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THE INFLUENCE OF CLIMATIC CONDITIONS ON THE PHENOLOGICAL AND ORNAMENTAL BEHAVIOR OF SOME VARIETIES OF THE GENUS *NARCISSUS* L.

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Abstract
The article presents the results of the study of 16 varieties of the genus Narcissus L., from an ecological and ornamental point of view. In the 3 consecutive years (2021, 2022, 2023), measurements were made on the plant height (H), flower diameter (Θ); the duration of the flowering period (days) was determined. Narcissus cyclamineus 'Tete-a-Tete' recorded the lowest average height (15 cm), but also the smallest average calyx diameter (3 cm). Narcissus poeticus 'Sinopel', Narcissus poeticus 'Recurvus' and Narcissus tazetta 'Martinette' had heights ranging between 33 cm and 35 cm. The duration of the flowering phase varied on average from 7 days for 'Martinette' to 18 days for 'Tete-a-Tete'. The following varieties stood out for their cup diameter (between 8 and 12 cm) and the beauty of their flowers: 'Tickled Pinkeen'; 'Kedron'; 'Gay Kybo'; 'Czardas'; 'Samantha', 'Sovereign', 'Geneve', 'Pink Charm'. Phenological observations showed that the flowering time for all the studied varieties depends on meteorological parameters and the category in which they are classified. Varieties with small flowers were used in seasonal floral compositions and in traditional ceramic vases. Varieties with large and beautifully shaped flowers, unicolor or bicolor, strong peduncles, pleasant aroma were introduced into floral arrangements in elegant vases.

Keywords: daffodils, varieties, floral-art.

1. INTRODUCTION

The genus *Narcissus* belongs to the *Amaryllidaceae* family and includes bulbous plants cultivated for their ornamental and biochemical properties (Takos and Rook, 2013; Mahen et al., 2025).
Species of the genus *Narcissus* are widespread in southwestern Europe, the Mediterranean region, North Africa, with its center of biodiversity in the Iberian Peninsula (Mathew, 2002; Rocio et al., 2012). The evolution of species in the genus *Narcissus* is impressive. Depending on the approach (David, 2017), the genus has between 26 and 86 species. Thus, Webb (1980), in his account for Flora Europaea, accepted only 26 species, Fernandes (1968) recognized 62; Blanchard (1990) included 64, and Mathew (2002) listed 86 species. A recent study by Aedo (2013), in Flora Iberica indicates 25 species present in Spain.
The horticultural classification of *Narcissus* cultivars into 13 divisions was described by Kington (1998) and, to avoid confusion caused by the reuse of previous names, the *International Narcissus Register and Classified List* is updated annually by supplements of newly registered names (Bastida et al., 2006). Daffodil breeding has traditionally been concentrated in the United Kingdom and the Netherlands. Hybridization has become very popular, resulting in thousands of commercial varieties

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of daffodils. Flower size, shape, color and fragrance are the main selection criteria in breeding to obtain new varieties (Zarifikhosroshahi et al., 2021).
Daffodils are one of the main crops that provide spring-flowering bulbs for decoration in parks, public or private gardens. Most species and varieties are pollinated by insects (Arroyo et al., 2002). Cut daffodil flowers, obtained both in the field and in forced culture, are used in floral art to make bouquets or floral arrangements (Hanks, 2002; Terry et al., 2021).
The article presents the results of the study of 16 varieties of the genus *Narcissus* L. cultivated in the field, regarding the influence of climatic conditions on biomorphological parameters (plant height, flower diameter), flowering duration, as well as the ways of their use in floral art.

2. MATERIALS AND METHODS

The material was represented by 16 types of daffodils, from 9 different groups, as follows:
1. 'Pink Charm', 'Tickled Pinkeen' - Large Cupped Group;
2. 'Dutch Master', 'Geneve' - Trumpet Group;
3. 'Tete-a-Tete' - Cyclamineus Group;
4. 'Kedron', 'Martinette' - Jonquilla Group;
5. 'Sinopel' - Small Cuped Group;
6. 'Canaliculatis' - Tazetta Group;
7. 'Recurvus' – Poeticus Group;
8. 'Samantha', 'Art Perfume', 'Gay Kybo' - Double Group;
9. 'Sovereign', 'Cum Laude', 'Czardas' - Corona Split Group.

