasionally during the blooming season a hot sun will dry out the mucros which causes them to stick together. A slight pressure with the fingertip at the locking point will release the hook-shaped projection and allow the flower to open.

PHYSIOLOGY OF THE DAFFODIL PLANT

Roots. The roots of the daffodil plant are constructed for the purpose of absorbing nourishment in the form of mineral salts which move into the cells along with water. There are twelve mineral elements essential for proper growth; six of the elements are classed as major elements since they are more essential to the plant than the minor elements. The major elements are nitrogen, potassium, phosphorus, sulphur, magnesium, and calcium; the minor elements are iron, manganese, copper, zinc, boron, and molybdenum.

The cells of the hair roots are able to take up the nutrients and water from the soil, but do not allow it to pass out-

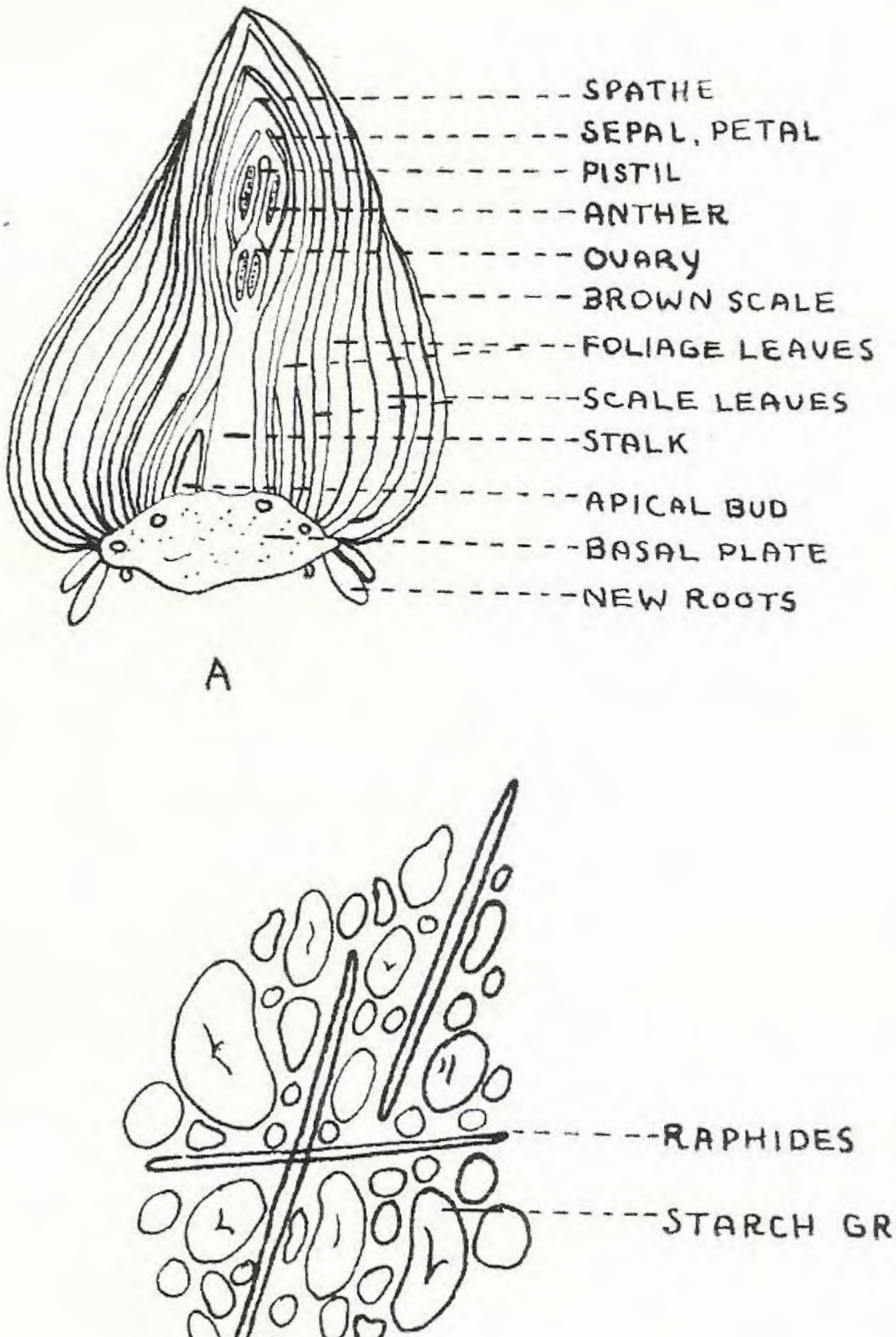

PLATE 31 HELEN K. LINK

DAFFODIL BULB

A. Longitudinal section of a flowering size daffodil bulb made prior to beginning of new growth; new roots have begun to form from basal plate and flower stalk has begun to elongate × 1. B. Microscopic view of mascerated tissue composing the scale leaves of bulb. Cells are packed with starch grains and raphides (calcium oxalate crystals) × 600.

ward. The walls of these cells contain many very small pores through which the fluids flow under the control of two membranes within the cell—the plasma and vacuolar. These membranes have thin walls and selective permeability which permits the passage of some materials and inhibits the flow of others. The membranes are thought to be lipid or fatty in character, a sievelike sheath with areas suited to the penetration of small molecules such as water, while restraining at the same time the outward movement of larger molecules such as sugar. The movement of the water from the soil into the plant through the plasma membrane is due to osmotic concentration of cell contents which press on the wall producing a turgor pressure. The cell wall restrains expansion of the cell by means of wall pressure.

The movement of salts into the plant cells is complicated by the process of accumulation. Ionic solutions move into the cell slower than non-ionic, also plant membrances restrict the rate at which ions move into the cell. The cell membranes have the ability to select between species of ions; some enter in abundance and others are restricted. The uptake of mineral salts by the roots is also tied in with increased plant respiration and uptake of oxygen.

TRANSPIRATION. Transpiration is the loss of water through evaporation from the leaf surfaces of the plant. The leaves of the daffodil plant consist of water-filled mesophyll cells. Wet surfaces of cells are in contact with intercellular spaces which lead to the outside of the leaf through the stomata (Pl. 30). Water lost by the leaves in the process of evaporation is brought up from the roots by the vascular system. If the roots are unable to absorb water due to lack of water in the soil, transpiration continues in the leaves, finally depleting their water supply and the plant wilts. Since the daffodil plant has large leaf surfaces, it is easy to understand why large quantities of water are needed for good culture. The salinity of the soil, the temperature, and soil aeration are other factors which influence uptake of water by the roots. Uptake of water is depressed by low soil water content, high soil solute concentrations, low soil temperature, and poor soil aeration.

The stomata of the daffodil leaves are located on both the upper and lower surfaces of the leaves, and are the main avenue for the escape of water vapor from the leaves of the plant. The opening of each stoma is bounded by two bean-shaped cells, known as guard cells (Pl. 33A), which are separated by a stomatal pore. The guard cells differ from other epidermal cells in that they usually contain plastids and thickened walls toward the pore area, thus when the guard cell becomes turgid, the thin wall at the outside of the cell pulls the stomatal pore open. As the guard cell loses turgidity, the stomatal pore closes (Pl. 33B). The opening and closing of the stomata are controlled by a number of environmental factors. Light and the water content of the leaf tissue are the most important, but recently it has been determined that the carbon dioxide within the cavity directly beneath the stoma plays an important part. When the carbon dioxide within the substomatal cavity is equal to that in the normal outside air, the stomata remain closed, but when the carbon dioxide concentration in the substomatal cavity is reduced below that of the surrounding air, the stomata promptly open. The degree of the opening depends on the amount of the reduction of carbon dioxide within the cavity. Light also produces stomatal pore opening. It is thought that during the process of photosynthesis, carbon dioxide is utilized which lowers the concentration within the substomatal cavity causing opening of the guard cells.

PHOTOSYNTHESIS AND RESPIRATION

The energy which supports the growth of the daffodil plant is derived directly from sunlight. Energy from the sun is taken up by the plant and transformed, by action of light upon the green pigment, or chlorophyll, of the leaves and stems, into carbon compounds upon which the plant lives and grows. In the photosynthetic process, carbon dioxide

from the air and water from the soil play an essential part. A by-product of photosynthesis is the liberation of oxygen into the air.

Plant respiration is the photosynthetic process in reverse. Products of photosynthesis are used up by plant growth; thus oxygen from the air combines with the carbon-containing compounds of the plant, and water and carbon dioxide are given off. Respiration of green leaves takes place both in the light and dark. Food stored in daylight hours by photosynthesis is used by plant respiration during periods of darkness. Through the photosynthetic process, daffodil leaves store starch in the scale leaves and leaf bases beyond the amount used for respiration (Pl. 31B). Thus the stored food from one year's growth supplies the carbon-containing compounds for growth and flowering of the plant the next year.

The removal of the leaves from the plant before they turn brown reduces the amount of starch which can be stored and may result in a lack of bloom the following season.

The daffodil plant has effective photosynthesis because of its large leaf surface, extensive intercellular spaces, and numerous stomatal openings; however, these same features also make transpiration effective.

