

HISTORY OF THE ORIGIN OF JERUSALEM ARTICHOKE

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Abstract

Jerusalem artichoke was brought to Europe in 1627, first to France, and from there to Italy, Holland and other countries. In Russia, Jerusalem artichoke appeared in the XVIII century, and people used it as a medicinal plant, and the infusion of tubers on wine was used to treat cardiovascular respiratory diseases.

Keywords. Jerusalem artichoke, plant, culture, ground pear, tuber, officinalis, inulin.

Introduction

Jerusalem artichoke (ground pear) – *Helianthus tuberosus* L, belongs to the plant kingdom (Vegetabilia), the division of angiosperms (Angiospermae), the class of dicotyledons (Dicotyledoneae), the order Asterales (Asteraceae), the subfamily Tubulitforae, the genus Helianthus (Helianthus L.) [Boltasov, 1991; Varlamova, 1991; Shazzo et al., 2013; Lebedeva et al., 2017; 2018; Smekalova et al., 2018].

Of the great variety of plant species existing on the globe (there are about 1.5 million of them), no more than 300 thousand species of plants have been described. Many of these plant species are not fully studied by man, and their potential is not being used in essence. One of these plants, the potential of which is used very limitedly, is Jerusalem artichoke.

The center of the genetic origin of the Jerusalem artichoke plant is North America. Wild forms of this valuable plant can still be found there. Before the arrival of Europeans in America, Jerusalem artichoke was introduced as a cultivated plant by the Indians. In particular, for local tribes, Jerusalem artichoke was the most important source of food and their existence. There are also other reports, according to which the culture was called "Jerusalem artichoke" after the name of the Indian tribe of Jerusalem artichoke, in the location of which it was found [Kozlovsky, 1911; Lekhnovich, 1930; Zhukovsky, 1964]. Jerusalem artichoke was cultivated here even before the arrival of Europeans to the continent [Kozlovsky, 1911; Lekhnovich, 1930; Stebut, 1956; Davydovich, 1957; Pasko, 1989; Kochnev et al., 2002; Gubanov et al., 2004].

This valuable plant has been known to man for more than 4 thousand years, which has repeatedly saved the peoples of many countries of the world in difficult years of famine [Kozlovsky, 1911;



Shazzo et al., 2013; Titok et al., 2018].

The famous Russian botanist and plant breeder, specialist in the origin, evolution and geography of cultivated plants P.M. Zhukovsky (1964) wrote as follows: "...The first botanical description and drawing we find in Column in 1616. A more detailed description and drawing of Jerusalem artichoke were given by Lauremberg in Rostov, in 1632. Asa Gray in 1883 correctly pointed out that Jerusalem artichoke originates from North America. Jerusalem artichoke was brought to Europe in 1627, first to France, and from there to Italy and Holland [Kozlovsky, 1911].

In the work of P.F. Medvedev et al., [1981], a number of versions are indicated about the import of Jerusalem artichoke to Russia. It is assumed that from the second half of the XVIII century, approximately in 1772-1777, Jerusalem artichoke may have come to Russia in several ways: across the sea from England to Arkhangelsk; from Germany to the Baltic States; from the Balkan countries to Moldova and Ukraine. It is possible that it penetrated from Russia to Central Asia, and to Iran and Afghanistan through India and China.

According to P.M. Zhukovsky, [1964] in Russia as a food crop, Jerusalem artichoke began to be grown at the beginning of the XIX century. Industrial cultivation of Jerusalem artichoke in Russia began in the Non-Black Earth zone, in the North Caucasus, Ukraine in the late XVIII - early XIX centuries. By the 1930s, the area of cultivated Jerusalem artichoke plantations occupied more than 50 thousand hectares [Pasko, 1989].

Jerusalem artichoke tubers contain: water - up to 78%, fiber - 2.06%, sugar - 4.3%, nitrogen-free substances - 8.5%, fat - 0.5%, ash - 1.05%. In terms of nutritional value, it is inferior to potatoes, and in terms of the amount of digestible protein, it is 1.6 times higher than the "second bread".

In terms of the content of vitamins B1, B2 and C, Jerusalem artichoke is several times higher than potatoes, carrots and beets. Jerusalem artichoke tubers contain much more silicon, zinc and iron, and the ratio of potassium and sodium is more balanced than that of potatoes and carrots. The green mass of Jerusalem artichoke contains: water - up to 78.2%, fiber - 3.0%, inulin - 5.0%, protein - 2.3%, nitrogen-free substances - 8.0%, ash - 2.7%, fat - 0.8%. Jerusalem artichoke is a valuable feed for farm animals, birds, and they eat it more willingly than other grass crops, both fresh and in the form of silage and haylage, which has a positive effect on their productivity than when they are usually fed with other types of feed.