In terms of flowering time, the 16 varieties cover the following categories: early, with flowering starting in March, medium, with flowering in April, and late, with flowering starting in the second half of April, with flowering extending into May.
The bulbs, purchased from certified sources, were planted in a mini-collection on the campus of the National University of Science and Technology Politehnica Bucharest, Pitești University Center, at Str. Aleea Școlii Normale no. 7.
The land was cleared of existing plant debris, after which it was dug to a depth of 30 cm, followed by leveling. 12 cm deep trenches were made, and sandy material was added to the bottom of the trenches for good drainage (Figure 1a). Daffodil bulbs were planted in each trench. For the smaller varieties 'Canaliculatis' and 'Tete-a-Tete', 20 bulbs were used, and for the other varieties 10 bulbs were used, spaced 12 cm apart. Each row was labeled (Figure 1b).

1a)  1b) 

Figure 1. Land preparation: a-adding sand to the open trenches for planting the bulbs; b-planting the bulbs in the trenches, by variety

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In the 3 consecutive years (2022, 2023, 2024), the influence of climatic conditions on the start of vegetation, the moment of flowering and the duration of the flowering period, under field conditions, was analyzed.
During the phenophases, measurements were made on the height of the floral stem (cm), the diameter of the flower (cm) and the duration of the flowering period (days) was determined.
The aesthetic qualities of the flowers and their suitability for different vases and floral compositions were assessed, taking into account the moment of flowering, flower shape, color, cup diameter, stem size. Creative activities with daffodils obtained in the mini-collection were carried out within the Floriculture Laboratory of the Horticulture specialization.
Data on average monthly temperatures (°C) and average monthly rainfall (mm/month), as well as the average of the years studied (2022, 2023 and 2024) are summarized in Table 1.

Tabel 1. Average monthly temperatures (°C) and average monthly rainfall (mm/month) in the period 2022-2024

Month	2022		2023		2024	
	Average monthly temperature (°C)	Average monthly rainfall (mm/month)	Average monthly temperature (°C)	Average monthly rainfall (mm/month)	Average monthly temperature (°C)	Average monthly rainfall (mm/month)
1	0,8	6,4	4,0	101,7	0,2	36,5
2	3,1	10,8	2,6	7,9	6,5	13,2
3	3,6	19,4	7,1	18,8	7,8	54
4	10,1	88	9,7	80,4	13,4	44,7
5	16,4	72,6	15,1	77,4	15,6	20,9
6	21,1	25,6	19,4	78,7	24,0	18
7	22,9	25,3	23,2	77,7	25,0	59,1
8	22,6	142,1	23,3	17	24,4	3,9
9	15,6	49,6	19,4	26,1	18,1	152,6
10	12,0	4,3	13,5	4,9	11,2	12,7
11	7,6	40,8	6,7	53,8	3,3	51,8
12	2,8	40,4	3,1	18,4	3,1	59,6
Mediate	11,6	x	12,3	x	12,7	x
Amount	x	525,3	x	562,8	x	527,0

3. RESULTS AND DISCUSSIONS

The analysis of climate data shows a trend of increasing average annual temperatures (°C) and an uneven distribution of the average amount of precipitation (mm/), with influences on important phenophases in the life cycle of plants (Marin et al., 2023), including daffodils.
Most of the varieties studied staggered their vegetation period over the 3 years, in the months of February-April, the meteorological conditions being different from the normal period.
The year 2024 recorded the highest values of average temperature (°C), of 6.5°C, in February, 7.8°C in March and 15.6°C in May. These conditions determined the acceleration of the start of vegetation and the onset of flowering, by approximately 10 days compared to normal, as such the duration of the flowering period was advanced compared to previous years.
Observations and data collected in 2022, regarding the date of vegetation start, flowering date, duration of the flowering period (days) and measurements regarding floral stem height (cm) and flower diameter (cm) were summarized in tabel 2.