TRANSLOCATION. Translocation is the distribution of nutrients within the plant. Carbon-containing compounds, photosynthesized by green leaves, are required by all tissues of the plant, and

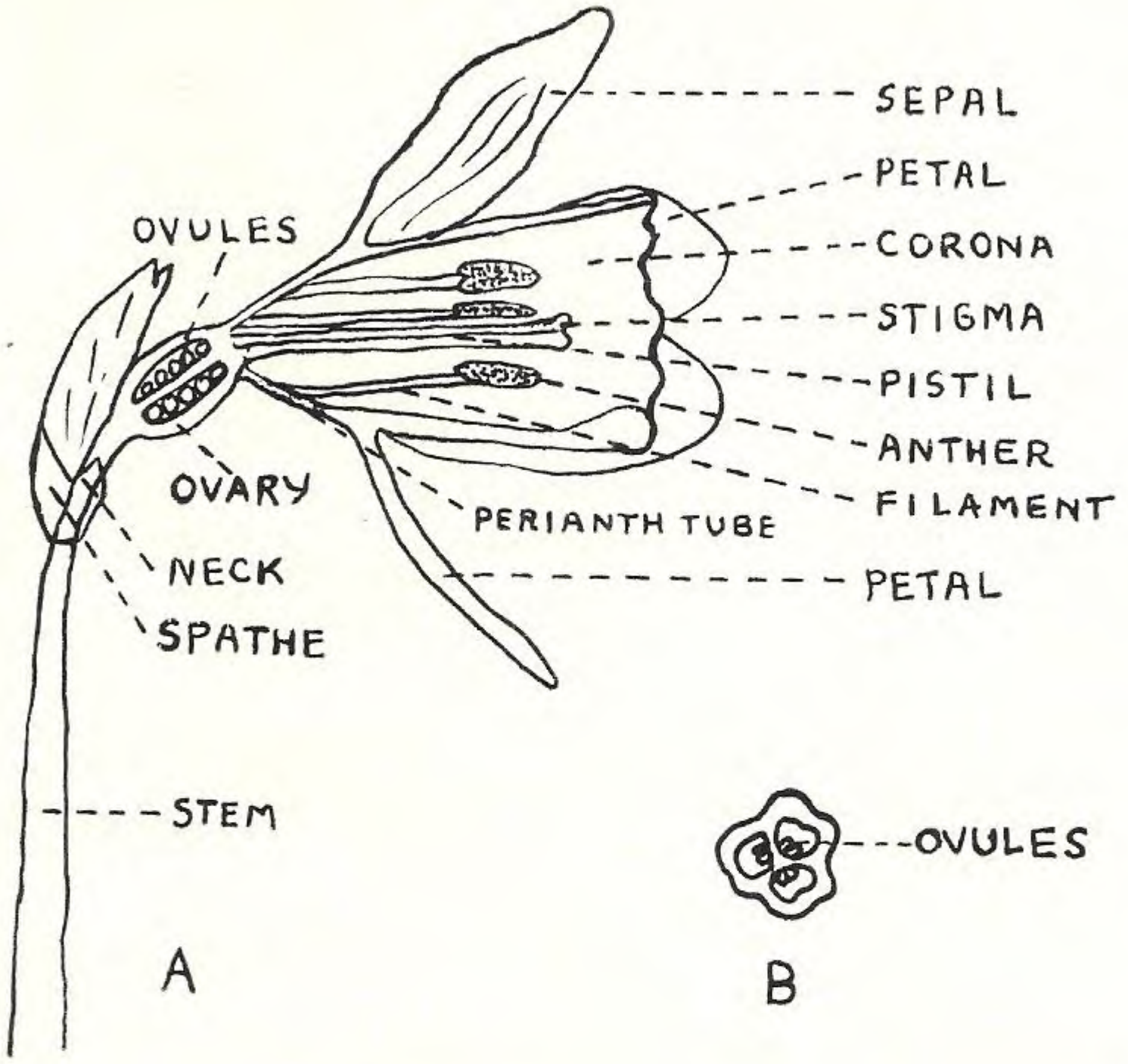

PLATE 32 HELEN K. LINK

DAFFODIL FLOWER

A. Longitudinal section of a large-cupped daffodil flower showing the floral parts × ¾. B. Cross section of the ovary × ¾.

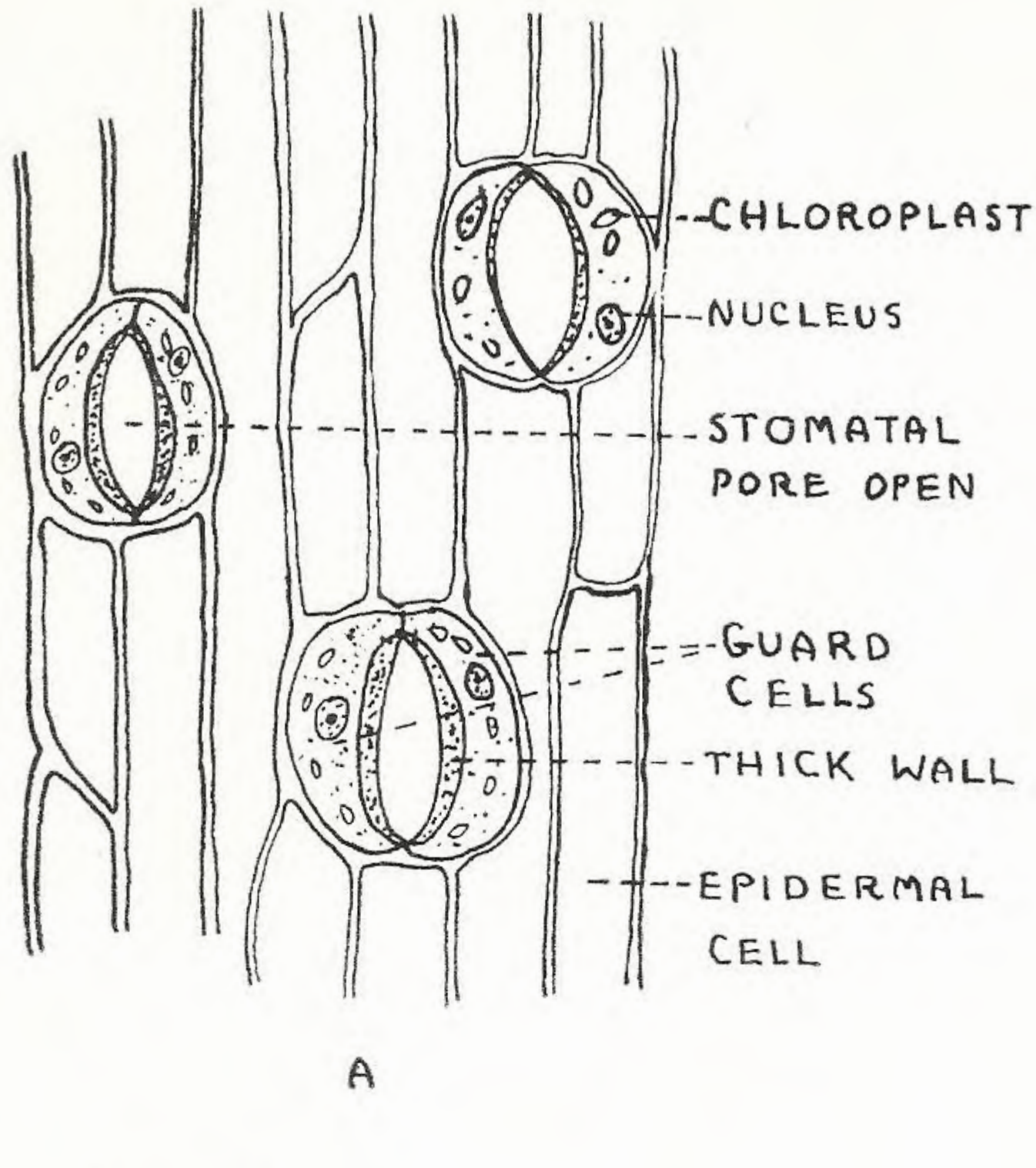

PLATE 33 HELEN K. LINK

DAFFODIL LEAF

A. Surface view of the epidermis of a daffodil leaf showing epidermal cells, stomata, and guard cells × 150. B. Guard cell in closed position × 600.

the nutrient elements taken in by the roots are moved throughout the plant to the leaf tips.

The movement of the nutrient elements takes place in the vascular system which is composed of two kinds of vessels, the xylem and phloem (Pl. 30). Photosynthate produced in the leaves is moved downward in the plant by the phloem to all growing and storage points. Carbon-containing compounds are moved from the leaves to other parts of the plant and the excess is stored in the form of starch in the bulb (Pl. 31B). The carbon-containing compounds are moved in the form of sucrose, amino

acids, vitamins, and other nitrogen-containing materials.

Temperature is a factor in the rapidity with which materials are translocated. Too high a temperature will impede movement and a range between 70° and 85° F. has been found to be most efficient. At low temperatures sugars tend to accumulate in the root, while at high temperatures respiration is increased and the leaves use up the sugars, leaving little to transport. Most of the growth of the daffodil takes place in cool weather, and most varieties do not do as well in hot climates as in cooler regions.

The phloem cells are living sieve-tube elements placed end to end to form tubes which are connected by protoplasmic strands. These elements carry nutrients in their cytoplasm to all parts of the plant by means of pressure flow. The force which drives the stream of solution is produced by a difference in turgor pressure between the cells where the nutrients are produced and the cells which receive the nutrients for use in respiration or storage. Other compounds beside sugar which are translocated by the phloem are plant hormones, virus molecules, systemic poisons, and radioactive materials.

The xylem vessels and tracheids of the vascular system carry the water and minerals taken up by the roots to the leaves as transpiration of water takes place from the leaves through the stomata. Minerals are able to transfer laterally from the xylem to the phloem.

The photosynthate produced in the leaves by the process of photosynthesis is in the form of sugar; however, excess sugar beyond the amount used for respiration is stored in the bulb in the form of starch. The sugar is transformed to starch by enzymatic action.

Sexual Reproduction. When the spathe splits and the flower emerges, the sepals and petals unfold. In a few hours, the anthers split longitudinally and become yellow with pollen grains. Insects may come to feed upon the pollen, or the wind may carry it to other plants or deposit the pollen upon the stigma of the same plant; thus pollination occurs by natural means, or man may take over the duties of Nature and carefully select the seed and pollen parents.

