

Research on the growing particularities of some basil genotypes (*Ocimum basilicum*) from southern Romania

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Abstract

Basil (*Ocimum basilicum*) is a species of interest due to its aromatic and therapeutic properties. The genotype of basil significantly influences the volatile oil content, due to genetic differences that determine the ability of each variety to synthesize and accumulate volatile compounds. These compounds are responsible for the aroma, therapeutic properties, and biological activity of the plant. Biometric determinations have allowed basil genotypes to be classified into three groups: weak genotypes of small stature (40-50 cm), such as dwarf basil, *Spicy Gloge basil*, *Greek basil*, *Siam Queen basil*, medium vigour genotypes, 60-90 cm, such as *Sweet Basil*, *Persian Basil*, *Grand Vert Basil*, *Dark Opal Red Basil*, and the third group is the group of vigorous genotypes, tall, 90-110 cm, such as *Cinnamon Basil*, *Holy Basil*, *African Basil*, *Serafim Basil*, and *Buzău Aromatic Basil*. The average green mass depends on the genotype and environmental conditions. This parameter is closely related to and influences the content of volatile substances that are so valuable in plant processing. The highest average green mass was recorded in the *Buzău Aromatic* genotype with a value of 360.32 g, the *Siam Queen Basil* genotype with 291.48 g, *Dark Opal Red Basil* with 290.56 g, and *Cinnamon Basil* with 290.10 g.

The average values for the seed germination period vary from genotype to genotype, being intrinsic values of each genotype characteristic marked in their genetic structure. The lowest average germination period values were recorded for the *Sweet Basil* genotypes, with 10 days, followed by the *Buzău Aromatic Basil* genotype, with average values of 10.33 days. Other values were recorded for the *Serafim basil* genotypes, with average values of 11 days, followed by *Macedon basil* with 11.33 days.

Keywords: *Ocimum basilicum*; Genotypes; Pathogen; Masă verde; Compuși bioactivi

1. Introduction

Considered a sacred plant, basil is present in the culture of many peoples, not just ours. In India, where it originated, it was elevated to the status of a sacred plant, cultivated in specially designated areas around shrines. Thus, only the king could harvest it, following a ritual that remains unknown. At Hindu funerals, it is customary to bathe the head in water with basil, accompanied by placing a basil leaf on the chest of the deceased [14], [12], [13], [2].

In the Middle Ages, in order to harvest basil, it was necessary to purify the right hand by washing it with water from three different sources, followed by the use of an oak branch, and the outfit had to be made of impeccable linen materials. In Egypt, this plant was used for embalming the dead, and in Roman culture it also had healing properties, being used not only in gastronomy.

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This herbaceous plant species is distinguished by its vertical stem with numerous branches, having a tetramuculate section and pubescence on the lower part. It grows in the form of a bush and can reach a height of up to 30-130 cm, depending on the cultivar. [10], [11], [6], [15]. This annual plant can also adapt to perennial crops, provided that the soil and climate conditions are favorable. Basil seeds fall to the ground and self-seed, which facilitates the establishment of a perennial crop. The leaves are arranged oppositely on the stem and have a petiole 0.8-1 cm long. The leaves are ovate-lanceolate in shape, measuring between 2 and 4 cm in width and 4 to 10 cm in length, with pointed tips and slightly serrated edges, having a wavy appearance, and the surface is smooth and velvety. Depending on the variety, they come in different shapes, sizes, and colors, with a specific fragrance characteristic of the species, being extremely aromatic. The root has a fibrous, well-branched structure that penetrates the upper layer of the soil. [9], [4], [5], [1].

The flowers have homozygous characteristics, displaying white, pink, or purple colors, depending on the specific variety. They are organized in groups of 5-10 in terminal pseudoverticils, each group of flowers being supported at the base by leaves transformed into bracts, which serve to protect the future seeds. They bloom throughout the summer until autumn, when the frosts appear. The calyx is pentagonal in shape, with a complete upper petal and a lower petal segmented into four small lobes. The flower structure includes four stamens and a pistil, the latter supported by the lower petal. Pollination is carried out by pollinating insects, being an entomophilous process. Four oval achenes develop inside the bilabiate calyx, and the fruit is an indehiscent nut containing four small, dark brown seeds. [3], [8], [7].