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Tabel 2. Measurements and determinations regarding the date of vegetation start, flowering date, duration of the flowering period (days) and measurements regarding stem height (cm) and cup diameter (cm), in the daffodils studied, in 2022

No.	Variety name	No. bulbs	Date planting	Vegetation start date	Flowering date	Flowering period (days)	Stem height (cm)	Flower diameter (cm)
1	'Martinette'	10	25.10.2021	15.02.2022	14.04.2022	7	25	5
2	'Samantha'	10	25.10.2021	21.02.2022	30.03.2022	12	18	7
3	'Sovereign'	10	25.10.2021	21.02.2022	01.04.2022	10	22	7
4	'Kedron'	10	25.10.2021	21.02.2022	14.04.2022	11	28	8
5	'Canaliculatis'	20	25.10.2021	02.03.2022	30.03.2022	8	22	6
6	'Tete-a-Tete'	20	25.10.2021	15.02.2022	20.03.2022	20	15	3
7	'Sinopel'	10	01.11.2021	02.03.2022	03.05.2022	14	35	8
8	'Recurvus'	10	01.11.2021	27.02.2022	17.04.2022	10	33	6
9	'Dutch Master'	10	01.11.2021	15.02.2022	01.04.2022	14	20	7
10	'Pink Charm'	10	01.11.2021	21.02.2022	14.04.2022	12	30	10
11	'Tickled Pinkeen'	10	01.11.2021	15.02.2022	30.03.2022	14	32	10
12	'Cum Laude'	10	01.11.2021	15.02.2022	24.03.2022	16	25	8
13	'Art Parfume'	10	01.11.2021	21.02.2022	04.04.2022	10	28	10
14	'Czardas'	10	01.11.2021	15.02.2022	30.03.2022	8	30	12
15	'Gay Kybo'	10	01.11.2021	02.03.2022	14.04.2022	9	25	10
16	'Geneve'	10	01.11.2021	02.03.2022	14.04.2022	9	22	10

In the first year after planting, the following varieties started growing very early, on 15.02.: 'Martinette'; 'Tete-a-Tete'; 'Tickled Pinkeen'; 'Cum Laude' and 'Czardas'. Of the 16 varieties, 'Tete-a-Tete' stood out both for its precocity of flowering, on 20.03 (Figure 1), but also for its longest flowering duration, of 20 days, compared to 'Martinette', which recorded the shortest flowering duration, of only 7 days. The rest of the varieties remained in bloom in culture between 8 and 16 days. The lowest average height was measured at 'Tete-a-Tete', of 15 cm, and the highest was recorded by 'Sinopel', of 35 cm, but it did not bloom. Given that its flowering period is at the beginning of May, it did not adapt to field conditions from the first year, and the very high temperature recorded during this period determined premature wilting, in the bud phase. 'Tete-a-Tete' had the smallest flower diameter (3 cm) unlike 'Czardas' (12 cm). To the other varietes: 'Geneve´, 'Gay Kybo', 'Art Parfume', 'Tickled Pinkeen', 'Pink Charm', the cup diameter was 10 cm.

Figure 2. Mini collection of daffodils, in the first year after planting

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Observations and data collected in 2023 were summarized in Table 3.

Table 3 Measurements and determinations regarding the date of vegetation start, flowering date, duration of the flowering period (days) and measurements regarding stem height (cm) and cup diameter (cm), in the daffodils studied, in 2023

No.	Variety	Starting vegetation	Flowering date	Duration of flowering period (days)	Average height (cm)	Flower diameter (cm)
1	'Martinette'	21.02.2023	03.04.2023	8	33	5
2	'Samantha'	21.02.2023	21.03.2023	10	25	8
3	'Sovereign'	21.02.2023	21.03.2023	14	30	6
4	'Kedron'	21.02.2023	03.04.2023	14	30	8
5	'Canaliculatis'	21.02.2023	16.04.2023	10	28	5
6	'Tete-a-Tete'	14.02.2023	07.03.2023	18	15	3
7	'Sinopel'	21.02.2023	13.04.2023	16	31	8
8	'Recurvus'	27.02.2023	13.04.2023	12	33	5
9	'Dutch Master'	14.02.2023	21.03.2023	14	30	9
10	'Pink Charm'	21.02.2022	03.04.2023	10	25	10
11	'Tickled Pinkeen'	14.02.2023	21.03.2023	14	28	10
12	'Cum Laude'	14.02.2023	13.03.2023	12	20	7
13	'Art Parfume'	21.02.2023	03.04.2023	14	22	10
14	'Czardas'	21.02.2023	03.04.2023	10	30	12
15	'Gay Kybo'	21.02.2023	10.04.2023	10	25	10
16	'Geneve'	21.02.2023	13.04.2023	10	20	8