When viewed under the microscope, the pollen grains of the daffodil appear ovoid in a lateral position (Pl. 34A). Each grain has an exine, or covering. In equatorial view, a culpus, or furrow, is visible (Pl. 34B). When the grain is rotated laterally, it resembles an orange section (Pl. 34C).

Before the pollen is shed, the microspore mother cell undergoes meiosis, a process in which the cells resulting from division are haploid and the chromosome number has been halved. *N. triandrus* has the chromosome count of $2n = 14$; the pollen grain when shed would be $n = 7$.

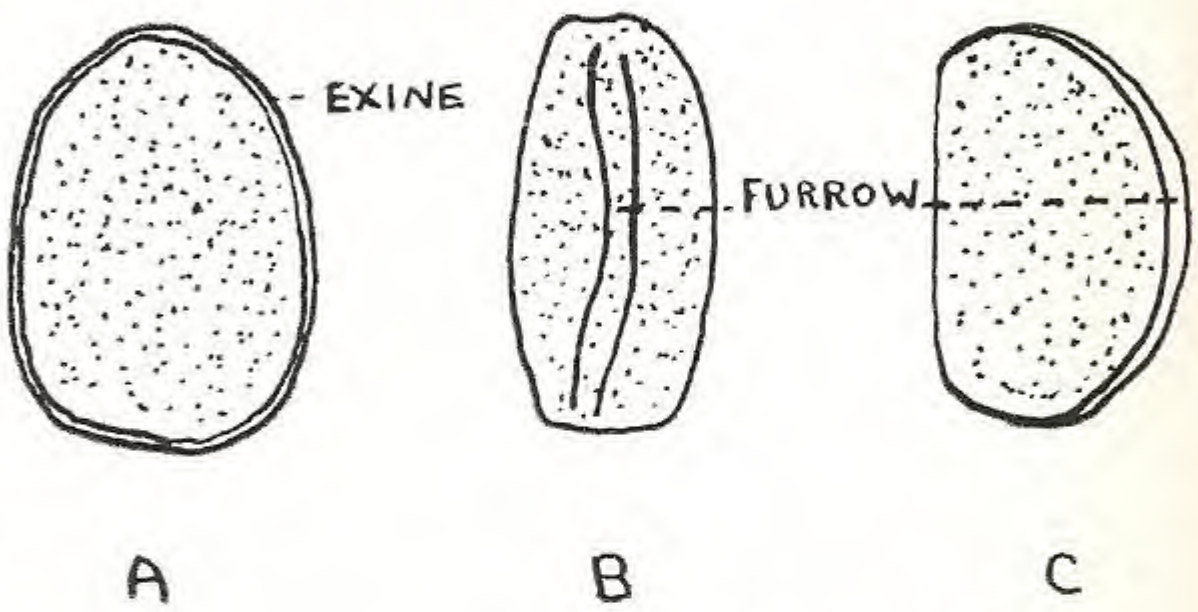

Plate 34 Helen K. Link

Daffodil Pollen Grain

A. Pollen grain in lateral view. B. Equatorial view showing furrow. C. Lateral view, grain rotated to show furrow × 600.

The mother cell, or megaspore, which eventually forms the egg, also undergoes meiosis and four megaspores result; three disintegrate and the remaining cell nucleus divides and redivides forming eight nuclei. One is the egg, three form the antipodals which are functionless, two which are termed synergids surround the egg and are also functionless, the remaining pair are the polar nuclei which fuse before fertilization occurs. The egg when ready for fertilization has the chromosome number $n = 7$ (Pl. 35B).

When the pollen grain is shed, it contains two nuclei, a generative nucleus and a tube nucleus. If the grain is viable, it starts to grow after it lands on the stigma. A tube emerges through the

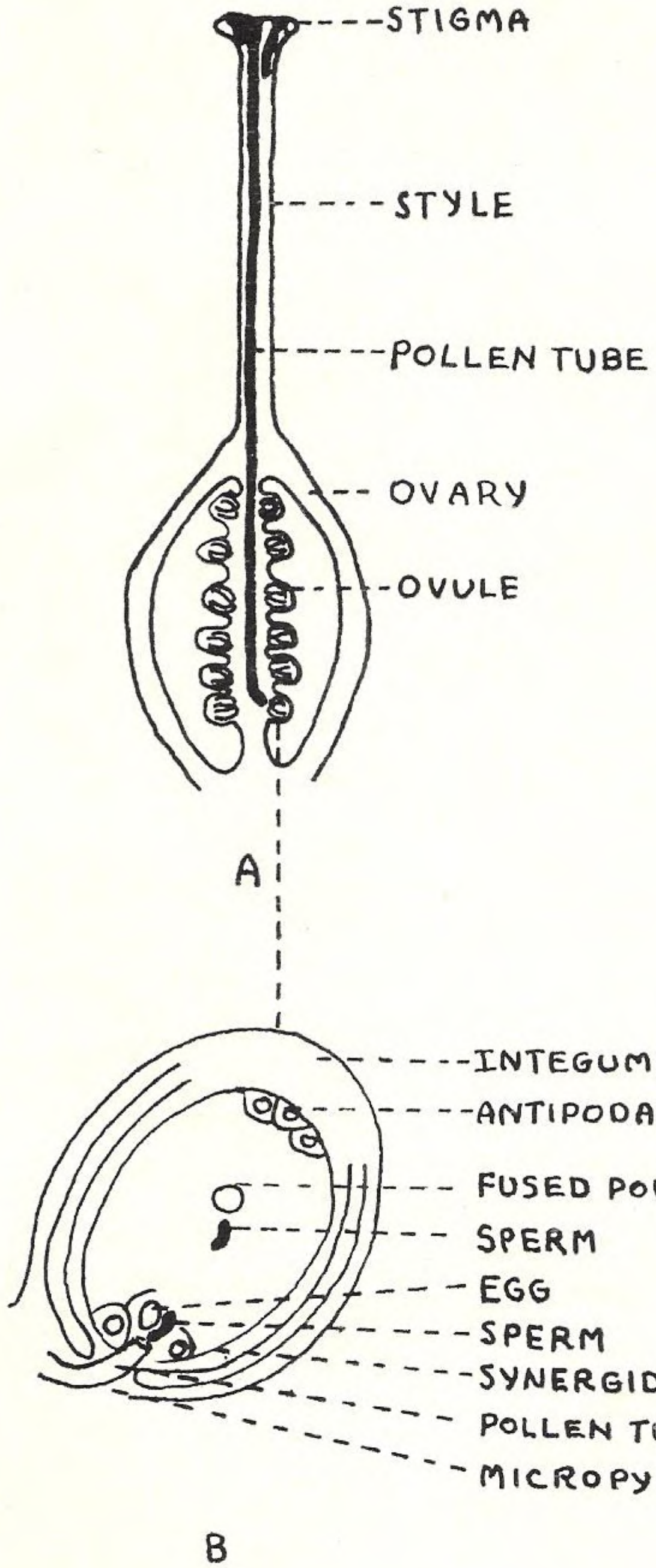

PLATE 35 HELEN K. LINK

PISTIL OF DAFFODIL FLOWER

A. Diagram of stigma, style, and ovary (which together comprise the pistil) showing growth of pollen tube into ovule × 50. B. Diagram of ovule showing ruptured pollen tube after release of the sperms. One sperm fuses with polar nuclei and the other with the egg × 150.

furrow of the pollen grain and grows downward through the stigma and style to the ovary where fertilization takes place (Pl. 35A). As the tube starts to grow, the generative nucleus divides to form two sperm nuclei which, together with the tube nucleus, travel down the tube as the tube itself grows through the micropyle of the ovule (Pl. 35B). Once inside the ovule, the tube ruptures and one sperm unites with the egg and the other with the fused polar nuclei of the ovule. The union of the sperm and the egg produces the potential embryo, and that of the polar nuclei and the second sperm produces the endosperm upon which the embryo of the seed lives until roots and leaves of the seedling are established. In the case where *N. triandrus* is self-pollinated, the sperms would carry seven chromosomes, the egg seven, and the young seedling fourteen, seven from the male parent and seven from the female, $n = 7$ and $2n = 14$. Genes for color, form, and so on are carried on the chromosomes.

A number of factors are involved in pollination and fertilization. Some varieties produce little or no viable pollen. Weather conditions may be a factor in growth of the pollen tube. Hot, windy weather may dry out the stigma and prevent the pollen grains from germinating. The failure of union between polar nuclei and sperm would deprive the embryo of a food supply. The death of the sperm or the egg would eliminate the possibility of seed production. There is also the possibility of dominant lethal genes in sperm or egg, or both. Since so many factors are involved in the production of viable seed, it is easily understood why some crosses produce few or no seeds.

If fertilization is successful, the seeds usually mature in five to six weeks. The pod, or ovary, splits at the point where the style previously joined the ovary and the seeds drop to the ground or may be collected in cheesecloth bags tied over the ovary.

—6— Regional Culture

A. THE SOUTH ATLANTIC COAST

This is a commentary on growing daffodils in the Southeastern United States, specifically that area lying between the Appalachian Mountains and the Atlantic Ocean and from Virginia to Florida. The main geographical regions are the Alpine or Mountain, the Piedmont, and the Coastal Plains. Geographically we are located at about the center of this area and believe that with slight modifications for soil and climatic differences, the following cultural procedures will produce good results. First, we must analyze the requirements of the daffodils we desire to cultivate and compare these with the conditions available. If it is possible to alter the existing conditions to meet more nearly the requirements of the plant, chances of success are increased.

