



CHEMICAL CONTENT OF SOME REPRESENTATIVES OF THE GENUS RIBES (*RIBES* L.)

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ABSTRACT

The article overviews the results of studying the biological characteristics and chemical content of cliff Ribes (*Ribes Bibersteinii* Berl. ex DC.) and mountain Ribes (*Ribes alpinum* L.) growing wild in

Ajara highlands and gaining high-quality raw materials and production. Based on studying simple carbohydrates in the fruits of research species, fructose and lactose appeared dominants and their contents were quantitatively determined. Glucose is dominant in mountain Ribes, while cliff Ribes contain more fructose; After studying organic acids in fruits, citric acids and malic acids were identified. The amount of citric acid is almost twice more than malic acid in the studied samples; the Amount of common phenols and common flavonoids, total anthocyanins in the fruits of research species were determined; antioxidant activities. Their fruits significant amount of anthocyanins. Wild-growing genus *Ribes* L.: *Ribes bibersteinii* Berl. ex DC. and *Ribes alpinum* L. (mountain Ribes) recognized as edible and suitable for processing are appreciated for their high content of bioactive compounds rising their medicinal properties.

KEYWORDS: *Ribes Bibersteinii* Berl. ex DC., *Ribes alpinum* L., Simple Carbohydrates, Organic Acids, Phenols, Flavonoids, Anthocyanins.

INTRODUCTION

Georgia is called an open-air bank for genetic resources, unique physical-geographical, climatic and soil conditions determine the flora diversity and create opportunities for the

cultivation of important species including medicinal, nectar-containing, aromatic, spicy, and poisonous plants.^[1-2]

While studying the useful plant genetic resources of Georgia, it was identified that the unique and diverse richness of the country is not properly catalogized and consumed. Moreover, technologies for caring, growing and rational usage of wildly used plants are not processed. The genus *Ribes*, such a popular plant belongs to one of these.^[5-6]

Therefore, we set a goal to study the biological peculiarities and chemical content of this valuable plant. Considering the features of the mentioned plant and the country's rich ethnobotanical traditions, it is possible to create a more efficient model for plant uses.

The genus *Ribes* (*Ribes* L.) is one of the significant berry crops in Georgia. It belongs to the family Grossulariaceae (*Grossulariaceae* DC.). There are lots of cultural forms and breeds of *Ribes* consumed in various ways, however, it's always interesting and topical to research wild species or ancestors of cultural forms. In addition, biodiversity protection and conservation, and sustainable consumption are one of the main priorities of contemporality. This issue is especially important for Georgia, which is rich in unique biodiversity but with a small landmass.^[4; 7-13]

Based on the analysis of ethnobotanical traditions and literature sources, we selected *Ribes* common to the highlands of Georgia. It is used for food, medicinal, cosmetic and perfumery purposes. The officinal raw materials of *Ribes* are leaves, shoots, fruit and bark. However, not only raw fruit is rich in bioactive substances, but also its dry, frozen and variously processed products.^[8;10;14]

OBJECT AND METHODS

Research goal - Studying biological peculiarities and chemical content of less distinguished and studied species of the genus *Ribes*, cliff *Ribes* (*Ribes Bibersteinii* Berl. ex DC.) and mountain *Ribes* (*Ribes alpinum* L.) growing wild in the floristic region of Georgia, in particular, Ajara highlands to receive high-quality raw materials and products.

Quantitative and qualitative identification of chemical content of bioactive substances in leaves, shoots and ripen fruits of *Ribes* – the content of simple carbohydrates was determined by high-performance liquid chromatography. Water extract of research sample with 1:1

proportion was prepared for carbohydrate chromatography including centrifugation, then the sample with 1:1 proportion is added to 80% acetonitrile (moving phase).

The sample was filtered in 0.45 mkr size filter before injection. For researching quantitative content of carbohydrates, high-performance liquid chromatography (HPLC)- Waters (RI detector, Binary HPLC Pump 1525), chromatographic column amide (250 mm 4,5 mm) and Carbohydrate, column temperature 40 0 C, eluent - 80% acetonitrile (Merck; Sigma-Aldrich), detection RI. Division of compounds was carried out with a high-performance liquid chromatography method and ultraviolet, refractive index detector, while ultra-high performance liquid chromatography (HPLC) mas (MS) and PDA detector were applied for the identification.

The number of common phenols was determined with the Folin-Ciocalteu method – calculated on gallic acid. The analysis was carried out with an 80% ethyl spirit for the complete extraction of phenolic compounds. 10 g of raw samples and 5 g. of dry one were taken for the analysis. For the determination of phenolic compounds, 1 ml was taken out from the total volume of the extract added to 5ml distilled water, 1 ml Folin-Ciocalteu reagent, 10 ml sodium carbonate solution and the volume was reached to a sign-line with distilled water, then delayed for an hour for the stabilization of a reaction. The determination was conducted with a 1 cm thick cuvette at 750 nm. A relevant extragent was selected for the control.

