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PROSPECTS FOR USING PLANTS OF THE ROSA L. GENUS

Resume. *The article provides an analysis of the current state of scientific research of the rosehip (Rosa L.) (Rosaceae family) and illustrates the prospects for their comprehensive study as sources of renewable plant raw materials for the production of domestic medicines. It is noted that the search for new types of medicinal plant raw materials is a very relevant task for the domestic pharmaceutical industry.*
Key words: *Rosa L., the flora of Kazakhstan, official medicine, folk medicine, medicinal plant, medicinal plant raw materials, biologically active substances, chemical composition.*

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ROSA L. ТҮРІНЕ ЖАТАТЫН ӨСІМДІКТЕРДІ ПАЙДАЛАНУ БОЛАШАҒЫ

Түйін: Мақалада итмұрын (Rosa L.) (Rosaceae тұқымдасы) түрлерінің ғылыми зерттеулерінің қазіргі жағдайы талданады және оларды өсімдік текті шикізаттың көздері ретінде кешенді зерттеу перспективалары көрсетіледі. Дәрілік өсімдік шикізатының жаңа түрлерін іздестіру отандық фармацевтика өнеркәсібі үшін өте өзекті екені атап өтілді.
Түйінді сөздер: Rosa L., Қазақстан флорасы, ресми медицина, халық медицинасы, дәрілік өсімдік, дәрілік өсімдік шикізаты, биологиялық белсенді заттар, химиялық құрамы.

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ПЕРСПЕКТИВЫ ИСПОЛЬЗОВАНИЯ РАСТЕНИЙ РОДА ROSA L.

Резюме: В статье приведен анализ современного состояния научных исследований видов рода шиповник (Rosa L.) (сем. Розоцветные - Rosaceae) и показаны перспективы всестороннего изучения их в качестве источников возобновляемого растительного сырья для получения отечественных препаратов. Отмечено, что изыскание новых видов лекарственного растительного сырья является весьма актуальной задачей для отечественной фармацевтической промышленности.
Ключевые слова: Rosa L., флора Казахстана, официальная медицина, народная медицина, лекарственное растение, лекарственное растительное сырье, биологически активные вещества, химический состав.

Introduction.

Today the pharmaceutical market is one of the most dynamic and fastest- growing. The increase in the market is due to the growing demand for drugs and prevention products around the world, which is driven by such phenomena as increasing welfare of the population, population growth, aging of the population and obesity.

Over the past several decades, the popularization of herbal medicine and the growth in its production have contributed to a significant expansion of their share in the pharmaceutical market. In developing countries, 70–95% of the population rely on herbal medicines for primary health care, mainly due to synthetic medicines' high cost or unavailability [1]. According to the World Health Organization (WHO), about 80% of the world's population use medicinal plants and other traditional medicines to meet their primary health care needs [2]. This scale of turnover of preparations based on herbal raw materials is due to a number of factors, such as a wide range of pharmacological activity, the possibility of using them in all age groups and their high safety with sufficient efficiency and availability.

In the context of the import dependence of the pharmaceutical market in Kazakhstan, the creation of new medicines based on domestic herbal raw materials is one of the most important tasks in the development of the pharmaceutical industry in the country. The territorial and geographical position of Kazakhstan provides a huge stock of medicinal plants that have been widely used in traditional medicine for centuries but have not yet found application in official medicine.

Materials and methods.

In this regard, plants of the genus rosehip (Rosa L.), belonging to the Rosaceae family, deserve attention.

Species of the genus rosehip (Rosa L.) are widespread in the temperate and subtropical climatic zones of the world, especially in the northern hemisphere, South Africa, India and Mexico. More than 200 wild species of this genus are widespread in all geographical areas and environments of the northern hemisphere. Nevertheless, all over the world, there are thousands of varieties, forms and hybrids of this genus, since the species of this genus are very variable and the ability of species to cross-hybridize due to common growth zones is noted [3]. The species belonging to the genus Rosa are among the most popular ornamental and garden plants on the planet.

Plants of the genus rosehip have long been used as a remedy. Rosehip fruits are of high value due to the content of biologically active substances, including vitamin C. As early as the 4th century, images of roses were found on silver coins during excavations in the Altai Territory. Theophrastus described multi-petaled roses in 300 BC. In Greece rose water and jam were made from rosehip petals, and many diseases were treated [3].

