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Perspective Species of Campanula L. Genus for Creation of Ornamental Compositions in Uzbekistan

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Abstract: ***Species of the genus Campanula is very diverse. Among them there are species with single flowers, with two, three and many-flowered inflorescences. Representatives of Campanulaceae family are very decorative and certain types are used in decorative floriculture at landscape gardening of Uzbekistan`s cities. Morphological diversity and simplicity of cultivation conduce to the wide spreading of culture.***

Keywords: introduced species of the genus *Campanula*, ornamental plants, horticultural crops, flowering, fruiting, leaves, self-seeding.

1. Introduction

Many species of the genus *Campanula* L. distinguished by the abundance and duration of flowering, diversity of its habit and resistance. They can be widely used for creating of different types of phytodesign. Morphological diversity, high decorative properties and simplicity of cultivation contribute to the wide distribution of culture.

Bell – flower is a herbaceous plant of the family *Campanulaceae* (*Campanulaseae* Juss.). In the culture spread mainly annual, biennial and perennial species. Rarely subshrubs. The genus comprises about 300 species distributed in temperate regions of the Northern Hemisphere, Europe, Caucasus, Central Asia and Western Siberia, in the Transylvanian Alps, on the Mediterranean coast. The types of habitats are very diverse: forests, meadows, rocks, rarely steppe. On the territory of Russia and the neighboring countries (within former USSR) grows 67 species of the genus *Campanula*, and 33 sub-species (100 taxons), including those in Central Asia - 7 species [3].

Bell-flower attracted the attention of gardeners long ago. Many of them introduced into European countries and North American, have become a part of orchard crop and are used in landscaping [5, 6].

Bell-flower in future are able to take its worthy place among the leading ornamental plants in flower beds of parks, gardens, squares and boulevards, as well as home gardens. Almost all types of bell-flowers are suitable as green-house and room culture, as well as for early forcing.

Introduction study of genus *Campanula* in the conditions of Tashkent Botanical Garden was started in 1967 in accordance with the method, developed by F.N. Rusanov [7]. Comprehensive monitoring and introduction study kinds of bell-flower kinds, growing in different geographic areas and different habitats were carried out in 1968-78 in experimental plots of Botanical Garden. Their biological and ecological features in Tashkent conditions and requirements for growth factors, which are closely connected with their geographical origin and ecology were ascertained. All these were taken into account in breeding and cultivation of studied species of *Campanula* genus. Then the collection was lost. In this regard, the study of biological and ecological features of bell-flower in the conditions of introduction, in order to select the most valuable species for landscaping cities of Uzbekistan is very urgent.

2. Materials and Methods

Field and laboratory studies were carried out on the basis of Tashkent Botanical Garden of Institute of the Gene Pool of Plants and Animals AS RUz The territory of Botanical Garden is located at an altitude of 480 m above sea level, the soil is typical gray soil. The amount of rainfall during the research was 228-585 mm. The climate is sharply continental.

Eight species of *Campanula* L. genus were the objects of research. Phenological observations and determination of morphological parameters were carried out by conventional methods [1]. Seed production was studied in accordance with the method of I.V.Vaynagy [2]. Static processing of obtained data was carried out as recommended by G.N. Zaitseva [4].

3. Results and Discussion

One of the problems in introduction of perspective ornamental species in the culture with the purpose of landscaping is to identify the characteristics of their flowering in the new modified growth conditions. The study of the growth and development of the bell-flower was begun again in 2013. In this regard, in the conditions of Botanical Garden an experimental nursery for mass study and breeding species of the genus *Campanula* was laid. The study of seed germination of 16 species of bell-flower obtained from the seed department of Botanical Garden was allowed to select 8 kinds, perspective for further research.

