| Studii şi Cercetări | Martie 2016 | Biologie | 25/1 | 18-27 | Universitatea"Vasile Alecsandri" din Bacău |
|---|---|---|---|---|---|

# RESEARCH ON THE INTRODUCTION OF THE SPECIES*ARONIA MELANOCARPA*, WITH A HIGH NATURAL VALUE, FROM THE SPONTANEOUS FLORA INTO ORGANIC FARMS

***Ioan Viorel Raţi, Dumitra Răducanu, Nicoleta Bădăluţă***

***Key words****: Aronia melanocarpa, organic farms, biometric measurements*

## INTRODUCTION

The contemporary period is characterised by a rapid economic development of industry, agriculture, transport, tourism, international economic relations, requiring a more intensive use of natural resources (Tănăsescu N., 2005).

Increased population demands for healthy food has led to the expansion of shrubs cultures by: the emergence of new growing areas; new systems of cultivation (crop protected in tunnels, greenhouses, growing without soil, organic production); new lines of fruit capitalization (natural products); an increase in the market share of fresh fruit; extending the consumption season to almost the entire year through imports from the southern hemisphere. All these require new quality standards for shrubs fruit, with a focus on the antioxidant capacity of fruits and their beneficial influence on human health. There is increasing awareness of the beneficial influence of the consumption of fresh shrubs fruit, but the ripening season is quite limited and overlaps with that of the shrubs from the spontaneous flora. Few varieties of the global selection suit the pedoclimatic conditions in Romania (Ligia Ion, 2007, the National Program for Rural Development 1014-2020).

Romania has favourable conditions for the promotion of organic farming, namely: fertile and productive soil; chemical processing and industrialization have not yet reached the levels of highly industrialized countries; Romanian traditional agriculture relies on the use of clean technologies; it is possible to delineate green, non-polluting perimeters for the application of environmentally friendly farming practices; the demand for organic products is growing; organic farming has become a source of income for the rural population (Sumedrea D., et al 2014, Tănăsescu N., 2005,Rati I. V, 2008).

*Aronia melanocarpa*is planted organically to attract European funds, as well as for the purpose of restoring certain ecological zones, habitat conservation, reclamation of wetlands, to prevent landslides and soil degradation in deforested areas. Due to its pivoting and strong root, the plant has the ability to grip the soil and stabilize it rapidly, being useful in absorbing wetlands. The plant has exceptional resistance to industrial and traffic pollution (Sumedrea D., et al 2014, Paulina Mladin 2007).This paper presents the results of the study conducted on the species *Aronia melanocarpa* (the Melborn variety) which belongs to the group of plants of the future with tolerance to environmental biotic and abiotic factors. Its fruits are rich in nutrients, polyphenols and anthocyanins, with numerous beneficial effects on the health of the human body, being sought both on the domestic and international market.

**The variety in the study** is listed in the official catalogue of crop plants varieties in Romania-I.S.T.I.S. The catalogue is approved under order of the Ministry of Agriculture and Rural Development by the Law no.266 / 2002 on the production, processing, quality control and certification, marketing of seeds and cuttings, as well as testing and registration of plant varieties. The varieties registered in the Romanian official catalogue are forwarded to the European Commission for inclusion in the Common Catalogues of the European Union, which allows their sale throughout the EU territory (Catalogul oficial al soiurilor de plante de cultură, 2013, Bucureşti).

**Origin and range of *Aronia melanocarpa***

*Aronia melanocarpa*is a deciduous fruit shrub growing in eastern North America, Scotland, Ontario, southern Florida, Ohio and Michigan. *Aronia melanocarpa* was brought to Europe in late nineteenth century by the Russians. In 1948, the Soviet Union established an area of 20.000 shrubs in St. Petersburg. In Eastern Europe and in Germany, Aronia is cultivated as ornamental and medicinal plant (Dirr, Michael 1990).

**Morphological description of the species *Aronia melanocarpa.*** The plant has the form of a bush with 5-8 stems growing from the root or with a single shank of 40-50 cm and a crown formed of 4-5 ring skeleton stems that grow annual shoots, growing to about 1.5-2 m tall (Beldie Al., 1979). At *Aronia melanocarpa* – the Melrom variety (Fig.1) , the root is fibrous and firmly rooted in the ground, with a strong pivot, strong horizontal offshoot sand numerous absorbent hairs.


Fig. 1. .*Aronia melanocarpa* Fructex (original): a - root of cuttings planted 2 years before, b - shoots, c-leaves, d - inflorescence, e - fruits, f - seeds

The shoots (Fig.1a) growing from the root are multiannual and smooth, presenting oval-spear shaped stipules, with red-brown colour and scaly silvery exfoliation, with prominent lenticels, exfoliating at the knots into dark curving loops. The leaves are bright green, glossy, simple, with an elliptical shape and crenate margins, slightly grey and with trichomes on the lower surface. The white-pink flowers (Fig.1d) are produced in spring, have a width of 1.5cm and are nicely scented. The flowers have 5 white petals and 5 pink sepals growing in corymbs of 10-15 together. The main pollinators are bees. The flowers are hermaphrodite (bisexual). Flowering occurs in May and lasts 10 days. The fruits (Fig.1e) are small and numerous, with a coloured and relatively thick peel, formed in mid-summer, of a black-purple colour and an epicarp covered with sparse hairs. The fruits are small round barrel-shaped beads. The taste is astringent and not edible before ripening. The original colour of the fruits is red turning to black when ripe.