Daffodils prefer a well-drained, deep, loamy soil slightly on the acid side and with plenty of moisture during the growing season and a cool soil during the dormant or resting period. They must also have adequate nutrition.

For best results, daffodils should be planted in soil well pulverized to a depth of at least 12 inches. If the soil below this level is hard and impervious to water, it should be loosened an additional 8 to 12 inches to insure good drainage. Heavy clay soils will be benefited by the addition of coarse sand and peat moss; spread 1 or 2 inches of each over the soil and work it in thoroughly. Peat moss is beneficial to all soils as it tends to aerate the soil and hold moisture.

Beds should be made up several weeks before planting time and should not be over 48 or 50 inches wide. If several are to be placed parallel to each other, leave 18 to 20 inches between beds for a walkway. Personally, I make the walkway slightly wider than my lawnmower. At the time the beds are made up, I incorporate a mixture of about half and half 20% superphosphate and bone meal (some growers question the use of bonemeal) at the rate of 4 to 5 lbs. per 100 sq. ft. into the soil in the root zone area, i.e., about 8 to 12 inches down. If wood ashes are available, they are also sprinkled in with the above mixture. The area should then be well watered and left for a week or two before planting.

Daffodils like a soil with a pH between 6.0 and 7.0. This is slightly on the acid side, a pH of 7.0 being neutral. If the soil is too acid, add ground limestone or ground dolomitic limestone (dolomite), wood ashes, or ground oyster shells, or other basic (alkaline) material. About 8 or 10 lbs. per 100 sq. ft. will lower the pH about one point on loams. Sandy soils will only require half of this amount and silt and clays about 1½ times that for loam. In most areas your county agricultural agent can arrange for a complete analysis of your soil at little or no expense to you.

Daffodil bulbs should be planted as soon as the soil begins to cool from the summer heat. This will vary with different areas of the region. In the mountainous sections planting may begin in September and continue until the latter part of October. In the Piedmont, from October 1st to November 1st is the usual planting time. In the Coastal Plains planting may be delayed three to four weeks, continuing until about December 1st. Bulbs need about six weeks to develop extensive root systems before extreme cold weather stops underground growth.

The depth of planting is determined by the type soil, climate, cultural meth-

ods, and location. The average size bulb is usually planted about 6 in. deep, measuring from the base of the bulb. In heavy clay soils the bulbs may be planted at a depth of 4 to 5 inches; in sandy soils the depth is increased to 8 inches. In the extreme south the depth may be increased to 10 in. as the soil temperature above this depth is not sufficiently low to encourage growth. Daffodils are extremely sensitive to soil temperature; they wait for cool soils to break their dormancy and in the spring excessive temperatures will send them back to dormancy before the bulbs have fully matured. Mulches may be used as an insulation to delay warming of the soil, and partial shade also retards temperature increases. When a mulch is used the depth of planting may be decreased slightly. Southern exposures will have higher temperatures as the rays of the sun strike the soil more directly; on northern slopes the rays hit the ground obliquely.

Heat, especially damp heat, is one of the main enemies of daffodils in the South, as it encourages fusarium or basal rot. Perfect drainage and mulches are the best weapons with which to fight it, but there are chemical controls which are discussed elsewhere in the Handbook.

In addition to keeping the soil temperature down, mulches serve other functions in the Southeastern United States, such as the control of weeds and the conservation of moisture. Sawdust or wood shavings, peanut hulls, ground corn cobs, pulverized leaves, and pine needles are all excellent mulches. Personally, I use pine needles about 3 inches deep.

At the Clemson University horticultural trial grounds in which the American Daffodil Society participates, all of their daffodil beds are overplanted with annuals as a green mulch during the summer months. Their bulb losses have been considerably higher than mine and it is believed that their heavier losses are due to nitrogen in the form of ammonium nitrate applied at the rate of one pound per 1,000 sq. ft. Excess nitrogen should be avoided in the Southeast in growing daffodils; use as little as possible to keep the plants in good growing condition. As the leaves emerge in early spring, an application of 4-12-12 or 5-10-10 at the rate of 3 lbs. per 100 sq. ft. is usually adequate.

Daffodils need plenty of moisture during their growing season. If a dry spell develops, water slowly and deeply about once a week or every ten days, but be sure the water reaches down to the root area. After blooming, water is still needed to mature the bulbs for the next season. Keep the leaves green as long as possible; do not break off leaves or tie in knots, as less area is exposed to the light and bulbs will not make maximum growth.

Bulbs may be left in the ground for several years, but enough room should be left at planting time for bulb increase; 8 or 10 inches each way is usually sufficient. When the bulbs show fewer and smaller flowers it is time to separate them. Wait until the leaves begin to turn yellow, then dig carefully so as not to injure or cut the bulbs, shake off excess dirt, remove damaged or diseased bulbs, and spread thinly in the shade to dry. When the outer coat is dry, the bulbs may be stored in a cool, dry place until fall. Do not pile them up as they must have air. Citrus bags are ideally suited for this purpose; for smaller amounts, nylon hose may be used. Tie off each variety with wire or string, label carefully, and hang up in the basement or other cool, dry place.

If your bulbs are used for naturalizing and you do not want to lift them often, plant them deeper, up to 10 inches. This discourages bulb increase.

In conclusion, a few comments about the relative performance of the different divisions of the daffodil classification in the Southeastern United States may be of interest:

1. Trumpets. As a whole they are very good, a little weakness is shown by the bicolors, but except for a few varieties the white trumpets are not long lived in this area.

2. Large cups. Here again, most are very good in the yellow range, with weakness showing up in the 2*b*'s, while the white cups in this division are the most difficult group to keep.

3. Small cups. About the same comments as for the large cups.
4. Doubles. Most of the doubles blast in this climate. Notable exceptions are Cheerfulness, Yellow Cheerfulness, Feu de Joie, Daphne, and White Lion.
5. Triandrus hybrids. All grow well here; excellent for naturalizing.
6. Cyclamineus hybrids. Most do well as they are early.
7. Jonquilla hybrids. These grow almost anywhere in the South and are excellent for naturalizing.
8. Tazetta hybrids. The farther south you go, the better this group grows.
9. Poeticus hybrids. Except for Actaea, they are too late for the South.
10. Species. Most will grow here with care.

Pinks. These belong to the *1b*, *2b*, and *3b* classes. They are not the easiest to grow, but they are showing improvement. Semishade helps preserve the color.

B. THE GULF COAST

The term "Gulf Coast," as commonly applied, refers to a narrow strip of country that extends from Pensacola, Florida, to Galveston, Texas. Throughout such a length, one will find a great variety of soil types, microclimates, and variations in weather patterns. One will also find a minimum of interest in daffodils. Whether this is due to actual trial and failures or not, the present writer has no idea. He is aware, however, that anyone who starts to grow daffodils must consider himself an experimenter with little knowledge available to him from any source.

The report that follows is written from Pass Christian, Mississippi, in an area that may be more or less typical of others. The soil is deep and sandy; always well drained, even to excess; humus is limited; rainfall distributed throughout the year with droughts in May, if at all; cold in January, while killing frosts may occur as early as mid-December and as late as late March. Summer temperatures sound worse than they are; the high may come to 100° F, but it is not as oppressive to humans as a much lower temperature in the North. It does appear to have some effect on the success with certain types of *Narcissus*. Thanks to the permeable character of the soil, fertilizing levels change quickly and the natural soil, always low, needs care in this regard.

Plantings here are of two sorts: groups in mass, more or less in the style of naturalization; and careful beds in which one grows varieties to examine and test for survival and whatever degree of excellence they may show. In each case, the planting areas are prepared with care as outlined, and the same practice of fertilization is carried out, though little watering has been given in the areas of naturalization. These last have been only relatively successful, and the failures can be laid largely to excessive root competition from shrubs and trees nearby and, in some areas, to excessive shade.

The test area is chiefly a long, narrow bed between grass walks, shaded in part by old pecan trees and serving also for spaced plantings of camellia and magnolia trees. In the earlier stages, varieties were planted in groups according to the division to which they belonged, but in the later additions, when the buyer was searching for this or that variety, the planting had to be mixed as to parental backgrounds. The bed, when nearly prepared, was higher than the level of the paths, but this soon changed as the peat in the bed was either used up or sank. The beds themselves vary, due to location, in the amount of shade that falls, and those beds that received the least shade were devoted to the jonquil progenies and to species, most of which come from hot enough areas in nature. As far as one can tell, this arrangement is and has been successful for years.

All beds, or parts of beds, are prepared well in advance of the planting season to allow preliminary settling. When the bulbs are placed, the trench is opened, a liberal supply of bonemeal added to the soil, mixed well into the soil, and the job is finished with a permanent label to mark the kind. In spring, particularly after the first season, the common commercial fertilizer, a 5-10-5 with an acid reaction, is spread

over the surface and watered in. This is repeated at whatever time appears to be the season when the bulbs will be making their new root growths.

Watering is done in dry weather and regularly for some varieties that give no bloom without it. Extra water must be given if late March and early April prove rainless. If one remembers to do it, the most common form of straight phosphate is added in the autumn feeding, since it is lacking in all soils in this immediate area. No effort has been made to use trace elements. Nothing has been done to approximate growing for exhibition, an elaborate business discussed elsewhere in this book. Nothing is done to provide shade for varieties with non-sunfast colors; in short, an ordinary garden.

No diseases have reared their heads, although some kinds, as bought, appear to have foliage that dies off prematurely, yellow from the tips but not showing either lesions or the veining that would suggest virus. As yet, no evidence of narcissus fly has appeared, though in several lots of purchases the bulbs showed that the source had had it. As the entire garden is regularly treated with dieldrin, this may have been safeguard enough.