Many types of bell-flowers are capable to form large clumps. It is mainly the representatives of forests, meadows and alpine meadows. The ability of quick forming of clumps depending on the fact that in these species numerous rhizomes have already developed at a young age. This process has been studied in the experimental plot of the

Botanical Garden in the following species of the genus *Campanula: C. alliariifolia, C. sarmatica, C. persicifolia f. Blue, C. persicifolia f. Alba, C. linifolia, C. glomerata, C. sibirica, C. medium.*

Campanula alliariifolia - herbaceous perennial plant, its height ranges from 30 to 65 cm. Stem erect, mostly simple. The stem and leaves are rough owing to short hairs. Stem leaves are cordate,cordate- oval or oval, the lower basal - triangular-cordate, with petioles, the upper - sessile, oblong-lanceolate, below densely velvety-pubescent. Flowers in length from 22 to 26 mm, on the stalks, are collected in few-flowered one-sided raceme. Fruits - drooping, dehisce at the bottom of the pod (Figure 1a.).

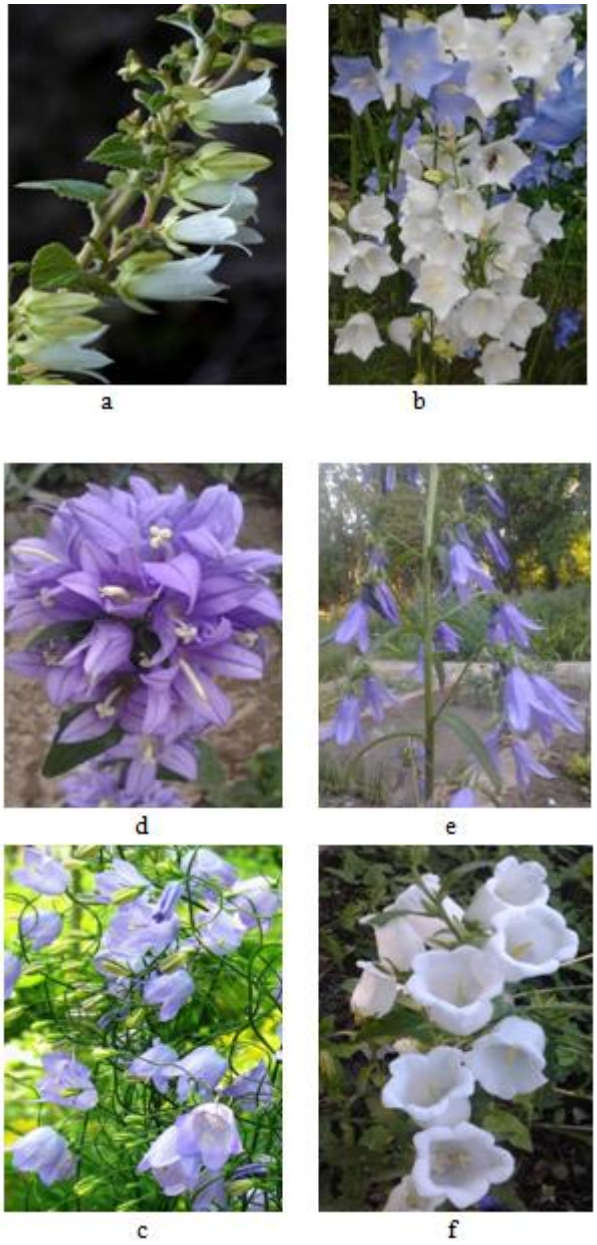
Campanula persicifolia f. blue and C. persicifolia f. alba. It is found in forests, forest lawns, shrubs, rarely - in the meadows of Europe (except Scandinavia, Denmark, England and the south), the Caucasus, the Western Siberia. It is cultivated in the Botanical Garden for many years, regularly blossoms and bears fruit. There have been seedlings from self-seeding. Numerous rhizomes of various sizes provide a rather intense vegetative reproduction. Bloom from mid-May to mid-July. It bears fruit from late July to mid-August (Figure 1 b.).

