III. INTRODUCTION OF PLANTS AND SUSTAINABLE USE OF PLANT RESOURCES

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THE RESULTS OF THE STUDY ON CULTIVARS OF *ARGYRANTHEMUM FRUTESCENS* (L.) SCH. BIP. IN THE “ALEXANDRU CIUBOTARU” NATIONAL BOTANICAL GARDEN (INSTITUTE)

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Abstract. A new study on several cultivars of *Argyranthemum frutescens* (L.) Sch.Bip. has been conducted in the “Alexandru Ciubotaru” National Botanical Garden (Institute). In the process of research, the regenerative ability of plants was studied and the optimal techniques of propagation were established for the tested cultivars. When assessing the decorativeness, the length of the flowering stage and the morphological characteristics of various cultivars of *A. frutescens* were recorded. Characteristics and suggested uses of 12 cultivars of *A. frutescens* are given below.

Key words: study on cultivars, introduction, *Argyranthemum frutescens*, ropagation, characteristics of the cultivars, uses.

REZULTATELE STUDIERII SOIURILOR DE *ARGYRANTHEMUM FRUTESCENS* (L.) SCH. BIP. ÎN GRĂDINA BOTANICĂ NAȚIONALĂ (INSTITUT) „ALEXANDRU CIUBOTARU”

Abstract. Un nou studiu asupra soiurilor de *Argyranthemum frutescens* (L.) Sch.Bip. a fost realizat în Grădina Botanică Națională (Institut) „Alexandru Ciubotaru”. În procesul de cercetare s-a studiat capacitatea regenerativă a plantelor și s-au stabilit termenele optime de multiplicare a soiurilor testate. La evaluarea decorativității, s-a determinat durata perioadei de înflorire și caracteristicile morfologice ale diferitor soiuri de *A. frutescens*. Sunt prezentate caracteristicile și unele utilizări recomandate a 12 soiuri de de *A. frutescens*.

Cuvinte-cheie: studierea soiurilor, *Argyranthemum frutescens*, introducere, multiplicare, caracteristicile soiurilor, utilizări.

Argyranthemum frutescens (L.) Sch.Bip. (family *Asteraceae*, genus *Argyranthemum* Webb ex Sch. Bip) is commonly named Paris daisy, marguerite or marguerite daisy. The species was formerly considered part of the genus *Chrysanthemum*, but now it is placed in an independent genus – *Argyranthemum*, which has 23 species. Marguerite daisy is native to the Canary Islands and Madeira. The representatives of the genus have adapted to various biotopes, they can be found in almost all plant communities of the Canary Islands – from thickets of xerophytic shrubs to cloud forests. They also occur on dry slopes among xerophytic shrubs and on volcanic plateaus at an altitude of more than 2 km above sea level. Some species of the genus have been cultivated for more than 200 years; the plants are perennial, valued for their abundant and long-lasting flowering but, in the Republic of Moldova, are grown as annuals, as they do not tolerate the low temperatures that occur in winter [3, 6, 7, 8, 9].

Some cultivars of *A. frutescens* were brought to the “Alexandru Ciubotaru” National Botanical Garden (Institute) from the Netherlands in 2014-2019. During this period, 15 cultivars of *A. frutescens* were introduced into the collection and were propagated and grown taking into account the conditions of the given climatic zone. Most varieties, as well as the species itself, are little-known or unknown in our country. The purpose of this study has been to select the best cultivars for use in landscaping. The aim of our research has been to study the adaptive and bioecological characteristics of various cultivars of *A. frutescens*.

MATERIALS AND METHODS

The research was carried out in the greenhouse and on the experimental site of the Ornamental plants Laboratory of the “Alexandru Ciubotaru” National Botanical Garden (Institute). Twelve cultivars of *A. frutescens* (L.) Sch.Bip. served as research subjects: 'Pompon white', 'Angelic Lemon', 'Angelic Magenta', 'Neptun', 'Pink Delight', 'Perfection pink', 'Angelic Burgundy', 'Giant Pink', 'Sole Mio', 'Bupy', 'Maize', 'Snow'. The research was done using the methodology of Krasnova, Visyashcheva, Yuskevich (1990). Phenological observations, recording biometric indicators in the open field, as well as the description of ontogenetic features were carried out according to the generally accepted methodology of phenological observations in the Botanical Gardens of the USSR (1979) [4], the shoot-forming ability was determined according to the methodology developed by Makarova, Vorobieva (1978).

