**Volume 24(3), 41 - 45, 2020**
**JOURNAL of Horticulture, Forestry and Biotechnology**
www.journal-hfb.usab-tm.ro

# Behaviour of some romanian genotypes of long peppers (*Capsicum annuum* L., var. *longum* Irish) in protected culture

**Apostol D.F.,[1*] Dinu Maria,[2] Giugea N.[2*]**

[1]University of Craiova, Faculty of Horticulture, Doctoral School of Plant and Animal Resources Engineering, 13 A.I.Cuza Street, 200858, Craiova, Romania
[2]University of Craiova, Faculty of Horticulture, Department of Horticulture and Food Science, 13 A.I.Cuza Street, 200858, Craiova, Romania

*Corresponding authors email: dan79apostol@yahoo.com, dinumariana@hotmail.com

**Abstract** The idea of this study started from the current growing practical need of truck farmers to grow long pepper varieties and hybrids in a protected and forced system. Varieties of foreign origin are generally used, in particular $F_1$ hybrids, instead of Romanian autochthonous varieties. The assortment of peppers, var. *longum*, has improved substantially lately in our country, and a proof in this respect are the 6 varieties: Bogdan, Lung de Ișalnița, Lung românesc, Doljan, Cosmin and Fermier obtained at SCDL Ișalnița, SCDL Vidra and SC Mefim Agro SRL (LLC) that are used in the present study. The observations and determinations showed that the Bogdan long pepper genotype, a semi-early variety, with large, yellowish green fruits at technical maturity, had a good behaviour in cold/unheated greenhouse culture, achieving a total production of 4.71 kg/pl. The late-maturing varieties also had a good behaviour such as Cosmin with 4.29 kg/pl and Fermier with 3.15 kg/pl. It was observed that the fruit length varied from 14.5 cm in Lung de Ișalnița to 18.7 cm in Lung Românesc and in terms of fruit diameter, this morphological characteristic varied from 3.6 cm in Lung Românesc to 7.2 cm in Fermier. Also, the Fermier genotype recorded an average number of fruits/plant of 18 while Lung Românesc recorded a number of 39 fruits/plant.

**Key words**

genotype, Romanian varieties, earliness, production

The pepper (*Capsicum annuum* L.) is native to South and Central America, and has been cultivated since ancient times in Mexico, Guatemala, Peru and Brazil. Most species and botanical varieties of the Capsicum genus are native to this part of the world, with the exception of a few species found in Japan. There are about 50 species of perennial peppers grown in tropical America. After the discovery of America, peppers were brought to Europe (1493) and spread to the south (Italy, France) in the 16th century and to the Balkan Peninsula in the 17th century (Ursu et al., 2013).

The Turkish first cultivated peppers in Eastern Europe, and then this spread to the Balkan countries. It is assumed that in Romania the pepper was brought by Bulgarian gardeners in the 18th century (Andronicescu et al., 1968), firstly in the south of the country, then spreading in all areas favourable to the culture of pepper.

The pepper fruits have a high nutritional value, given by the high content of sugars and vitamins and the fact that peppers are consumed more fresh, a state in which these components are processed directly by the human body. They are an excellent source of natural antioxidants, micronutrients (vitamins C, E and carotenoids) that are crucial in preventing or reducing chronic and age-related diseases [12].

Vitamin C has a strong antioxidant character and can vary greatly depending on the genotype and maturity of the fruit harvest (technological maturity or physiological maturity) [6]. In addition to ascorbic acid, pepper fruits also contain other vitamins, such as $B_1$, $B_2$, $B_3$ and E vitamins.

The pepper is of great importance from an economic and food point of view due to the quality of its fruits, as well as the great diversity of cultivars and cultivated varieties, contributing to the consumption of fresh or preserved vegetables and also to crop rotation in vegetables. It is a species that fights well against diseases and pests in the biological system [4, 8]. The genetic variability is the most important condition in a horticultural plant cultivation program [6]. As a result, researching the genetic variation between genotypes is always very difficult, thorough and long-lasting. Due to the nutritional properties of this species, consumption has increased in recent decades and, therefore, researchers pay special attention to the creation of new varieties and hybrids. The studied 6 varieties are created in Romania, in the climatic conditions specific to our country, taking into account the consumer preferences. The present study aimed at observing their behaviour in the culture, in a cold greenhouse, focusing especially on the production characteristics due to the significant yield that can be obtained per unit area.