2. Material and methods

The plant material used in the study consists of basil genotypes from southern Romania, in sufficient numbers to conduct a meaningful study of the growth characteristics of basil genotypes (Figures 1., 2., 3., 4.) included in the study:

2.1. Aromatic Basil from Buzau – *Ocimum basilicum* L. – common basil – SCDL Buzau variety



(sursa/source: original)

Figure 1 Aromatic basil from Buzau - *Ocimum basilicum*

2.2. Serafim purple basil – *Ocimum basilicum* var. *violaceum* Alef. - SCDL Buzau variety



(sursa/source: original)

Figure 2 Purple basil Seraphim *Ocimum basilicum* var. *violaceum*

2.3. Sweet basil L1 – *Ocimum basilicum* L. sweet basil Genovese basil – origin Italy



(sursa/source: original)

Figure 3 Sweet basil Genovese *Ocimum basilicum* L

2.4. Lemon basil L2 – *Ocimum basilicum* L. – origin Spain.



(sursa/source: original)

Figure 4 Limonero basil - *Ocimum basilicum*

The research was conducted over three growing seasons, from 2021 to 2024, and involved measurements of the phenotypic characteristics of different basil genotypes, namely growth rate at 15 days, plant height, average bush diameter, average shoot length, and average number of shoots per plant. Other characteristics studied include the green mass weight of basil for the 16 genotypes studied (table 1) over the three years allocated to the research. Other research addressed the average *values of the germination period* for the 16 genotypes studied over the three years allocated to the research.

Table 1 Plant material basil plant biometrics for the 16 genotypes studied

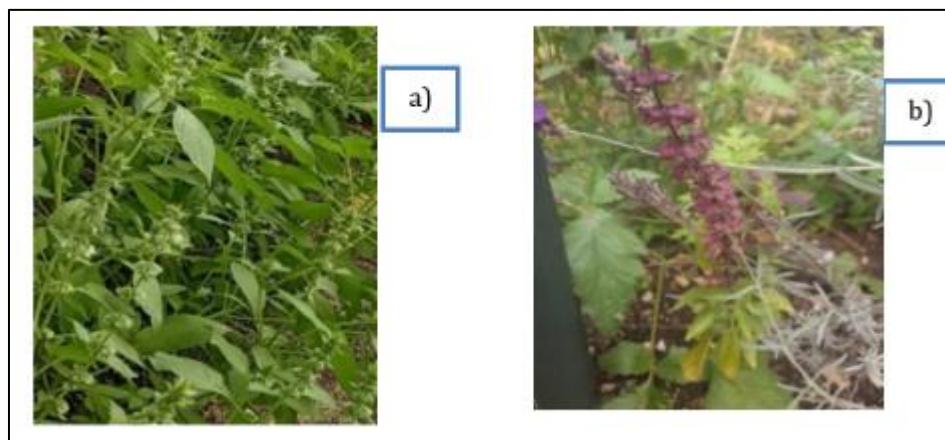
Nr crt.	Genotypes studied	Average height of the plant (cm)
1.	Aromatic Basil from Buzau	75,50
2	Purple basil Serafim	77,10
3	Sweet basil L1	62,20
4	Lemon basil L2	73,30
5	Greek basil	30,21
6	Basil with salad leaves L4	84,40

7	Grand Vert Basil L5	60,30
8	Persian basil	52,48
9	Spicy Globe Basil L7	37,51
10	African basil L8	118,00
11	Holy basil var. Krishna L9	78,10
12	Macedonian basil	60,85
13	Dwarf basil Smarald	29,40
14	Dark Opal red basil	56,56
15	Siam Queen Basil	51,48
16	Basil cinnamon	110,50

(sursa/source originală)

3. Results and discussion

Table 2. presents the results of the biometric analyses of the basil genotypes studied during the three years allocated to the research. These showed that, in terms of average plant height, the values varied depending on the genotype and ranged from 29.40 cm for the *Dwarf Basil* genotype, followed by the *Greek Basil* genotype with 30.21 cm. The highest values for this parameter were recorded for the *African Basil* genotype at 118 cm, followed by the *Cinnamon Basil* genotype at 110.50 cm. There were also middle values for most genotypes, such as *Aromatic Buzău* with 75.50 cm, *Sweet Basil* with 62.20 cm, *Persian Basil* with 52.48 cm, *Dark Opal Basil* with 56.56 cm, (figure 1. and figure 5b) and *Siam Queen Basil* with values of 51.48 cm. Regarding the parameter – average bush diameter, the lowest values were recorded for the *Dark Opal* genotype with 36.10 cm, followed by the *Dwarf Basil* genotype with 37.20 cm, and the highest values were recorded for the genotypes with 85.60 cm, followed by the *African Basil* genotype with values of 80.87 cm. (Figure 1.4.) Average values were recorded for most genotypes, such as *Grand Vert basil* with values of 55.34 cm, *Basil Serafim* 55.00 cm, and *Holy basil* 52.77 cm.



