Section 2. Medical science

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ANTIOXIDANT AND ANTIHYPOXIC ACTIVITY OF EMODIN AND CHRYSOPHANOL

Abstract. The aim of this research is to study the biological activity of phenolic compounds of *Rumex pamiricus* plant in Uzbekistan. Two known anthraquinone derivatives, chrysophanol and emodin has been isolated from the chloroform fraction extract of *Rumex pamiricus* roots. Chrysophanol and emodin were tested *in vitro* for antioxidant and antihypoxic activity.

Keywords: *in vitro*, antioxidant, antihypoxic, anthraquinone, chrysophanol, emodin, *Rumex pamiricus* Rech. f., *Polygonaceae*

1. Introduction

Herbal remedies play an important role in modern medicine and it appears feasible that the compounds from herbs can be helpful in prevention or treatment of different diseases [1]. The interest of natural drugs as adjunctive therapy for acute and chronic diseases has grown significantly in the recent years [2]. The phenolic compounds are of great importance in terms of various biological activities in the research work in this area. Phenolic compounds are probably the most explored natural compounds due to their potential health benefits as demonstrated in a number of studies. Continuing these studies, we began to study the phenols of the plant *Rumex pamiricus* in order to isolate natural compounds from local plant raw materials and study biological activity [3].

Plants of the genus *Rumex* L. (sorrel, dock) are widely distributed in North America, Central and Eastern Europe, Kazakhstan, the Far East and partly in the Caucasia, Russia and East Asia [4; 5; 6; 7]. This genus includes more than 250 species distributed worldwide. 16 species grow in Uzbekistan [3; 8; 9]. The herb *Rumex pamiricus* belongs to the family of *Polygonaceae*, which is widespread in Central Asia (Pamir-Alay, Tian Shan, Dzungarian Alatau), Kashgaria. One of the most common types of *Rumex* in Uzbekistan (Tashkent, Samarkand and Kashkadarya regions) [2]. It grows along wet mountain meadows, along the banks of mountain rivers and lakes. Perennial herbaceous plant reaching 60–100 cm in height (Figure –1) [3]. Since ancient times, concoction or tea from various parts of this herb has been used in folk medicine to treat diarrhea, dysentery, stercoral ulcer, as appetizer, analeptic medicine for lever, heart, as antihemorrhagic, to treat hepatitis, fever and other diseases [2]. Plants belonging to the *Polygonaceae* are known to produce a large number of biologically important secondary metabolites, such as anthraquinones, flavonoid glycosides, phenolic acids, naphthalenes, stilbenoids, steroids and leucoanthocyanidins [10]. Among wild plants, *Rumex* plants have a great potential [3]. They are already widely used as food, fodder, melliferous, and medicinal plants [6; 11; 12].

Figure 1. *Rumex pamiricus* Rech. f. Location: Beldersay, Chimgan mountains (Ugam Chatkal National Park), Tashkent region. (Pictures author: G. D. Shermatova)

2. Experimental part

2.1. Antioxidant activity of emodin and chrysophanol

The antioxidant activity of the studied substances was determined by their effect on the intensity of lipid peroxidation (LPO) processes, which was assessed by the accumulation of malondialdehyde (MDA) in *in vitro* experiments. The content of malonic dialdehyde (MDA) in experiments *in vitro* was determined by color reaction with thiobarbituric acid [209, p. 66–68]. LPO was induced with 10 μM FeSO4 in the presence of 200 μM ascorbate in a medium containing 145 mM KCl, 25 mM Tris HCl, pH 7.4. All studied samples at a dose of 1*10–5 mg/ml were dissolved in 95% ethyl alcohol. An oily solution of pharmacy vitamin E (10%) at a concentration of 1*10–5 mg/ml was used as a reference drug.

Antioxidant activity *in vitro* of the studied compounds is presented in Table 1.

Table 1. – Antioxidant activity of emodin and chrysophanol

Compounds	10^{-5} g/ml	
	MDA (n/mol/mg)	Effect in%
Control	0.98±1.25	–
Vitamin E	0.23+0.012	76.0
Emodin	0.56±0.010*	42.0
Chrysophanol	0.68± 0.009*	31.0

*Note: *statistically significant differences were noted compared with the corresponding control: at p<0.05.*

Discussion: As can be seen from the table, their inhibitory effect on the processes of lipid peroxidation in experiments *in vitro* was manifested in the range of 31.0–76.0%. The antioxidant effect of the two studied substances (emodin and chrysophanol) was 42.0–31.0%. The reference drug vitamin E (76.0%) has a more pronounced antioxidant activity.

2.2. Antihypoxic activity of emodin and chrysophanol

The antihypoxic activity of emodin and chrysophanol and the reference drug mildronate was studied on white mice of both sexes under normobaric hypoxic hypoxia. Animals were placed in a hermetic chamber 2 hours after drug administration. The results are presented in table 2.

Table 2. – Antihypoxic activity of emodin and chrysophanol

Compounds	Dose, mg/kg	Lifespan, min	Effect,%	P
1	2	3	4	5
Control	–	16.3±0.58		

1	*2*	*3*	*4*	*5*
Emodin	50 mg/kg	20.3±0.67	24.5%	$p<0.1$
Chrysophanol	50 mg/kg	21.7±1.02*	33.0%	$p>0.05$
Mildronate	100 mg/kg	23.5 ± 0.88*	44.0%	$p>0.05$

Discussion: An analysis of the experimental data presented in Table 2 indicates that, with a preliminary single administration under conditions of acute normobaric hypoxic hypoxia, the studied substances to one degree or another contribute to an increase in the lifespan of animals. The most pronounced increase in life expectancy under the influence of chrysophanol-33.0% (21.7±1.02 min). A slightly less pronounced effect was observed in emodin, its effect was 24.5% (20.3±0.67 min). Both compounds are inferior to mildronate in antihypoxic action – 44.0% (23.5 ± 0.88).

3. Conclusion

1. Emodin and chrysophanol have moderate antioxidant activity (42 and 31%, respectively) compared to the reference drug vitamin E (76%).

2. Chrysophanol has antihypoxic activity (33%) at the level of the almost control drug mildronate (44%). Emodin showed moderate activity (24%).

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