Short Review

Fruits of japanese quince are a valuable commodity for the food and pharmaceutical industry

Samatova Sh. A. [1], Berdiyev M. F. [1], Ergasheva N. G. [1,*]

Abstract

The article presents analytical data on the medicinal content of the fruit of the Japanese quince (Chaenomeles japonica) introduced to Shakhrisabz. Based on the study of its growth and development under the conditions of introduction, it was determined that it is promising for Shahrisabz and will produce many goods in the new conditions. It was concluded that it is possible to spread it to other regions and enrich the food and pharmacopoeia industry with valuable raw materials by developing a scientifically based technology for increasing fertility in new conditions.

Keywords

introduction, shrub, fruit, pectin, enzyme, flavonoid

1 Department of Botany of Karshi State University, Uzbekistan

*** Corresponding author:**
E-mail address: mirtemir01554.gmail.com

Citation: Samatova, Sh. A., Berdiyev, M. F., Ergasheva, N. G. (2024). Fruits of japanese quince are a valuable commodity for the food and pharmaceutical industry. Acta Biologica Slovenica 67 (1)

https://doi.org/10.14720/abs.67.1.18243

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Plodovi japonske kutine so dragoceno blago za živilsko in farmacevtsko industrijo

Izvleček

V članku so predstavljeni analitični podatki o zdravilni vsebnosti plodov japonske kutine (Chaenomeles japonica), prinesene v Shakhrisabz. Na podlagi študije njegove rasti in razvoja v pogojih uvedbe je bilo ugotovljeno, da je obetavna in ekonomsko zanimiva rastlinska vrsta za dotično regijo. Ugotovljeno je bilo, da ga je možno razširiti tudi v druge regije in obogatiti živilsko in farmakopejsko industrijo z dragocenimi surovinami z razvojem znanstveno utemeljene tehnologije za povečanje rodnosti v novih razmerah.

Ključne besede

vnos, grm, plod, pektin, encim, flavonoid

Japanese quince is a new fruit-ornamental plant that is expanding its cultural area more and more. The advantages of this cultivar are its high economic efficiency and potential for expanding the area, easy reproduction, and resistance to diseases and pests, which allow it to grow without toxic chemicals. These properties increase the biological and ecological value of Japanese quince fruits and serve to save money (Fedulova et al. 2016).

Japanese quince (Chaenomeles japonica) is a small ornamental shrub belonging to the Rosaceae family and grows naturally in Japan. It grows up to 0.5-1.0 m tall in natural conditions and produces 2 cm thorns. Branches grow. The compact root system is located in the soil's upper layer up to 10 cm. The leaves are side-lobed, shiny, dark-green, broadly ovate, 3-5 cm long. The flowers are golden-red, with a large diameter of up to 4 cm, and hundreds of flowers are formed on one bush. The fruit is green to golden yellow, sour, and fragrant, and contains a large amount of organic acids (4-5%), pectin (06-2.6%) and aromatic substances. Jam, wine, juice and other products are made from its fruits (Osipov et al. 2013). It is a drought-resistant, light-loving decorative, fruit-bearing, honey-producing plant (Kaminskiy et al. 2013).

Currently, Japanese quince is being researched for preparing juices, aromatization and fibre extraction, determination of healing properties, use in functional nutrition and other purposes. The interest in growing it is increasing day by day due to the beneficial properties of its fruit. Regarding vitamin C content (100-230 mg/%), its fruit is not inferior to black currant. It contains five times more vitamin C than lemon. The amount of vitamin R (910 mg/%) is ten times more than that of apples (Osipov et al., 2013). The freshly picked fruits of the plant are hard and very sour, and they are difficult to eat. Still, the biologically active components, aroma and high fibre content are very suitable for industrial processing of the fruit (Baranowska-Bosiacka et al. 2017). As a result of research on the use of fruits in the food industry, it was found that the fruit of Japanese quince has high antioxidant properties and contains a large amount of phenols. It has been revealed that wine and liquor products made from fruits have high commercial potential (Tarko et al. 2014) and can be used as valuable products in functional nutrition (Prichko et al. 2014). Due to the high antioxidant properties of plant fruits, it is recommended that microcapsules be prepared from them. Antioxidant properties of microcapsules, the amount of phenolic compounds contained in them, as well as the effect of α-glucosidase, pancreatic lipase, acetylcholinesterase and 15-lipoxygenase enzymes in vitro, and it was found that they retain their healing properties even under such conditions (Turkiewicz et al. 2020).