Since it is the considered opinion of the writer that each daffodil lover in the lower South will have to make his own voyage of discovery, the best that can be reported here are such generalizations as indicate where success has come with a minimum of difficulty.

In most general terms, the garden here indicates that one will succeed with relatively few trumpets of value, but with a wide range of large cups, with practically all jonquil hybrids save Tittle-Tattle which needs more water to insure bloom than can be given here, with practically all triandrus derivatives, and, within the limits of those which have been tried, with nearly all cyclamineus hybrids, though these exhibit a wide range of robustness. All the bulbocodiums do well as plants, although those that flower in winter are often ruined by weather, rain as much as cold. All tazettas and their progenies do well, save the few that are very late in blooming, such as old Aspasia and the commonly found × *biflorus*, and those few like Sacred Chinese that want to flower in January. And should the gardener want something distinctive, he should try the autumn-blooming species, all of which have done well here.

The only hope he may cherish, after some of his failures, is that some small part of a bulb will continue, perhaps for years, and finally grow into a stock that will accept his conditions and climate. In the garden here, the trumpets Kingscourt, Royalist, and Goldcourt, all of which appeared to be failures, have now, after about five years, made a new stock from one or more offsets and thrive.

No double has been successful, save one of the old Phoenix varieties, probably Butter and Eggs, and that is established in many parts of the South. Twink is reported from other gardens as dependable but has not been tried here.

If one must have yellow trumpets, the only kind that has been uniformly successful here has been Garron. Kandahar appears to be a likely addition but is a less elegant flower. In other gardens, even nearby, King Alfred succeeds. Here it gives only magnificent foliage and generous increase.

Now that the group of large cups has been so greatly increased in number by the hybrids that are almost of trumpet proportions, one may get a garden effect from them, as, for example, St. Keverne which is a glorious yellow and happy. Galway, which is superb, has not yet settled down but if the surviving offsets continue, it will rival the yellow trumpets and is well worth waiting for. And if one may be allowed the scandal of suggesting that many of the large-cupped cyclamineus hybrids are, in effect, trumpets, as are some of the later jonquil hybrids, the trumpet effect is assured. Cyclades, new here but well established, is a fine trumpetlike cyclamineus hybrid. Both Woodcock and Ripple come close to looking like trumpets, though in the jonquil group. Doubtless there are others.

PLATE 36

MOUNT HOOD
Trumpet (Div. 1c)

Among the large-cupped varieties with brilliant color in the cup and a fine yellow perianth, Armada has been the outstanding success here; one clump has been in position without lifting for six years and is blooming as well as when it was first planted. It is ahead of Fortune here, though this, too, is fine. Ceylon, a more recent arrival, has been uniformly successful and fine. Many of the older varieties, such as Rustom Pasha, Narvik, Rouge, Carbineer, Diolite, Home Fires, and Indian Summer, have all been excellent. For those with white perianth and colored cup, Tudor Minstrel is the only one outstanding as yet. On the other hand, the all-white Parkmore, is almost as fine as a white trumpet! It appears to be more certain with us than Beersheba, though locally Mount Hood is usually the more successful.

Among newer plantings, Mr. Mitsch's lovely Chemawa has been exceptional, and in a small group of things from Ireland, all of which grow magnificently but are not yet settled as to permanence of performance, there have been excellent blooms from Border Chief, Court Martial, Jaguar, Madeira, and Pirate King.

It is impossible for the writer to make any final selection among the triandrus hybrids, as all do well, show a wide range of heights and habits, colors and styles of bloom, and include some that are properly miniatures; these last grown here only to know them. Certainly any southerner should explore the triandrus widely and not be content with good old Thalia, no matter how fine it is.

With few exceptions, the writer has no great passion for any cyclamineus hybrid and regrets that he has failed with the species itself. Cyclades, already mentioned, is outstanding and golden, and the commoner ones all do well, other than Jenny and Dove Wings which seem to need a little more care than they have here. Of the very new things, Titania has done well but no longer has the full appearance that one looks for in any cyclamineus child.

The lists are full of hybrids that belong in the jonquil group, and one may have as wide a choice as he wishes. It has been our practice to buy all of them except the most expensive novelties, and all have done well when the stock was sound. The first group to come into common use—Trevithian, Lanarth, and, a little later, Chérie—are still fine, but there are now so many better things one need not bother with the beginnings. The great advantage of the newer kinds is lower stature, more flowers per scape, a wider range of blooming dates, and a greater variety of color patterns, including some that are practically pure white. The only named variety which has failed has been Golden Goblet, in which, possibly, there is too much trumpet ancestry.

In Div. 8, the tazettas, one must decide whether he wants the nameless, commonly grown things of the South—most of them first class garden plants—or the newer hybrids once known conveniently as "poetaz." These last fall into two marked groups: those with many flowers per scape reflecting the tazetta ancestor, and those with fewer blooms suggesting the poeticus parent.

This writer has gathered all he might from each group, the nameless and the named. For garden effect and for picking, he would abandon none. It is difficult to make any choices, and it is hoped that some time in the near future someone will undertake to make more of the type that was foreshadowed in the late P. D. Williams' Medusa, Glorious, et al, using a fine type of poet as one parent, rather than the poets which seem to have been used earlier, although there is no record of any such, save Ornatus, in some of the first hybrids from Holland.

In this group are also many kinds that are either miniatures or near-miniatures, most of them with very fine character and lovely blooms, but the collection here is by no means complete or authoritative, and we can only report that so far all have done well.

Among the pink daffodils, there is nothing that can be reported as outstanding here. The older Wild Rose, Rose of Tralee, and Lisbreen have all been failures. The poor-quality Pink Rim is permanent and regular; Mabel

Taylor appears to be safe and sure but has not been here long enough. Salmon Trout has grown well but in 1965 gave poor color in spite of regular watering. Undoubtedly, there must be others that would do well.

No poeticus of any kind has been successful here, though relatively few have been tried. All appear to be too late, needing more water than can be managed. A few persist but do not bloom.

In the division for species, it can be said that all bulbocodium species and their immediate allies have done well, but some of the forms that are always winter-flowering run the risk of frost or, more often, devastating rains. Their hybrids, such as Taffeta and kin, all run the same risks.

The species that have caused most comment here have been *viridiflorus, serotinus,* and *elegans.* All bloom in October before any risk of frost, and, while the usual garden visitor rarely sees them unless they are pointed out, he may sense the delightful scent of *viridiflorus* and, in time, note the delicacy of *elegans. Serotinus* is here in very limited numbers, so missing it can cause no comment. The small species for spring do make talk; their small sizes being the most frequent cause of exclamation. Their only fault is their scarcity, and no good garden effect will come from them until they are planted in real groups.

What the South really needs more than anything else, and I refer to the Deep South in the common meaning of that term, is a larger group of experimenters to prove a wider range of success, and a small group of breeders who will choose as parents individuals known to be of merit and successful in our long, warm summers with their irregular rainfall and our indecisive and often troublesome winters.

C. THE CORN BELT

I suppose if a person living in our Middle West desired to raise the finest daffodils in all varieties, he would move to the Iberian peninsula. Here the daffodil was born. Mountains stand knee deep in the sea. Spring is moist, cool, and with a tang of salt sea air even at one to four thousand feet of elevation. And spring lasts about six months. Summer is arid, but despite the hot Spanish sun, the shadows are cool, and, although the soil may bake, it is never hot and moist. Fall slides into winter, and winter imperceptibly into spring; snow lies on the mountain peaks, but the daffodil roots are thrusting into the pebbly earth of mountain slopes, or into the rich soil of sub-alpine valleys during the entire time.

In case the family budget rebels at a pastel villa in Spain, how about a cabin or a ranch in northwest Oregon? All late winter and spring, the soft fog drifts inward upon clam digger and daffodil fancier alike. It is only during the short, dry summer that Mt. Hood can really see the extent of its holdings. The bulbs, fattened by a long, cool spring, ripen and mature and fashion next year's flowers during the rainless summer.

But suppose the daffodil fancier is firmly anchored to Iowa, Nebraska, Missouri, Kansas, Oklahoma, or a reasonable facsimile—what then? Actually, marvelous daffodils are grown in those areas; but knowledge is helpful, and effort is required.

To grow good daffodils in the Middle West, we have merely to do two important things: First, convert our climate, as nearly as possible to that of northwest Oregon. Second, seek out daffodils whose lack of sophistication allows them to be happy in a midwestern community.

Here in Des Moines, where I live, spring often begins on Sunday and ends on Thursday. I have had —1° on March 28th, only to experience +80° with hot, dry winds a week later. This doesn't sound much like the Iberian peninsula, but then I have learned to cheat the weatherman a bit.

First, *seek out your areas of microclimate.* That southern exposure at the base of a warm brick wall will bring spring two weeks early. The shadow of a building, or a stand of evergreens may let winter linger, and spring comes late to such an area. I have four daffodil beds at the crest of a gentle slope; the two which fall off to the south are seven

to ten days ahead of those which slope to the north, although both are in full sun.

Second, *realize that all daffodils do not blooom at the same time.* As a rule of thumb, yellow-cups and trumpets bloom early; flat, white-faced flowers bloom late. It is good to lean toward early blooming varieties, since some late bloomers are blasted by summer's first breath. Don't deny yourself the late flowers, but put them in an early microclimate. The judicious use of plant types and microclimates can give four to six weeks of bloom. Not many plants do better.