Campanula linifolia is a bell-flower found in Alpine mountain belt of Northern Europe. Perennial plant with thin stems rising up to 25 cm, basal leaves are rounded-ovate, long-petiolate, located in the lower part of the stem. The flowers are medium to 2-2.5 cm, drooping, purple-blue. It blooms from June to November (Fig.1c). The study of seasonal dynamics of flowering showed that two flowering peaks of bloom were observed in Campanula linifolia.

Campanula glomerata common in the mountains of Siberia, reaching the alpine zone, grow well in meadows, in bushes, forest glades. A perennial herb with erect stems up to 60 cm. Flowers color is from dark purple to white, two centimeters in diameter. It blooms in mid-spring about two months. It is a relatively shade-enduring type (Fig. 1d).

Campanula sibirica is a biennial bell-flower with erect stem, height to 50 centimeters. Flowers with a diameter 2.5-3 cm, gathered in racemose inflorescence. Flowering period is from late April to September (Fig. 1 e). Leaves along the edges are some hairy, unclear rounded, serrated; lower petiolate, elliptical or oblong, sometimes narrow spatulate. It is distributed in the European part of Russia in dry forests, steppes, grassy fields suburbs, rarely found in crops as a weed.

Campanula medium is a biennial plant. Stem is erect. Height from 70 to 105 cm. The leaves of rosette are oval-lanceolate or lanceolate, palmately-dentate. Inflorescence – paniculate or many-flowered wide raceme. Reproductive shoots are semi-rosette elongated. The flowers are white, blue and purple, up to 7 cm long, erect, straight teeth, broad, ovate, pointed, on the edges and midrib short hairs (Figure 1 f).



species of Campanula: a – *C. alliariifolia; b – C. persicifolia*; c – *C. linifolia; d - C. glomerata; e – C. sibirica; f - C. medium.*

As a result of phenological observations from the abovementioned species of this genus four highly decorative types of bell-flower were selected, which are not only beautiful during flowering, but also (as was found in the experiments) are unpretentious in the process of cultivation in the conditions of the Botanical Garden.

The dynamics of flowering in four species (C. *persicifolia* L., C. *medium* L., C. *glomerata* L., C. *alliariifolia* Willd), possessing by high ornamental value were studied. During two years on 10 plants of each species observations were made. Studied species are belong to the life form of herbaceous polycarpic. Floral zone occupies a significant place in sprout system.

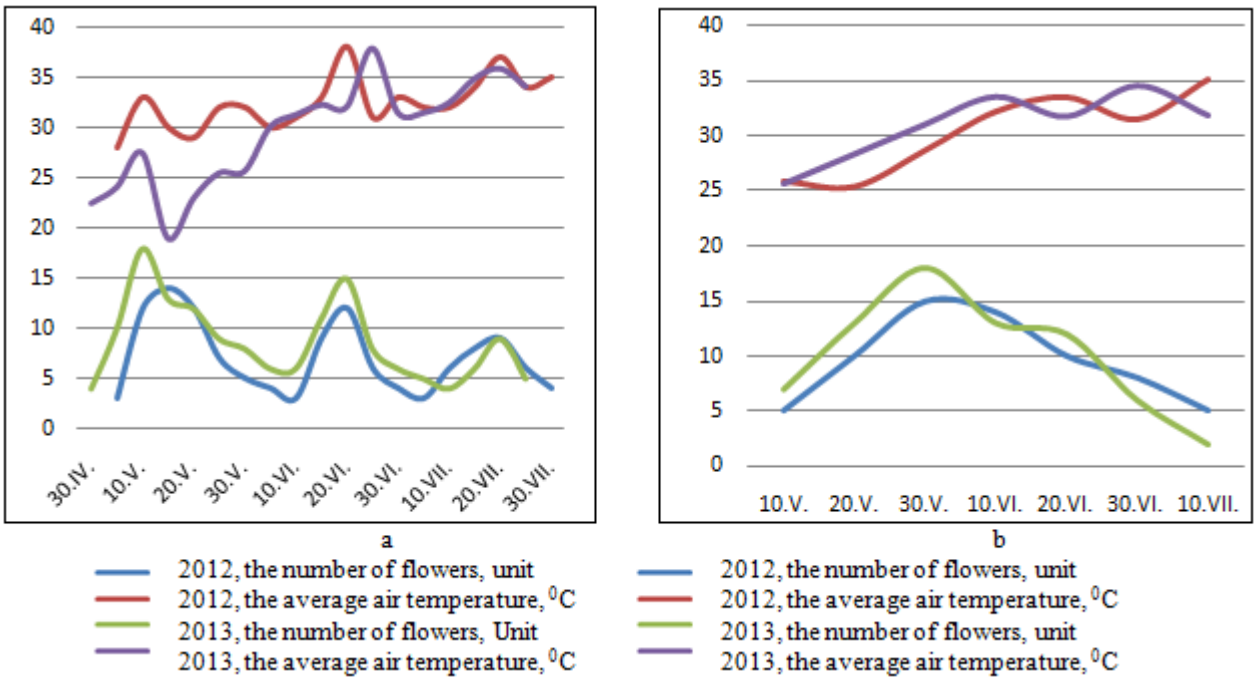
In general, the nature of flowering in the species of *Campanula* genus in both years of research in general was similar. An earlier start of flowering was observed in C.