## Material and Method

Six genotypes of long pepper (*Capsicum annuum* L.) var. *longum* originating in Romania were grown in a cold greenhouse in Șimnicu de Sus, Dolj County (south-western Romania) (44°24′23″N 23°48′09″E). These genotypes were cultivated in an experiment organized in randomized blocks, in three repetitions respecting the norms of the experimental technique [5]. The colour of the fruits as well as the earliness of the 6 genotypes of long peppers, i.e. Bogdan, Lung de Işalnița, Lung Românesc, Doljan, Cosmin and Fermier are presented in table 1 and fig. 1-6. The applied technology was the classical one for the pepper cultivation in greenhouses, the planting density being of 3-4 plants/$m^2$ [9].

During the vegetation period, observations and biometric determinations were made referring to fruit length, fruit diameter, average fruit weight and number of fruits per plant as well as to the total production, in order to establish the productive capacity of the studied genotypes. The recorded production data were statistically processed by analysis of variance and by the Duncan test, and the level of statistical significance was established using the limit difference (LD).

**Table 1. The studied long pepper varieties**

| Genotype | Provenance | Earliness | Fruit colour at maturity | |
|---|---|---|---|---|
| | | | Technical maturity | Post-maturity |
| BOGDAN | SCDL Işalnița | Semi-early | Yellowish green | Red |
| LUNG DE IŞALNIȚA | SCDL Işalnița | Semi-late | Dark green | Dark red |
| LUNG ROMÂNESC | SCDL Işalnița | Semi-late | Yellow-green | Red |
| DOLJAN | SCDL Işalnița | Semi-late | Yellow-green | Orange |
| COSMIN | ICDLF Vidra | Late | Dark green | Dark red |
| FERMIER | SC Mefim Agro SRL | Late | Dark green | Dark red |

Fig. 1 Genotype Bogdan

Fig. 2 Genotype Lung de Işalnița

Fig. 3 Genotype Lung Românesc

Fig. 4 Genotype Doljan

Fig. 5 Genotype Cosmin

Fig. 6 Genotye Fermier

## Results and Discussions

The observations and biometric determinations conducted in this study highlighted the main morphological characteristics of the fruits of the 6 Romanian long pepper genotypes studied in cold greenhouse cultivation conditions (Table 2) as well as the obtained production.

The length of the fruit recorded high values in all 6 genotypes of the studied long pepper, average values of 14.5 cm being recorded in Lung de Işalnița and 18.7 cm in Lung românesc, the Bogdan and Fermier varieties recording high values of 17.7 cm. It should be noted that this long pepper crop benefited from the classic cultivation technology, the authors wanting to highlight the good behaviour as well as the production obtained in this cropping system.

The diameter of the fruit, measured at the base of the fruit, recorded average values ranging between 3.6 cm in the Lung de Işalnița genotype and 7.2 cm in the Fermier genotype, a large diameter of the fruit, 5.5 cm, was also recorded in the Cosmin genotype (table 2).

The shape index (SI = L/D) represented by the ratio between the length of the fruit and its diameter, had values ranging between 2.46 in the Fermier genotype and 4.16 in the Lung Românesc genotype. The very large diameter of the Fermier genotype and the value of the shape index of 2.46 indicate that this variety has a moderately triangular fruit in longitudinal section, while the value of the shape index of 4.16 in the Lung românesc genotype indicates the fact that the shape of the fruit in longitudinal section is narrowly triangular.

The average weight of the fruit and the number of fruits per plant are characteristics that define the productive biological potential of a genotype. The average weight of the fruit, expressed in grams, recorded medium values in the Lung de Işalnița (68 g), Lung românesc (72 g) and Doljan (73 g) genotypes and high values in the Cosmin (118 g), Bogdan (170 g ) and Fermier (177 g) genotypes. These values demonstrate the stability of these genotypes in terms of this morphological element of the fruit. The applied technology as well as the environmental conditions did not greatly influence this characteristic given that the study was conducted in a greenhouse culture. Jadczak et al., (2010) compared several varieties and hybrids of peppers grown in the field. The authors found significant differences between the length, width and average weight of the fruit. Szafirowska and Elkner (2008) in their research reported a lower fruit weight and a thinner pericarp in the Caryca F1 hybrid compared to the Mercedes genotype, however the morphological characteristics of pepper fruits were highly dependent on the evolution of weather conditions in the vegetation period. In a study of climatic conditions in Eastern Poland (Lublin), the average weight of mature fruit was 134.2 g in the Caryca F1 hybrid (Rożek et al., 2012), an average weight similar to that of fruits from certain Romanian hybrids. Buczkowska et al., (2014) described the same hybrid, Caryca F1, as a variety characterized by large fruits with thick pericarp. The cited and presented results confirm that the climatic conditions strongly affect the morphological parameters of fruits in open field cultivation.