Third, *make your own rules*! Most daffodil experts live in a kindlier climate than you or I. Why fight it? Just ignore their rules and suggestions and do what comes naturally to you. The book says, "plant as soon as the bulbs are received, if possible by the end of August." This is great in Ireland, but not in Iowa. To consign new bulbs to a moist, highly organic soil whose temperature is over 90° F. can only lead to losses by disease. Disease in daffodils is uncommon, but moist heat will bring on an attack of whatever is available. *I plant the last week in September. I plant 6 in. to the base of the bulb. I dig a little potash and superphosphate under the bulbs,* because these elements do not travel through organic soil. *I occasionally plant on sand* (if I have time and enough help). This does nothing for the blooms or bulbs, but does make digging a bit easier. *I dig every three years,* if I want the best. The best blooms are from two-year down bulbs in Oregon; but we're just a year or two slower. Clumps last four or five years without especial deterioration, except for size of bloom. I *do not "treat" the bulbs* I dig. I have treated, at one time or another, with everything from whiskey to antibiotics—and fooled only myself. *It is better to dig early than late;* usually around the Fourth of July. The green foliage which has flopped on the ground points the way to the bulb and serves as a handle while digging. Cut the tops off about the neck of the bulb and shake the dirt from the roots. *Lay the bulbs out* in a cool, shaded area with good air circulation. I use the garage floor, but then my wife humors me. *Under no circumstances should the bulbs be heaped* up or piled up. This is the kiss of death to bulbs in the moist middle of the stack. I place the labels on or under the group of bulbs. After four weeks, the dried dirt, desiccated roots, and outer scales may be cleaned from the bulbs with a cautious thumb, and *the bulbs are sacked up. I use string onion or potato sacks* (burlap allows no air circulation); nylon hose work well if the female population of the house permits. The sacks are hung on nails or pegs in a shed, or placed on chicken wire shelves. I tried the air-conditioned basement, but the lack of circulating air and the humidity took their toll. If you must make a choice, daffodil bulbs withstand heat far better than moisture—and hot moisture is murder. *I never replant bulbs* immediately. To do so consigns them to the hot, moist grave.

What about mulch? *A mulch is not necessary because of cold* (we get —15° to —20° each winter). However a mulch keeps down weeds and prevents the spattering of blooms during the torrential rains which are a part of spring. I have tried all mulches available in this area. Pine needles (not available) are excellent; sphagnum moss is good (and expensive); ground corn cobs result in a mildewed mess; and grass clippings ditto. Probably *the best mulch is good turf*—sounds silly, but then, so did the horseless carriage. I have a friend who likes ground, shredded oak leaves. Daffodils like a bit of acidity in the soil, and she not only wins prizes but also has a really well-grown collection of daffodils.

Daffodil foliage takes a long time to mature and is not especially beautiful in itself. I think the word has gotten out that it is bad form to braid or tie up the foliage. This interferes with plant nutrition and makes the foliage about as unobtrusive as a set of false chin whiskers. It is far better to disguise the daffodil tops, and this is readily done by interplanting daffodils and hemerocallis in a border. The lively early daffodil blooms draw attention from the pale-

PLATE 37

CARLTON
Large-cup (Div. 2a)

green day-lily ramets; later, the towering hemerocallis leaves and bloom scapes overwhelm the daffodil foliage—to mutual advantage. And neither plant is really much bother. Also, for some reason or other, many daffodil fanciers lean toward hemerocallis as a second love; and the day-lily expert just naturally seems to gravitate toward daffodils, come springtime.

Now that we've diddled the climate into thinking we're Spanish or Portuguese, what about *a choice of daffodil varieties.* First, here are a few rules of thumb:

1. White trumpets or large-cupped daffodils were not made for Iowa. It's good to try them, but remember, I told you so.

2. Jonquils are immune to Iowa's worst, and live up to their best. Many jonquil hybrids bloom late, but that microclimate can fool them.

3. Poets do well here, but late doubles (with poeticus blood) never quite get off the launching pad.

4. Don't be disappointed at those "burning red lead cups, solid back to the ovary"—so what if they turn out to be red rimmed. The man who wrote the catalog was selling daffodils, and, also, had never experienced a midwestern sun, rampant on a field of blue.

5. Throw away things you really don't like, or which don't do especially well in your garden; make room for the many lovely, cheerful blooms that enjoy your home cooking.

There are three ways of acquiring daffodils that like you:

1. If they like your neighbor, they should like you. Check around your locality. If you can talk a friend out of a few bulbs, so much the better; locally acclimatized bulbs are always the best bet.

2. Buy a few of this and that. Abandon the weak and unhappy, and cling fast to those that are happy with you.

3. A few hybridizers are trying to come up with a strain of daffodils which do well in the Middle West. Instead of holding your breath while they work this out, why not step forward in this area yourself. I have always felt that commercial hybridizers threw away better bulbs than they kept—as far as Iowa is concerned. A plant which is not outstanding in Oregon, Ireland, or Tasmania may be thrifty, healthy, and a knockout in your home town. So just order some mixed seedlings from a reputable source, plant them out, and be your own judge. In a few years, you will have acquired some daffodils whose requirements are fulfilled in your garden. They will do better than many named and expensive novelties. As a matter of fact, there is no law which says you can't name your own little acquisition as you see fit—as a godparent you have some rights. And what if Perkin's Favorite is more healthy, beautiful, and reliable than the Empress of Ireland? That's your secret.

D. THE SOUTHWEST

The Southwest is the land of little rain, of hot summers and moderate or mild winters, of wild winds, little cloud cover, brilliant sunshine, of widely fluctuating temperatures, and the freak storm from fall through spring. It is an area which includes all of Oklahoma, the northern half of Texas, and the northern parts of Arizona and New Mexico excluding the higher elevations. Unalleviated, these conditions produce flowers that are small and poorly colored with stems that are short.

Many areas are devoid of trees or any sort of windbreak. Only those who live in wooded areas can create a microclimate without building high walls, growing large hedges, or resorting to lath houses or cool greenhouses, and flowers from plants grown under the latter two conditions are ineligible for competition in daffodil shows approved by the American Daffodil Society. The fortunate sections of the Southwest have 25 inches of rain per year, but it is usually spasmodic and frequently comes as gulley-washers with long periods of drought in between.

There are soils of all kinds from fine river sand which may contain root-knot nematodes to wonderful loam rich in humus but with enough grit to be well-drained, silt, a shallow layer of yellow clay on top of shale, or a stiff black gumbo that is much too sticky when wet and

much too hard with large cracks when dry. The pH varies with the type of soil. Some water supplies may be highly alkaline, in which case the correction for pH must be a continuous one. So we are faced generally with climatic and soil conditions that are not conducive to the growing of even good garden daffodils to say nothing of flowers of exhibition quality.

The problems are basically four: providing shade, windbreaks, more uniform moisture, and soil improvement, the latter being closely related to the others. Providing shade, except for a temporary sort of cloth or baskets or boxes moved in for the moment, can be a tedious process for those in the more arid regions. Walls or high hedges are the best protection from winds.

The problem of soil improvement can be discussed only as a personal problem, because knowledge is, of necessity, limited principally to one's own growing conditions. Here on a gentle slope with little, but slowly increasing shade, daffodils have been grown for 25 years in a silt soil with a pH of 6.5. The soil has been mulched annually, to the extent of two or three tons, with humus of all types: ground cotton burrs (the residue from ginning cotton), ground corn cobs, bagasse (shredded sugar cane), leaves, composted weeds, corn stalks, and the tops of Indian Head cannas. When the beds are remade all this has been turned under with coarse sand, limestone chips, and gypsum also being incorporated in the soil. Still there have been many losses from basal rot, and many varieties, except older ones, do not give good bloom after the second year.

During one dry season it was necessary to lift some clumps in bloom. Although they had not had the best of soil conditions and care, it was a vigorous old variety that had survived for years. The bulbs were found to have no more than two or three roots per bulb, a slender defense against occasional temperatures of 90° and winds of 40 miles an hour. It was evident that something extra in the way of soil improvement was needed. About this time heavy root systems were noted on some cuttings rooted in Perlite—a white, porous, nonorganic substance—and how they clung to life even though they were not regularly watered. So it was decided that even though the constituents of this material were not available, Perlite would be incorporated in the soil. Accordingly, it was added and a generous amount mixed with only a small amount of soil was put under the bulbs in lieu of the usual sand. There were no harmful effects and by the next year it had been ascertained that Perlite was inert except for a small amount of calcium, so the amount was increased. Bulbs grown in soil so treated and down three years, with care given to shade and watering, yielded flowers of exhibition quality. Upon digging, great clumps of sound bulbs were found, as large as any received from a dealer. Only in isolated instances was there basal rot.

The bulbs were returned to the ground immediately with a thick mulch of shredded sugar cane. All the bulbs came up the next year, a rare experience before Perlite was used. Bulbs down five years have been found to be in excellent shape although with clumps so large and heavy that division was plainly overdue.

I am aware that immediate replanting is frowned on in warmer sections of the country, but it is practiced here by some gardeners and found not to affect the bulbs adversely as far as I am aware. It may be that the drier soil here in summer inhibits the organisms which cause basal rot in other southern states where the humidity and rainfall are greater. It is difficult to see how it would be more harmful to lift a bulb and replant it immediately than just to leave it down all summer. Newly purchased bulbs or those which have been dug and stored are usually planted toward the end of September.

Perlite makes an excellent mulch, a 2-in. covering reducing the temperature at the surface of the soil by 5° when the air temperature is at 100°. It discolors with age, which is probably desirable

PLATE 38

SELMA LAGERLÖF
Large-cup (Div. 2b)

PLATE 39

WHITE LION
Double (Div. 4)

from an esthetic standpoint, but it does not deteriorate. It may be turned into the soil when lifting the bulbs. Perlite gives great promise of being the answer to soil improvement which will make possible wider growing of daffodils of better quality under our trying conditions.

As a general rule, all white daffodils, with the exception of the triandrus hybrids, are subject to basal rot in this area. Among the trumpets, the reversed bicolors and the lime-colored yellows do well. The large, coarse trumpets suffer from wind damage unless protected. King Alfred does poorly throughout much of the Southwest.