The determination of total anthocyanins was conducted according to europarmaceopeis. Spectrophotometric identification of optical density of research samples was carried out with 528 nm 1 cm thick cuvette, calculated on cyanidin-3-O-glucoside chloride. Antioxidant activity was identified with the DPPH method, which is a colorimetry of free radicals with 50% inhibition. This method was described in 1958 by Blois for the first time and then modified many times.

The DPPH method for the identification of antioxidant activities is a rapid, simple and precise test method. It is applied not only for the identification of the ability to restrain free radicals of different compounds but also for measuring antioxidant activities in edible products and juices.

Experiment: Our publications give the outcomes of expedition-route research of wild species of Ribes: *Ribes Bibersteinii* Berl. ex DC. and *Ribes alpinum* L. growing more than

1500-2030 m above the sea level in highlands of Khulo municipality of Ajara, in particular, at the border of upper and subalpine belts of Agara valley.^[3;11] It is detected, that the coverage of Ribes species in the mentioned valley is characterized by independent groups along with the groups of low trees and plants and shrubs.

Based on the experiment, it was detected that mountain Ribes contain more glucose ($1,99\pm 0,04$), and more fructose is found in cliff Ribes ($0,86\pm 0,02$) (Table № 1).

Table № 1: Simple carbohydrates in the species of the genus Ribes.

№	sample title	Simple carbohydrates	
		Fructose g/100g	Glucose g/100g
1	<i>Ribes Bibersteinii</i> Berl. ex DC.	$0,86\pm 0,02$	$0,64\pm 0,01$
2	<i>Ribes alpinum</i> L.	$0,96\pm 0,02$	$1,99\pm 0,04$

While studying organic acids in Ribes fruits, citric and malic acids were identified. It must be mentioned that the amount of citric acid is double than malic acid in the studied samples.

The amount of citric acid fluctuates from $1,46\pm 0,03$ mg/g to $1,68\pm 0,03$ mg/g and malic acid ranges from $0,97\pm 0,02$ - $0,86\pm 0,02$ mg/g (Table № 2).

Table № 2: Organic Acids in the species of the genus Ribes.

№	Sample title	Organic Acids	
		Citric Acid g/100 g	Malic Acid g/100 g
1	<i>Ribes Bibersteinii</i> Berl. ex DC.	$1,46\pm 0,03$	$0,97\pm 0,02$
2	<i>Ribes alpinum</i>	$1,68\pm 0,03$	$0,86\pm 0,02$

Amount of common phenols and common flavonoids, total anthocyanins in the fruits of research species were determined; antioxidant activities (Table № 3).

Table № 3: The content of common phenols, common flavonoids and total anthocyanins in the fruits of Ribes species.

Sample title	The content of common Phenols calculated on gallic acid	Flavonoids calculated on rutins		Anthocyanins calculated on cyanidin-3-O-glucoside chlorides		
		Mg/kg on dry mass	Mg/kg on raw mass	Mg/kg on dry mass	Mg/kg on raw mass	Mg/kg on dry mass
<i>Ribes alpinum</i> L.	12804	51217	6434	25737	1322	5288
<i>Ribes Bibersteinii</i> Berl. ex DC.	14725	58901	6434	25737	1967	7868

CONCLUSION

Based on studying the biological characteristics and chemical content of cliff Ribes (*Ribes Bibersteinii* Berl. ex DC.) and mountain Ribes (*Ribes alpinum* L.) growing wild in Ajara highlands and gaining high-quality raw materials and production, it was identified, that. Based on studying simple carbohydrates in the fruits of research species, fructose and lactose appeared dominants and their contents were quantitatively determined. Glucose is dominant in mountain Ribes, while cliff Ribes contain more fructose.

After studying organic acids in fruits, citric acids and malic acids were identified. The amount of citric acid is almost twice more than malic acid in the studied samples.

Amount of common phenols and common flavonoids, total anthocyanins in the fruits of research species were determined; antioxidant activities. The fruit of the species of wildly growing Ribes (*Ribes* L): *Ribes bibersteinii* Berl. ex DC. and *Ribes alpinum* L. contain a significant amount of flavonoids. The anthocyanins are colored herbal glycosides and belong to the group of flavonoids. The name comes from the Greek words *anthos* – flower and *cyanos* – blue. A Ribes contain a big amount of flavonoids. Flavonoids are natural bioactive heterocyclic compounds with oxygen atoms in the ring. The name originated from the Latin word *flavus* -yellow.

Wild-growing genus Ribes (*Ribes* L): *Ribes bibersteinii* Berl. ex DC. (cliff Ribes) and *Ribes alpinum* L. (mountain Ribes) recognized as edible and suitable for processing are appreciated for their high content of bioactive compounds rising their medicinal properties.

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