RESULTS AND DISCUSSIONS

According to published sources, *A. frutescens* can be propagated by seeds and by vegetative methods [3, 6]. We received the plants as rooted cuttings, from which mother-plants were subsequently grown. During the entire growing season, observations on plants were carried out and the results indicated that *A. frutescens* does not set seeds under the climatic conditions of our country. Therefore, the main method of propagating this species in Moldova is a vegetative one, namely – by green cuttings. It is convenient and effective, gives a large amount of high-quality, uniform planting material. Strong, fast-growing vegetative shoots of *A. frutescens* are the best material for propagation by cuttings. When studying the ability of *A. frutescens* to propagate vegetatively, we analyzed the regenerative ability of its cultivars. Thus, the number of cuttings taken from one plant at once was counted (Table 1).

The obtained results have shown that all tested cultivars of *A. frutescens* have a rather high productivity of cuttings.

To determine the optimal propagation time for *A. frutescens* under the conditions of the NBGI, cuttings of the studied cultivars were taken in autumn and from January to May. The results are shown in Table 2.

Table 1. The number of cuttings taken from one plant of different cultivars of *Argyranthemum frutescens* (L.) Sch.Bip.

Cultivars	Average number of cuttings taken from one plant (pcs.)	
	2017	2018
'Neptun'	94,0	98,2
'Pink Delight'	49,4	58,4
'Giant Pink'	95,2	90,3
'White Swan'	65,8	84,4
'Angelic Lemon'	48,8	65,0
'Angelic Magenta'	44,8	60,4
'Angelic Burgundy'	36,4	27,8
'Sole Mio'	53,2	45,8
'Bupy'	35,8	28,0
'Maize'	45,2	58,8
'Snow'	46,5	60,5
'Perfection pink'	58,3	68,9

Table 2. The duration of rooting of different cultivars of *Argyranthemum frutescens* (L.) Sch.Bip.

Cultivars	Average duration of rooting (days), by month						
	October	Novem-ber	January	February	March	April	May
'Giant Pink'	40	40	30	30	30	28	26
'White Swan'	40	45	35	32	30	30	25
'Angelic Lemon'	54	45	38	30	26	28	28
'Angelic Magenta'	48	43	28	28	26	26	28
'Neptun'	45	45	30	32	30	28	25
'Pink Delight'	42	45	30	28	25	28	24
'Angelic Burgundy'	40	46	42	38	32	28	26
'Sole Mio'	50	51	45	30	32	28	25
'Bupy'	52	50	46	42	34	30	25
'Maize'	50	50	48	40	32	28	30
'Snow'	45	42	45	42	30	26	26
'Perfection pink'	40	42	40	38	30	28	25

Based on our results, we came to the conclusion that the cuttings of various cultivars of *A. frutescens* take roots in 24-54 days. Our research has shown that the best time to root cuttings is March-May. In autumn, rooting is slower, although in both cases, the success rate is 100 %. But given that the growth energy of the root system of *A. frutescens* is slowed down, to obtain seedlings with a well-developed root system, a longer rooting period is needed, therefore, the optimal time for their propagation is autumn.

When assessing the decorativeness of a flowering plant, one of the main indicators is the duration of flowering. In late April - early May, rooted cuttings were planted in the ground. Throughout the growing season, the plants were cared for, the development phases were recorded, the morphological features, timing and duration of flowering were studied, the decorativeness of the cultivars of *A. frutescens* was assessed (Table 3.)

Table 3. The bloom time of different cultivars of *Argyranthemum frutescens* (L.) Sch.Bip.