The average number of fruits harvested per plant recorded high values, given that the genotypes of the studied long peppers recorded an indeterminate increase and the plants had 3 arms. The lowest average number of fruits per plant was recoreded in the Fermier genotype (18), but it compensates with the high weight of the fruit, 177 g. The Lung românesc genotype recorded the highest number of fruits per plant, 39, but with an average weight of fruit of only 72 g (Table 2). There is a direct correlation between the average weight of the fruit and the average number of fruits per plant. Also, the average number of fruits / plant was very much influenced by the number of remaining arms/plant. Three arms for this cropping system are many because the plants grow a lot in height and

provide shade, thus causing the premature fruit drop.

**Table 2 The main morphological characteristics of long pepper fruits (average values)**

| Genotype | The length of the fruit (cm) | Fruit diameter (cm) | SI (L/D) | Fruit weight (g) | Number of fruits / plant |
|---|---|---|---|---|---|
| Bogdan | 17.7 | 4.8 | 3.69 | 170 | 28 |
| Lung de Işalniţa | 14.5 | 3.6 | 4.03 | 68 | 33 |
| Lung Românesc | 18.7 | 4.5 | 4.16 | 72 | 39 |
| Doljan | 17.5 | 4.3 | 4.07 | 73 | 27 |
| Cosmin | 16.6 | 5.5 | 3.02 | 118 | 38 |
| Fermier | 17.7 | 7.2 | 2.46 | 177 | 18 |

The statistical analysis of production data highlights the biological potential of long pepper genotypes studied in cold greenhouse conditions (Table 3). The comparison of the average productions was done according to the average number of the variants. The calculation and expression of the absolute average production was done in kg / plant.

The absolute average yields recorded in the studied long pepper genotypes were between 1.97 kg/plant in Doljan and 4.71 kg/plant in Bogdan. The Cosmin genotype recorded a total average production above the average number of the variants (4.29 kg / plant). The difference of the total average productions of the two cultivars compared to the average number of the variants is quite large, of +1.56 kg/plant in Bogdan and +1.14 kg/plant in Cosmin. The differences are statistically significant, being positive. The production from the Fermier genotype is below the average number of the variants (3.15 kg/plant), the difference being very small, of -0.04 kg/plant, which is not statistically significant. It turns out that the best results were recorded by the Bogdan genotype, a semi-early variety and by the Cosmin genotype, which is a late variety.

The analysis of multiple comparisons (Duncan test) of long pepper genotypes shows that there are significant differences between most genotypes (Table 4). The best genotypes are Bogdan and Cosmin, with the most significant differences.

**Table 3 The total average production of long pepper varieties**

| Genotype | Total average production | | The average difference (± kg / pl) | Significance of differences |
|---|---|---|---|---|
| | Absolute value (kg / pl) | Relative value (%) | | |
| BOGDAN | 4.71 | 147.6 | +1.56 | *** |
| COSMIN | 4.29 | 134.5 | +1.14 | *** |
| $\bar{x}$ | 3.19 | 100.0 | 0.00 | Control |
| FERMIER | 3.15 | 98.7 | -0.04 | - |
| LUNG ROMÂNESC | 2.79 | 87.5 | -0.4 | o |
| LUNG DE IŞALNIŢA | 2.21 | 69.3 | -0.98 | ooo |
| DOLJAN | 1.97 | 61.8 | -1.22 | ooo |

$LSD_{5\%}$ = 0.31 kg/pl; $LSD_{1\%}$ = 0.43 kg/pl; $LSD_{0.1\%}$ = 0.60 kg/pl

**Table 4 The multiple comparisons (Duncan test) of total average yields recorded by the long pepper varieties**

| No. | Genotype | Average $\bar{x}$ | The difference from the variant on the position | | | | |
|---|---|---|---|---|---|---|---|
| | | | 2 | 3 | 4 | 5 | 6 |
| 1. | BOGDAN | 4.71 | 0.42* | 1.56* | 1.92* | 2.5* | 2.74* |
| 2. | COSMIN | 4.29 | - | 1.14* | 1.58* | 2.08* | 2.32* |
| 3. | FERMIER | 3.15 | - | - | 0.36* | 0.94* | 1.18* |
| 4. | LUNG ROMÂNESC | 2.79 | - | - | - | 0.58* | 0.82* |
| 5. | LUNG DE IŞALNIŢA | 2.21 | - | - | - | - | 0.24 |
| 6. | DOLJAN | 1.97 | - | - | - | - | - |