V.N. Kozlovsky [1911] reports on the importance of Jerusalem artichoke that "this is the only plant of all cultivated plants that is not afraid of frost, drought, rain, or depleted soil, does without manure, will abundantly give birth in one place for decades, and what is also important for us (although sad to realize) requires almost no care. At the same time, it does not punish you, like other plants, for negligence in summer work or for "not digging" it for the winter. In a word, this is an ideal plant, sent to us, the Slavs, by fate itself."

Jerusalem artichoke is considered a universal crop in agriculture and it is difficult to find such a plant as Jerusalem artichoke as versatile and multifaceted [Pasko, 2003; Kochnev et al., 2006; Partoev et al., 2015]. The total biomass of Jerusalem artichoke can be used as valuable fodder in animal husbandry [Beisenbiev, 1956; Kovalenko, 1969; Filippov, 1970; Belyak et al., 1982; Samatsky, 1991; Plokhonnikov, 1992; Gritsienko, 1999; Bogomolov, 2001; Kurtiyakova, 2001; Stepanov, 2003; Pustovoy, 2004], and tubers can be a high-quality product for people, both fresh and boiled [Bachman, 1957; Filonov, 1993; Chepurnoy, 1999; Pasko, 1999; Tsukgiev et al., 2006], a valuable medicinal product for many diseases, primarily for diabetes mellitus, and an important





bioresource for the production of bioethanol [Baillarge, 1949; Glukhov et al., 1992; Startsev, 1993; Varlamov et al., 1999, 2000; Lebedeva et al., 2017; 2018; Smekalova et al., 2018].

N.V. Vavilov [1987] called for and contributed to "the introduction into practice of Jerusalem artichoke, one of the new crops that has been of particular interest to us in recent years." Jerusalem artichoke or ground pear (*Helianthus tuberosus* L. – tuberous sunflower) is a perennial large-herbaceous inulin-bearing plant. For economic purposes, they are propagated by tubers, the seeds are used in breeding.

Jerusalem artichoke, due to its ecological plasticity, can germinate in various regions of the world - from the tropics to the northern regions of agriculture (65 °C). The biological potential of this plant is associated with a fairly high demand for the vegetation period with a sum of active temperatures up to 2700-3600 ° C. The aerial part of plants (organs) is cold-resistant. Leaves can be damaged at -2 ... -5 ° C, and stems are not damaged even at -7 ... -12 ° C. Tubers of different varieties of Jerusalem artichoke are more frost-resistant and they tolerate -10 ° C for 30 days. Tubers can repeatedly freeze, thaw and not lose viability. Tubers in the soil retain their viability with a snow cover of 0.2-1.0 m, when the air temperature drops to -34...-54°C. The above-ground part of plants and roots die off every year, and tubers, if they are not dug out of the soil, remain viable in the ground and give normal full-fledged shoots in the spring.

Jerusalem artichoke crops can be used in monoculture. With good agricultural techniques, it is possible to obtain a biomass yield outside the crop rotation for 15 years.

Numerous experiments have established that high yields of Jerusalem artichoke biomass can be obtained with annual cultivation of Jerusalem artichoke [Kochnev, 2006; Pasko, 2003; Shazzo et al., 2008].

Science and practice have established that Jerusalem artichoke yields even with unfavorable climatic parameters of the year.

K.A. Timiryazev [1936] established that "Jerusalem artichoke is one of the most intensive field crops, that the consumption of solar energy for the formation of organic matter in Jerusalem artichoke is 1/180, while that of rye, oats (grain, straw, root residues) is 1/80". They also found that ... "One hectare of Jerusalem artichoke is able to absorb 6 tons of carbon dioxide from the air per year, and 1 hectare of forest is 3-4 tons. Taking into account this ability of Jerusalem artichoke for the environment and its resistance to acid rain, it is suggested that it is expedient to include Jerusalem artichoke in green spaces around industrial cities with strong air pollution [Pasko, 2003]. It has also been established that Jerusalem artichoke withstands an increased content of oxides of sulfur, nitrogen, hydrogen sulfide, ammonia and other gases and cleans the air well from them [Kochnev, 2006; Pasko, 2003; Shazzo et al., 2008].

Maximum accumulation of solar energy is the most important problem of world science. The efficiency of agrocenosis is determined by the percentage of photosynthetic active radiation (PAR) absorbed by it from the total amount of physiologically active radiation coming to its surface during the growing season of the crop.

According to A.A. Nichiporovich [1959,1967,1982], ... "crops with a PAR efficiency of 1.3-3.0% are considered good, and those with 3.5-5.0 are considered record-breaking."

