**Volume 26(4), 103 - 107, 2022**
**JOURNAL of Horticulture, Forestry and Biotechnology**
www.journal-hfb.usab-tm.ro

# The nutritional potential of some *Elaeagnus umbellata* biotypes selected in Romania

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**Abstract** *Elaeagnus umbellata* Thunb. a member of the *Elaeagnaceae* family is a deciduous shrub widely distributed in Asia and Southern Europe. The aim of the present study is to evaluate some bioactive compounds with nutraceutical properties of the fruit to promote potential applications as a food supplement and to strengthen the knowledge of this underestimated species. The research was conducted on four biotypes of *Elaeagnus umbellata* following some physico-chemical indicators. These researches identified the selection 'Sel.1' and 'Sel.4' with the highest values of polyphenol content of 3439.13 mg GAE / kg FW, respectively 2695.65 mg GAE / kg FW, and 'Sel.1' and 'Sel.3' with a similar vitamin C content of approximately 17 mg / 100 g.

**Key words**

*Elaeagnus umbellata*,
fruit quality,
biochemical characteristics,
vitamin C.

Autumn olive fruit (*Elaeagnus umbellata*) is a delicious reddish berry from the *Elaeagnaceae* family that comprises a good source of various nutrients. The fruit is astringent until ripe, then it acquires a sweet-sour aroma. Pseudodrupes can be eaten fresh or processed in preserves, fruit juices, herbal tea, candy, soup, sauce, ice cream topping, dessert, wine, pudding, jam and jelly etc. [1].

*Elaeagnus umbellata* has great potential as a raw material for pharmaceutical industries, soil stabilization, reclamation, and for economic activities [2]. It is found wild or grown as ornamental plants for its dense shrub-like structure, fragrant blossoms and silvery foliage with long elliptic leaves with sharp tips and short petioles [3]. Due to its ornamental value, drought tolerance, adaptability to different environments, and compact structure, it is grown in urban areas as a hedge [1].

Apart from their edibility, the plant parts have been used in folk medicine as anti-inflammatory, antipyretic, muscle relaxant, astringent, analgesic, and antiulcer agent [3, 4]. The berries of *Elaeagnus umbellata* are an excellent source of minerals and vitamins, especially vitamin A, C, E, flavonoids and other bioactive compounds. It is also a good source of essential fatty acids [5]. The composition of these oils contains phytosterols and vitamin E (tocopherol), which could have significant values in medicine [1]. 100 g of *Elaeagnus umbellata* fruit contains 8.34 g of total sugar, 8.13 g of reducing sugars, 0.23 g of non-reducing sugars, 1.15 g of organic acids and 12.04 mg of vitamin C [6]. It also contains lycopene, b-carotene, lutein, phytofuluene and phytoene [7, 8]. Research indicates that *Elaeagnus* genus fruit may be useful in the treatment of diseases involving oxidative stress: fever, asthma, rheumatoid arthritis, type 2 diabetes, cardiovascular and breast cancer. This is largely due to the antioxidant properties of *Elaeagnus umbellata* fruits [9]. Also, they are used as a remedy to reduce blood pressure, against coughs, and for pulmonary infections. Recent studies have shown the antibacterial activity of aqueous extracts from fruits of *Elaeagnus umbellata* in inhibiting the growth of *Staphylococcus aureus* and *Escherichia coli* [10]. Epidemiological studies have shown that the increased consumption of foods rich in carotenoids is correlated with a diminished risk of several diseases [11]. Lycopene is widely believed to protect against various forms of cancer and myocardial infection, including prostate cancer. Thus, *Elaeagnus umbellata* has the potential to deter heart disease, cervical cancer and gastrointestinal tract [7, 8, 12]. These berries can contain more than 15 times more lycopene than tomatoes [13]. The lycopene content per 100 g ranged from 17.87 to 47.33 mg. In contrast, fresh tomato fruit which is the major dietary source of lycopene, has lycopene content of 0.88 to 4.20 mg per 100 g. This newly identified source of lycopene may provide an alternative to tomato as a dietary source of lycopene and related carotenoides [1].

Mineral compounds are another essential ingredient in the fruit from the *Elaeagnus* family [14] examined by spectrophotometry the content of calcium (Ca), iron (Fe), magnesium (Mg), potassium (K), phosphorus (P), and sodium (Na) of *Elaeagnus umbellata* fruit [9].