Of the large cups, the yellow and orange or reds are the most successful. Here again the whites rot with a few exceptions, but the reversed bicolors and lime-colored yellows are quite satisfactory. Red rims burn badly and orange and red cups will be paler than normal unless protected from the constant sun. The small-cupped whites are prone to rot and those with red rims also burn badly.

Except for the Cheerfulness clan, doubles blast unless they can be given a cool, shaded situation. On the whole the triandrus, cyclamineus, jonquilla, and tazetta hybrids do well, especially the jonquils. The late-blooming poets are not satisfactory and pinks have a tendency to basal rot.

Recommending named varieties can be misleading due to the varied conditions within this region and even within one's own experience this year's favorite may be next year's failure. However, it might be said that the following have been quite dependable:

1*a* Burgemeester Gouverneur, Emperor, Garron, Goldcourt, Golden Melody, Grape Fruit, Hunter's Moon, Kingscourt, Mulatto, Trumpet Major.
1*b* Empress, Music Hall, Glengariff.
1*c* Beersheba, Broughshane, Mt. Hood.
2*a* Armada, Bahram, Ceylon, Carlton, Dunkeld, Fortune, Golden Torch, Hugh Poate.
2*b* Duke of Windsor, Festivity, Jules Verne, Selma Lagerlöf, Willamette.
2*c* Still Waters.
2*d* Binkie.
3*b* Matapan.
4 Cheerfulness, Yellow Cheerfulness.
5*a* King's Sutton.
6*a* February Gold, March Sunshine, Peeping Tom.
7*a* Golden Goblet, General Pershing, Sweetness.
7*b* Goldilocks, Trevithian.
8 Geranium.
10 × *biflorus, jonquilla, poeticus recurvus* [syn. Pheasant's Eye], × *tenuior,* × *odorus* (syn. campernelli).

E. THE PACIFIC NORTHWEST

As are England, Ireland, and Holland, the Pacific Northwest section of the United States is considered very nearly ideal for the culture of all types of daffodils. As almost all gardeners know, daffodil bulbs are commercially produced in this area in enormous quantities. The soil is deep, there is abundant moisture but not excessive heat, and diseases are not a very serious problem for the home gardener. Daffodils find most of our soils to their liking and about the only concern is to avoid one which is poorly drained in view of our ample rainfall. In addition, heavy clay soils should be shunned or have enough humus added to make them friable.

While daffodils will flourish in almost any situation here, they will benefit from a careful selection of stock and observance of a few good cultural practices. The first and most important step any gardener will take is to select sound, healthy bulbs which can be obtained from reputable growers and seed houses. Choice of the numerous colors, types, and season of bloom is an individual matter, and disease-free stock of virtual-

ly all types is available.

In any locality, bulbs can be planted after the fall rains begin and the soil is cool and moist. Planting can commence here as early as September 1, but most gardeners and commercial growers plant between mid-September and mid-October. This allows a minimum of six weeks for heavy rooting before the approach of our brief winter brings growth to a halt.

The soil should be worked well to the depth of a foot or more. Bulbs to be left down for two or three years should be given at least 4 inches of space if planted in rows and 8 inches each way if bedded in blocks or clumps. About 4 inches of soil should cover the tops of the bulbs.

Daffodils do not require rich soil, but foliage will be more lush and flowers will have more substance if an optimum fertility is attained. Almost any balanced plant food will do. A commercial fertilizer such as 10-20-20 has been found to be satisfactory. It can be applied as a side dressing at the time the bulbs are planted or as a top dressing subsequently, but it must never come in actual contact with the bulbs. Mulches are not necessary here although they do no harm. Their main value is to discourage weeds which grow vigorously in the mild climate like every other plant.

When the foliage begins to emerge early in the year, the first task of daffodil growers is to watch for plants showing symptoms of virus. The most common one here is the Yellow Stripe virus and the only method of control is prompt destruction of infected plants. The leaves should also be examined several times during the growing season for diseased plants.

Otherwise, no particular attention need be paid the plants until just before the flowers open. One or two applications of Bordeaux or micronized copper spray before and after the blooming period is beneficial. Its purpose is the control of Botrytis, a fungus disease prevalent in abnormally wet seasons causing brownish spots on the blooms and early dieback of the foliage, thus retarding growth of the bulb.

The daffodil fly is a common pest and even bulbs which are free when planted can become infested from a neighboring garden. Commercial growers here control the fly with a preplant immersion in cold water to which aldrin, chlordane, or heptachlor has been added according to directions. Heptachlor is the most popular since it requires a shorter period of immersion. Enough residue of any of these materials adheres to the bulbs to kill newly hatched grubs as they try to enter the bulbs the following season.

Fusarium, or basal rot, is not nearly the problem here that it is in warmer climates. Mercury compounds are available for control, but they should be used with the utmost caution, both for the sake of the bulb and the gardener.

If there is any need to spray for weed control, it is advisable to check with a county agent or other authority on selective weed sprays.

The foregoing is not intended as more than passing references to the pests and diseases which may occur in the Northwest. Complete information on identification and treatment will be found in Chapters 7 and 8.

If bulbs are to be lifted, it can be done beginning about June 15 with the early varieties, but in general the first two weeks in July are preferred. Usually bulbs are not returned to the soil until fall and the secret for carrying them through in good shape is to store them in containers which protect them from rain and direct sunlight and yet allow air to circulate through and around them.

The mild winters give us the boon of a long flowering season. Depending on the year it can be expected to start any time after the first of January with *N. asturiensis,* followed by the bulbocodiums, and *N. cyclamineus* and extending well into June. No thought need be given as to which varieties do best in Oregon and Washington. Any daffodil which will grow in the British Isles or Holland will grow in the Pacific Northwest which means that any species or garden hybrid likely to be offered by cat-

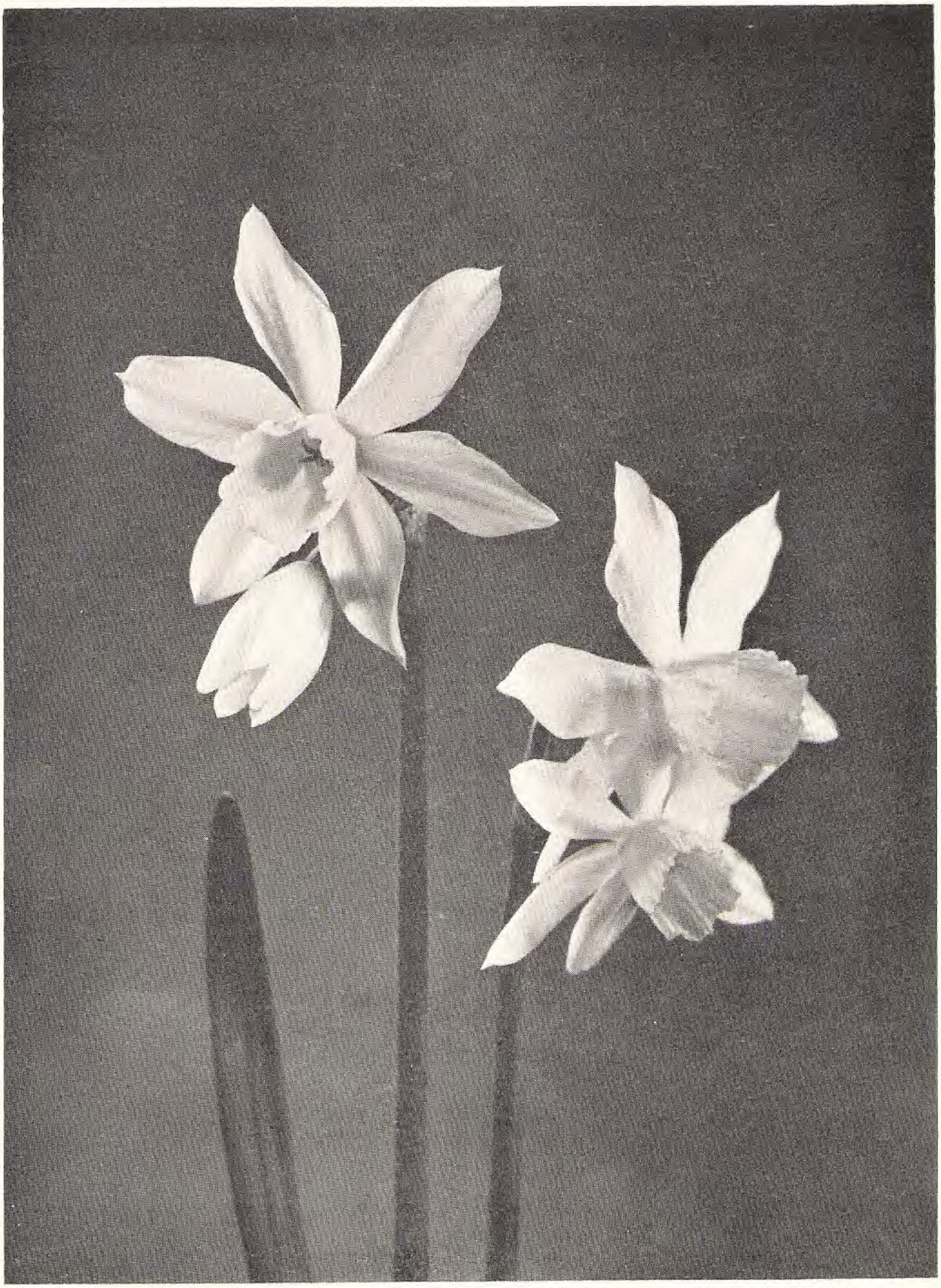

PLATE 40

THALIA
Triandrus (Div. 5a)

alog or found in stores will be perfectly at home in this area.

