

Research on the variability of some morphological characteristics in local populations of *Calendula officinalis* L.

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Abstract The study aimed at the morphological analysis of the inflorescences of the local populations of *Calendula officinalis* L. collected from the western region of Romania, from Timis County. The determinations were made to establish the differences between these local populations. The morphological analysis of the inflorescences consisted of measurements at the length of the ligulate radiate flowers, tuberos central and the diameter of the *Calendula officinalis* L anthodes. The largest ligulate radial flowers were found in the Săcălaz population (3.46 cm). The length of the central tuberos flowers varied between 0.46 cm in Petrana genotypes and 4.5 cm in the population of Săcălaz. The populations that exceeded the control in terms of the diameter of the anthodes were: Săcălaz population and Dumbrăvița population. High variability identified in the analyzed populations, it allows us to select potential parents for future breeding works of species.

Key words

Calendula officinalis L.,
morphological analysis,
landraces

Calendula officinalis L. (Family *Compositae*) commonly known as Marigold or Calendula, is an annual plant that can be grown in all soil types, but is commonly found in Europe, East and West Asia, and United States. Approximately 25 species are included in the Genus *Calendula*, of which the most common are *Calendula officinalis*, *C. arvensis*, *C. alata*, *C. stellata*, *C. tripterocarpa*, *C. suffruticosa* etc. [5].

Calendula officinalis L. is the most current and cultivated species being used for landscaping, for interiors, as well as cut flowers in various floral arrangements [9]. In addition, marigold is used in human medicine, nutrition, cosmetics and veterinary medicine [1, 8].

Marigolds have an important economic value, their cultivation experiencing a continuous growth in recent years, due to the considerable widening of the spectrum of use of raw materials (flowers, leaves and seeds) as a source of oils, especially appreciated for their composition [6].

C. officinalis L. (marigolds) forms all three types of flowers during the growing season due to the fact that it is a polymorphic species [2].

From the point of view of the ornamental value as well as that of the industrial value, the genotypes with a large number of ligulate flowers in the inflorescence and a large number of inflorescences / plant are of great importance. For breeding and genetics, obtaining genotypes with involved flowers is the main objective for breeding species of the genus *Calendula* and especially of the species *Calendula officinalis* L. Some researchers believe that the type of flowers involved is a recessive genetic character and is

determined by the number of fertile ligules that form in the outer part of the anthode. The ligulate (marginal) flowers are of great importance, because from them seeds are obtained, the tubular (central) flowers being sterile [7].

The study aimed at the morphological analysis of the inflorescences of the local populations of *Calendula officinalis* L. collected from the western region of Romania, from Timiș County. The determinations were made in order to establish the existing differences between these local populations

The morphological analysis of the inflorescences consisted of measurements at the length of the ligulate radiate flowers, tuberos central and the diameter of the anthodes of *Calendula officinalis* L.

Material and Method

The biological material is represented by a collection of *Calendula* landraces from Timiș County. The landraces were compared with the Petrana variety used as an experimental control. The local populations were collected from locations (Timișoara, Ghiroda, Sănanđrei, Orțișoara, Calacea, Lovrin, Duestii Vechi, Sănnicolau Mare, Remetea Mare, Izvin, Recaș, Săcălaz, Dumbrăvița, Covaci). Morphological analysis of the inflorescences of *Calendula officinalis* L. collected was performed in order to establish the differences between landraces from Timiș County, western Romania. The morphological analysis of the inflorescences consisted of measurements at the length

of the ligulate radial flowers, tuberous central and the diameter of the anthers of *Calendula officinalis* L. In order to determine the significance of the differences between the landraces for each character, the processing of the experimental data was done by analyzing the variance and the t test. The meanings were expressed on the basis of symbols (*, **, ***, 0; 00; 000) [3].

