

## WILD BERRIES IN UKRAINE

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*This review has been prepared in the framework of the FP7 BaSeFood project related to traditional foods of plant origin. Areal distribution and stocks of wild berries in Ukraine are described, as well as botanical characteristics of berries, chemical composition of wild berries, their medicinal properties, and use of some wild berries as food. It is concluded that perspectives of the wild berries in Ukraine are not used to the full extent.*

Key words: food, wild berries, chemical composition, medicinal properties

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Ключевые слова: пищевые продукты, дикорастущие ягоды, химический состав, медицинские свойства.

### Areal distribution and stocks of wild berries

Raw material resources of Ukraine are extremely rich in various kinds of wild plants. Most of them are the real treasures of biologically active substances having distinct physiological effects on the human body. These crops include wild berries, natural reserves of which can not only use them for local needs, but also at the industrial scale.

Most of the wild raw materials that are stored up, either used in a fresh form, or are sent for drying or preparing wine, and only 4% are used for canning. Almost not used for processing such berries as mountain ash, black elderberry, Juneberry, in small amounts are used hips, cranberries, black chokeberry, bilberry, blueberry, cranberry, although one can preserve all kinds of wild fruits and berries. Using of these raw materials could continue the processing season, enrich and expand the range of canned products. But there are some obstacles, such as microcarpousness of the fruits, their mediocre taste, but mainly is ignorance by people of their useful properties.

Recently, a new gardening trend has appeared called therapeutic horticulture, which as its main goal has enrichment of garden plants range by such wild crops that have high organoleptic properties and contain high amount of biologically active substances.

Notable among these plants is chokeberry introduced in the culture of therapeutic horticultures relatively recently, but having many supporters among professional and amateur gardeners. Chokeberry comes from North America. In European countries it was cultivated as ornamental plants. The first mentioning of it in Russia occurred in the 30th of XIX century. In St. Petersburg and Riga botanical gardens it was used as an ornamental plant. First as a fruit it was mentioned by I.V. Michurin. In 1905, as a result of hybridization of chokeberry with ash, he obtained Liqueurna and Dessertna of Michurin varieties of mountain ash. Distribution of chokeberry as a horticultural crop began in 1935 due to the Altai Experimental Station of Horticulture. Academician M.V. Lysavenko then wrote about it as a very valuable plant for processing in the food industry.

Early fruitiness, high yield, resistance to diseases and pests, and simplicity of growing conditions, valuable biochemical and technological fruit quality, high profitability of growing chokeberry provide for a broad application in production. Chokeberry gives fruits starting from 3-4 year and a maximum yield from 1 shrub can reach 10 kg. Therefore already in 1970, industrial plantations in the USSR occupied 5.4 thousand hectares.

In Ukraine chokeberry appeared later than in Russia. The first production plantations were established in Kharkiv in 1958, then in 1963 in Podolia (Podolsky Zonal Experimental Station of Horticulture), and in 1967 - production of plantation at Skvirskogo research field in Kyiv region. The climate of Ukraine, particularly thermal conditions, compared with the initial conditions of the distribution chokeberry are entirely suitable for its cultivation. So now it is widespread throughout Ukraine, but most of its plantations are in Kyiv, Sumy, Kharkiv and western regions. The total area under plantations is more than 2000 hectares (excluding amateur gardening). Chokeberry yield ranges from 135.7 centner / ha (Vinnitsa region) to 197.0 centner per hectare (Kiyev region) [1].

No less interesting culture, which also comes from North America is Juneberry. Local people have long used its fruit for making juice and wine. In Ukraine in 1886 Juneberry juice was used for winemaking in Uman School of Horticulture [2].

Juneberry is one of the few fruit plants that can withstand the sharp continental climate and thus provide stable high yield of berries. In the wild form Juneberry grows in mountainous wooded part of the Crimea and the Carpathians. Industrial plantations spread all over Ukraine, especially in steppe areas. Juneberry has no fruiting periodicity, and it gives solid and high yields of berries. The average yield of one tree is 9–14 kg. Planting of 10-20-year-old age give yield from 4 to 10 t/ha, depending on planting density and degree of mechanization [23].

But not only the gardens and plantations of trees of foreign plants is a source of biologically active materials. Wildlife of Ukraine is extremely rich with valuable fruits and berries, and there are very large reserves in every region but not fully used. An example of such plants may be blueberries, black elderberry, and mulberry.

