SELECTION OF THE *OCIMUM BASILICUM* L. BREEDING MATERIAL AND PROSPECTIVE HYBRIDS IN IMPROVEMENT PROCESS

Ludmila DOMBROV[1]

e-mail: l.dombrov@gmail.com

Abstract

This paper presents the results of research to improve the species Ocimum basilicum L. in the collection of spicy and aromatic plants of Botanical Garden (Institute) ASM, comprising approx. 20 basil varieties of diverse origin. The primary goal of basil improvement is obtaining seasoning forms for fresh consumption and for drying with special taste qualities, pleasant aroma, no stinging shades, properly leafy, small and medium, to be grown in containers, without neglecting productivity and tolerance to diseases and pests. Using the intraspecific hybridization between parental forms *O. basilicum* var. *chamaeleonicum L., O. basilicum* cv. *Siam Queen, O. x citriodorum L., O. basilicum* var. *minimum (L.) Danert, O. basilicum* cv. *Opal-mini, O. basilicum* var. *purpurescens Benth.,O. basilicum* cv. *Purple Ruffles* and the individual and mass selection, eight hybrids have been identified in which improved quality, productivity and appearance are seen, confirmed by the morphometric measuring.

Key words: basil, hybrid, improvement, *Ocimum basilicum,* selection.

Compared to achievements in breeding of food, industrial, ornamental plants, improving and selecting culinary varieties in Moldova were not a priority for some time (Chisnicean L., 2012). The multitudes of registered varieties belong to foreign breeders, or the varieties registered earlier in the country have been improved. In coriander, thyme, basil etc. local varieties and populations obtained by cross-pollination are grown, having a poor production potential. The seeds used to produce fresh seasoning material sold in the country are imported or locally produced. Fundamental breeding works were carried out in Georgia, Azerbaijan, Romania, USA (Lawrence B. *et al*, 1980; Plugaru V., 1996). Basil is used fresh or dried as a condiment, for garnishing dishes, preparing vinegar, oil and spiced wine, therefore besides improving productivity, an enhanced quality of basil, *Ocimum basilicum* is sought, obtaining new forms for salad or as a dry condiment, with high taste properties, properly leafy, with high content of active ingredients, with high productivity, resistant to diseases and unfavorable environmental factors (drought, frost), suitable for mechanized harvesting etc. The article contains the description of the results obtained during three years of works to improve the *O. basilicum* variety: initial material used the qualitative value of the resulting hybrids (culinary and technological qualities, appearance).

MATERIAL AND METHOD

Basil varieties of various origin, including 5 domestic varieties (cv.*Lamaita,* cv. *Frunza verde,* cv.*Cretisor,* cv. *Purpuriu,* cv. *Opal-mini*) (Chisnicean L., 2012), varieties selected abroad *Albahaca* (Mexico), *Ararat* (Georgia), *Filosof* (Ukraine), *Sweet Leaf* (Poland), *Siam Queen*, *Purple Ruffles* and some varieties *O. basilicum* var. *cinammonum* (Turkey, Ukraine, Germany), *O.* x *citriodorum* L. (Germany), *O.basilicum* var. *minimum* (L.) Danert (Italy), O. *basilicum* var. *difforme* Benth. (Poland, Russia), *O. basilicum* var. *purpurescens* Benth. (Poland, Italy). The basil is a material with a very strong genetic variability. The response of basil varieties in the introduction collection was studied by sowing seeds obtained from free pollination over a longer period (Girenko M.N., 1975; Ceapoiu N., Potlog A., 1990). Following the annual selection forms with constant features of adaptation to local climate conditions were selected, which make up nowadays the named collection. Seven parental forms were selected among them *O. basilicum* var. *chamaeleonicum* L., *O. basilicum* cv. *Siam Queen, O.* x *citriodorum* L., *O. basilicum* var. *minimum* (L.) Danert, *O. basilicum* cv. *Opal-mini, O. basilicum* var. *purpurescens* Benth., *O. basilicum* cv. *Purple Ruffles* for intraspecific hybridization. Using forced pollination the female parent flowers were castrated, isolated, pollinated with pollen collected from the parent pattern and isolated again until separate harvesting of hybrid combinations. Further repeated individual and mass selection is used to assess the recombination capacity until constant

[1] Botanical Garden (Institute) of the Academy of Sciences of Moldova, Chişinău, Republic of Moldova

forms are obtained. The produced hybrids have been subject to morphometric measurements for assessing their quality and productivity.