The species of the genus rosehip (Rosa L.) are thorny shrubs up to 2 m high with brown-red branches covered with rare, curved thorns. Their leaves are pinnate, with elliptical ovate sharp serrated leaflets. Flowers are single or 2-3. Fruits are spherical or ovoid, glabrous, orange or red, fleshy, and contain numerous fruits.

Despite significant variability of species of the genus Rosa L., their chemical composition is an important criterion in taxonomy. Flowers, fruits and leaves contain vitamins - C, E and K, as well as flavonoids, anthocyanins, carotenoids, tannins, pectins, phenolic acids, steroids, terpenes and trace elements [4].

10 species of plants of the genus rosehip grow in the flora of Kazakhstan: spiny rosehip (Rosa acicularis Lindl.), Albert's rose (Rosa alberti Regel), Begger's rose (Rosa beggeriana Schrenk), dog rose (Rosa canina L.), shield-bearing rosehip (Rosa corymbifera Borkh.), Fedchenko's rosehip (Rosa fedtschenkoana Regel.), loose rosehip (Rosa laxa Retz.), cinnamon rosehip (Rosa majalis Herrm.), prickly rosehip (Rosa pimpinellifolia L.), wide-thorn rosehip (Rosa platyacantha Schrenk.) (Table 1) [5].

The SPh of the Republic of Kazakhstan contains monographs on the raw material of spiny rosehip (Rosa acicularis Lindl.), Begger's rose (Rosa beggeriana Schrenk.), shield-bearing rosehip (Rosa corymbifera Borkh.), Fedchenko's rosehip (Rosa fedtschenkoana Regel.), cinnamon rosehip (Rosa majalis Herrm.). Fruits are used as raw materials. Rosehip fruits are a false berry formed from an overgrown floral receptacle. In shape, the fruits are spherical and slightly elongated, ovoid and elongated, elliptical and fusiform, depending on the species. There is a hole at the top of the fruit - a trace of the removed calyx; sometimes 5 whole-edged sepals closed at the top are preserved on individual fruits. And the dog rose fruits have lobed, bent downwards sepals; when they break off, a pentagonal platform remains. The walls of the fruit are thin, fragile, wrinkled on the outside, shiny or matte, rough on the inside from the abundance of hard bristly hairs. The sizes of the fruits are different depending on the species: length from 0.7 to 3 cm, in diameter - from 0.5 to 1.5 (1.7) cm. Their color is from orange-red to reddish-brown, dark brown; no smell, the taste is sour-sweet. Inside the false fruit there are real fruitlets - small, oblong nuts of light brown color.

Rosehips of the Caninae section differ in appearance from those of the Cinnamomeae; they are larger, of a darker (dark red or burgundy) color; the sepals are pinnate, after flowering they are usually bent down and pressed against the fruit, after ripening they crumble and a pentagonal disc remains in their place.

Rosehip species of the Cinnamomeae section

Rosehip Cinnamon (May rosehip) Rosa majalis Herrm. - a thorny shrub 0.5-2 m high. Its branches are brown-red, with a few small, slightly curved thorns, usually 2 at the base of the leaves. The leaves are pinnate, consisting of 7-9 oblong-elliptical or ovate, serrated leaflets. The flowers are single or 2-3 with 5 sepals, lanceolate, simple, The fruits (hypanthia) are spherical or ovoid, smooth, glabrous, orange or red, fleshy; contain numerous small fruits (nuts). Along with the May rosehip, fruits of other rosehip types of the Cinnamomeae section are harvested; spiny rose (Rosa acicularis Lindl.,), loose rosehip (Rosa laxa Retz.) and other species of this section.

Harvesting of fruits is carried out in August-September when

Table 1 - Characteristics of Kazakhstani species of the Rosa L. genus, used in folk (FM) and official (OM) medicine