Blueberries have long been used by population as food. It has good taste, has long been known by its indisputable curative properties, it is available for collection and widespread in forest-steppe zone of Ukraine, especially in western areas and Polesie, where it forms thickets. The area of coniferous and deciduous forest is the most common place for blueberries. In the Carpathians it forms dense thickets - clean or with blueberry for hundreds of hectares. Here, the average yield of blueberries is 100 kg / ha.

Total area in Polisskiy area is about 300 thousand hectares, and in the western Ukraine – 114 500 ha [15]. Collection of raw blueberries in Ukraine on average is from 2 thousand tons per year, and dried – about 100 tons. The greatest harvest of blueberries of 543.1 tons was in the USSR in 1963. Yields are uneven for years and ranges from 33–48%. Blueberries grow at soils of different acidity, humidity and mechanical composition, sometimes on rocks and peat bogs, but it prefers fine-grained soils [16].

Often one can find in Ukraine such a plant, as black elderberry. The most common it is in the zone of deciduous and pine forests of the Right Bank, in the steppe, slightly less of them are in the Carpathians, in Polesie, and Levoberezhye. It usually grows in lawns, banks of rivers and streams forming thickets under the cover of forests, as well as weeds in the fields, meadows, and gardens. Most of the black elderberry bushes, about 380 hectares, are in the woods of Kyiv and Cherkasy regions.

Yield of black elderberry is: 2 t/ha in the woods, 6 t/ha in open field. In general, Ukrainian berries biological stock is 2600 tons; an operational reserve is 1825 tons. Major biological and operational stocks of black elderberry are respectively: 635 tons and 444 tons in Cherkaskiy region; 525 tons and 368 tons in Kiyevskiy region, 520 tons and 364 tons in Khmelnytskiy region; 397 tons and 202 tons in Vinnytsia region. Almost all the industrial harvesting of black elderberry performed in Ukraine mainly in those areas; as well as in Chernigov, Poltava, Transcarpathia, Sumy and other regions.

Mulberry is drought tolerant and relatively heat-loving plant. In Ukraine, its crown, especially thin branches, often are frosted, but after two or three years, traces of these lesions almost completely disappeared. Species grow best in fertile soils, but it does not die even when it is in the shade of other species. Mulberry trees in average have height of 15 m, but in the Ukraine it is 7-10 m. In the genus of the mulberry family there are 1500 different plant species: baobab, fig, even hops and hemp. Homeland of mulberry is China. In the Himalayas, the black mulberry tree in the mountains rise to a height of 4000 meters above the sea level, but it grows also at the plains. There are 20 species of the plant, most of them growing in China. This is one of the tree species that was cultivated for a long time. There is evidence that in the gardens of Babylon it was grown as a medical drug 2500 BC, and in China by 3000 BC.

The black mulberry in the wild form grows in Central Asia, Caucasus and especially in the Transcaucasia. As a cultural plant it is common in some areas of the Caucasus, Central Asia, all over Ukraine and especially in the Crimea and Moldova.

In Russia, mulberry breeding started during the reign of Ivan the Terrible, who ordered to build a silk-weaving mill for the needs of the royal court. Peter I and Catherine II promoted the culture of this plant and building the silk-weaving mills. In the XVIII century, they began to plant mulberry in Ukraine. In the reign of Peter I in the tract near Kyiv menagerie (now here is the National Botanical Garden of Academy of Sciences of Ukraine) were mulberry plantations. According to the decree of Peter, the felling of these trees was forbidden.

Now mulberry is cultivated throughout Ukraine, especially in the steppe and forest-steppe zones. From one tree from 20 to 50 kg of berries are collected annually. Thus, Ukraine has significant reserves of raw berries, which are a source of biologically active substances, and have typical botanical characteristics and rich chemical composition.

#### **Botanical characteristics of berries**

Black elderberry – *Sambucus nigra* L. – *Caprifoliaceae*

Many shrub or small tree, simple to the terms of growth, 2-6 m in height, with ash-brown bark on the trunks of fractured and gray-brown at young branches and trunks. Prefers areas with rich soils, where creating small groups, but often grows as single copies. The leaves are large dark green, opposite, odd cirrus. Flowers are small, fragrant, stacked flat inflorescence, 12-20 cm diameter fruit – luscious, shiny, black-purple drupe bacciform diameter of 3-6 mm, round shape, weighing 0.28 grams, with 2-4 oblong flat bones. Berries are small, collected in a large bunch of black and shiny purple color, mucous membranes, have sweet-sour taste and specific odor. Ripen in August - September and remain on the bushes after the leaves falling [7, 10].