As I said in the beginning, the Pacific Northwest is undoubtedly the finest section of the United States for growing daffodils. It is virtually impossible to keep them from growing. So if you are an armchair gardener and even these simple observations sound arduous, throw your bulbs out on a grassy plot or in an orchard and forget them. Nature will stand them up, contractile roots will pull them into the soil, and they will still be blooming twenty years hence. About the only justification I have for making these suggestions is that you may get somewhat better flowers and certainly greater enjoyment if you give at least token observance to them.

F. THE PACIFIC SOUTHWEST

Gardeners who join the trek to Southern California will have little use for any previous experience in growing daffodils. All they need to bring with them is their enthusiasm and an open mind.

The highest temperatures of the year often occur here during late September or early October; occasionally the heat continues right up to November, so that late fall is the best time for planting daffodils in this corner of the United States. One waits, however impatiently, until the soil temperatures have cooled considerably and the evenings hold the promise of cooler days with hints of rain.

Sunny California is an attractive slogan, but the other side of the coin carries the inscription that drought is a way of life with us. This was semi-arid country when the pioneers settled here and planted vast groves of orange, lemon, avocado, walnut, and other trees. With such improvements to the watershed the rainfall increased until as much as 14 inches could be anticipated in a normal rainy season which lasts from October through March. During and after World War II huge industries moved in followed by hordes of workers who leveled the groves. As the population increased the rain lessened, until two years ago our rainy season brought us scarcely 4 inches.

The blooming season is very long throughout Southern California, although it becomes somewhat compressed as one moves north or into nearby higher elevations. The "Sacred Chinese Lilies" (*tazetta orientalis*) will be in bloom in Los Angeles by Thanksgiving along with Paper Whites, *N. viridiflorus* and *N. serotinus*. Santa Barbara will be two or three weeks earlier and Yucaipa at an elevation of 4,000 ft. occasionally sees snow and will be three weeks later. These deviations within short distances simplify the problem of filling all classes at a daffodil show. Somewhere nearby it is early or late or mid-season.

Our soils are varied, from light and well-drained to hard as a piece of terra cotta, or it may be decomposed granite overlaid with humus or pure river sand crawling with nematodes. The chances are you will find yourself on a heavy variety which bakes to armor plate in the summer sun, but whichever it may be, it can be improved by the addition of humus and wood ashes.

The ground should be well worked, preferably to a depth of 18 inches. A few days before setting out the bulbs, work it over once more, adding a little bonemeal and some cool fertilizer, such as one of the non-burning sludge derivatives. Water the beds well and let them settle. The soil for planting should be cool and damp but not wet to the touch; when clutched into a ball in the hand, it should retain its shape but with a slight crumbling at the edges. If it balls tightly and fails to crumble and looks shiny when released, it is too wet; if it fails to hold its shape at all, it is too dry.

The actual planting of the bulbs is a simple procedure, one that is followed wherever bulbs are grown. Dig a hole to a depth of no more than three times the diameter of the bulb being sure to level the bottom. Set the bulb flatside down and cover with soil. Dampen the beds with a fine sprinkler after planting and continue to water about once a week, or oftener should there be drying winds. When the bulbs start through the soil, spray with a malathion spray to discourage thrips and keep the beds damp but not saturated. When a daffodil is

growing it can stand a lot of water; more at that time than at any other in its life cycle. A drink of low-nitrogen fertilizer of slightly acid reaction will help the quality of blooms, the color will be benefited thereby, and the acidity will help counteract the alkalinity of the hard water in this area.

The strict admonition to allow all foliage to ripen naturally after blooming is the same here as elsewhere. When the foliage has turned yellow brown and is limp and comes away with a slight tug, then and only then is it safe to remove it. When the foliage is removed, it will leave holes the size of one's finger; fill these immediately with soil to which a little insect repellent has been added, otherwise they become runways for earwigs, sowbugs, ants and other pests as well as serving as funnels down which water will run and encourage rot.

Just before or after cleaning the beds of old foliage for the summer, shallow-rooted annuals can be interplanted, forming a natural cover and cooling agent for the beds during their resting period. Annuals which are good for this purpose are alyssum, petunias, marigolds (the good, strong, smelly, old-fashioned kind may be especially beneficial in repelling nematodes, so it is rumored) . Mulching the beds with woodshavings, redwood bark, or dry vegetable material is an aid in keeping down weeds and maintaining a constant supply of moisture. However, if such material is used, do not work it into the soil in the fall. To do so will rob the soil of its nitrogen and the bulbs will not have enough for their own needs; unless more is added the nitrogen balance is destroyed and when once this balance is disrupted it is difficult to attain again. Therefore, it is better to remove the old mulch, fertilize as the plants need it, and then mulch with new material. Compost the old mulch so that it may serve yet another purpose.

It has been said that no plant is difficult to raise if its requirements are met, but few gardeners can comprehend that any adaptation is involved in transplanting a daffodil bulb from its cool, moist home in England or the Pacific Northwest to the hot and arid climate of Southern California. The time required for this adjustment can often equal that necessary to grow an entirely new bulb, or from four to seven years, depending on the type. This is particularly true with some varieties in Divs. 3 and 9. Not only must a bulb adjust to an unfamiliar atmosphere, soil, water, climate, and type of culture, but also to an entirely new time schedule.

The blooming period is one of the most intriguing characteristics of a daffodil. The more northern regions have a shorter blooming period than Southern California; here the period of bloom is longer with a greater distinction between the early, midseason, and late stages. The adjustment to the preferred blooming date by the plant will not be noticed by the casual gardener, but to the serious fancier who keeps a notebook, this process will be fascinating. He will note that during the first three or four years the blooming dates never, or hardly ever, coincide; usually it will become progressively earlier except in Divs. 3 and 9 where quite often the reverse will be experienced. Gradually stabilization will result and the opening dates will be found to lie within the span of a week or less.

Some varieties are almost akin to a calendar in their regularity; Arctic Gold, Content, Diotima, Binkie, Ceylon, Polindra, Silver Chimes, Chérie, Hesla, and Actaea are in this category. Strangely, Lemon Doric, a seedling of Binkie, has yet to settle down, though it has been in the garden for over five years and in its present site for three. The first year it bloomed March 25, and the date has been advancing each year since then; this past season it opened January 30.

The time of adjustment can be shortened if the bulb is left undisturbed for at least three years after its initial planting. Some varieties, mainly trumpets, the whites in all divisions, and the poets resent being disturbed as often as recommended for the best blooms. It must be remembered the atmosphere has a much lower percentage of moisture than elsewhere and in such a dry atmosphere the bulb, when out of the ground, loses

PLATE 41

FEBRUARY GOLD
Cyclamineus (Div. 6a)

much of its stored moisture and is thereby weakened. It is this factor which could possibly explain lack of stamina or the failure of performance on the part of a new bulb.

One of the challenges presented to the daffodil grower in this region is that of the high desert winds which often come at show time. To combat these and the accompanying low humidity, some growers erect stake frames around which are secured gunny or muslin fabric to form screens. Water is then sprayed over the material, thus raising the humidity and lowering the temperature within. Care must be taken that such structures do not become airborne and fly through the beds.

Some screening must be given the delicately hued and red-cupped flowers if fading and burning are to be prevented; therefore, consider protection from the sun and winds when selecting the planting site. There are very few red and pinks which will not burn if exposed to the sun and wind; winds can burn a bloom before the sun even touches it. It is better to rely on natural shields such as shrubs and trees, and permanent structures such as houses and walls, than to build temporary screens which are subject to destruction from the winds.

Cultural practices which produce firm substance and clear, bright colors are basically simple. The soil must have a slightly acid reaction to insure the best color, and it is better to create this with leafmold soils than chemicals. Acid fertilizers low in nitrogen and high in potash and phosphates, of the type sold for camellias, have proved satisfactory here in Southern California, where the soil is alkaline and the water is hard and heavily chlorinated.

Of all the divisions, Div. 9, the poets, give us the most trouble. Where extremes of temperature can be avoided and the water supply is maintained to their liking, they are superb. They seem to require more humidity during their growing and blooming periods than other types.

The whites are a bit difficult if the soil is so heavy that drainage is poor, but incorporating a goodly amount of sand and some leafmold to lighten the soil and improve the drainage will help. It must be remembered that if the soil is light it will heat during the hot summer days, and if water is applied at such times the beds will steam and the bulbs rot. It is better to have a groundcover or a thick mulch over beds exposed to summer sun to help maintain a lower soil temperature than to leave them without any protection.

Almost every variety of daffodil can be grown outdoors in Southern California, although, as I have suggested, some are less tolerant than others. It is dangerous to generalize beyond one's own experience, so I will only say that under my conditions and with the care I am able to give them, the following varieties have proved to be quite satisfactory:

1*a*. Kingscourt, Inver, Moonmist.
1*b*. Frolic, Trousseau.
1*c*. Cantatrice.
1*d*. Spellbinder.
2*a*. Ceylon, Galway, Home Fires, Indian Summer, Ormeau, Revelry.
2*b*. Polindra, Red April, Rosario, Statue, Ulster Beauty.
2*c*. Snow Dream, Wedding Bell.
2*d*. Binkie.
3*a*. Ardour, Doubtful, Market Merry.
3*c*. Chinese White, Silver Princess, Silvermine.
4. Erlicheer, Royal Sovereign, White Lion.
5*a*. Rippling Waters, Thalia, Tresamble.
5*b*. Dawn.
6*a*. Bartley, February Gold, Roger.
7*a*. Sweetness.
7*b*. Hesla
8. Golden Dawn, Silver Chimes
9. Actaea.