Species	Distribution in Kazakhstan	Chemical composition	Therapeutic action, application	Stocks, introduction of the species
1	2	3	4	5
Rosa acicularis Spiny rosehip	Shrub, found in the north of flat and low-land Kazakhstan, in the mountains from the Altai to the Western Tien Shan.	Raw material: whole plant. Contains tannins, flavonoids, catechins, vitamins C, B2, P, carotene, carbohydrates, essential and fatty oils.	Choleretic, astringent, antiseptic, anti-inflammatory, vasoconstrictor, diuretic, fixing, antibacterial, analgesic, tonic, anti-febrile, hemostatic (PR, 1987, p. 74). Used by OM (SPh 8-11; SPh RK;Mashkovsky, 2005; SRMKaz-2013), FM, WM.	Commercial reserves of raw materials are determined in the Dzhungarsky, Zailiysky Alatau and on the Ketmen ridge. (Medicinal plants of Kazakhstan 1996). Cultivated in SBG, DBG, KBG.
Rosa alberti Regel – Albert's rose	Shrub, found from the Altai to the Western Tien Shan. Used as a vitamin (PR, 1987, p. 75). OM is used (SRMKaz-2013, 42-4901-08).	Raw material: fruits. Contains vitamins C, P, carotene, flavonoids (PR, 1987, p. 75).	Used as a vitamin (PR, 1987, p. 75). Used by OM (SRMKaz-2013, 42-4901-08).	Commercial reserves of raw materials are determined in the Dzhungarsky, Zailiysky Alatau and on the Ketmen ridge. (Medicinal plants of Kazakhstan 1996).
Rosa beggeriana Schrenk – Begger's rose	Shrub, found in the Tarbagatai, Dzhungarskiy Alatau and Tien Shan mountains.	Raw material: whole plant. Contains flavonoids, catechins, tannins, vitamins C, E, P, B2, essential and fatty oils (PR, 1987, p. 76).	Used as a fixing, multivitamin, choleretic, tonic (PR, 1987, p. 76). Used in OM (SPh 8-11; SPh RK), and FM.	Small reserves of raw materials have been identified on the Karzhantau Ridge (Gemedzhieva et al., 2014). Cultivated in SBG.
Rosa canina L.- Dog rose	Shrub, found in northwestern Kazakhstan and theTien Shan.	Raw material: whole plant. Contains triterpenoids, vitamin C, phenol carboxylic acids and their derivatives, tannins, flavonoids, wax, steroids, carbohydrates, triterpene alcohols, carotenoids, anthocyanins, leukoanthocyanidins, lipids, higher aliphatic hydrocarbons, essential and fatty oils, tocopherols (PR, 1987, p. 77).	Used as a detoxifying, analgesic, astringent, hemostatic, adaptogenic, antipyretic, diuretic, choleretic, anthelmintic, tonic (PR, 1987, p. 77). Used by OM (SPh-11),WM, FM, Exp.M (WURP, 2001, p.494).	Cultivated in SBG.
Rosa corymbifera Borkh. - Shield-bearing rosehip	Shrub, found in the Kyrgyz Alatau, Karatau and Western Tien Shan.	Raw material: whole plant. Contains phenol carboxylic acids and their derivatives, flavonoids, carotenoids, vitamins C, E, P, tannins, fatty oil (PR, 1987, p. 78).	Used for anemia, asthenia, peptic ulcer, hypoacid gastritis, urinary and cholelithiasis (PR, 1987, p. 78). Used by OM (SPh-11; SPh RK), and FM.	Cultivated in SBG.
Rosa fedtschenkoana Regel – Fedchenko's rose	Shrub, found in the low and middle mountains of the Dzhungarskiy Alatau and Tien Shan.	Raw material: fruits. Contains vitamins C, P, E, tannins (PR, 1987, p. 79).	Used as a choleretic, astringent, antiseptic, diuretic, anti-inflammatory, vasoconstrictor, fixing, antibacterial, analgesic, tonic, anti-febrile, hemostatic (PR, 1987, p. 79). Used by OM (SPh 8-11; SPh RK;Mashkovsky, 2005), and FM.	Cultivated in SBG.