Chokeberry – *Aronia melanokarpa (Michx) eliot* – *Rosaceae*

Frost and drought-resistant shrub long, up to 3 m, strongly branched. At young age crown is compressed, then it becomes extensive. Leaves simple, elliptical shape with short petioles. The upper surface of leaves is dark green, glossy, lower is of the silver-gray color, slightly fluffy. Flowers are small, white, with five petals, collected of 12 - 15 in a dense inflorescence. Fruit is apple-shaped, juicy sour-sweet berries of the astringent, tart flavor. Berries are very large, of round or slightly cramped form of black or black and magenta color with a matte surface. Weight is 0.6-1.5 g, skin is tight that promotes preservation in a fresh form. In the berries there are from 3 to 5 small seeds that do not affect the taste of the berries. Berries ripen in August – September. Ripe fruit on the branches is held tight and not crumble. In a cool dark room, berries can be stored up to 2 months [7, 13].

Juneberry – *Amelanchier medic* – *Rosaceae*

Many light-loving shrub, up to 2 m, simple to the soil, resistant to frost and drought. Can withstand down to –40 –45 °C. Bark smooth, dark gray. Leaves with short petioles, dense, oval, dark green above, lighter below, with sharp teeth along the edges. Flowers 12-20 mm in diameter, white with pink tinge, collected in 8.5 pieces very thick bunch, located on top of short twigs. Juneberry blossoms in May. Bacciform fruits, 10-15 mm in diameter, from round to pear-shaped back and gathered in a small cluster at maturation is first red, then purple, almost black color with bluish bloom, pleasant sweet taste, no smell. In the berries there are a small number of fine seeds of flat shape, smooth, brown. Ripening of berries occurs during July – August. Ripe fruit will not fall and hang on the bushes, gradually drying [7, 12].

Bilberry – *Vaccinium myrtillus L.* – *Vacciniaceae*

Low long bush 15-50 cm tall, with creeping roots and erect cylindrical, ribbed stems that mainly grows in forests on wet ground. Stems branched, at the bottom they have a gray color and green at the top. Leaves thin, ovate, light green, smooth with edges, slightly pointed. In winter the leaves fall. Flowers pink, countenance fell, located one or two in the bottom of the young twigs. Fruit - globular berry black and blue with a touch of bluish to 1 cm in diameter, juicy, pleasant sour-sweet taste and delicate aroma. In the berries there are numerous small oval seeds of light brown color. Ripening of berries occurs in July – August, 40-50 days after flowering [7,12].

Black mulberry – *Morus nigra L.* – *Moraceae*

Mulberry is a tree with a spreading crown up to 15 m. The leaves are hard, rough, blanking. Mulberry lives 300 and sometimes up to 500 years. Blossoms in May 15-20 days, the fruits ripen in the second half of June. Flowers in mulberry are tiny, inconspicuous, with a simple perianth, yellow-green, collected in axillary inflorescences. Flowers pollinated by the wind. Mulberry fruit is drupe, genuine berry, which is formed from flowers that grow during ripening. Length 1.5-2.5 cm, 1.2-1.7 cm wide, ripens in black or dark purple. The fruit is somewhat similar to blackberries, sweet, very juicy, odorless, dark color, oblong shape. From one tree collected annually from 20 to 50 kg of berries. Ripening of berries occurs in June - July. In the world, grows 20 kinds of mulberry with different colors of fruits: black, white, yellow, yellowish-pink. Nearest relative of the mulberry is fig, which also belongs to the mulberry family [7,12].

### Chemical composition of wild berries

Wild berries stand out among other plants with rich chemical composition and high content of biologically active substances. Each kind incorporates different ratio of these components, but they are all priceless gift of nature that allows a person to restore strength and health.

Chokeberry among other cultures has the greatest range of properties. This berry has been studied by many researchers of different fields – medicine, biology, food chemistry – and they all find valuable material for their needs. Ripe berries contain 74.1-81.0% of water, 6.5-10.6% of different sugars (glucose, fructose sucrose, ramnose), 0.3-0.6% pectin substances, 0.2% nitrogen compounds, 0.7-1.8% organic acids (citric, malic, quinine, amber). By content and composition of organic acids chokeberry is well ahead of tangerines, strawberries, raspberries and red currants [18, 19, 20, 24].