**Plant uses**

Over time, the species *Aronia melanocarpa* was given many uses, with relevance in several areas.

The plant was shown to be useful in food, medicine, environmental conservation but also as an ornamental plant in gardens and terraces (www.agriculturae ecologica.ro). In US, the fruits of Aronia are sold as powder used in protein shakes, purees, ice cream and food supplements. Voruta is a company in Lithuania that exports wine made from Aronia and in Poland the fruits are dried and used for tea and cakes (Kulling, S.E. and H. M. Rawel. 2008).Natural dyes and fragrances are extracted from Aronia berries and used in beverages and yoghurts. Due to their antioxidant properties, Aronia berries have been introduced in the diet of Russian cosmonauts (Hardin, J. W., 1973). Besides constituting a source of food and income for people, in areas where this plant grows spontaneously it also constitutes a source of food for animals (Hardin, J.W, 1973).

**Chemical composition and nutritional value**

Thus, 100 g of fresh fruit of *Aronia melanocarpa* contain 1480 mg of anthocyanins, 664 mg of proantocyans and 15-30 mg of vitamin C. One litre of Aronia juice contains 7 g of polyphenols, is rich in vitamin C and antioxidants. The fruits have a high content of proantocyans and quinic acid, a high concentration of vitamin P, which helps fix vitamin C in the body. The plant produces pigments in the fruit skin to protect the pulp and seeds from ultraviolet radiation. Preservation of Aronia fruits for longer periods is achieved through cold preservation (*freezing them at -20° C*). The fruits thus preserved are of high quality and have maximum nutritional value, as compared to their initial value. It is recommended to freeze the fruits as soon as possible after harvest, to avoid loss of nutritional value (Kulling, S.E. and H. M. Rawel. 2008).

***Aronia melanocarpa* in organic farms**

Aronia plantations will not do well in skeletal, salty soils or in those with excessive moisture. The plantation slope should not exceed 10-15%. Land preparation before planting consists in performing the operations characteristic of fruit shrubs: removal of all other plants from the area; deep ploughing (20-25 cm) is performed immediately after the distribution of organic fertilizer, which is the basic fertilizer, to incorporate it into the soil as evenly as possible; performing a two-way crossed levelling of the ploughing; marking the land for planting distances of 2.8-3.5 m between rows and 1.2-1.5 m between plants in a row; the seeding material consists of cuttings with roots, layers or potted plants obtained in vitro.

In general, planting is carried out in early November or early spring when the ground allow the sesoil operations. Even if basic fertilization has been applied, it is recommended that each planting hole receive 8.6 kg of garden soil and 30 g of superphosphate. Before plantation, the cuttings must be trimmed by shortening of the main roots and soaking them in mud.

In young plantations of Aronia, the soil is kept free of weeds by hoeing the rows of plants or repeated mulching. The interval between the rows is also kept clear of weeds by repeated levelling or grass growing. In fruit-bearing plantations, organic fertilization is applied regularly with 40 t/ha, or annually, every autumn, with 30 g / plant of complex fertilizer (NPK) and every spring with 20g / plant of ammonium nitrate. When plants grow over the age of 10-12 years and the production decreases, it is recommended to regenerate the bushes by cutting old stems and replacing them with new ones. This intervention is performed gradually over 3-4 years. Along multiannual stems there is applied cutting to remove second-order branches, and dry, weak or thin branches are eliminated from annual stems as they yield poor crops (Sumedrea D., et al 2014).

## MATERIAL AND METHODS

**The plant material used in the study**

*Aronia melanocarpa* – the Melrom variety – is a variety pending approval by Piteşti-Mărăcineni ICDP. The plant is vigorous, with multiannual shoots (Fig.2), its corymbs produce a large number of fruits of a black-purple and diminished astringent taste. For vegetative propagation, there was used the variety Nero N.

Fig. 2 Aronia plantation at Piteşti (original-left) and seeding material (right)

The flowers were observed and analysed in May 2013 at *Aronia melanocarpa*, the fruits were harvested 10-15 August 2014, and shoots with leaves were harvested in early September 2013.

Fruit seeds were extracted using a scalpel and tweezers. Biometric and biochemical measurements were performed on *Aronia* fruits, namely: fruit length, thickness, fruit and dry fruit weight, sugar content and the number of seeds in a berry. The root was extracted from the soil using a spade in late March 2013. This study exploited the following material bases: the greenhouse of the society Fructex Bacau, *Aronia melanocarpa* plants, Canon photo camera, scalpel, tweezers, hoe for the morphological description.

For the biometric measurements of fruits, seeds and dry matter there were used: electronic callipers, analytical scales AGN 200 Axis, weighing vials, Memert (Germany) dryer, Zeiss refractometer to determine the sugar content of the fruit.

In order to apply the soil treatments there were used the atomizer and the necessary substances. For the multiplication process, there were used *Aronia* cuttings and peat pots.