Rosa laxa Retz. - Loose rosehip	Shrub, found in the steppe zone of flat and mountainous Kazakhstan.	Raw material: fruits. Contains carotenoids, vitamins C, P (PR, 1987, p. 80).	Used as a vitamin supplement for anemia, asthenia, peptic ulcer, hypoacid gastritis, liver diseases, nephritis, cystitis (PR, 1987, p. 80). Used by OM (SRMKaz-2013, 42-4901-08), FM.	-
Rosa majalis Herrm. - Cinnamon rose	Shrub, found in the steppe zone of flat and low-hills Kazakhstan, in the Altai and Tarbagatai mountains.	Raw material: fruits. Contains vitamins C, P, carotenoids, catechins, flavonoids, anthocyanins, leukoanthocyanidins (PR, 1987, p. 81).	It is used as a multivitamin, choleretic, tonic, adaptogenic (PR, 1987, p. 81). Used by OM (SPh-11, SPh RK; PhMRK 42-138-97; SRMKaz -2013), FM.	Commercial reserves of raw materials have been found on the Ketmen, Dzhungarskiy Alatau, Western Tarbagatai, Zailiyskiy Alatau, Kurchumskiy ridge, in the Irtysh region (Medicinal plants ..., 1998, p. 113).
Rosa pimpinellifolia L. (=Rspinosissima) - Prickly rosehip	Shrub, found everywhere, except deserts.	Raw material: fruits. Contains organic acids, carotenoids, vitamins C, P, tannins, flavonoids, anthocyanins (PR, 1987, p. 84); O-glycosidated flavonols (of kaempferol and isorhamnetin) (Porter et al., 2012)	Suitable for industrial production of food coloring with P-vitamin activity (PR, 1987, p. 84). Used by FM.	Cultivated in SBG.
Rosa platyacantha Schrenk - Widethorn rosehip	Shrub, found in the Dzhungarskiy Alatau and Tien Shan.	Raw material: fruits. Contains triterpene saponins, vitamins C, carotene, flavonoids, phenol carboxylic acids, cumin, tannins, anthocyanins (PR, 1987,p.83).	Used as a source of vitamin C (PR, 1987, p. 83).	-

List of abbreviations

SPh RK – State Pharmacopeia of the RK
PR - Plant resources of the USSR
SRMKaz – state register of medicines
SBG – state botanical garden
DBG - Dzhezkazgan botanical garden
KBG - Karaganda botanical garden
OrM - oriental medicine
OM – official medicine
FM - folk medicine
WM - Western medicine
Exp.M - experimental medicine
WURP - wild useful plants of Russia
PhMRK - pharmacopoeial monograph of the Republic of Kazakhstan

they take on an orange-red or red color. Fruit collection must be completed before frost. The fruits are collected in buckets or baskets and quickly scattered for drying in a layer of 2-3 cm on mats, metal nets in warm ventilated rooms. The raw materials are mixed periodically. It is preferable to use fast artificial drying in dryers of various types at a temperature of 80-90 ° C, which ensures the preservation of vitamin C in the raw materials [6].

Rosehip species of the Caninae section

Dog rose (Rosa canina L.) is a shrub up to 3 m high with thin branches covered with sparse, strong, curved thorns, strongly widened towards the base. The leaves are alternate, pinnate, with 5-7 elliptical sharp-serrate leaflets. From the upper side, the leaves are dark green, from the lower one - greyish-green. Stipules are fused with the base of the petiole. The flowers are large, on long pedicels, solitary, sometimes arranged 2-3 together, at the base with lin-

ear-lanceolate bracts. There are 5 sepals, pinnately dissected, bending down after flowering and falling off long before the fruit ripens. Corolla is 5-lobed, pale pink, or white. The fruits are false, formed by an overgrown receptacle (hypanthium), enclosing fruitlets (nuts).

Collecting fruits of dog rose and other species of the Caninae section is carried out throughout the autumn, from the moment of their complete reddening to frost. The harvesting period is longer than that of the rosehip of the Cinnamomeae section, therefore, air drying in dry hot weather is most often used. Unripe fruits contain insufficient organic acids and carotenoids, so they are not good for collecting. [7].

Refined raw materials are crushed false fruits, freed as much as possible from hairs and fruitlets - nuts. These are separate pieces of false fruit of various shapes and sizes. Raw materials of peeled fruits are often used in the form of powder [7].

Extracts and compounds isolated from various types of rosehip are widely used as traditional medicines. They are used to treat skin diseases, diarrhea, arthritis, and liver and kidney dysfunction [8-16]. Alcohol extracts from various rose species also showed some antiviral activity without any cytotoxic effects [17]. The anticancer effect of plants of the genus rosehip (Rosa L.) is explained by the rich content of biologically active substances that exhibit antioxidant effects. Studies have shown that neutral and acidic phenols are the main components of the rosehip extract (Rosa L.), and inhibit the growth and proliferation of various cancer cells [18]. It was noted that extracts from R. canina contain isoflavone phytoestrogens, which have in vitro antitumor activity against breast cancer (MCF-7) [19]. Extracts from other plants, such as R. rugosa, also contain other active compounds that affect the epigenetics of cancer cells, inhibit the activity of Histone acetyltransferases, and induce apoptosis in prostate cancer cell lines [20].