The bulbs were not removed at the end of the flowering process (May 2022), and in 2023, all varieties started growing in the mini-collection. The first daffodils to start growing were: 'Tete-a-Tete', 'Dutch Master', 'Tickled Pinkeen' and 'Cum Laude', on 14.02., and the last, those belonging to the 'Recurvus' variety, on 27.02. The month of March recorded an average temperature approximately 3°C higher than in the previous year, which determined the flowering of all daffodils studied at least one week earlier. Regarding average rainfall, the values were very close to 2022. 'Tete-a-Tete' had the longest flowering period, 18 days, and 'Martinette' the shortest, 8 days, the other varieties remained in flower in culture between 10 and 16 days. In all varieties, in the second year after planting, the height of the stem increased, except for 'Sinopel'. If in the first year it recorded the highest height (35 cm), and the flowers did not open, in the following year, as a result of adaptation to field conditions, the floral stems did not exceed 33 cm, and flowering was normal. The highest height of the floral stem was obtained in 'Martinette' and 'Recurvus' (33 cm), and the lowest in 'Tete-a-Tete' (15 cm).

Precocity in flowering was shown by 'Tete-a-Tete' (07.03.), the last daffodils to bloom, starting with 16.04. being: 'Canaliculatis', 'GayKybo' and 'Geneve'. 'Tete-a-Tete' had the smallest flower diameter, 3 cm, and 'Czardas' the largest, 12 cm.

All 16 varieties were more robust than in the previous year, and the aesthetic appearance of the flowers was much more visible and intense, impressing with the shape of the perianth or corolla, color (unicolor or bicolor varieties), and in some daffodils even with the fragrance.

In figure 3 (a-l), measurements are captured regarding the stem height (Figure 3 a-e), the diameter of the cups (Figure 3 f-h), as well as the appearance of the most spectacular cups of: 'Cum Laude' (Figure 3i), 'Art Perfume' (Figure 3 j), 'Czardas' (Figure 3k), 'Gay Kibo' (Figure 3l).

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Figure 3. Measurements of stem height (3a, 3b, 3c, 3d, 3e), cup diameter (3f, 3g, 3h) and decorative appearance (3i, 3j, 3k, 3l) of daffodils in the second year after planting

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Observations and data collected in 2024, regarding the date of vegetation start, flowering date, duration of the flowering period (days), average dimensions of the height of the floral stems (cm) and the diameter of the cups (cm) for the 16 varieties studied are summarized in Table 4.

Table 4. Measurements and determinations regarding the date of vegetation start, flowering date, duration of the flowering period (days) and measurements regarding the height of the stem (cm) and the diameter of the cups (cm), for the daffodils studied, in 2024.

No.	Variety	Starting vegetation	Flowering date	Duration of flowering period (days)	Average height (cm)	Flower diameter (cm)
1	'Martinette'	21.02.2024	03.04.2024	8	33	5
2	'Samantha'	21.02.2024	05.03.2024	10	25	8
3	'Sovereign'	21.02.2024	05.03.2024	14	30	6
4	´Kedron´	21.02.2024	03.04.2024	14	30	8
5	'Canaliculatis'	21.02.2024	16.04.2024	10	28	5
6	'Tete-a-Tete'	11.02.2024	23.02.2024	18	15	3
7	'Sinopel'	21.02.2024	13.04.2024	16	33	8
8	'Recurvus'	27.02.2024	13.04.2024	12	35	5
9	´Dutch Master´	14.02.2024	05.03.2024	14	30	9
10	'Pink Charm'	21.02.2024	03.04.2024	10	25	10
11	'Tickled Pinkeen'	14.02.2024	21.03.2024	14	28	10
12	'Cum Laude'	14.02.2024	05.03.2024	12	20	7
13	'Art Parfume'	21.02.2024	02.04.2024	14	22	10
14	'Czardas'	21.02.2024	03.04.2024	10	30	12
15	'Gay Kybo'	21.02.2024	04.04.2024	10	25	10
16	'Geneve'	21.02.2024	10.04.2024	10	20	8

In 2024, the average temperatures recorded 6.5°C in February, 7.8°C in March and 13.4°C in April, values approximately 3°C higher than in previous years, which determined the start of vegetation and flowering of the 'Tete-a-Tete' daffodils as early as February, and of the other varieties approximately 10 days earlier than in 2023.