(sursa/source originală)

Figures 5 a)African Basil Plants and b)Dark Opal Basil

In terms of growth rate at 15 days, the lowest values were recorded for the *Dark Red Basil* genotypes, with values of 3.28 cm, followed by the *Siam Queen Basil* genotypes, with 4.30 cm, and *Spicy Globe Basil*, with 4.70 cm. The highest values were recorded for the *Cinnamon Basil* genotype with 85.60 cm and *African Basil* with 80.87 cm. The growth rate was relatively accelerated, with most genotypes recording growth between 5 and 7 cm in 15 days of vegetation. In terms of the average shoot length parameter, the highest values were recorded for the *Cinnamon Basil* genotype with 97.30 cm, followed by the *Buzău Aromatic Basil* genotype with values of 80.30 cm, *African Basil* with a value of 77.62 cm, and the *Lemon Basil* genotype with values of 70.10 cm. (Figure 3.) The lowest values were recorded for the *Dwarf basil* 11 genotype, with 80 cm, *Busuioc limonero*, with 19.30 cm, *Busuioc Spicy Globe*, with 26.41 cm, and *Busuioc Siam Queen*, with 28.61 cm. (Figure 4. and figure 6) In terms of the average number of main shoots, the highest values were recorded

for the *Greek basil* 15, *Spice Globe basil* with 10, *Aromat de Buzău*, *Salad leaf basil*, *Persian basil*, and *Cinnamon basil* genotypes with a value of 9.



(sursa/source originală)

Figures 6 *Lemon basil* and *Siam Queen basil*

Table 2 Results regarding basil plant biometrics for the 16 genotypes studied, over the 3 years allocated to the research

Nr crt.	Genotypes studied	Average height of the plant (cm)	Average diameter of the bush (cm)	Growth rate at 15 days (cm)	Average shoot length (cm)	Average number of main shoots
1.	Aromatic Basil from Buzau	75,50	60,60	5,50	80,30	9,0
2	Purple basil Serafim	77,10	55,00	6,10	70,00	8,0
3	Sweet basil L1	62,20	43,05	6,20	64,20	5,0
4	Lemon basil L2	73,30	64,10	5,90	70,10	6,0
5	Greek basil	30,21	40,23	4,52	19,30	15,0
6	Basil with salad leaves L4	84,40	65,56	7,10	60,20	9,0
7	Grand Vert Basil L5	60,30	55,34	5,52	37,50	5,0
8	Persian basil	52,48	49,02	6,00	32,00	9,0
9	Spicy Globe Basil L7	37,51	46,00	4,70	26,41	10,0
10	African basil L8	118,00	80,87	7,42	77,62	8,0
11	Holy basil var. Krishna L9	78,10	52,77	5,46	54,42	7,0
12	Macedonian basil	60,85	70,15	5,10	54,40	6,0
13	Dwarf basil Smarald	29,40	37,20	4,00	11,80	7,0
14	Dark Opal red basil	56,56	36,10	3,28	30,10	4,0
15	Siam Queen Basil	51,48	46,29	4,30	28,61	7,0

16	Basil cinnamon	110,50	85,60	6,10	97,30	9,0
(sursa/source originală)						

The results of the biometric measurements allowed the basil genotypes to be classified into three groups: weak genotypes of small stature (40-50 cm), such as *Dwarf basil*, *Spicy Gloge basil*, *Greek basil*, *Siam Queen basil*; medium vigour genotypes, 60-90 cm, such as *Sweet Basil*, *Persian Basil*, *Grand Vert Basil*, *Dark Opal Red Basil*; and the third group is the group of vigorous genotypes, tall, 90-110 cm, such as *Cinnamon Basil*, *Holy Basil*, *African Basil*, *Serafim Basil*, and *Buzău Aromatic Basil*.