Cultivar	Date					
	plantation	budding	beginning of flowering	full bloom	loss of decorativeness	Length of the flowering stage (days)
'Neptun'	07.06	20.04	28.06	17.08	01.11	127
'Pink Delight'	07.06	15.04	20.06	15.08	01.11	135
'Giant Pink'	07.06	28.04	25.06	26.08	01.11	132
'White Swan'	08.06	25.04	30.06	29.08	01.11	123
'Angelic Lemon'	08.06	20.04	25.06	28.09	01.11	132
'Angelic Magenta'	06.06	25.04	28.06	15.09	29.10	122
'Angelic Burgundy'	06.06	28.04	25.07	28.08	29.10	101
'Sole Mio'	06.06	01.05	10.07	15.09	29.10	111
'Perfection Pink'	08.06	20.04	25.07	18.08	01.11	100
'Bupy'	09.06	25.04	25.07	25.09	31.10	99
'Maize'	09.06	20.04	30.07	28.09	29.10	89
'Snow'	09.06	01.05	25.07	25.09	31.10	99

We have observed that the flowering stage in some marguerite daisy cultivars begins immediately after the rooting of cuttings, even in the container, before planting them in the ground. A more intensive growth and development of all experimental cultivars was observed in September and early October, at the same time, the largest number of inflorescences was produced. Based on the data in Table 3, it takes a little more than two months for marguerite daisy plants to grow and develop. All the cultivars bloom for a long period (89-135 days) – throughout the summer and autumn, up to the first frost.

A. frutescens has great potential for use in landscaping: it is unpretentious, relatively drought- and cold-tolerant, blooms abundantly for a long time and is resistant to diseases and pests. Plants are attractive not only during flowering, but throughout the entire growing season, due to the shape of the bush and beautiful leaves. On the basis of the research carried out, we determined the characteristics of the studied cultivars of *A. frutescens*, developed a set of care tips and outlined the optimal directions for its use in landscape design.

The characterization of *Argyranthemum frutescens* (L.) Sch.Bip. cultivars

Figure 1. '*Perfection Pink*'

Figure 2. '*Snow*'

'*Perfection Pink*' (Figure 1) – spreading bush, 25 -35 cm tall, with medium leafiness, not resistant to flattening. Inflorescences 2.5-3.5 cm in diameter, pale pink with a lilac tint, with a wide brown center, which at the beginning of blooming has a greenish edging. They are located in the upper part of the crown on elongated peduncles. In the process of blooming, they change color from bright to paler, towards the end of the flowering stage, they become almost white. The leaf segments are large, leathery, dark green. Can be used for planting in containers, flowerbeds and mixborders.

'*Snow*' (Figure 2) – compact, spherical bush, 15-25 cm tall, in the second year it reaches 45-50 cm in height. The inflorescences are anemone-like, flat, white with a yellowish-cream center, 2-3 cm in diameter. Leaf segments densely cover the shoots, are medium-sized with a grayish tint. The flowering stage lasts for 3-3.5 months. It can be planted in containers, flowerbeds, mixborders and can also be grown alone.

'*Sole Mio*' (Figure 3) – compact spherical bush, 15-50 cm tall, densely covered with small leaf segments. Numerous anemone-like inflorescences, 2-2.5 cm in diameter, with a wide convex center, the ray florets are located along the edge of the inflorescence, they are very small and paler than the central ones – the disk florets. The leaf segments are small, delicate, dark green. It looks great in flowerpots, rectangular flowerbeds, sloped flowerbeds, in group planting.

'*Bupy*' (Figure 4) – 25-45 cm tall, compact, spherical bush, 20-50 cm in diameter, with dense foliage. The inflorescences are delicate, chamomile-like, crimson with bright yellow center, 2.5-3 cm in diameter, changing color intensity during flowering. The leaves are dissected into small segments, light green in color. It blooms for 3-4 months. It is recommended for planting in pots and various types of flowerbeds.

Figure 3. '*Sole Mio*'

Figure 4. '*Bupy*'

'*Giant Pink*' (Figure 5) – 25-60 cm tall, compact, spherical bush, with dense foliage, covered with pale pink, chamomile-like inflorescences, 3-4 cm in diameter. The leaves are dissected into small segments, dark green with a grayish tint. It blooms, on average, for 135-140 days. It is recommended for planting in pots and various types of flowerbeds.