**The location where the studies were conducted**

SC Fructex SRL is a company that promotes, together with other fruit growers in Romania, and not only, a professional, responsible approach to plant protection issues and Romanian agriculture in general. It advises growers in producing cuttings and is nationally recognized for the biotypes of apple, sour cherry and buckthorn (www.fructex.ro).

**Pedoclimatic conditions in the field**

The **study area** is located in the middle basin of Bistrița River, on the confluence terraces of Bistrița and Siret River. The main relief lines ensure the sheltered location from the western front air masses that, in their descent along the western slope of Petricica Peak, undergo processes generated by the Foehn effect, as well as the sewage effect along the Siret. Valley of the smaller northern sector air masses and the warmer southern ones. Lower eastern altitudes do not hinder access above the circulation area from the eastern sector, largely connected to the eastward advancement of the Euro-Siberian anticyclone.

**Soil**

The experimental polygon consists of soft alluvial, carbonate soil bearing relicts of gleysation, formed on coarse fluvial deposits with coarse and clay-sandy structure, the parent rock - fluvial deposits; phreatic water 2,5-3mdeep with no flooding potential.

**Morphological description of the soil profile**

**Am=0-22 cm**. Dark brown, grainy, clay-sandy texture, effervescent with hydrochloric acid, moderate porosity, tubes and bunks with moderate frequency roots with clear passage. It has a slightly basic pH 7.5 and 6.6% carbon content. The soil is naturally laden with humus (*4.5%),* excessively laden with potassium *(>200ppm*) and phosphorus *(>500ppm*), medium laden with total nitrogen (*0.23%).*It has a sand content of 45.5%, 27% dust and 17.5% clay.

**Ac=22-36 cm**. Yellowish brown colour, clay texture (*19.2% clay; 29.9% dust; 52.9% sand),* moderately alkaline pH 7.8. Large granular structure, unstable with average effervescence, capillarity, frequent roots with clear passage. Medium carbonate (*6.7%)* and humus (*4.2%)* content.

**C1=36-61 cm.** Yellowish brown colour, clay texture (*18.1% clay; 23.9% dust; 58% sand*), with no structure, moderate effervescence in hydrochloric acid, moderate porosity with rare tubes and banks, rare roots with clear passage. Moderately alkaline pH8.5, medium carbonate content (*7.2%)* and low humus content (*1.2%).*

**C2=61-90 cm**. Yellowish brown colour, sandy-clay texture (*8.1% clay; 8.8% dust; 83.1% sandy*), with no structure, moderate porosity, rare roots, gradual passage. Moderately alkaline pH8.7, medium carbonate content (4.4%).

**C3=90 cm and below**. Yellowish colour with greyish and bluish spots, sandy-clay texture (*7.8% clay; 9.5% dust; 82.75 sand*). Restructured, without effervescence with hydrochloric acid. It has high porosity and rarely presents roots, a moderately alkaline pH (8.95) and moderate carbonate content (4.7%).

The analyses performed on 4 samples collected with the probe from the plantation area (*2 samples on the 0-20 cm depth and 2 samples on the 20-40 cm depth*) indicate the same situation as the soil profile analysis. The pH limits are7.6-7.8 (*slightly alkaline*). The carbonate content varies between 4.9 and 6.4, being quite homologous for the depth 0-40 cm, the humus content has greater variety, decreasing in the 20-40 cm layer by 0.40-0.45%. Phosphorus and potassium show the same excessive amounts (*greater than 200 and 500 ppm*).

**Climate**

The climate of the study area is temperate continental, with a tendency towards aridity caused by continental air invasions, which can often be excessively cold in winter, and excessively hot and dry in summer. Thus, the thermal difference between the external minimum and maximum temperatures recorded has reached 72.1° C. Analysis of the multiannual thermal regime resulted in an average temperature of 9.2° C for the studied area, with negative values in December, January and February.

Multiannual average precipitations recorded during the observations interval 1896-1955 were 544.3 mm and 544.0 mm for the interval 1981-1993. The average amount of precipitations is below 30 mm for the interval December-March, and more than 40 mm for the interval April-October.

Most precipitations (*between 87.7 and 90.3 mm*) were recorded in June, the month in which cyclones intensify their activity and torrential rains increase their frequency. Relative air humidity is generally high due to the presence of the Siret and Bistrița water courses and existing water accumulation.

## RESULTS AND DISCUSSIONS

### Biometric measurements of Aronia fruits and seeds

The 30 samples subjected to measurements have enabled us to establish the fruit growth parameters (length, thickness, weight) under circumstances of intensive cultivation in greenhouses on a mixture of sandy-clay soil. The fruit height (H) has recorded values between 7.4 mm and 11.3 mm. The fruit width (l) has recorded values between the minimum 9.3 and the maximum 11.4 mm. The arithmetic mean has recorded, for all the samples, values between 9.77 and 10.25 mm. The Aronia fruit parameters obtained in 2012 are: 9.77 mm (height), 10.25mm (width), 0.8711 (weight) (Fig. 3).

The biometric measurements applied in 2014 (Table 1) have an average large diameter of 13.47 mm, an average small diameter of 12.05 mm and an average fruit width of 1.23 g.