Analyzes conducted to evaluate the activity of phenolic compounds obtained from the fruit of the plant confirmed that five compounds isolated from it: isoquercitrin, rutin, (+)-catechin, (-)-epicatechin and chlorogenic acid have antimicrobial properties against gram-positive and gram-negative bacteria. In particular, Enterococcus faecalis bacteria showed the highest sensitivity to these compounds. The analysis showed that Japanese quince fruit can be used as a promising antioxidant and antimicrobial agent to enrich the diet and replace chemical preservatives in the food and cosmetics industry (Urbanaviciute et al., 2020). The flavanols in Japanese quince fruit have made normal cells more resistant to apoptosis and cancer cells more

sensitive. Studies have shown that fruit polyphenols have a strong antiproliferative effect on prostate and breast cancer cells, inhibiting their growth but not reducing the number of healthy cells. It has also been found to inhibit the invasiveness of cancer cells and reduce the expression level of several genes involved in apoptosis, angiogenesis and metastasis (Lewandowska et al., 2013).

Japanese quince fruits contain large amounts of macro- and micronutrients, ascorbic acid, phenolic compounds, fibre, and low amounts of oxalates. The average amount of iron in freshly picked fruits is 0.516 mg/g, copper 0.146 mg/g, zinc 0.546 mg/g, magnesium 16.729 mg/g, and calcium 22.920 mg/g. In experimental conditions, it was observed that the concentration of lipid peroxides decreased in hepatocytes incubated with Japanese quince extract. Still, it did not affect the concentration of the active form of oxygen in mitochondria. It has been found that signs of apoptosis and necrosis are not observed in hepatocytes under the influence of any concentration of Japanese quince fruit extract. Japanese quince was considered to have a hepatoprotective effect due to the antioxidant and antiapoptotic effect of the aqueous extract of the fruits on hepatocytes (Baranowska-Bosiacka et al. 2017).

It was found that cookies enriched with freeze-dried (lyophilized) fruits of Japanese quince had a 2-3.5 times higher radical scavenging activity than the control option and fewer secondary products formed from lipid oxidation. Enriched cookies contained more volatile hexanal, heptanal, octanal, and 2-heptenal (E) than the control. Because of acetic acid predominance (7.05-23.37%) in the volatile properties of the cookies, they were rated as having a higher intensity of sourness and citrus odour. Biscuits stored for 16 weeks were found to have an increased amount of carbohydrates compared to freshly made ones, and carbohydrates that were not present in freshly made biscuits were formed. Consumers preferred cookies with 1.0 and 1.5% freeze-dried fruit over cookies with 6.0 and 9.0% freeze-dried fruit (Antoniewska et al. 2019).

The effect of procyanidin extract from Japanese quince fruits on the activity of metalloproteinases secreted by human peripheral blood mononuclear cells and human leukaemia cells was studied. It has been proven that the extract effectively inhibits enzyme activity. The efficiency of scavenging radical cations explains their antioxidant activity. It is concluded that Japanese quince polyphenols can be used for cancer prevention, and their biological activity mechanisms should be studied (Strek et al. 2007). Phytochemical analysis of fat and protein fractions in the residue released during winemaking from Japanese quince was carried out. It was determined that the oil extracted from residual products is rich in unsaturated fatty acids, tocopherols and phytosterols, and the protein contains all non-exchangeable amino acids. Fat and protein fractions extracted from waste products have been recommended for use in the food and cosmetic industries (Ben-Othman et al., 2023).

This plant was introduced to Uzbekistan as an ornamental plant not long ago. At the beginning of our century, following the relevant decisions of the Cabinet of Ministers, large construction works were carried out in the cities of Karshi and Shahrisabz, and new decorative plants were brought to the region and planted. In this regard, Japanese quince bushes introduced to Shahrisabz City are growing well and producing abundant crops. Since the plant is resistant to cold, it starts its vegetation in Shahrisabz conditions in early February. From the second half of February, the first buds begin to appear from the flower buds on the plant's one-year-old branches, and branches begin to appear from the vegetative shoots. Flowering begins in the first days of March and lasts until the middle of April. The first flowers turn into fruits in the first days of April. At the end of flowering, that is, from the second ten days of April, the growth of branches accelerates significantly. From May, the growth slows down, the fruits begin to ripen, and the growth of branches continues until July. In July and the first half of August, the plant's growth stops completely. From the second half of August, repeated growth at the expense of side branches begins and continues until late autumn. This state of plant growth and development has been observed in most of the subtropical and tropical, as well as Chinese-Japanese flora introduced to South Uzbekistan (Yoziev et al. 2001).

Author Contributions

For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used “Conceptualization, S.Sh, B. M., E. N.; writing—original draft preparation, S.Sh, B. M., E. N.; writing—review and editing, S.Sh, B. M., E. N. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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