The aim of the present study is to evaluate some bioactive compounds with nutraceutical properties of the fruit, to promote potential applications as a food supplement and to strengthen the knowledge of this underestimated species who languishing in obscurity.

## Material and Method

The research was conducted in the experimental field of the Research Institute for Fruit Growing, Pitesti-Maracineni (44°54′11″N 24°52′29″E, 287 m elevation a.s.l.). Fruits quality traits: fruit weight (g), length (mm), diameter (mm), soluble solids content (°Brix), pH, firmness (N), moisture content (%), total solids (%), total phenolic content (mg GAE/kg FW), vitamin C (mg/100 g FW), were evaluated.

The samples were harvested at the optimal stage of maturity, between the last decade of October.

The average weight of a fruit was determined by the weighing of a sample of 50 fruits with an electronic balance with an accuracy of 0.01 g, for each biotype and expressed in g/fruit.

The fruit length and diameters were measured using a calliper of a sample of 50 fruits for each biotype and expressed in mm.

The fruit firmness was determined with a non-destructible penetrometer on a number of 50 fruits per biotype and expressed in units HPE.

Chemical analyses and laboratory determinations were performed in three repetitions, this consisted in determining the soluble solids, pH, moisture content, total solids, vitamin C and total polyphenols.

Total soluble solids content of fruits, expressed in ºBrix, was determined by refractometric method using ABBE digital refractometer (PR Series). The Vitamin C content expressed in mg/100 g of fresh fruit was determined by the titrimetric method after the extraction with 2% hydrochloric acid. The total polyphenols content expressed as milligrams of gallic acid/g (GAE / kg FW) of fresh fruit, was determined by using spectrophotometrically method with pg instruments T70+(UV-VIS) spectrophotometer, and the extraction of the polyphenols was made using, as solvent, methanol in water, ratio methanol: water of 80:1 by the Folin-Ciocâlteu method [15]. The pH of fruit juice was measured by squeezing the autumn olives fruits, using a multimeter C- 561, calibrated with 7 and respectively 4 pH solutions [16].

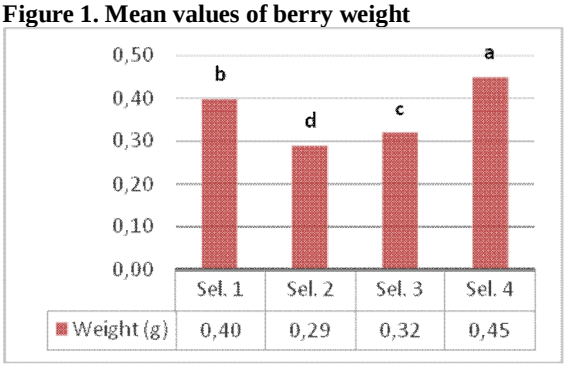
Water and total dry matter were determined by the gravimetric method, by measuring the water loss before heating at 105°C [17].

The results were subjected to variance analysis (ANOVA) for comparison of means, followed by Duncan´s Test test ($p < 0.05$). The samples were prepared and analyzed in triplicate (three samples for three biological repetitions). Statistical analysis was performed with SPSS Statistics 20.0 (IBM, Armonk, NY, USA, 2011).

## Results and Discussions

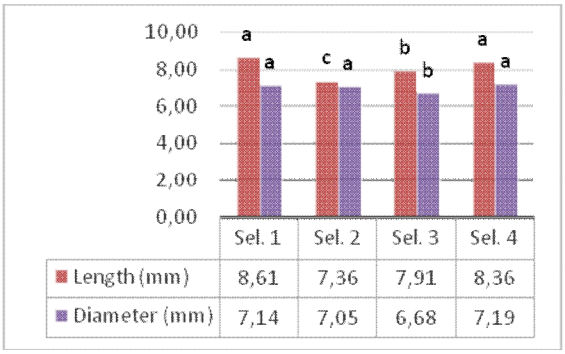
The biotypes with larger-sized fruits positively influences consumers' decisions. The berry weight, length, diameter, the firmness of the fruits, represent quality parameters for choosing the cultivars for commercial market, thus Figure 1 shows the mean values of autumn olive berry weight of the four biotypes selected. The results are gruped in four different homogeneous series (a,b,c,d). The values obtained showed a significant difference between the biotypes. 'Sel.4' (0.45 g/fruit), followed by 'Sel.1' (0.40 g/fruit) recorded the highest values. Other results from the literature show that it has been obtained an average value of 0.32 g [1].