The fruit weight (Wt) has recorded values between 0.4455 gr for sample1and1.2747gr for sample 2 (Table 1). The arithmetic mean of the 30 measured samples is 0.8711 (Fig.4.).

.

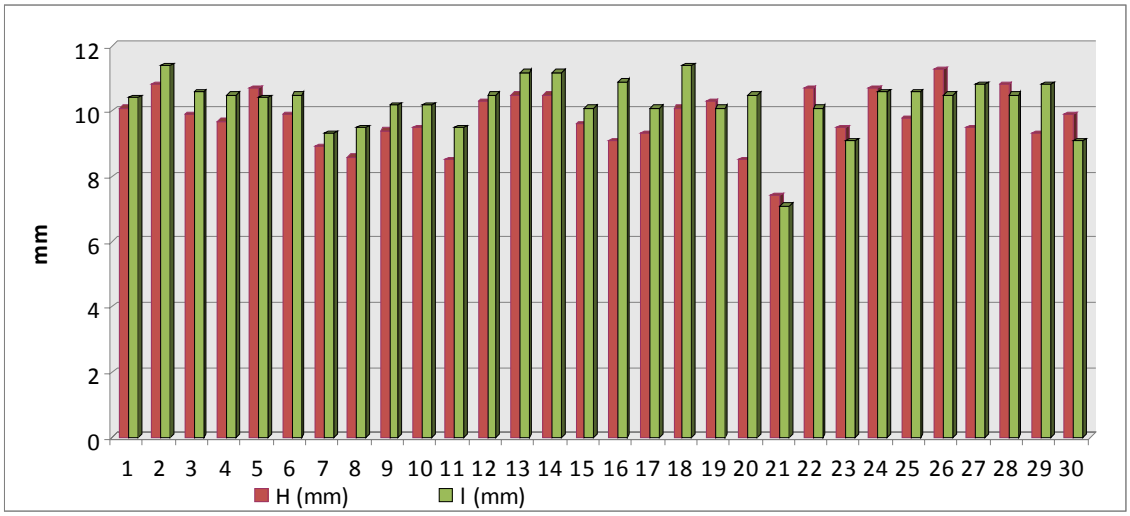


Fig.3 Biometric measurements for Aronia fruits – fruit height and fruit width (mm) (2012)

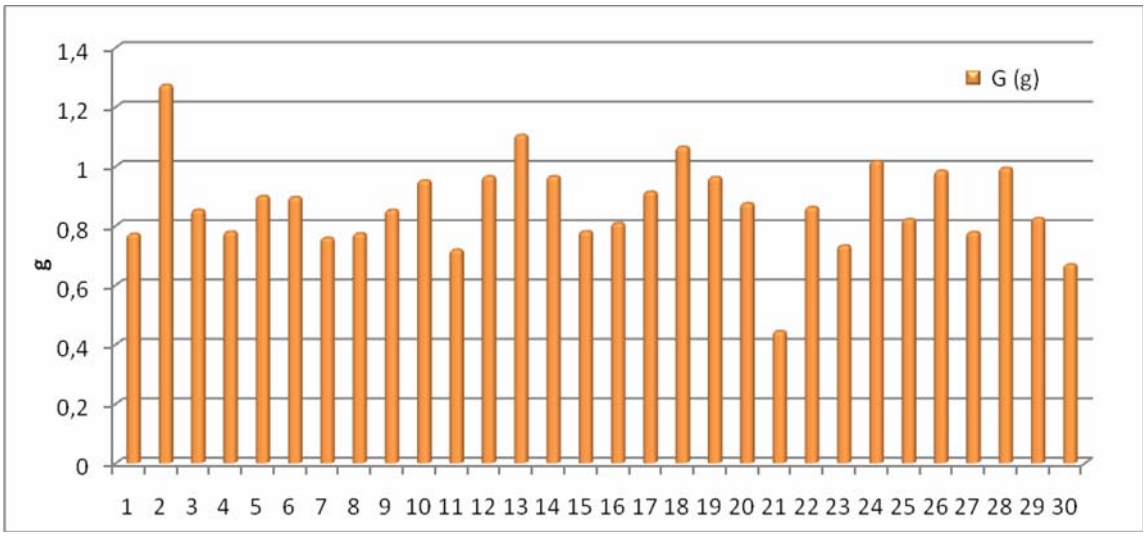


Fig. 4. Mass of Aronia fruits (g) (2012)

Table 1. Biometric measurements for *Aronia melancarpa* fruits harvested on July 30th, 2014, at S.C. Fructex, Bacău

