ANNALS OF THE UNIVERSITY OF CRAIOVA

Series: *✓ Biology*
✓ Horticulture
✓ Food products processing technology
✓ Environmental engineering

Vol. XXX (LXVI) - 2025

VARIABILITY OF MORPHOLOGICAL AND PRODUCTION CHARACTERS IN SOME BASIL GENOTYPES

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Keywords*: Ocimum basilicum L,* genotypes, morphological characters

ABSTRACT

The pharmacological properties of basil (Ocimum basilicum L.) make this plant a green pharmacy that has anti-inflammatory, antifungal, antibacterial, antioxidant, wound healing and antiviral properties possessing a wide range of bioactive phytochemicals, including alkaloids, phenols, flavonoids, tannins, saponins, reducing sugars, cardiac glycosides, steroids and glycosides. In this study, 11 genotypes from different areas of the world and a variety obtained at BRGV Buzău cultivated in 2022 in the Teaching Field of the Faculty of Horticulture in Craiova were used. The morphological characters analyzed placed the genotypes in different classes. Considerable variations were observed between individual genotypes, which were predominantly due to the morphological characters of the plant and obviously to the amount of vegetative mass obtained. The most representative character was the production of fresh and dry biomass, highlighting 3 genotypes with a production of over 2000 g/plant and 5 genotypes with over 1000 g/plant.

INTRODUCTION

Since ancient times, scientists and doctors have used various species of medicinal plants to cure certain diseases. Due to the increase in drug resistance and their negative effects, many researchers and people around the world have become increasingly interested in medicinal plants and their metabolites or extracts. This is due to their non-toxicity and numerous health benefits when used to treat numerous conditions.

The genus Ocimum comprises over 150 species that have been reported worldwide, but commercially important basil varieties mostly belong to the species *Ocimum basilicum* L. (Yaldiz and Camlica., 2021) Sweet basil (*Ocimum basilicum* L.) is a member of the Labiatae family and is important for the production of essential oil that is widely used in the food, pharmaceutical and cosmetic industries. Also, the essential oil obtained from the aerial organs of the plant contains linalool, eugenol, methyl chavicol, methyl cinnamate, ferulate, methyl eugenol, triterpenoids and steroidal glycosides and has a high economic value because it contains important components, such as eugenol, chavicol and their derivatives (Siddiqui et al., 2007b; Zheljazkov, Callahan and Cantrell, 2008) with an important role for health (Tuțulescu et al., 2016; Zhakipbekov et al., 2024).

Basil genotypes show great variability in morphological characters represented by: plant height; bush shape; leaf size; color (green to dark purple); leaf margin (smooth, serrated, crenate, etc.) flower color (white, red, pink and purple); flowering period and aroma.

The conservation of genetic variability and the efficient use of available accessions are important for the future for an efficient and long-term management of germplasm and breeding programs. Following the awareness programs carried out in recent years, towards awareness of the economic importance of medicinal and aromatic plants, it is imperative to take initiatives for the cultivation and management and sustainable development of basil varieties. Industrialized countries can produce high-yield and quality products at low costs, using advanced techniques for the improvement of medicinal and aromatic plants (Kizil et al., 2010).

Due to the numerous properties that medicinal and aromatic plants have, they should be cultivated on significant areas, thus obtaining a large and quality production, sustainable for the use of market potential.

Numerous studies have been carried out worldwide that aimed to explain the morphological, phenological and agronomic variability of local populations of sweet basil from different parts of the world (Dinu et al., 2025; Talawade et al., 2024; Yaldiz and Camlica., 2021; Carovic-Stanko et al., 2011). In this regard, in 2024, Talawade et al. studied the aforementioned characters in 40 basil genotypes from different regions of India to observe their behavior in the semi-arid region of Haryana. Many studies are still needed to investigate the behavior of genotypes from different areas of the world from a genetic and chemical point of view, depending on the cultivation and breeding practices used and desired.

To this end, the present study was conducted to observe the morphological and production characters in basil genotypes from different areas of the world and cultivated in the climatic conditions of our country. This genetic variability can be exploited in aromatic and medicinal plant breeding programs to develop improved varieties using an appropriate breeding methodology.

MATERIAL AND METHODS

The experiment was conducted in the Banu Mărăcine teaching field, Faculty of Horticulture in Craiova (44◦19′ N and 23◦51′ E). The biological material included 12 basil genotypes from different geographical regions of the world. The culture was established in the open field, through seedlings that were produced in a heated greenhouse. For the production of seedlings, the seeds were sown in peat mixed with perlite in a ratio of 9:1 on April 19, 2022, and when the plants were 15 cm in height, they were planted in the field at 60 cm between rows and 30 cm between plants per row (May 23, 2022), in randomized blocks, in three repetitions with 20 plants/repetition. All the necessary technological works were applied to obtain a quality production.

The average climatic data for the vegetation period (May-October) had the following values: 20.1 °C temperature, 46.5 mm precipitation and 64.1 % humidity. The basil crop was irrigated by drip irrigation because the species is quite demanding in terms of water requirements. The fertilizer applied was the Cropmax product 1l/ha applied once a week.