Results and Discussions

In *Calendula* depending on the number of ligulate flowers are found the following types of flowers: simple flowers (1-2 rows of ligules); semi-involute

flowers (3-5 rows of ligules); flower wrapped (> 5 ligule rows). The type of flowers is important for use for decorative purposes, industrial or medicinal, and genotypes with involved flowers are the most used. Thus, the work of breeders should be focused on creating genotypes with beaten flowers and intensely colored in orange [4]. The largest radial ligulate flowers were found in the populations of Timișoara (2.16 cm), Ghiroda (3.4 cm), Săcălaz (3.46 cm), the results obtained by these populations exceeded the very distinctly significant control. With significant differences compared to the control were also the population from Sănicolau Mare as well as those from Recaș population (Table 1).

Table 1. Results regarding the morphological analysis of the length of the ligulate radial flowers (cm)

Local population	Average (cm)	Relative value (%)	Difference (cm)	Significance
Petrana (control)	1.233	100.000	0.000	Control
Timisoara	2.167	175.676	0.933	***
Ghiroda	3.400	275.676	2.167	***
Sânandrei	1.667	135.135	0.433	-
Orțișoara	1.683	136.486	0.450	-
Calacea	1.667	135.135	0.433	-
Lovrin	1.600	129.730	0.367	-
Dudeștii Vechi	1.533	124.324	0.300	-
Sănicolau Mare	1.733	140.541	0.500	*
Remetea Mare	1.400	113.514	0.167	-
Izvin	1.700	137.838	0.467	-
Recaș	1.757	142.432	0.523	*
Săcălaz	3.467	281.081	2.233	***
Dumbravita	1.700	137.838	0.467	-
Covaci	1.433	116.216	0.200	-
		LSD _{5%}	LSD _{1%}	LSD _{0.1%}
		0.474	0.638	0.848

From the point of view of the length of the central tuberous flowers (table 2), the local populations presented values between 0.46 cm in Petrana genotypes and 4.5 cm in the population of Săcălaz. Of the analyzed populations, those that exceeded the control

were Timișoara population (1.3 cm), Calacea population (1.53 cm), Izvin population (1.4 cm), Recaș population (1.7 cm) and Săcălaz population (4.5 cm), these results have been ensured statistically very significant positive.

Table 2. Results regarding the morphological analysis of the length of the central tuberous flowers

Local population	Average (cm)	Relative value (%)	Difference (cm)	Significance
Petrana (control)	0.467	100.000	0.000	Control
Timisoara	1.300	278.571	0.833	***
Ghiroda	0.900	192.857	0.433	-
Sânandrei	1.057	226.429	0.590	*
Orțișoara	0.933	200.000	0.467	*
Calacea	1.533	328.571	1.067	***
Lovrin	0.600	128.571	0.133	-
Dudeștii Vechi	0.833	178.571	0.367	-
Sănicolau Mare	1.000	214.286	0.533	*
Remetea Mare	0.900	192.857	0.433	-
Izvin	1.400	300.000	0.933	***
Recaș	1.700	364.286	1.233	***
Săcălaz	4.500	964.286	4.033	***
Dumbravita	1.300	278.571	0.833	***
Covaci	0.567	121.429	0.100	-
		LSD _{5%}	LSD _{1%}	LSD _{0.1%}
		0.463	0.623	0.829

From the analysis of the results it can be seen that all the analyzed populations exceeded the control, but the longest length of the central tuberos flowers was made by the population from Săcălaz. From the data presented in table 3 it can be seen that the largest diameter of the anthodes was observed in the population Izvin (5.36 cm), and the smallest in the

population Ghiroda (1.4 cm). From the point of view of this character, the populations that exceeded the control were: populations Izvin, Recaș, Săcălaz and Dumbrăvița.

The largest diameter of the anthodes was registered in the local population Izvin, and the smallest in the local population Ghiroda.