| No. | Large diameter (mm) | Small diameter (mm) | Weight (g) | No. | Large diameter (mm) | Small diameter (mm) | Weight (g) |
|---|---|---|---|---|---|---|---|
| 1 | 14.73 | 11.73 | 1.14 | 51 | 13.09 | 11.24 | 1.20 |
| 2 | 12.07 | 11.20 | 1.47 | 52 | 12.09 | 10.26 | 1.15 |
| 3 | 14.41 | 12.30 | 0.95 | 53 | 13.17 | 11.16 | 1.30 |
| 4 | 12.90 | 11.06 | 1.04 | 54 | 12.95 | 11.29 | 1.40 |
| 5 | 13.34 | 12.01 | 1.05 | 55 | 12.83 | 12.06 | 1.30 |
| 6 | 13.73 | 13,34 | 1.03 | 56 | 13.45 | 12.48 | 1.46 |
| 7 | 13.84 | 13.37 | 1.09 | 57 | 13.40 | 11.83 | 1.26 |
| 8 | 13.40 | 13.03 | 1.23 | 58 | 11.75 | 9.68 | 0.98 |
| 9 | 12.87 | 11.97 | 1.23 | 59 | 12.80 | 11.24 | 1.07 |
| 10 | 15.04 | 12.41 | 1.40 | 60 | 13.17 | 12.40 | 1.20 |
| 11 | 12.83 | 11.14 | 1.45 | 61 | 12.19 | 10.30 | 1.13 |
| 12 | 13.44 | 12.89 | 1.97 | 62 | 13.81 | 10.62 | 1.09 |
| 13 | 13.68 | 14.50 | 1.22 | 63 | 11.75 | 11.21 | 0.72 |
| 14 | 13.19 | 11.09 | 1.37 | 64 | 11.27 | 10.67 | 1.06 |
| 15 | 14.71 | 12.08 | 1.10 | 65 | 11.77 | 10.04 | 1.06 |
| 16 | 13.02 | 13.03 | 1.01 | 66 | 10.56 | 10.03 | 0.88 |
| 17 | 15.21 | 13.20 | 1.11 | 67 | 10.37 | 9.87 | 0.85 |
| 18 | 13.55 | 11.05 | 1.22 | 68 | 11.79 | 10.64 | 1.01 |
| 19 | 12.59 | 10.87 | 1.52 | 69 | 11.06 | 10.06 | 1.20 |
| 20 | 15.14 | 12.53 | 1.31 | 70 | 10.75 | 9.36 | 1.31 |
| 21 | 13.08 | 11.39 | 0.98 | 71 | 13.17 | 10.83 | 1.48 |
| 22 | 14.19 | 12.74 | 1.32 | 72 | 12.34 | 10.56 | 1.32 |
| 23 | 13.50 | 11.85 | 0.83 | 73 | 11.83 | 11.70 | 1.37 |
| 24 | 13.06 | 11.57 | 1.50 | 74 | 12.40 | 11.18 | 1.12 |
| 25 | 12.96 | 11.32 | 1.32 | 75 | 13.51 | 11.02 | 1.43 |
| 26 | 12.32 | 10.56 | 0.88 | 76 | 13.08 | 11.05 | 1.39 |
| 27 | 13 | 11.50 | 1.25 | 77 | 13.17 | 11.28 | 1.29 |
| 28 | 13.49 | 11.45 | 1.02 | 78 | 12.83 | 11.33 | 1.26 |
| 29 | 12.06 | 10.81 | 1.40 | 79 | 12.55 | 11.58 | 1.45 |
| 30 | 13.59 | 10.84 | 1.13 | 80 | 12.58 | 10.29 | 1.09 |
| 31 | 13.97 | 12.13 | 1.20 | 81 | 11.63 | 10.49 | 1.33 |
| 32 | 11.70 | 10.15 | 1.48 | 82 | 12.21 | 10.94 | 1.19 |
| 33 | 13.62 | 12.35 | 1.07 | 83 | 11.81 | 10.52 | 1.54 |
| 34 | 13.59 | 11.35 | 1.48 | 84 | 12.33 | 11.34 | 1.40 |
| 35 | 14.14 | 11.95 | 1.49 | 85 | 13.85 | 12.20 | 1.05 |
| 36 | 14.12 | 11.56 | 1.07 | 86 | 13.36 | 11.15 | 1.43 |
| 37 | 12.81 | 9.58 | 1.47 | 87 | 12.97 | 12.37 | 1.30 |
| 38 | 11.56 | 10.50 | 1.32 | 88 | 11.45 | 11.40 | 1.31 |
| 39 | 13.62 | 12.60 | 1.20 | 89 | 12.72 | 10.16 | 1.09 |
| 40 | 13.39 | 11.72 | 1.19 | 90 | 12.32 | 10.44 | 1.28 |
| 41 | 12.54 | 11.12 | 1.29 | 91 | 13.07 | 11.61 | 1.06 |
| 42 | 13.24 | 12.39 | 1.50 | 92 | 13.47 | 11.17 | 1.30 |
| 43 | 12.77 | 12.27 | 1.45 | 93 | 12.66 | 11.18 | 1.12 |
| 44 | 11.56 | 11.39 | 1.30 | 94 | 13.64 | 11.89 | 1.21 |
| 45 | 12.63 | 11.87 | 1.29 | 95 | 12.40 | 10.78 | 1.23 |
| 46 | 12.42 | 10.29 | 1.40 | 96 | 12.92 | 12.66 | 1.36 |
| 47 | 13.49 | 11.60 | 1.50 | 97 | 11.52 | 11.30 | 1.12 |
| 48 | 10.82 | 12.02 | 1.41 | 98 | 12.66 | 10.93 | 1.13 |
| 49 | 12.74 | 10.80 | 1.30 | 99 | 12.10 | 10.31 | 1.21 |
| 50 | 12.80 | 11.51 | 1.55 | 100 | 11.67 | 10.41 | 1.49 |
| Average | 13.47 | 12.05 | 1.23 | | | | |

**Seeds**

To determine the number of seeds from the fruit of Aronia there were used 27 fruits, the values recorded ranging between 1 and 6 seeds. The minimum value of seeds found in a fruitwas1 and the maximum was 6 seeds. The arithmetic mean for the number of seeds was 3.40 (Fig. 5)

Figure 5 is a graphical representation of the analysis of the number of seeds found in Aronia fruits. The graph reveals that the number of seeds in a berry varies from 1 seed per fruit to 6 seeds per fruit.