**Figure 1. Mean values of berry weight**



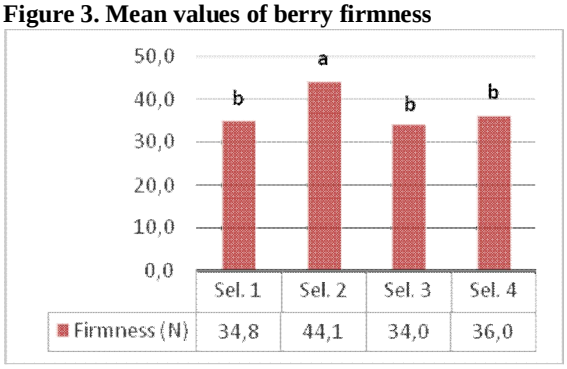

Autumn olive produced slightly flattened spheres, oblongue fruits. 'Sel.4' has an average of 8.36 mm in length and 7.19 mm in diameter and 'Sel.1' has 8.61 mm in length and 7.14 mm in diameter (Figure 2.). Results are a little bit higher with previous research [1; 13].

**Figure 2. Variations in average berry length and diameter**




*Elaeagnus umbellata* fruits lose easy their firmness as a result of postharvest metabolic processes beacause they have a thin epicarp, without wax, who are easy expose to dehydration. Firmness is related to the freshness and juiciness of fruits. The firmness of fruits can be a good indicator of the ripening process. Analyzing the values of the all byotipes in the case of firmness we can see according to the data in Figure 3. that 'Sel. 2' cv. (44.1 N) had the highest value compared to the other selections.

**Figure 3. Mean values of berry firmness**




Being a slightly known species, most of the studies aim at determining active biochemical compounds with an important role on human health. In the present study, some quality parameters of the fruits were determined in the environmental conditions of Romania (Argeș). The sensory quality of fruits is influenced by the ratio between the sugar content represented by soluble solids and organic acids (pH).

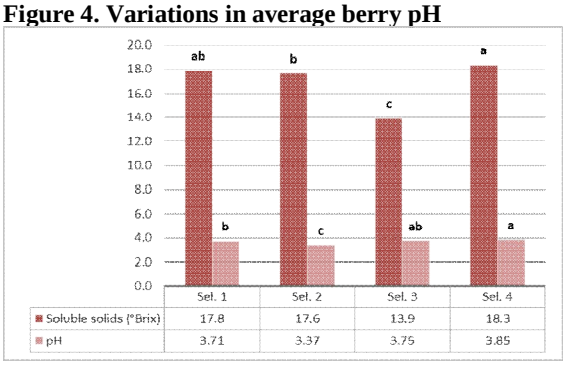
Figure 4. shows the evolution of the average values of the soluble solids and pH content.

For the content of soluble solids of the autumn olive fruits studied, three statistical classes were obtained (a,b,c), with values that reached a maximum of 18.3 °Brix at 'Sel.4', and a minimum of 13.9 °Brix at 'Sel.3'.

The data from the present study are obtained from plants that were not administered any phytosanitary treatment, organic or chemical fertilizers.

For comparison results of sea buckthorn fruits of the total of soluble solids content has an average variation between 5.28 °Brix and 12.66 °Brix [18], the autumn olive fruits having higher values.

**Figure 4. Variations in average berry pH**

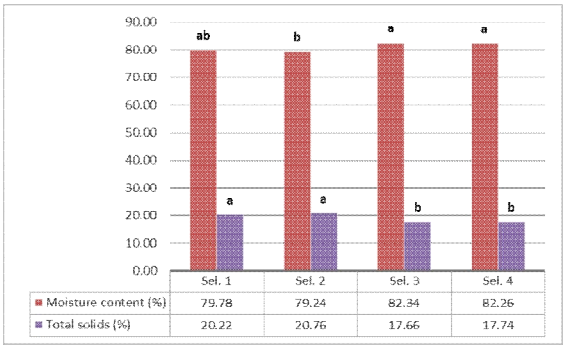



For pH, the highest value was registered by the biotype 'Sel.4' (3.85) and the lowest being at 'Sel.2' (3.37). The low pH values of the fruits indicate a rich content of organic acids. The fruits more acidic tend to maintain their integrity for a longer time.