RESULTS AND DISCUSSIONS

Improvement works started as a selection of the most valuable forms of basil, which have a higher adaptive potential, with the prospect of performing new varieties. Since the aim is to obtain small culinary varieties the following were chosen for hybridization: *O. basilicum* var. *chamaeleonicum*, *O. basilicum* var. *minimum*, *O. basilicum* cv. *Siam Queen*, *O. basilicum* cv. *Opal-mini*, which are small and medium, *O.* x *citriodorum* for increased content of limonene and *O. basilicum* var. *purpurescens*, *O. basilicum* cv. *Purple Ruffles*, for anthocyanin and the increased number of leaves. In the second year all seeds of hybrid combinations were sown and valuable hybrids selected. In the third year, the number of plants allowed the morphometric measurements of these hybrids to assess productivity and qualitative value.

Hybrids $1F_2$ (*figure 1*) and $4F_2$ (*figure 2*) are products of the crossing of *O. basilicum* var. *chamaeleonicum* ♀ x O. *basilicum L.* cv. *Siam Queen* ♂. $1F_2$ is dwarf sized (25.3 cm) has purple inflorescence shades, many leaves, spicy smell and pleasant taste. $4F_2$ is small (45.2 cm), with short pink flowering, round bush, increased number of leaves, a pleasant smell of cloves.

Figure 1 **Hybrid $1F_2$**

Figure 2 **Hybrid 4 F_2**

Hybrid $2F_2$ (*figure 3*) with parents *O. basilicum* cv. *Siam Queen* ♀ x *O. basilicum* var. *chamaeleonicum* L. ♂ is small (46.1 cm), with short inflorescences, round-oblong bush, increased number of leaves, pleasant spicy smell and taste.

Hybrid $3F_2$ (*figure 4*) is the result of hybridization of *O. basilicum* var. *chamaeleo-nicum* L. ♀ x *O. basilicum* var. *citriodorum* L. ♂, is short (42.2 cm), with medium inflorescences, increased number of leaves, a pleasant lemon scent. To increase the amount of limonene, up to 4-5 backcrosses will be performed.

Figure 3 **Hybrid $2F_2$**

Figure 4 **Hybrid $3F_2$**

Hybrid $5F_2$ (*figure 5*) has *O. basilicum* var. *minimum* ♀ x *O. basilicum* cv. *Siam Queen* ♂ as parents. The hybrid is short (54.2 cm), has medium pink inflorescences, long bush, increased number of medium leaves, pleasant intense smell of cloves.

Hybrid $6F_2$ (*figure 6*) obtained by crossing *O. basilicum* cv. *Siam Queen* ♀ x *O. basilicum var. minimum* ♂ is medium long (57.1 cm), short pale pink inflorescences, an increased number of medium leaves, pleasant intense smell of cloves and allspice.

Figure 5 **Hybrid $5F_2$**

Figure 6 **Hybrid $6F_2$**

Hybrid $7F_2$ (*figure 7*) resulted from hybridization of *O. basilicum* cv. *Opal-mini* ♀ x *O. basilicum* var. *purpurescens* ♂ is medium long (56.2 cm), with short purple inflorescences, increased number of medium leaves with toothed margins, which provide a decorative aspect, intense fragrance of cloves and allspice. Hybrid $8F_2$ (figure 8) with parental forms *O. basilicum* cv. *Opal-mini* ♀ x *O. basilicum* cv. *Purple Ruffles* ♂- has a medium height (57.8 cm), short purple-violet inflorescences, increased number of medium leaves with a toothed margin, which gives it a decorative aspect, pleasant intense smell of cloves and allspice.

Figure 7 **Hybrid 7F₂**

Figure 8 **Hybrid 8F₂**

Hybrids whose parental forms contain anthocyanin, have inherited this pigmentation, and its intensity varies from pigmented flowering to hybrids with anthocyanin coloration, hybrids with pigmentation on all organs, which have both parents with anthocyanin.

The morphometric measurements show that hybrids $1F_2$, $2F_2$, $3F_2$, $4F_2$ that have *O. basilicum* var. *chamaeleonicum* L., small height, have inherited this feature, their height ranging from 25.3 to 46.1 cm. The other hybrids are midsized (54.2 - 57.8 cm) (*table 1*).