Table 3 Results regarding the weight of green mass of basil for the 16 genotypes studied, over the 3 years allocated to the research

Nr crt.	Genotypes studied	Average green mass weight (inflorescences and leaves) (g)
1.	Aromatic Basil from Buzau	360,32
2	Purple basil Serafim	240,12
3	Sweet basil L1	145,12
4	Lemon basil L2	236,20
5	Greek basil	150,56
6	Basil with salad leaves L4	263,40
7	Grand Vert Basil L5	220,30
8	Persian basil	260,48
9	Spicy Globe Basil L7	169,51
10	African basil L8	199,00
11	Holy basil var. Krishna L9	288,11
12	Macedonian basil	185,85
13	Dwarf basil Smarald	135,40
14	Dark Opal red basil	290,56
15	Siam Queen Basil	291,48
16	Basil cinnamon	290,10

(source original)

Table 3 shows the results for the green mass weight parameter (inflorescences and leaves), which is important for the distillation process and the production of essential oils. The highest average green mass was recorded for the *Aromat de Buzău* genotype with a value of 360.32 g, followed by the *Siam Queen basil* genotype with 291.48 g, *Red Dark Opal basil* with 290.56 g, and *Basil cinnamon* with 290.10 g. The average green mass depends on the genotype and environmental conditions. This parameter is closely related to and influences the content of volatile substances that are so valuable in plant processing. The germination period of basil seeds is an important parameter that varies from genotype to genotype. For this purpose, observations related to seed germination were made. They were sown on March 12 for all genotypes, in the same spaces and conditions.

Results regarding the average germination period (presented in Table 4.) are also a parameter that varies mainly depending on the genotype, so that the longest average germination period was recorded for the *Holy Basil var. Krishna* genotype with 25 days, followed by the *Persian basil* genotype with an average value of 16.66 days, the *Greek basil* genotype with average values of 14.66 days, as well as the *Liminero basil* genotype with average values of 14.66 days and the *dwarf basil* genotype with average values of 14.66 days, then the *Cinnamon Basil* genotypes, with average values of 14 days. The lowest values for the average germination period were recorded for the *Sweet Basil* genotypes with 10 days, followed by the *Buzău Aromatic Basil* genotype with average values of 10.33 days. Other values were recorded for the *Serafim basil* genotypes, with average values of 11 days, followed by *Macedon basil*, with 11.33 days.

Table 4 Results regarding the average values of the germination period for the 16 genotypes studied, over the 3 years allocated to the research

Nr crt.	Genotypes studied	Germination period (days) - 2022	Germination period (days) - 2023	Germination period (days) - 2024	Average number of days to germination
1.	Aromatic Basil from Buzau	10	11	10	10,33
2	Purple basil Serafim	11	12	10	11,00
3	Sweet basil L1	10	9	11	10,00
4	Lemon basil L2	15	14	15	14,66
5	Greek basil	16	15	13	14,66
6	Basil with salad leaves L4	13	12	14	13,00
7	Grand Vert Basil L5	10	11	12	11,00
8	Persian basil	17	17	16	16,66
9	Spicy Globe Basil L7	13	12	13	12,66
10	African basil L8	14	12	13	13,00
11	Holy basil var. Krishna L9	25	24	26	25,00
12	Macedonian basil	11	12	11	11,33
13	Dwarf basil Smarald	15	14	15	14,66
14	Dark Opal red basil	14	13	14	13,66
15	Siam Queen Basil	15	12	14	13,66
16	Basil cinnamon	14	14	14	14,00

(source original)

4. Conclusions

The conclusions of the biometric determinations allowed the basil genotypes to be classified into three groups: weak genotypes of small stature (40-50 cm), such as *Dwarf basil*, *Spicy Gloge basil*, *Greek basil*, *Siam Queen basil*; medium vigour genotypes, 60-90 cm, such as *Sweet Basil*, *Persian Basil*, *Grand Vert Basil*, *Dark Opal Red Basil*; and the third group is the group of vigorous genotypes, tall, 90-110 cm, such as *Cinnamon Basil*, *Holy Basil*, *African Basil*, *Serafim Basil*, and *Buzău Aromatic Basil*. The average green mass depends on the genotype and environmental conditions. This parameter is closely related to and influences the content of volatile substances that are so valuable in plant processing. The highest average green mass was recorded in the *Buzău Aromatic* genotype with a value of 360.32 g, the *Siam Queen Basil* genotype with 291.48 g, *Dark Opal Red Basil* with 290.56 g, and *Cinnamon Basil* with 290.10 g. The conclusion regarding the average values of the seed germination period varies from genotype to genotype, being intrinsic values of each genotype characteristic marked in their genetic structure. The lowest average germination period values were recorded for the Sweet Basil genotypes with 10 days, followed by the *Buzău Aromatic Basil* genotype with average values of 10.33 days. Other values were recorded for the *Busuioc Serafim* genotypes, with average values of 11 days, followed by *Busuioc Macedon* with 11.33 days.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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