The total number of mineral substances is 1.85-2.97% (calculated for dry basis), including macro elements in (mg / g): K – 9.13, Ca – 1.30, Mg – 1.00, Fe – 0.05-1.2, P – 0.78-0.92; trace elements in (µg / g) Mn – 0.05-2.5, Cu – 0.3-0.8, Zn – 0.10, Co – 0.06-0.15, Cr – 0.02, Al – 0.02, Se – 3.63, Ni – 0.11, Sr – 0.06, Pb – 0.02, B – 4.80. Especially valuable is the ability of chokeberry to concentrate and accumulate selenium and iodine. The

iodine content is 0.005-0.01 mg/100 g, as it contains only red currant and persimmon, and more only in feijoa fruit known as the best source of this element [18, 19, 24].

Depending on location and climate of the region, vitamin content varies very widely. It may contain vitamin C from 7.4 to 167 mg/100 g, other vitamins (in mg / 100g): carotene – 2.3-3.2, nicotinic acid – 0.4-0.6, vitamin B<sub>2</sub> – 0.16, alpha-tocopherol (vitamin E) – 0.8 -2.2, folic acid – 0.1-1.5, phylokinone – 0.8, pyridoxine – 0.06, cyanine – 0.3, thiamine – 0.01, riboflavin – 0.13-0.17 [18].

Undoubtedly, the most valuable parts of chokeberry are bio flavonoids with P-vitamin properties, such as catechins, flavonols, and anthocyanin. The amount of vitamin-P substances in any fruit is from 1.5-2.0% to 4-5% in some varieties. In the catechins epicatechin in chokeberry prevails. This is one of the most active components of tea catechins. Flavonoids are mainly derivatives of quercetin. Substances with P-vitamin activity also include the majority of flavonoid compounds including flavonons, anthocyanin, and leukoanthocyan. In chokeberry, flavonol glycoside is a derivative of aglycone – quercetin and presented in the main routine and quercitron. Most of aglycones were found in the free state. Anthocyanin fruits are derived of chokeberry cyanidin. Leukoanthocyanins are presented. When quantifying the anthocyanin and leukoanthocyanins in fully mature fruit, content of anthocyanin was from 3.1-4.1% and leukoanthocyanins – 1.0-1.8% by weight on dry basis. Even comparing with such a good source of bioflavonoids as orange, yields of chokeberry is more than 5-6 times. If in orange content of bioflavonoids is 0.6%, in chokeberry it is 3.0-3.5% by weight of crude substance, and sometimes 5%. Far fewer of these substances are in cranberries, rose hips, red pepper, asparagus tea. In chokeberry amihdalyn has been also found – 4-24 mg/100 g, coumarin, tannin – 0.35-0.6%, cyclic alcohol sorbitol – 3.5% [9].

Much more common in Ukraine is black elderberry. The value of this plant is confirmed by centuries of its use in various fields of human activity from food and medical to purely technical. People have found applications throughout the plant, from root to branches and flowers and berries. Mature black elderberries contain 83-85% of moisture, 6.0-8.0% of monosaccharides, almost equally glucose and fructose, 1.5-2.0% of sucrose, 1.3-1.4% of organic acids (malic, acetic, valeric, wine, and coffee), pectin substances – 1.0-1.2%. There is also a small quantity of amino acids and carboxylic acids.

The total content of minerals is 0.64 mg/100 g of dry matter. There are minerals, such as Mn – 0.03, Ca – 10.0-20.0, K – 250.0-300.0, Wa – 0.03, s – 0.02-0.05 (mg/100 g of crude substance). Vitamins in black elderberry are represented by ascorbic acid, 5.0-50.0 mg/100 g, carotene – 0.49-1.0 mg/100 g, vitamin E group – 0.08-0.33 mg/100 g, and folic acid – 0.03-0.04 mg/100 g [10, 18, 19].

As chokeberry, black elderberry is of the great value as a source of R-active substances. Anthocyanin pigments are represented mainly by three derivatives of cyanidin and glucose. In the berries there are also sambutyn and sambutyamin. The content of flavonols is about 100.0 mg/100 g, the total content of catechins is 180.0 mg/100 g including free ones – 90.0 mg / 100 g, leukoanthocyanes – 130.0 mg/100 g, anthocyanin – 2400.0 mg / 100 g of crude material. The amount of polyphenol substances is 7000 mg/100 g, including tannins – 300-350 mg/100 g.