To identify the mass of seeds (g), there were weighed 50 seeds, the resulting values ranging between 0.0017 and 0.0053 (Table 2).

The minimum value for seed weight is 0.0017 for sample 44 and the maximum value is 0.0071, found at sample 15. The arithmetic mean for seed weight is 0.0044g (Fig. 6). The dry matter determined for 1 gram of plant material (Aronia fruit) is 23.5444% (Fig.7). This high percentage indicates that the pulp is nutritionally rich. The fruit contains 76.4556 % humidity.

In 2014, the applied measurements revealed an average of 12.01% of dry matter and 10,7% degrees Brix. (Table 2).

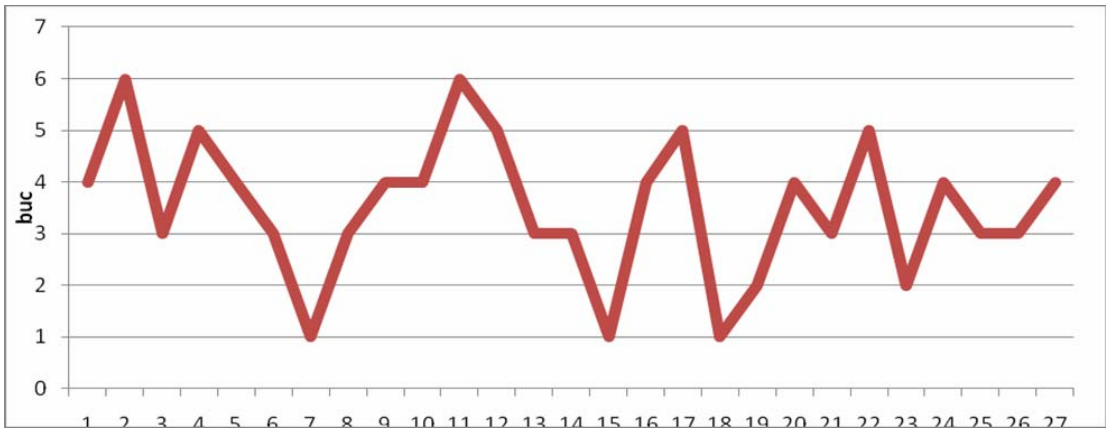


Fig. 5. Number of seeds in *Aronia melanocarpa* fruits (2012)

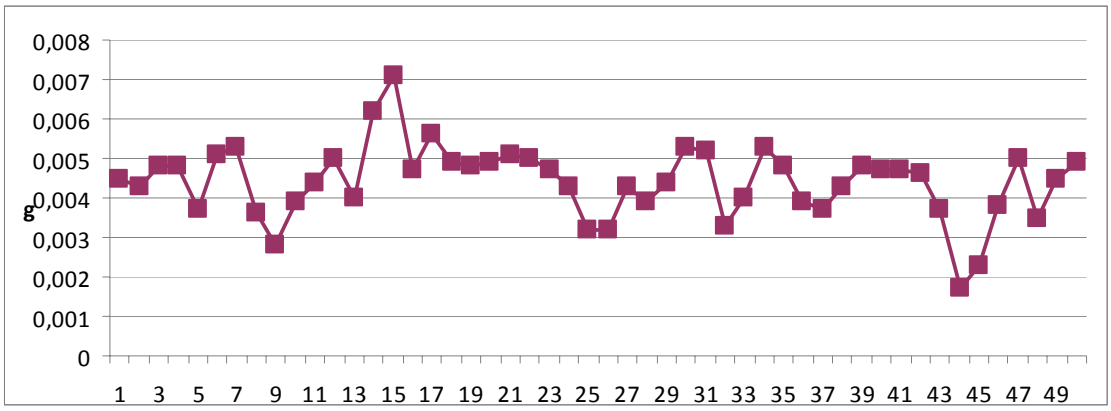


Fig.6. Mass of seeds in *Aronia melanocarpa* fruits (2012)