Biologically active substances contained in the species of the genus rosehip are also used for the cosmetic industry. R. alba, R. borboniana, R. canina, R. centifolia, R. damascena, R. davurica, R. floribunda, R. gallica, R. hybrida, R. moschata, R. multiflora, R. rubiginosa, R. rugosa and R. spinosissima are currently used for cosmetic purposes and have scientifically proven skin care activity [21]. For example, ethanolic extract of R. multiflora flowers prevents ultraviolet (UV) -induced biochemical damage leading to photoaging by reducing reactive oxygen species (ROS), interleukin (IL) -6, IL-8, and matrix metalloproteinase (MMP) [22]. The authors have shown that the powder from the seeds and their shells of the rosehip R. canina can increase the lifespan of cells, reduce wrinkles, moisturize and increase the elasticity of the skin [6]. Extract from R. gallica petals reduces the expression of solar UV-induced MMP-1, which is a sign of wrinkle formation [23]. Extracts and compounds isolated from R. canina, R. gallica, and R. rugosa have been extensively studied to assess their effectiveness as potential ingredients for skin lightening [24–26]. It was found that polyphenols contained in large amounts in Rosa sp., especially quercetin, kaempferol, and ellagic acid, have in vitro inhibitory activity against tyrosinase, an enzyme responsible for melanin synthesis [26]. The phytochemical composition of plants of the genus rosehip (Rosa L.) varies and depends on geographic location, ecology, soil composition, and other environmental factors [27].

Recent studies by Dani et al. have shown that the phytochemical composition of Rosa sp. also depends on the development and aging of flowers [28]. The most studied parts of Rosa L. plants are rosehip fruits, which are known to be a rich source of natural antioxidants, for example, polyunsaturated fatty acids (PUFAs) such as linoleic acid, as well as flavonoids, triterpenoids, and phytosterols [29]. Galactolipids, which are also found in rosehip, have shown some anti-inflammatory and antitumor activity [30]. It was found that R. rugosa buds contain acidic polysaccharides with antioxidant and antiaging properties [31], neuroactive depsid glucosides, flavonoids, and tannins [32]. Flavonoids, including derivatives of kaempferol and quercetin, were also found in the flower buds of R. damascena [33]. It has been shown that the leaves of various plant species of Rosa L. contain significant amounts of polyphenols, ranging from 5.7 ± 0.08% to 15.2 ± 0.21% of the dry weight of the raw material [34]. R. canina leaves have a higher content of polyphenols than fruits [35].

Results and discussions.

Rosehip preparations

In scientific medicine, fruits are mainly used in the form of infusions, extracts, syrups, pills, candies, pills as vitamin agents. Obtained from the rose hips of the Cinnamomeae section carotolin (oil extract of carotenoids) is used externally in the treatment of trophic ulcers, eczema and other diseases, and rosehip oil is used externally for cracks and abrasions in the nipples of nursing women, bedsores, trophic ulcers of legs, dermatoses. In addition to dry rose hips, fresh cultivated varieties of rose hips, obtained by breeding May rosehip, Webb's rose and edge-row rose are also used as raw materials for obtaining syrup, carotoline and oil. [6]. The fruits of the dog rose (Rosa canina L.) are used as raw materials for the preparation of holosas, which has a choleretic effect and is used for cholecystitis and hepatitis [6].

Plants of the genus Rosa L. due to their rich chemical composition, represented by vitamins, flavonoids, anthocyanins, carotenoids, tannins, pectins, phenolic acids, steroids, terpenes and microelements, are of great interest as a source of natural renewable raw materials. Among them, wide-thorn rosehip (Rosa platyacantha Schrenk), growing in Kazakhstan, is of scientific and practical interest for a comprehensive and in-depth study as a promising source of raw materials for the creation of new domestic drugs. A review of the literature showed that there are no modern data on the phytochemical and pharmacognostic study of the wide-thorn rosehip raw material. The development of medicines based on affordable and highly economical domestic medicinal plant raw materials makes it possible to contribute to the import substitution policy of the Kazakhstani pharmaceutical market.

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