Juneberry as a food plant in Ukraine is still little known to the public, but it has been used for a long time as an ornamental specie for planting settlements. Meanwhile, recently, it attracted attention and commercial interest as a technical culture that can be used with success in the food industry. This is connected primarily with the ability of Juneberry to accumulate sugars, high in solids and the presence of natural preservatives, which act as phenolic compounds.

In Juneberry there are 77.0-83.0% of moisture, 6.0-12.0% of sugars (mainly monosaccharides), pectin substances – 0.55-1.12%, 0.4-0.7% organic acids (mainly malic and amber ones). Total ash content in berries is 3.3-4.0 mg/100 g, mineral composition is very diverse. According to various authors, depending on the variety of berries, growing conditions and climate characteristics of the area, the content of trace elements is the following: Na – 0.5-0.7, P – 0.7-1.0, Si – 10-20, Mn – 0.002-0.2, Mg – 7.6-14.5, Ca – 10.0-20.0, Fe – 2.0 mg/100 g of total ash content of raw materials [2, 18, 19, 24].

Vitamin composition of Juneberry mainly consists of water-soluble vitamins. By their accumulation Juneberry refers to plants with the intermediate level of these nutrients. Thus, accumulation of vitamin C – 12.0-40.0 mg/100 g, in some varieties to 61.0 mg/100 g of vitamin C – 60-150 mg/100 g, thiamine – 30 µg/100 g, Riboflavin – 12 µg / 100 g, the amount of carotenoids in average 1.50-2.02 mg/100 g of raw material including beta-carotene 0.189-0.302 mg/100 g, folic acid – 0.05 mg/100 g.

An important group of biologically active substances is a complex of phenolic compounds in Juneberry represented by different groups of these substances. As in previous cases, their content is affected by many factors. Analysing various sources, we can assume that the contents of anthocyanin and leukoanthocyanes is 737-2041 mg/100 g, catechins – 150-220, flavonols (in terms of quercetin) – 143-403, chlorogenic acid – 117-340, triterpenoids 235-374 calculated on ursolic acid, betaine – 300-980 mg/100 g. Some authors have noted the

presence of sitosterol, tanning and coloring materials – 0.8%. Overall, the total content of phenolic compounds is 2800 mg/100 g of raw weight of Juneberry [2, 18].

Blueberries, unlike Juneberry, was used and very popular with people not only as a delicacy and delicious food, but also as a wonderful healing herb that saved men from many diseases. The unique chemical composition of blueberries is recognized worldwide leading to growing them at special plantations and wide use in medical applications. Moisture in blueberries is 85.9-86.8%. The structure consists of berries sugar – 5.3-8.5% (fructose, lactose), pectin – 1.1%, cellulose – 1.18%, 1.3% organic acids (malic, citric, lactic, succinic, oxalic, and traces of quinine). The total content of minerals is 2.1 mg/100 g, including – Na-6.0, K – 51.0, Ca – 16.0-9.20, Mg – 7.6-14.5, P – 39.8-56.2, Fe – 7.0 Mn – 2.0-3.0, Cu – 0.9 mg / 100 g of dry matter.

Vitamin C in blueberries is 10.0-75.0 mg/100 g, depending on climatic and regional conditions, carotene – 0.75-1.6, B vitamins – 0.04-0.09, niacin – 0.37, folic acid – 0.03-0.05 mg / 100 g, vitamin R – 1.0-1.2%. Blueberries are the only source of so called vegetable insulin. Its content is 2%.

Phenolic substances of bilberry are presented by flavonols in the quantity of 550.0 mg/100 g, anthocyanin – 985-2041 mg/100 g, preferably within cyanidin-3-galactosid and delphinidin-3-glucoside. Leukoantocyanins in berries – 180.0, content of catechins is 409.7, the amount of polyphenols is 2283.0 mg/100 g of condensed tannins – up to 12% of the total polyphenols content [18, 19, 20, 24].