persicifolia (06.V, 28.IV) and C. *glomerata* (08.V, 03.V), somewhat later in C. *medium* (18.V, 16.V) and later in C. *alliariifolia* (08.VI). Longer bloom was observed in the species C. *alliariifolia* and C. *persicifolia*, having many-flowered inflorescences. Shorter flowering occurs in C. *glomerata* and C. *medium* with few-flowered inflorescences (Table. 1).

Table 1: Flowering characteristic of species of *Campanula* L. genus

Indexes		The start of bloom	The end of bloom	Flowering duration, d.	The length of inflorescence	The number of buds in inflorescence, un.	The number of opened flowers in inflorescence, un.
C. persicifolia	*2012*	06.V	03.VIII	80-89	79,5±1,2	160,2±1,0	148,3±0,6
	2013	28.IV	23.VII	75-85	78,2±0,5	153,3±1,8	142,7±0,5
C. medium	*2012*	18.V	09.VII	47-55	77,9±0,6	59,8±0,5	57,7±0,6
	2013	16.V	05.VII	40-45	86,9±0,9	57,7±0,6	53,6±0,7
C. glomerata	*2012*	08.V	22.VI	28-30	34,1±0,2	73±0,6	71,7±0,4
	2013	03.V	11.VII	35-45	32,8±0,4	81±0,2	76±0,9
C. alliariifolia	*2012*	08.VI	25VIII	74-78	75,6±0,6	182,2±1,8	177,8±1,2
	2013	08.VI	28.VIII	75-85	65,7±1,8	175,2±1,1	168,5±1,6

The exploration of seasonal blooms dynamics showed that C. *persicifolia* at flowering in comparison with C. *medium* is more extended, three peaks were observed (Fig. 2a). Flowering begins at a temperature-25^{0}C. The first flowering peak was marked on 12.V at 30^{0}C , then it was the decline of flowering, and after that the second - 18.VI at a temperature – 37^{0}C. The third peak - 16.VII was marked at a sufficiently high temperature-36^{0}C, flowers were much smaller than in the first flowering peak. A similar bloom with the ups and downs in this species was described in the conditions of Siberian Botanical Garden SB RAS (Novosibirsk) by T.I.Fomina. [9]. However, the same species in the conditions of Tashkent the third flowering peak was marked. In 2012, single flowers were observed on the 95th day from the beginning of flowering.