Observations made for the 12 genotypes were recorded at the appropriate stage of plant growth, i.e. from flowering to the reproductive stage of the crop, for the following 9 different qualitative traits: color, appearance, blade, leaf margin and shape, color and length of the inflorescence. For determining the production of green plantains, harvesting took place at the beginning of flowering and lasted from the first week of July to the third week of August. For dry weight, the plant was dried in a room at a temperature of approximately 35 °C.

RESULTS AND DISCUSSIONS

The 12 basil (*Ocimum* spp.) genotypes studied presented the following results which are presented in the tables below.

Regarding the leaf color, it was observed that all 12 basil genotypes were classified into five different groups (green, light green, dark green purple and greenish purple) (Table 1). Light green leaf color was observed in 3 genotypes, green in 4 genotypes, dark green in 2 genotypes, purple in two genotypes while greenish purple was presented in only one genotype.

The leaf appearance was waxy glossy in 11 genotypes and matte-pubescent in one genotype (table 1).

Table 1

Morphological characteristics of the basil leaf

Genotipes	Color	Appearance	Edge	Leaf image
G1-Aromat de Buzău	light green	glossy	weakly serrated	
G2- Pot dwarf Basil (Grecia)	light green	glossy	it is not serrated	
G3- Liguria Basil (Italia)	light green	glossy	it is not serrated	

G4- Oltenia Basil (România)	green	glossy	it is not serrated	
G5- Oltenia Basil (România)	purple	glossy	weakly serrated	
G6- Cluj Napoca Basil (România)	purple	glossy	weakly serrated	
G7- Vidin Basil (Bulgaria)	greenish purple	glossy	weakly serrated	
G8- Iran Basil	dark green	glossy	weakly serrated	
G9- Turcia Basil	dark green	glossy	weakly serrated	

G10- Bulgaria Basil	green	glossy	weakly serrated	
G11- Israel Basil	green	matte-pubescent	strongly serrated	
G12- Genoveze Basil (Italia)	green	glossy	Corrugated	

The leaf shape was elliptical in all basil genotypes, none of the genotypes presented a different leaf shape (Table 1).

Based on the flower color, the basil genotypes were classified into three categories, which included white, white-purplish, purple and pink (Table 2). Of the 12 genotypes, 7 presented white flower color, 2 genotypes presented purple flower color, 2 were with white-purple flowers and one genotype with pink flowers.

The length of the inflorescences was also monitored, and the average values classified the genotypes into 3 categories: with small flowers, up to 3 cm long, with medium flowers over 3 – 6 cm long (6 genotypes) and with large flowers over 6 cm (6 genotypes). The flowers were grouped in simple racemes or in compound racemes (Table 2).

Table 2.

Morphological characteristics of the flowers of the studied basil genotypes (average values)

Genotipes	Flower color	Inflorescence length (cm)	The flower from a botanical point of view
G1-Aromat de Buzău (România)	white	4.64	simple racem
G2- Pot dwarf Basil (Grecia)	white	3.60	simple racem

G3- Liguria Basil (Italia)	white	5.20	compound racem
G4- Oltenia Basil (România)	white	7.70	simple racem
G5- Oltenia Basil (România)	White-purple	6.00	simple racem
G6- Cluj Napoca Basil (România)	purple	6.60	simple racem
G7- Vidin Basil (Bulgaria)	White-purple	6.33	simple racem
G8- Iran Basil	white	6.60	compound racem
G9- Turcia Basil	white	6.20	compound racem
G10- Bulgaria Basil	purple	3.27	compound racem
G11- Israel Basil	pink	11.32	simple racem
G12- Genoveze Basil (Italia)	white	5.90	simple racem

The biomass production obtained in a single harvest (July-August) ranged from 250 g in V2 to 3600 g in V1. After evaluating this character, 3 genotypes with a production of over 2000 g/plant, 5 with a production of over 1000 g/plant and 4 genotypes with a production below 1000g/plant were highlighted (Table 3). A direct correlation was recorded between the green biomass and what results after drying (Table 3).

Table 3.

Average basil production per plant (g)

Variant	Production(g)	
	Green plant	Dry plant
G1-Aromat de Buzău (România)	3600	1005
G2- Pot dwarf Basil (Grecia)	250	60
G3- Liguria Basil (Italia)	2400	570
G4- Oltenia Basil (România)	1000	270
G5- Oltenia Basil (România)	1100	275
G6- Cluj Napoca Basil (România)	900	220
G7- Vidin Basil (Bulgaria)	2450	379
G8- Iran Basil	1700	260
G9- Turcia Basil	1170	180
G10- Bulgaria Basil	1100	240
G11- Israel Basil	800	190
G12- Genoveze Basil (Italia)	500	140

The differences observed in the yield of fresh and dry biomass between genotypes from different countries may be the result of different environmental and genetic factors, chemotypes, harvesting time, meteorological conditions and cultural practices used.