Mulberry black is also a known plant, which has long been used by people around the world as food and industrial crops. But a deep study of its chemical composition was carried out just by a few scientists, so details in the literature are not enough. Fruits contain 9,0–12,5% of sugars represented mainly by monosugars – glucose and fructose, only a small quantity in their composition is sucrose. Pectin substances occupy 0.54%, almost equal quantities of pectin and protopectin. The content of organic acids is 0.4-0.6% dominated by apple and lemon ones, but there is 0.1% of phosphoric acid. Amino acid content in mulberry is 0.4% and the amount of free amino acids ranges from 30 to 300 mg / 100 g. In berries they have found essential amino acids, such as arginine, tyrosine, threonine, lysine, histidine, leucine, serine, methionine. The dominating part is in amino acids:  $\alpha$ -alanine, asparagine, aspartic acid, tryptophan. The total ash content in black mulberry fruits is 0.8%. The content of the major trace elements in mg / 100g of fresh raw materials: Na – 1.6 Mg – 51.0, Ca – 24.0, Fe – 32.0, K – 350.0. Especially valued black mulberry for the high content of easily digestible iron. Vitamin composition of mulberry fruits is the most common substance P-vitamin – 0.8 mg/100 g. The content of vitamin C – 10.0, carotene – 0.02, B vitamins 0.02-0.04 mg/100 g. Bioflavonoids in black mulberry, as well as in other dark colored berries, are mainly presented by anthocyanin – cyanidin derivatives. In the mature substance content of these compounds within the phenolic substances of low raw material is 75%. The total amount of catechins is 80 mg/100 g, flavonols – 500, leukoantocyanins – 100-210, anthocyanin, polyphenols compounds (according to Leventhal) – 2660 mg/100 g [18, 19, 20].

Thus, the above-mentioned wild berries are rich in chemical composition, allowing them to be widely used for treatment and prevention of various diseases.

### **Medicinal properties of wild berries**

The specific feature of plants growing wild in a greater extent than cultural is that they are able to synthesize a huge amount of various chemical compounds belonging to different classes. But it is important that the therapeutic properties have only those that show physiological (biological) activity. Particularly acting in the body, such biologically active substances are able to stop or prevent pathological conditions and return the state to normal. In addition to the active substances contained in plants there are related substances that may affect the main pharmacological action of BAS – to raise or to lower their absorbability, to be synergists or antagonists, reduce or enhance their toxic effects.

Considering the vegetable raw materials as a natural source of mineral complexes, one should keep in mind that macro- and micronutrients are found in organically linked and the most accessible digestible form. In fruits of wild plants, the balance and the quantitative value is such that cannot be found in other foods.

Some wild plants contain even the daily therapeutic dose of trace elements, from 50 to 200 micrograms. For example, chokeberry, blueberries and black elderberry have some kind of therapeutic dose of Mn – 0.03%, which treats nervous system, cardiovascular disease, normalizes the activity of the muscle system.

Nickel, which is in the black elderberry in the quantity of 0.001-0.002% reduces the catalase activity in reproductive organs, titanium – 0.05-0.02 mg / % – a strong reducing agent, as well as presented in these berries zinc. The presence of copper within black elderberry and bilberry (0.898 mg/%) – a component of redox enzymes – lactase and ascorbate-oxidase. Molybdenum retards fluoride in the body and prevents tooth decay – black elderberry in its content has 0.0002%.

Chokeberry reveals noticeable invigoration effect on homeostasis system, so it is used in various pathological disorders of blood clotting, such as in hemorrhagic diathesis, increased permeability and fragility of blood capillaries. In clinical practice the fruits of this plant are used in diabetes (due to the content of sorbitol),

glomerulonephritis, allergic conditions. Recently it was found that chokeberry contains a substance that improves liver, promotes the formation and outflow of bile. In addition, fruits of chokeberry exhibit therapeutic effects in thyroid hyperfunction.

Chokeberry is a radioprotector, capable of displaying accumulated in the body cesium-137 and also has detoxification properties. It is used in pathological states caused by ionizing radiation, different intoxications, toxicosis of pregnancy and to increase immunity and total resistance of the organism.

As an auxiliary product, chokeberry fruits and preparations derived from them are recommended for bacterial endocarditis, rheumatic disease, arachnoiditis, typhus, scarlet fever. Very good effect has the use of chokeberry juice at the early stages of hypertension, with bleeding of various origins, gastritis. External application of juice gives effect in the treatment of burns, allergic skin diseases, such as eczema, neurodermatitis, and dermatitis. The juice is also effective in preventing atherosclerosis and P-vitamin deficiency. In medicine they use fresh fruits, juice, extract, tincture, dried fruits and vitamin pills R. It is very important that the chokeberry fruits retain their therapeutic properties even after processing.