One of the ways to solve this problem is considered to be the method of cultivation of highly productive crops and varieties of plants. Jerusalem artichoke can be classified as one of these field crops. For example, the PAR utilization rate for Jerusalem artichoke (Interes) is 2.4-4.2% and



Jerusalem sunflower (Novost VIRa) is 3.9-5.3%, while for corn it is only 1.1%, and for most field crops 0.5-1.5%.

At present, it has been established in different countries of the world that when cultivating Jerusalem artichoke in the most favorable agroecological conditions, the maximum yield of green mass is 150 t/ha, and the yield of tubers up to 230 t/ha, and it should be noted that the final agrobiological potential of Jerusalem artichoke has not yet been established.

The highest productivity of Jerusalem artichoke, as a plant that responds well to improved nutritional conditions and irrigation, can be achieved by cultivating it on highly fertile lands with good irrigation. Jerusalem artichoke also protects irrigated lands well from the rise of groundwater, thereby tolerating dry years, thanks to its powerful root system, which is capable of developing up to 24 atmospheres of sucking force.

Jerusalem artichoke, due to its powerful root system with high absorption capacity, yields in various types of soils (on saline and saline soils). However, Jerusalem artichoke does not grow well on highly acidic and swampy soils. On the other hand, it will be a mistake to assume that Jerusalem artichoke is not at all picky about the soil. It can produce abundant yields on nutrient-rich or well-fertilized soils than poor soils. Jerusalem artichoke also grows very well on loose black soils, highly fertile loamy soils and on well-drained floodplain and other types of soils.

Jerusalem artichoke is a bio-ameliorant plant that promotes soil cultivation, protects soils from wind and water erosion. This plant is an excellent soil reclamator and therefore Jerusalem artichoke is planted on lands taken out of the agricultural wedge, as a result of oil production, coal, quarries, former landfills and former landfills. On such soils, after 2-6 years of growing Jerusalem artichoke, the land restores its agrobiological fertility.

Jerusalem artichoke is also an effective biological protector of the environment and, in comparison with other plants, accumulates less heavy metals, radionuclides and nitrates than other plants [Pasko, 1999, 2003; Shazzo et al., 2008]. Jerusalem artichoke It is also an important biological protector of the environment. Therefore, it can be cultivated in environmentally unfavorable areas, as it accumulates nitrates, heavy metals, radionuclides less in its organs than other plants. In addition, this plant does not need pesticide treatment, as it is well resistant to many diseases and pests. In connection with these morpho-biological properties, Jerusalem artichoke always provides a full-fledged environmentally friendly product [Pasko, 1999; Pashchenko, 2006].

Jerusalem artichoke, as a fodder for the livestock industry, contributes to the improvement of the structure of grown feed, increases the nutritional, environmental and energy safety of livestock products [Golubev et al., 1994; Kochnev et al., 2002; Pasko, 2002; Shazzo et al., 2013; Partoev et al., 2016; Sadriinov, 2018].

Thus, Jerusalem artichoke, which is not currently widespread in industrial farming, should be considered as a highly promising crop from the point of view of production, processing and multi-purpose use.

Jerusalem artichoke tubers have a high nutritional value. They contain many physiological active substances, from among macro- and microelements, pectin substances, dietary fiber, inulin and other important mineral elements and compounds.

The organs of the aerial part of plants, tubers, roots and stolons of Jerusalem artichoke contain many necessary macroelements, such as sodium, chlorine, potassium, calcium, phosphorus, magnesium, sulfur and trace elements, such as silicon, iron, zinc, selenium, copper, manganese,

iodine, cobalt, chromium, molybdenum, nickel, boron, vanadium, titanium, germanium, silver, lithium, tin, cadmium, aluminum, arsenic, bismuth, beryllium, strontium, mercury and others.

In the field of medicine, many years of research by scientists have established that the elements contained in the organs of Jerusalem artichoke plants are the main biogenic minerals and are necessary for humans to ensure normal life, health, well-being and longevity [Kochnev, 1996; Pasko, 2003; Shazzo et al., 2008].

In addition, Jerusalem artichoke plant parts contain a large amount of dry substances (up to 20%), among which up to 80% are polymer homologues of fructose, incl. inulin. As you know, inulin is a polysaccharide, the hydrolysis of which leads to the production of a sugar that is harmless to diabetics - fructose. Jerusalem artichoke also contains fiber and a rich set of mineral elements, including (mg/% per dry matter): iron-10.1; manganese – 44.0; calcium – 78.8; magnesium-31.7; potassium-1382.5; sodium-17.2 and others.

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