## Conclusions

The comparative study of some Romanian long pepper genotypes, grown in protected culture in cold greenhouse, highlighted the suitability of some of them for this culture system. In terms of the average weight of the fruit, the Cosmin genotypes recorded 118 g/fruit, Bogdan recorded 170 g/fruit and Fermier

recorded 177 g/fruit. The total production per plant recorded high values in the Fermier varieties with 3.15 kg/pl, in Cosmin with 4.29 kg/pl and in Bogdan with 4.71 kg/pl. It should be noted that the Bogdan genotype is semi-early and the green-yellow colour of the fruit at technological maturity, is an asset for this culture system. Also, the tradition of the Romanian people to preserve the long pepper by pickling recommends the studied genotypes for this use as well. Our study on the assortment of long peppers grown in cold greenhouse in the climatic conditions of our country presents the selection of the most valuable genotypes suitable for different uses and commercialization.

## References


[1] Andronicescu, D., Angelescu, H. 1968. Ardeiul. Editura Agrosilvică, Bucureşti.

[2] Buczkowska, H., Sałata, A., Rożek, E., 2014. Diversity of the utility and biological value of fruits of some sweet pepper cultivars. Acta Scientiarum Polonorum Hortorum Cultus, 13(4): 49–62.

[3] Butnariu, H., Indrea, D., Petrescu, C., Savițchi, P., Chilom, Pelaghia, Ciofu, Ruxandra, Popescu, V., Radu, G., Stan, N., 1992. Legumicultură. Editura Didactică şi Pedagogică, Bucureşti.

[4] Caruso,G., Stoleru, V., Munteanu, N., Sellitto, V.M., Teliban, G.C., Burducea, M., Tenu, I., Morano, G., Monica Butnariu, 2019. Quality Performances of Sweet Pepper under Farming Management. Notulae Botanicae Horti Agrobotanici Cluj-Napoca, 47(2): 458-464.

[5] Ceapoiu, N., 1968. Metode statistice aplicate în experienţele agricole şi biologice. Editura Agro-Silvică, Bucureşti.

[6] Dinu, M., Dumitru, M.G., Pintilie, I., 2013. Comparative study of certain hot pepper genotypes *(Capsicum annuum* L.) cultivated in Oltenia, România. (IJSR) International journal of Scientific Research, 2(7): 54-57.

[7] Dinu Maria, Rodica Soare, Gheorghita Hoza, Cristina Băbeanu, 2018. Changes in phytochemical and antioxidant activity of hot pepper fruits on maturity stages, cultivation areas and genotype. South Western Journal of Horticulture, Biology and Environment, 9(2): 65-76.

[8] Hoza Gheorghita, Ionela Dobrin, Maria Dinu, Alexandra Becherescu, Viorel Ilie, Ioana Catuneanu Bezdadea, 2016. Research Regarding the Use of Natural Predators for the Control of Pests for Pepper in Protected Culture. Agriculture and Agricultural Science Procedia, 10:192-197.

[9] Indrea, D., Apahidean, S.A., Apahidean, Maria, Măniuțiu, D.N,. Sima, Rodica 2007. Cultura legumelor. Editura Ceres, Bucureşti.

[10] Jadczak, D., Grzeszczuk, M., Kosecka, M. (2010). Quality characteristics and content of mineral compounds in fruit of some cultivars of sweet pepper (*Capsicum annuum* L.). Journal of Elementology, 15(3): 509–515.

[11] Rożek, E., Nurzyńska-Wierdak, R., Kosior, M. (2012). The yield structure and technological traits of fruits of several sweet pepper cultivars from a single harvest. Acta Scientiarum Polonorum Hortorum Cultus, 11(5): 31–41.

[12] Soare, R., Dinu, M., Băbeanu,C., Popescu, A., Popescu, M., 2017. Nutritional value and antioxidant activies in fruit of some cultivars of pepper *(Capsicum annuum* L*.).* Journal of Agroalimentary Processes and Technologies, 23(4): 217-222.

[13] Szafirowska, A., Elkner, K. (2008). Yielding and fruit quality of three sweet pepper cultivars from organic and conventional cultivation. Vegetable Crops Research Bulletin, 69:135–143.

[14] Ursu, P., Berar, V., Poşta, G., 2013. Studies concerning the influence of genotype and planting density on some morphological characters in an assortment of paprika pepper cultivars grown in solarium type. Journal of Horticulture, Forestry and Biotechnology, 17(2): 342-347.