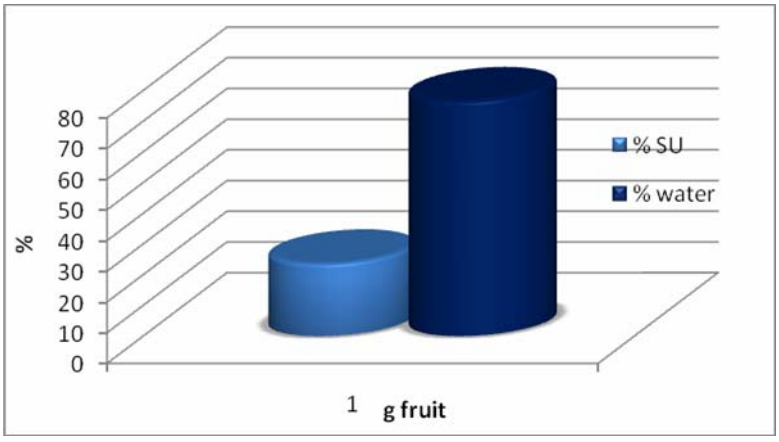


Fig.7. Mass of seeds in *Aronia melanocarpa* fruits (2012)

Table 2 Measurement of dry matter and sugar content for *Aronia melanocarpa* fruits (2014)

| No. | Dry matter (%) | Sugar (degrees Brix) | No. | Dry matter (%) | Sugar (degrees Brix) |
|---|---|---|---|---|---|
| 1 | 13 | 11 | 51 | 12 | 10.4 |
| 2 | 13.2 | 9.8 | 52 | 11.4 | 10.2 |
| 3 | 14.8 | 12.6 | 53 | 11.8 | 10.4 |
| 4 | 13.4 | 9.8 | 54 | 10.8 | 9.6 |
| 5 | 14.8 | 12.6 | 55 | 11.6 | 10.4 |
| 6 | 12.01 | 14.8 | 56 | 12.4 | 11.2 |
| 7 | 11.98 | 11.4 | 57 | 11.8 | 10.6 |
| 8 | 15 | 13.08 | 58 | 10.2 | 9.4 |
| 9 | 14.8 | 12.8 | 59 | 11.4 | 10.2 |
| 10 | 12 | 10.4 | 60 | 12.2 | 11.3 |
| 11 | 13.8 | 12 | 61 | 10.8 | 9.2 |
| 12 | 15 | 12.8 | 62 | 11.8 | 10.2 |
| 13 | 15.2 | 13 | 63 | 14.4 | 12.2 |
| 14 | 13.4 | 9.8 | 64 | 13.6 | 11.4 |
| 15 | 10 | 8.8 | 65 | 12.4 | 10.8 |
| 16 | 12.4 | 10.6 | 66 | 10.6 | 9.2 |
| 17 | 13 | 11 | 67 | 11.6 | 9.8 |
| 18 | 10 | 8.8 | 68 | 13 | 12.8 |
| 19 | 13.2 | 11.2 | 69 | 13.2 | 9.8 |
| 20 | 10.8 | 9.6 | 70 | 12,2 | 10.4 |
| 21 | 9.8 | 8.6 | 71 | 10 | 9 |
| 22 | 9.2 | 8 | 72 | 12.2 | 10.2 |
| 23 | 14 | 12.2 | 73 | 15.2 | 13.2 |
| 24 | 12.4 | 10.8 | 74 | 14.2 | 12.4 |
| 25 | 10.8 | 9.2 | 75 | 14 | 12 |
| 26 | 13.6 | 11.8 | 76 | 12.2 | 10.2 |
| 27 | 12.6 | 11.4 | 77 | 12.4 | 10.4 |
| 28 | 8.6 | 7 | 78 | 10.6 | 9 |
| 29 | 10.2 | 8.8 | 79 | 11.2 | 10.4 |
| 30 | 11.2 | 9.6 | 80 | 12.8 | 11 |
| 31 | 13 | 11 | 81 | 14 | 12 |
| 32 | 11.2 | 9.4 | 82 | 11.2 | 9.8 |
| 33 | 13.6 | 11.8 | 83 | 11.8 | 10 |
| 34 | 11.2 | 9.6 | 84 | 12.4 | 11 |
| 35 | 14.2 | 12.2 | 85 | 10.2 | 9.2 |
| 36 | 13 | 11.2 | 86 | 11.2 | 9.4 |
| 37 | 11.2 | 9.8 | 87 | 12.8 | 10.4 |
| 38 | 10.2 | 8.8 | 88 | 13.2 | 11.4 |
| 39 | 14.2 | 12.2 | 89 | 10.2 | 8.8 |
| 40 | 11.2 | 9.6 | 90 | 11 | 9.8 |
| 41 | 10 | 9 | 91 | 15.8 | 13,8 |
| 42 | 15 | 13 | 92 | 13.2 | 11.2 |
| 43 | 14.8 | 13 | 93 | 12.6 | 10.8 |
| 44 | 10 | 8.2 | 94 | 12.4 | 10.2 |
| 45 | 11.3 | 9.8 | 95 | 11.6 | 10 |
| 46 | 12.2 | 10.2 | 96 | 14 | 12 |
| 47 | 14.6 | 12.2 | 97 | 15.2 | 13.2 |
| 48 | 9.8 | 8.4 | 98 | 14.2 | 12.8 |
| 49 | 11.4 | 9.6 | 99 | 14 | 12 |
| 50 | 13,4 | 11.6 | 100 | 12.2 | 11.2 |
| Average | 12.01% | 10.7% | | | |

**Vegetative propagation of *Aronia melanocarpa***

**Propagation by green cuttings**

Green cuttings were planted in June and, as shown in the figures below (Fig.7a-d.), they yielded fruit. To ensure good vegetation, green cuttings were provided optimal rooting substratum conditions. This contains a mixture of peat and river sand, placed on a layer of pea gravel. To ensure controlled water supply to the cuttings in order to increase the crop yield, there was used a guide irrigation system.