The average values of the water content of the fruits varied from 79.24% ('Sel.2') to 82.34% ('Sel.3'). Due to the rich water content, the fruits of this species are easily perishable.

Total solids content (%) was significantly influenced by biotype, grouped into two different series (a,b). There is a significant decrease in the total solids content of the 'Sel.3' biotype (17.66%) compared to the other biotypes studied. The highest total solids content was recorded in the 'Sel.2' biotype (20.76%).

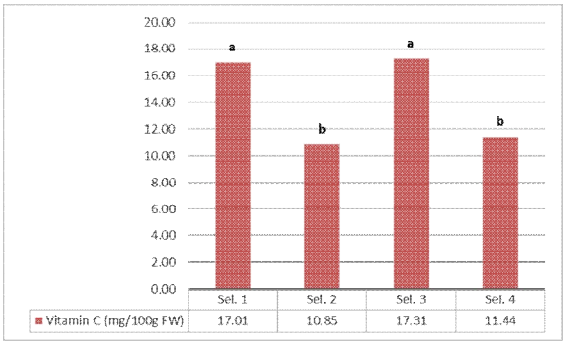
**Figure 5. Variations in average berry water and total solids content**




Vitamin C, known as ascorbic acid, is a compound with 6 carbon atoms (C6H8O6). In the human body Vitamin C acts as an antioxidant by preventing free-radical-induced damage to DNA, quenching oxidants that can lead to the development of cataracts [19].

In the Figure 6. there are two different homogeneous series of vitamin C content in the biotypes of autumn olives studied (a,b). The biotype with the highest content was 'Sel.3' (17.31 mg/100g FW) followed by 'Sel.1' (17.01 mg/100g FW) and 'Sel.2' (10.85 mg/100 g FW) had the lowest vitamin C content. Earlier studies indicated 14.3% mg of vitamin C per 100 gram of fruit, which was little lower as compared to our highest investigation [2]. Autumn olive represents a good source of vitamin C. The consumption of 100 g of berries may cover from 30% to 50% of the recommended daily intake (60–90 mg/d) [1].

**Figure 6. Comparision of concentrations of vitamin C**



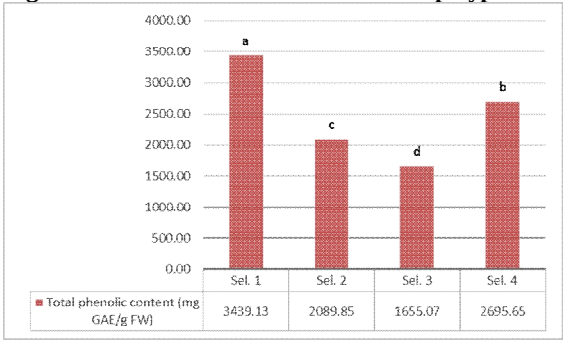

In the autumn olives biotypes, the content of total polyphenols varied between 1655.07 mg GAE/kg FW - biotype 'Sel.3' and 3439.13 mg GAE/kg FW -

biotype 'Sel.1'. The results are gruped in four different homogeneous series (a,b,c,d).

The total phenolic content represents a marker of antioxidant capacity and it is generally used as an antioxidant activity test. Phenolic compounds are known to inhibit free radicals and prevent the deformation of DNA [20].

Compared to other studies on the same species is higher, and similar to the values recorded for other known superfruits such as red raspberry, blueberry, and cherry [1].

**Figure 7. Variations in total content of polyphenols**




## Conclusions

The preliminary results of this work allowed to contribute to the knowledge of *Elaeagnus umbellata* fruits, especially concerning their nutraceutical aspects. Herein, we reported some physical characteristics and chemical compositions of *Elaeagnus umbellata* fruits.

These researches identified the selection 'Sel.1' and 'Sel.4' with the highest values of polyphenol content, also 'Sel.1' and 'Sel.3' registered good values at vitamin C content.

Based on their rich and beneficial composition it can be concluded that *Elaeagnus umbellata* fruits is a valuable horticultural product.

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