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Research Article

The Actual Aspects of Analysis of Medicinal Plants, Growing on the Territory of Orenburg Region

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ABSTRACT

The favorable climatic and geographic conditions for vegetation of medicinal plants of Orenburg region were described. Present information was confirmed by the results of qualitative and quantitative analysis of biologically active substances in different raw material, which grows on the territory of Orenburg region. The research's results allow saying that the content of biologically active substances in raw material of studied plants corresponds to normative parameters, and in some cases exceeds them. The optimal extraction conditions for medical raw material were developed. Non-officinal plant was compared with officinal medical raw material and showed impressive results. The domestic raw material was compared with similar import one and proved its effectiveness in preclinical results. New medicinal drugs were developed on the bare of current results.

Keywords: *Frangula alnus* Mill., *Rhamnus cathartica* L., *Salvia tesquicola* Klokov & Pobed., *Aronia melanocarpa* Elliot., *Crataegus sanguinea* Pall., medical raw material, standardization.

INTRODUCTION

Orenburg region is a subject of the Russian Federation, which locates in the South of country and covers 123 700 km^2. The remoteness from seas and oceans shape sharply continental climate of Orenburg region. The great number of rivers and lakes, meadows and valleys and the Ural Mountains form the plant life of this region. The main floral areas are forest-steppe and steppe. The great amount of atmospheric precipitations (350-450 mm) and sunny days (almost 300 days per year) positively effects on flora of Orenburg region. The half of all territory is used as arable lands because of soil's high fertility. The large share of all natural vegetation is medical herbs. Unfortunately, only a small part of them were studied. This tiny part of these plants, which was studied on the base of Orenburg State Medical University, includes *Frangula alnus, Rhamnus cathartica, Aronia melanocarpa, Crataegus sanguinea* and *Salvia tesquicola.*

Frangula alnus and *Rhamnus cathartica* are closely related species and used as a source of laxatives. It is known that the laxative effect of *Frangula alnus* and *Rhamnus cathartica* appears due to the presence of anthracenderivatives, such as frangulin A and frangulin B[1,4]. Bark of *Frangula alnus* and fruits of *Rhamnus cathartica* is used as a medicinal raw material [4]. Fruits of *Rhamnus cathartica* are harvested after full ripening in August and September. Bark of *Frangula alnus* is harvested in spring during sap flow and stood for a year or thermally treated in a drying cabinet at the temperature of 100 ^{0}C. These measures are necessary because of the presence of the derivatives of anthranol in fresh-gathered bark, which causes strong gag reflex[4,5,6]. *Frangula alnus* and *Rhamnus cathartica* grows in forests, meadows and were found in floodplains on the territory of Orenburg region.

Salvia tesquicola and *Salvia officinalis* are closely related species. *Salvia tesquicola* is non-officinal plant and used only in folk medicine as astingent, anti-inflammatory and anti-microbial agent. The chemical composition of *Salvia tesquicola* includes diterpene acids, flavonoids, tannins and other biologically active substances in accordance with literature information. *Salvia tesquicola* grows in steppes[4].

Aronia melanocarpa is a deciduous shrub up to 2.5 meters with numerous brunches[4,6]. Fruits of *Aronia melanocarpa*, which are harvested after full ripening in September, are used as medicinal raw material. Pharmaceutical effects of *Aronia melanocarpa* fruits are multivitamin, antihypertensive and hemostatic because of flavonoids; vitamins C, B_1, B_2, E, PP; tannins; organic acids and others in chemical composition[4,6].

Crataegus sanguinea is a high shrub or rarely a small tree up to 1-4 meters. Fruits of *Crataegus sanguinea* are used as a medicinal raw material. Fruits are rounded, blood-red or rarely orange-yellow with 2-3 seeds and mealy flesh. Fruits are harvested after full ripening in September. *Crataegus sanguinea* possess cardiotonic and hypocholesterolemic effects, due to the presence of

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saponins and flavonoids. *Crataegus sanguinea* grows in sparse forests, along rivers in the steppe zone[4,6].

The aim of present work is a generalization of all information about qualitative composition and quantitative amount of biologically active substances of medical plants, which are growing on the territory of Orenburg region.

RESULTS AND DISCUSSION

Objects of study were barks of *Frangula alnus*, fruits of *Rhamnus cathartica, Aronia melanocarpa, Crataegus sanguinea*, leaves and herbs of *Salvia tesquicola.* Raw materials of studied objects were prepared during 2016 on the territory of Orenburg region. The isolation of individual substances from medicinal plant raw materials was carried out by column chromatography. Monitoring of substances' seperation was performed by TLC analysis on the plates "Sorbfil PTLC-AF-A-UV." Spectra ^{1}H NMR and ^{13}C NMR were obtained on «Bruker AM 300", mass spectra were recorded on a mass spectrometer «Kratos MS -30». Electronic spectra were registered by using UV-spectrophotometers "UNICO 2800", Specord 40 (Analytik Jena).