Therapeutic properties of blueberries were first described by Pliny and Dioskorides (1st century AC). In the 16th century a healer Kalpepper found positive effects of blueberries on the liver and stomach, chronic cough and lung diseases. Then blueberries were used in acute and chronic disorders of the gastrointestinal tract, colitis, enterocolitis, and dysentery.

Blueberries contain tannins of pyrocatechin group (7%), which enables them to effectively apply astringent with acute and chronic diarrhea, especially in children, in the form of decoctions, stewed fruit and jelly. Fresh fruit and decoctions are used as a dietary product for anemia and gout. They also have anti-inflammatory, diuretic, tourniquet and antibiotic properties, regulate metabolism and activity of the gastrointestinal tract. Blueberries show strong bactericidal action, including dysentery bacillus and infestant of the typhoid fever.

In blueberries there are substances that can reduce blood clotting, so they are very useful in preventing thrombosis, myocardial infarction. Anthocyanin helps to normalize hematoencephalic barrier, restore its permeability and thereby prolong life. Glucoside that was found in blueberries, helps to reduce blood glucose levels that is used in the practice of diabetes care. Thick decoction, extract and ointment-based blueberries successfully treat eczema, dermatomycosis, burns. Infusions and decoctions are used in the treatment of angina, pharyngitis, stomatitis. Succinic acid contained in blueberries, contributes to the elasticity of blood vessels.

Carotenoids of bilberry improve night vision function and visual apparatus, for this alcohol tincture as a prophylactic measure is used. Chemical nature of substances that are in blueberries favorably act on the vision, yet not fully deciphered. It is known that flavonoids of blueberries make strong retinal capillaries and stimulate regeneration of rhodopsin, the pigment of the eye. Studies conducted in Italy, France, the United States showed a wide range of healing properties of blueberries. Most studies were conducted with a group of blueberry flavonoids, called anthocyanins [3, 4, 5, 6, 21].

The first serious studies of blueberries were held at the Research Center of the Estonian University of Nutrition. It was found that blueberries can restore many body functions and resist aging [4].

Bilberry extract increases the amount of dopamine in the brain that regulates important processes, for example, promotes the production of somatotropin (growth hormone), which is responsible for renewal and regeneration of cells of the whole organism. Under the influence of blueberries they observed improvement throughout of cell membranes and the transmission of nerve impulses.

Another important feature of blueberry flavonoids is their ability to raise the level of glutathione, known to be the most important endogenous antioxidant produced by the body. It is the protector of the nervous tissue and effective converter of the chronic inflammation.

Black elderberry as a remedy was used in the Middle Ages, even though Hippocrates, Dioskorid, Teofast indicated the medicinal properties of elderberry.

Berries of black elderberry are traditionally used as an antipyretic, diaphoretic and laxative, and for treatment of rheumatism. In folk medicine berries are recommended to use for treatment of serious illnesses, such as diabetes, stomach ulcer, hepatitis, neuralgia, sciatica, lumbago, benign and malignant tumors, with lesions of radiation and related diseases of the thyroid gland and lymphatic system. Observed a mild kind of analgesic effect, reduce pain responses of central origin. In some areas of Ukraine and Azerbaijan black elderberry is used to treat cancer [14].

The juice of the elderberry is recommended for respiratory diseases, arthritis, anemia, various skin diseases [14, 18, 22]. Against tuberculosis and hemorrhoid they use marmalade, prepared from ripe elderberry. Heavy fruit extract improves appetite, stimulates the formation of red blood cells [11].

Therapeutic value of mulberry is difficult to overestimate in the treatment of heart diseases. It is enough to take during a month 250 g berries daily to significantly improve the patient's condition. Broth of mulberry normalizes blood pressure. Mulberry fruits are used in scientific and folk medicine in anemia caused by low and zero acidity of gastric juice, in diseases of liver and gall bladder, with dysbacteriosis, caused by prolonged use of

chemical drugs and broad-spectrum antibiotics. Systematic use of mulberry fruit improves vision, reduces obesity and blood clearance, and normalizes metabolism and blood-forming processes in the body. Infusion of ripe fruit is a diaphoretic in colds. Mulberry fruits have antihelminthic properties, useful in diseases of the stomach. Puree of berries is the excellent remedy against cough, constipation. By juice diluted with water it is good to rinse the throat and mouth during inflammation.