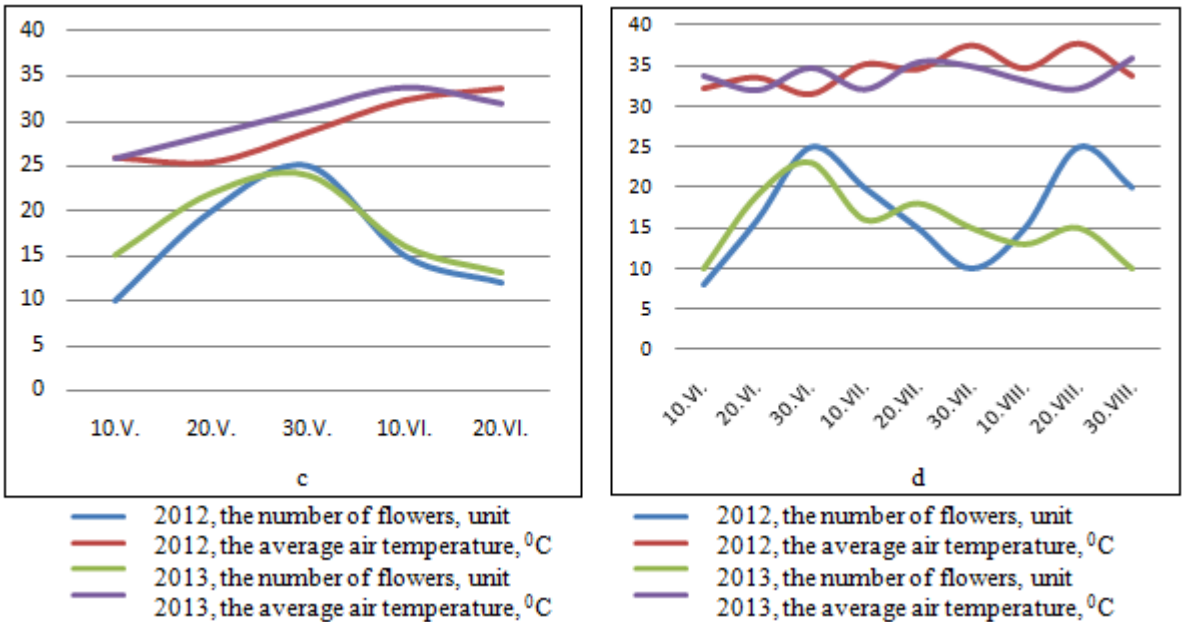


Figure 2: Seasonal dynamics of flowering: *C. persicifolia* (a); *C. medium* (b); *C. glomerata* (c); *C. alliariifolia* (d)

In C. *medium* the mass flowering completed in 2.5-3.5 weeks. Flowering peak was in the period from 17.V (29,7^{0}C) to 14.VI (32,8^{0}C). On the generative stem simultaneously bloom 10-14flowers and there were 16-25 buds. One flower bloomed for 5-7 days (Figure 2 b).

A variety of flowers color and their habit of such species as C. *persicifolia* and C. *medium* causes their wide growing in flower beds in combination with other plants. All of them are highly decorative due to multi-floral inflorescences, long bloom and can be recommended for landscaping of cities and populated areas of Uzbekistan. Semi-shade areas with abundant watering are optimum conditions for abundant blooms.

The results of conducted research on study of flowering, growth and development reintroducted species of *Campanula* genus in soil and climatic conditions of Tashkent Botanical Garden allow to make the following conclusions:

In general, the introduction of bell-flowers in Tashkent is successful. The best it was in European species, growing in forests, meadows, in the middle belt of mountains. All species of studied bell-flower bloom , bear fruit, sprout from self-seeding, reproduce vegetatively . Some of them are capable to naturalization in our environment, requiring only sufficient moisture. Species that grow on dry rocky slopes is introduced without much difficulty, but good drainage is needed and cannot be tolerate to flooding.

Thus, Campanula genus can be considered as perspective for shade-gardening due to the high decorativeness of many species and by simplicity of culture.

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