'*White Swan*' (Figure 6) – compact bush, 25-40 cm tall and 20-45 cm in diameter. The leaves are pinnately dissected, juicy green, dense. The inflorescences are numerous, double, pom-pom-like, 2-3 cm in diameter, pure white with a yellowish-cream center, which stands out in full bloom. It can be grown both indoors and outdoors. After a short period of dormancy, it blooms (indoors) at

Figure 5. '*Giant Pink*' Figure 6. '*White Swan*'

the end of January. Outdoors, it blooms for 120-130 days. In the third year, the bush reaches a height of 1-1.2 m. It is recommended for containers and various types of flower beds, but also looks great when it is planted alone

Figure 7. '*Angelic Burgundy*' Figure 8. '*Angelic Lemon*'

'*Angelic Burgundy*' (Figure 7) – spherical, spreading bush, 25-70 cm tall and 20-60 cm in diameter. The inflorescences are numerous, chamomile-like, medium-sized, 2-2.5 cm in diameter, dark-purple with a bright yellow center. It blooms for about three months. It is suitable for growing in vases, pots, rectangular flowerbeds, mixborders and sloped flowerbeds

'*Angelic Lemon*' (Figure 8) – spherical bush, 20-50 cm tall, 40-50 cm in diameter, with dense foliage. The leaves are pinnately dissected, silvery green.

The inflorescences are 3-3.5 cm in diameter, anemone-like, bicolor: the ray florets are pale lemon and the disk florets are more vividly colored – bright yellow. The flowering stage is long-lasting – 130-145 days. It can be grown in pots, mixborders, can be planted in groups with other species or alone.

Figure 9. '*Angelic Magenta*'

'*Angelic Magenta*' (Figure 9) – compact bush, 18-35 cm tall, 20-30 cm in diameter, with dense foliage and elastic stems. The leaves are dissected into small segments, bright green. The inflorescences are anemone-like, bicolor, 2-3 cm in diameter. The ray florets are bright magenta, and the disk florets – creamy white. This cultivar is recommended for group plantings, mixborders, rectangular flowerbeds, vases, pots and containers.

'*Pink Delight*' (Figure 10) – 30-45 cm tall, spreading bush with medium leafiness. The leaves are pinnately dissected, grayish-green. The inflorescences are dark pink, double, 3-4 cm in diameter, on long peduncles. It blooms for over three months. It is recommended to plant this cultivar in groups or alone, in mixborders and in vases.

'*Maize*' (Figure 11) – compact, hemispherical, 18-40 cm tall bush, with dense foliage. The leaves are dissected into medium-sized, bright green segments. The inflorescences are light yellow, semi-double, medium-sized, 1.5-2.5 cm in diameter. The ray florets are arranged in 4-5 rows, unevenly – the larger ones along the edge,

Figure 10. '*Pink Delight*'

and the smaller – to the center. The disk florets are darker, by the end of the flowering stage, the center becomes convex. It blooms for 3 months, but is susceptible to excessive water-logging, leaves are affected the most (they turn yellow and wilt). This cultivar is a perfect choice for sloped flowerbeds, rectangular flowerbeds, mixborders and vases, pots or containers.

'Neptun' (Figure 12) – spherical, compact bush, 25-50 cm in diameter, 20-45 cm in height, with dense foliage. The leaves are dissected into medium-sized segments of dark green col-

Figure 11. 'Maize'

Figure 12. 'Neptun'

or with a grayish tint. The inflorescences are simple, chamomile-like, white with a bright yellow and slightly convex center, 2-2.5 cm in diameter. It blooms for about 130 days. It is recommended for sloped flowerbeds, rectangular flowerbeds and containers.

CONCLUSIONS

1. All the tested cultivars of *Argyranthemum frutescens* (L.) Sch. Bip. can be successfully propagated by cuttings.
2. To obtain seedlings with a well-developed root system by the time of planting, autumn is the optimal season to take cuttings.
3. In our country, the flowering stage lasts for 89-135 days and reaches its peak in September-October.

4. All 12 tested cultivars of *A. frutescens* are able to complete the full cycle of growth and development under the conditions of the “Alexandru Ciubotaru” National Botanical Garden (Institute), they are resistant to diseases, pests and unfavorable growing conditions. They are very attractive ornamental plants, which look great in various types of flowerbeds and in containers.

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