Table 1

Central stalk height at harvest, cm

Hybrid	Min. value	Max. value	Average value X	P% Error	DL05 Limit difference
$1F_2$	24.9	25.8	25.3	4.5	2.3
$2F_2$	45.9	46.5	46.1	4.7	3.1
$3F_2$	41.8	42.5	42.2	5.0	3.0
$4F_2$	45.0	45.5	45.2	5.4	3.4
$5F_2$	54.0	54.5	54.2	4.5	3.4
$6F_2$	57.0	57.4	57.1	4.4	3.5
$7F_2$	56.0	56.4	56.2	4.4	3.5
$8F_2$	57.6	58.0	57.8	4.3	3.5

Mass green production of a plant ranges from 102.8 g for $1F_2$ to 110.8 g for $8F_2$. There is no correlation between the plant size and mass green production, since the small hybrids are more branched and leafy than those with average size and are not worse in terms of mass green production per plant (*table 2*).

Table 2

Mass green production per plant, g

Hybrid	Min. value	Max. value	Average value X	P% Error	DL05 Limit difference
$1F_2$	102.1	103.2	102.8	2.2	3.2
$2F_2$	109.5	110.2	110.0	2.9	4.1
$3F_2$	104.8	105.5	105.2	3.0	4.5
$4F_2$	105.5	106.0	105.6	3.2	4.5
$5F_2$	106.7	108.0	107.6	3.1	4.7
$6F_2$	107.4	107.8	107.5	3.4	4.7
$7F_2$	109.9	110.6	110.4	3.0	4.7
$8F_2$	110.6	111.0	110.8	3.1	4.9

The production of fresh leaves per plant ranges from 47.5 g at $3F_2$ to 56.1 g at $8F_2$. The largest number of leaves is in the hybrid 6F2 (51.3%), while the lowest one in $3F_2$ (45.1%) (*table 3*).

Table 3

Fresh leaves production per plant, g

Hybrid	Min. value	Max. value	Average value X	P% Error	DL05 Limit difference	Share of leaves, %
$1F_2$	48.0	48.5	48.2	2.3	3.2	46.8
$2F_2$	51.2	51.6	51.4	2.6	3.9	46.7
$3F_2$	47.4	47.8	47.5	2.8	3.2	45.1
$4F_2$	50.2	50.7	50.3	2.6	2.9	47.6
$5F_2$	51.9	52.6	52.3	2.5	2.9	48.6
$6F_2$	55.3	55.6	55.4	2.5	2.9	51.3
$7F_2$	55.4	55.8	55.7	2.4	3.1	50.4
$8F_2$	55.9	56.4	56.1	2.1	2.9	50.6

The mass of fresh stalksranges between 52.1 g at $6F_2$ and 58.4 g at $2F_2$. Hybrids ($1F_2$-$5F_2$) whose genitors are *O. basilicum* var. *chamaeleonicum* and *O. basilicum* var. *minimum* (L.) Danert, forms with many branches of the stalk, have a higher share of stalks than leaves (51.4% -54.9%), except the hybrid $6F_2$, in which the leaves prevail (51.3%) *(table 4*).

Table 4

Fresh stalks production per plant, g

Hybrid	Min. value	Max. value	Average value X	P% Error	DL05 Limit difference
$1F_2$	53.9	54.9	54.3	2.4	3.3
$2F_2$	58,1	58.9	58.4	2.1	3.5
$3F_2$	57.0	57.9	57.7	2.3	3.5
$4F_2$	55.0	55.7	55.3	2,4	3.3
$5F_2$	55.0	56.9	55.3	2.3	3.4
$6F_2$	51.8	52.4	52.1	2.1	3.3
$7F_2$	54.2	55.1	54.8	2.4	3.5
$8F_2$	54.5	55.1	54.7	2.3	3.5

Hybrids obtained meet the set goals (green mass productivity with outstanding organoleptic qualities, shorter vegetation period, resistance to diseases, pests, drought, etc., but also the appearance of the bush) and will be analyzed further in order to select the forms to be proposed as varieties.

CONCLUSIONS

The original material for improving *Ocimum basilicum* included basil varieties of diverse geographical origin of the Botanical Garden (Institute) of the Academy of Sciences of Moldova collection.

Following intraspecific hybridization, of the seven selected genitors more hybrids resulted, of which eight were selected as meeting the objectives.

Hybrids are forms for salad, possessing appropriate organoleptic features (pleasant taste and smell with notes of clove, allspice or lemon).

Hybrids have small or medium size, rounded or upward bush, which makes them suitable for growing in containers or using as decorative plants.

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