'Tete-a-Tete' recorded the lowest average height (15 cm), but also the smallest average diameter of the cup (3 cm). The highest average stem heights were measured in 'Martinette', 'Sinopel' and 'Recurvus', ranging between 33 cm and 35 cm. The duration of the flowering phase varied on average from 7 days in 'Martinette' to 18 days in 'Tete-a-Tete'.

The varieties: 'Pink Charm', 'Art Parfume', 'Gay Kybo' recorded an average cup diameter of 10 cm, and 'Czardas', as in previous years, a diameter of 12 cm.

The aesthetic characteristics of the flowers were impressive in the third year after planting. Considering the place of daffodils in Romanian culture, their connection with tradition and simplicity, an attempt was made to highlight these particularities by creating floral compositions.

As the daffodils bloomed, they were introduced into different types of arrangements, depending on the flowering period, the height of the stems, the color and shape of the flowers.

Different types of vases, materials or rustic or modern accessories were used. The styles and techniques used aimed to emphasize the purity and at the same time the elegance of these flowers. Early daffodils, with shorter stems: 'Tete-a-Tete' (Figure 4a); Sovereign (Figure 4b); 'Dutch Master' (Figura 4c); 'Samantha' (Figura 4d) pair well with rustic vases and seasonal plant material such as: hazel branches, coniferous branches, wood, moss, tulips, muscari, other flowers.

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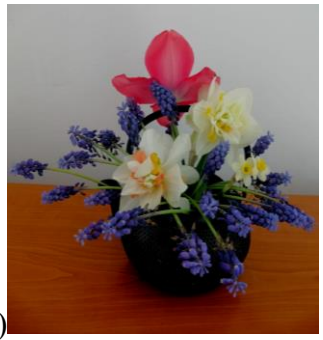
Daffodils with large, single or bi-colored flowers: 'Pink Charm' (Figura 4e); 'Tickled Pinkeen' (Figura 4f); 'Csardas' (Figura 4g); 'Gay Kybo' (Figura 4h), or those with more flowers per stem, like 'Kedron' (Figure 4i) are also suitable for simple arrangements, with 1, 2 or 5 flowers, demonstrating that beauty can also be offered by a simple flower, picked from nature, which, when associated with a blooming spring branch, manages to better reproduce the spring atmosphere.

4a)  4b) 

4c)  4d) 

4e)  4f) 

4g)  4h)  4i) 

Figure 4. Floral arrangements with early daffodils

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The naturalness of daffodils is also well highlighted by woven baskets, using either a single variety of daffodils (Figure 5a) or creating spring compositions (Figure 5b), with several varieties, in different shapes and colors of the cups, along with primroses, hyacinths, moss, leaves.
Daffodils are also suitable for modern arrangements, using colored ceramic pots (Figure 5c), associations with decorative grasses (Figure 5d), but also for paintings (Figure 5e) or bouquets made with the spider technique (Figure 5f).

5a)  5b) 

5c)  5d) 

5e)  5f) 

Figure 5. Modern arrangements with daffodils

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4. CONCLUSIONS

The flowering time for all studied varieties depends on meteorological parameters.
Temperature plays an important role in starting vegetation, the onset or delay of the flowering period.
Heavy rainfall associated with extreme weather events can bend stems and damage flowers in varieties with large cups.
'Sinopel', under field conditions, did not reach the flowering stage in the first year, but adapted to field conditions in the following years.
Early varietes with short stem: 'Tete a Tete'; 'Dutch Master'; 'Pink Charm'; 'Sovereign'; 'Tickled Pinkeen'; 'Samantha' can be used in rustic pots, baskets, alongside seasonal plant materials.
Varietes with long stem, single or double flowers, large cups and fragrant like 'Czardas'; Art Perfume; 'Gay Kybo'; 'Canaliculatis'; 'Geneve' can be used in modern art flower.
All studied cultivars can be expanded in culture under the climatic and soil conditions of our city.

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