Table 3. Results regarding the analysis of the diameter of the anthodes (cm)

Local population	Average (cm)	Relative value (%)	Difference (cm)	Significance
Petrana (M)	3.200	100.000	0.000	Control
Timisoara	3.600	112.500	0.400	-
Ghiroda	1.400	43.750	-1.800	OOO
Sânandrei	3.500	109.375	0.300	-
Orțișoara	3.467	108.333	0.267	-
Calacea	3.767	117.708	0.567	-
Lovrin	3.500	109.375	0.300	-
Dudeștii Vechi	2.900	90.625	-0.300	-
Sannicolau Mare	3.400	106.250	0.200	-
Remetea Mare	3.433	107.292	0.233	-
Izvin	5.367	167.708	2.167	***
Recaș	4.500	140.625	1.300	***
Săcălaz	4.433	138.542	1.233	***
Dumbrăvița	5.200	162.500	2.000	***
Covaci	3.800	118.750	0.600	-
		LSD _{5%}	LSD _{1%}	LSD _{0.1%}
		0.655	0.882	1.172

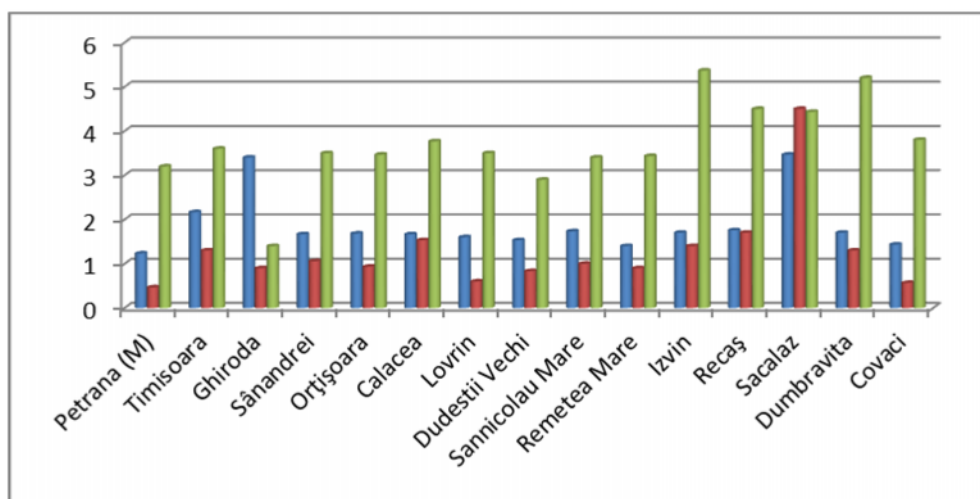


Fig. 1. Graphic representation of flower characters

Following these determinations, differences were highlighted between all 14 local populations studied. (fig.1). From the research carried out on the flowers of *Calendula officinalis* L. it was found that the morphological aspects of the anthodes, the ligulate radial flowers and the central tuberos flowers fall within the limits allowed by specialists. Obtaining genotypes with involved flowers were the main objective for the improvement of species of the genus *Calendula* and especially a species *C. officinalis* L.

According to some researchers, the type of flowers involved is a recessive genetic character and is determined by the number of fertile ligules, which form in the outer part of the anthode. Flowers ligulate (marginal) have a great importance, because from them are obtained seeds, tubular flowers (central) being sterile [7].

Conclusions

The largest ligulate radial flowers were found in the population Timișoara (2.16 cm), population Ghiroda (3.4 cm), Săcălaz population (3.46 cm). The local populations presented values of the length of the central tuberos flowers between 0.46 cm in Petrana population and 4.5 cm in the population of Săcălaz. The largest diameter of the anthers was observed in the local population Izvin (5.36 cm), and the smallest in the local population Ghiroda (1.4 cm). The populations that exceeded the control in terms of the diameter of the anthers were: Săcălaz population and Dumbrăvița population. The study of the main characteristics of the flowers allowed us to evaluate the variability of the biological material used, and to identify some potential parents, for the future hybridization programs.

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