Fig.7a. Close-up of green cuttings (original)

Fig.7b Annual two-year shoots with fruits (original)

Fig.7c. Two-year-old branches with fruits, plant grown in a greenhouse (original)

Fig.7d.Cuttings harvested during dormancy planted for root growing (original)

**Propagation by dry cuttings**

Propagation by cuttings was carried out in March 2013, these having a good rooting capacity (Table 3). Of the 200-planted cuttings, 80.5% grew roots in a fairly short period of 2-3 weeks (Fig.7. a-d) Table 5.9 presents the number of cuttings planted for two biotypes of *Aronia melanocarpa*: NeroB and NeroS. There was found the greater ability to grow roots of cuttings from the NeroB biotype (*88 with roots from the 100 planted*) and a smaller ability to grow roots of the biotype NeroS (*73 with roots from the 100 planted*).The average yield in dry cuttings is 80.5%. The rooted cuttings produced in the nursery are certified under the laws of Romania and can be used for establishing fruit shrubs in organic farms.

Table 3. Testing the propagation by cuttings at *Aronia melanocarpa* biotypes

| Species | Selection | Cuttings planted (buc) | Cuttings rooted (buc) | Efficiency (%) |
|---|---|---|---|---|
| *Aronia melanocarpa* | Nero-B | 100 | 88 | 88 |
| | Nero-S | 100 | 73 | 73 |
| Total (media) | | 200 | 161 | 80.5 |

**CONCLUSIONS**

The future of agriculture in this century is mainly focused on achieving healthy products, maintaining soil fertility, optimizing agricultural production and the environment, without neglecting the problem of food security.

Fruit shrubs are species with moderate environmental factors requirements, therefore behaving very well in Romania. These shrubs grow easily and yield fruits quickly, and the fruits obtained are nutritious, economical and highly therapeutic.

The *Aronia melanocarpa* species can grow in Romania, our results confirming its adaptability.

The overall objective of this work was to study the species *Aronia melanocarpa* – the Melrom variety – with a view to introducing them into commercial ecologically certified plantations. This fruit is rich in nutrients, the dry fruits having high nutritious values (23.54%).

The species fits the criteria for development of horticulture conducted by PNDR 2014-2020 for the absorption of European funds.

## ABSTRACT

Fruit shrubs are species with moderate environmental factors requirements; therefore behave very well in Romania. These shrubs are growing easily and yield fruits quickly, and the obtained fruits have high nutritious, economical and therapeutic value.

The measurements applied in this study enable better understanding of species and varieties in terms of organic farming and productivity testing that support the promotion of these species (*Aronia melanocarpa*) as suitable for orchards.

The species is well suited for organic breeding, the success of dry cuttings being 80.5%, whereas the percentage of seed germination is 90-100% successful.


## REFERENCES


1. BELDIE AL., 1979 - Flora României - determinator ilustrat al plantelor" Editura Academiei Române;
2. DIRR MICHAEL, 1990 - Manual of Woody Landscape Plants. Champaign:Stipes Publishing;
3. ELDONE VERHART, 2009 - Aronia-a new crop for Iowa, 3/4/2009;
4. HARDIN J.W., 1973 - The enigmatic choke berries.Bull.Torr Club100:178-184;
5. ION LIGIA, 2007 - Pomicultura, Ed Ceres, Bucuresti;
6. KULLING S.E., ANDH.M. RAWEL„2008 - Chokeberry (*Aronia melanocarpa*)-are view on the characteristic component sand potential health effects. Planta Medica 74(13):1625-1634;
7. MLADIN PAULINA, 2007 - Un valoros arbust fructifer i ornamental, ICDP Piteşti;
8. RATI IOAN VIOREL, RADUCANU DUMITRA, BADALUTA NICOLETA, RATI LUMINITA, 2008 - Agricultura ecologica. Note de curs, Editura Alma Mater, Bacau, pag 1-3;
9. SUMEDREA D., et al, 2014 - Pomi, arbuşti fructiferi, căpşun-ghid tehnic şi economic" Piteşti 2014 Invel Multimedia,, pag 17-25; 261-274;
10. TĂNĂSESCU N., 2005 - Pomicultura pentru toți, Editura Universității Pitești, pag. 275;

*** Catalogul oficial al soiurilor de plante de cultură din România, Bucureşti 2013;

www. fructex.ro;

www.madr.ro;

http://www.madr.ro/docs/agricultura/legume-fructe/Ghid-Pomicultura-final.pdf;

www.agriculturaecologica.ro.


## AUTHORS' ADDRESS


RAȚI IOAN VIOREL, RADUCANU DUMITRA, BĂDĂLUȚĂ NICOLETA – "VasileAlecsandri" University of Bacău, Faculty of Sciences, Department of Biology and Environmental Protection, Mărăşeşti Street no. 157, Bacau, e-mail: ratiioanviorel@yahoo.com; dumitra_manea@yahoo.com; nicoletadogaru@yahoo.com