The chemical composition of *Frangula alnus*, *Rhamnus cathartica* were isolated and dominate anthracenderivatives were characterized (6-O-α-L-rhamnopyranoside of frangula-emodin (frangulin A) and 6-O-β-O-apiofuranoside of frangula-emodin (frangulin B), 1-O-β-D-glucopyranoside of emodin, 3-O-rutinoside of rhamnetin) by using UV, NMR spectroscopy, mass spectrometry, TLC and HPLC, different chemical reactions[1]. The results of preclinical studies proved that the maximum laxative effect of the drugs, which are based on bark of *Frangula alnus,* is achieved at a dose of 50 mg/kg. The maximum laxative effect of the drugs, which are based on fruits of *Rhamnus cathartica*, is achieved at much lower dose - 25 mg/kg. The maximum laxative effect of the drugs, which are based on leaves of *Cassia acutifolia,* is achieved at a dose of 25 mg/kg[3]. Respectively, herbal medicinal preparations on the basis of *Rhamnus cathartica* on force of the pharmacological effect are not inferior to herbal medicinal preparations, which are imported from abroad. The methods of qualitative and quantitative analysis using thin-layer chromatography and spectrophotometry were developed in the course of analysis. The technology of obtaining new drugs "*Frangula* syrup" and "*Rhamnus* syrup" was justified[2].

The ratio "the raw material: extract" 1:3 for producing of "*Rhamnus* syrup" and "*Frangula* syrup" was proved in the previously developed technologies. The relative degree of the determination of the total anthracenderivatives in *Rhamnus* Syrup and *Frangula* syrup in the previously developed method with confidence probability 0,95 is no more than ±4,17%. The content of total anthracenderivatives vary from 0,12±0,002% to 0,25±0,003% in "*Rhamnus* syrup" and from 0,30±0,02% to 0,39±0,02% in "*Frangula* syrup" (calculated on frangulin A)[2].

Raw materials including leaves and herbs of *Salvia tesquicola* and medical raw material of *Salvia officinalis* were comparatively studied. The research method of quantitative of total diterpene acids of different species of genus *Salvia*, which was taken out from the literature information, was carried out by using the standard sample of carnosic acid. The method of quantitative determination of the content of diterpene acids in different species of genus *Salvia* was carried out by using UV-spectrophotometer at the analytical wavelength 282 nm. The relative degree of the determination of diterpene acids in *Salvia tesquicola* in conducted method with confidence probability 0,95 is no more than ±3,53%. The research results allow to say that the content of diterpene acids in herbs of *Salvia tesquicola*, which is growing on the territory of Orenburg region, is maximum and amount 1,67±0,04%.

Despite the fact that the birthplace of *Aronia melanocarpa* is North America, this shrub widely grows in local residents' gardens in Orenburg. The technique of quantitative determination of flavonoids in fruits of *Aronia melanocarpa* by spectrophotometry method at wavelength 534 nm with using standard sample of cyanidin-3-O-glucoside[7] is described in Pharmacopoeia of the Russian Federation. The lower limit content of flavonoids is 3%. The content of flavonoids in fruits of *Aronia melanocarpa*, which is growing in gardens of local residents of Orenburg, is 7,5±0,2%.

The large amount of shrubs of *Crataegus sanguinea* grows in Orenburg region and is widely used by the local population as a cardiotonic agent. The quantitative determination of flavonoids in fruits of *Crataegus sanguinea* by spectrophotometry method at wavelength 412 nm with using standard sample of hyperoside[7] is described in Pharmacopoeia of the Russian Federation. The optimal extraction conditions of flavonoids from fruits of *Crataegus sanguinea* Pall. are following: exrtactant - 70% ethyl alcohol, the ratio of "raw-extractant" 1:30, extraction time - 60 min[1]. The relative degree of the determination of total flavonoids in fruits of *Crataegus sanguinea* Pall. in present method with confidence probability 0,95 is no more than ±3,5%. The content of total flavonoids in fruits of *Crataegus sanguinea* Pall., which are growing on the territory of Orenburg region, is 0,22±0,002%; in industrial samples of raw materials of *Crataegus sanguinea* (OAO "Krasnogorskleksredstva") is 0,19±0,002%.

It is obvious, that the climatic conditions of the Orenburg region are favorable for the accumulation of large amounts of biologically active substances in medicinal plants.

CONCLUSION

Medical raw materials of *Frangula alnus* Mill., *Rhamnus cathartica* L., *Salvia tesquicola* Klokov & Pobed., *Aronia melanocarpa* Elliot., *Crataegus sanguinea* Pall., which are growing on the territory of Orenburg region, were studied during the research. The research's results allow saying that the content of biologically active substances

in raw material of studied plants corresponds to normative parameters, and in some cases exceeds them.

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