The presence of complex biologically active compounds in the fruits of Juneberry provides therapeutic effect in preventing various diseases. Broth of the fruit is used in the treatment of angina, inflammation of the mouth, festering of wounds. The presence of sitosterol counteracts the accumulation of sterols that helps to prevent diseases like atherosclerosis. Methylated glycol (betaine) is the compound that prevents fatty liver, reduces cholesterol in the blood. Therapeutic effect of using Juneberry includes also lower blood pressure, restorative and anti-inflammatory effect.

Coumarin in Juneberry has the bactericidal and antitumor action. R - active compounds bearing heavy metal ions off the body normalize capillary permeability.

Considering the chemical composition and medical effects of wild berries, one can conclude that their use in food can enrich the latter with biologically active substances and increase antioxidant properties of food.

### **Use of some wild berries as food**

Chokeberry pureed with sugar, thorns grated with sugar, mountain ash pureed with sugar - these products are traditionally used as standalone products and as semi-products for manufacturing of other products. Concentrated extracts of aronia in acidic medium is an effective ruby color dye for soft drinks, ice cream, and confectionery. They are also used as dyes and color stabilizer for soft drinks, increasing the microbiological stability during storage without preservatives [17].

Mulberry is used to produce various food products and flavors. Mulberry fruits are edible raw, they cook from them marmalade, jelly, vinegar, juice, stewed fruit, wine, and liqueur. From the juice of black mulberry syrup is prepared (bekmes dubash). Concentrated products that are derived from mulberry berries are dried fruits, extracts, bekmesy. They are transportable and can in appropriate circumstances withstand long periods of storage. Mulberry fruits can be used in fruit and berry wines. Some of interest is the production of wine (ethyl alcohol) from mulberry. In this direction experience of the Caucasian peoples is interesting. They for a long time produce high-quality alcohol from mulberry, somewhat similar to cognac kept in oak barrels. Mulberry is suitable for making wines and liqueurs. Mulberry can be used for making jam and stewed fruit (the most promising species in this respect is black mulberry).

From the dried berries mulberry flour is made, which is added to dough in the confectionery industry, as well as in chemical composition, they contain 9.52% of sugars and thus the taste is pleasant, acids and sugars are more harmonious than in other fruit supplements. Dried fruits are crushed and added to dough when making cookies that can be stored for a long time. In the Caucasus, berry pulp is added to flour and a delicious sweet bread and pita mulberry are baked [9]. The simplest type of processing is mulberry pureed with sugar. Fruits are mixed with sugar at a ratio of 1:0.75. This product can be used as semi-finished products for further processing. Mulberry jam, jelly, candy can be made.

### **Conclusion**

It is shown that different kinds of wild berries have very useful chemical, nutritional and medicinal properties. At the same time, numerous advantages of the wild berries are not used to the full extent in Ukraine.

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## ВПЛИВ ТЕМПЕРАТУРНОЇ ОБРОБКИ НА ФЕНОЛЬНІ РЕЧОВИНИ ПРИ ВИРОБНИЦТВІ СОКІВ ІЗ ДИКОРΟΣЛОЇ СИРОВИНИ

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*Розглянуто вплив температурної обробки на вміст фенольних речовин при виробництві соків із дикорослої сировини. Досліджено зміну барвних і фенольних речовин під впливом температурної дії та при використанні ферментів комплексної дії: Fructozime Color, МЕК.*

*Influence of thermal processing on the content of phenolic compounds in the production of juice from wild resources. The change of coloring and phenolic substances under the influence of temperature and using the enzyme complex action.*

Ключові слова: горобина чорноплідна, чорниця, бузина чорна, ферментоліз, ферменти, антоціани, фенольні сполуки.

За статистичними даними, населення України споживає фруктів, ягід, а також вітамінів вдвічі менше норми, рекомендованої міжнародним комітетом ФАО/ВОЗ. Значення свіжих плодів та ягід у раціоні людини важко переоцінити, тому що вони не тільки постачають організму поживні речовини, але й мають вагомий вплив на процес травлення і засвоювання їжі. Окрім того, ці продукти є джерелом біологічно активних сполук, необхідних людському організмові для нормального існування. Для надійного захисту