The results of the present study are superior to those obtained by Egata et al. (2017), who reported that the fresh weight of plants ranged from 44.58 to 231.53 g plant^{-1} and also noted that the maximum dry weight ranged from 10.06 to 31.57 g plant^{-1} in Ethiopian sweet basil genotypes. Also, previous studies have reported a diversity of values for fresh weight of different basil cultivars from 240.2 to 1105.9 g m^{-2}, and the dry weight was in the range of 47.9–202.8 g m^{-2} (Bekhradi et al., 2015; Ekren et al., 2012).

Knowledge of the various morphological and production characters of plants allows breeders to effectively utilize the available germplasm lines for the development of elite genotypes (Singh et al., 2020; Arya et al., 2024).

CONCLUSIONS

All morphological and production parameters evaluated were different depending on each affected genotype. Considerable variations were observed between individual genotypes, which were predominantly due to the morphological characters of the plant and obviously the amount of vegetative mass obtained. This information would be important to indicate the effect of geographical origin on the agromorphological and production traits of the genotypes. Promising basil genotypes can be used in various breeding programs with a potential to increase their use.

ACKNOWLEDGMENT

This research was funded by the Romanian Ministry of Rural Development and Agriculture, project ADER 5.2.1./2023.

REFERENCES

Arya R.K., Kumar V., Verma P.K., Kumar P., 2024. Morphological characterization of lemon grass genotypes under semi-arid conditions of Haryana. Indian J. Plant Genetic Resources, 37(2),1-6.

Bekhradi F., Luna M.C., Delshad M., Jordan M.J., Sotomayor J.A., Martinez-Conesa C., Gil M.I., 2015. Effect of deficit irrigation on the postharvest quality of different genotypes of basil including purple and green Iranian cultivars and a Genovese variety. Postharvest Biology and Technology, *100*, 127–135. https://doi.org/10.1016/ j.postharvbio.2014.09.017

Carovic-Stanko K., Liber Z., Politeo O., Strikic F., Kolak I., Milos M., Satovic Z., 2011. Molecular and chemical characterization of the most widespread Ocimum species. Plant Systematics and Evolution, 294, 253–262. https://doi.org/10.1007/s00606-011-0471-x.

Dinu M., Soare R., Botu M., 2025.Characterization of morphological and production traits in basil genotypes from Romania. DOI: 10.17660/ActaHortic.2025.1416.29.

Egata, D.F., Geja, W., Mengesha, B. 2017. Agronomic and biochemical variability of Ethiopian sweet basil (*Ocimum basilicum* L.) accessions. Academic Research Journal of Agricultural Science and Research, 5, 489–508.

Ekren S., Sonmez C., Ozcakal E., Kurttas Y.S.K., Bayram E., Gurgulu H., 2012. The effect of different irrigation water levels on yield and quality characteristics of purple basil (*Ocimum basilicum* L.).*Agricultural Water Management*, *109*, 155–161. https://doi.org/10.1016/j.agwat.2012.03.004.

Khalil S.E., Nahed G., Aziz A.E., Abou Leil, B.H. 2010. Effect of water stress and ascorbic acid on some morphological and biochemical composition of *Ocimum basilicum* plant. Journal of American Science, 6, 33–44.

Siddiqui B.S., Aslam H., Begum S., Ali S.T. 2007b. New cinnamic acid esters from *Ocimum basilicum*. Natural Product Research, 21, 736–741, https://doi.org/10.1080/14786410601083639

Singh S., Lal R.K., Singh B., 2020. Genetic variability in Ocimum L. germplasm: Medicinal and economic potential for value addition and product development. In Book: Botanical Leads for Drug Discovery (Singh, B. editor), Springer Publishers, Singapore 243-253.

Talawade V.K., Kumar K., Singh I., Arya R.K., 2024. Morphological Characterization of Different Ocimum spp. Germplasm Lines under Semi-Arid Region of Haryana. Ekin Journal of Crop Breeding and Genetics 10(2),94-104.

Tuțulescu F., Dinu M., Corbu A.R., Ioniță E.I., 2016. Antimicrobial effects of several essential oil from aromatic plants. Notulae Scientia Biologicae,8(4), 477-481.

Yaldiz G., Camlica M., 2021. Agro-morphological and phenotypic variability of sweet basilgenotypes for breeding purposes. Crop Science. 61,621–642, DOI: 10.1002/csc2.20391

Zhakipbekov K., Turgumbayeva A., Akhelova S., Bekmuratova K., Blinova O., et al., 2024. Antimicrobial and Other Pharmacological Properties of *Ocimum basilicum*, *Lamiacea*. Molecules*,* 29(2), 388; https://doi.org/10.3390/molecules29020388

Zheljazkov V.D., Callahan A., Cantrell, C.L. 2008. Yield and oil composition of 38 basil (*Ocimum basilicum* L.) accessions grown in Mississippi. *Journal of Agriculture and Food Chemistry*, 56, 241–245, https://doi.org/10.1021/jf072447y