

The study of the antioxidant activity of the herb hawkbill (*Picris hieracioides* L.)  
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#### SUMMARY

The antioxidant activity of water and water-alcohol extracts from hawkweed herb was determined by the permanganometric method and the content of flavonoids and hydroxycinnamic acids in them was determined. It was shown that the maximum antioxidant activity is characteristic of the hydroalcoholic extract obtained with 70% ethyl alcohol -  $36.12 \pm 1.67$  mg/g in terms of rutin,  $35.86 \pm 1.66$  mg/g in terms of cynaroside and  $21.43 \pm 0.99$  mg/g in terms of quercetin. At the same time, the maximum amount of flavonoids ( $0.43 \pm 0.02\%$ ) and hydroxycinnamic acids ( $2.48 \pm 0.11\%$ ) was also established.

Key words: hawk throat, herb, antioxidant activity, flavonoids, hydroxycinnamic acids.

#### RESUME

The antioxidant activity of aqueous and hydroalcoholic extracts of the herb *Picris hieracioides* by permanganometric method and the content of flavonoids and hydroxycinnamic acids were determined. It was shown that the maximum antioxidant activity, for wateralcohol extraction, obtained with the help of ethyl alcohol 70% –  $36.12 \pm 1.67$  mg/g in terms of rutin,  $35.86 \pm 1.66$  mg/g in terms of cynaroside and  $21.43 \pm 0.99$  mg/g in terms of quercetine. The maximum number of flavonoids ( $0.43 \pm 0.02\%$ ) and hydroxycinnamic acids ( $2.48 \pm 0.11\%$ ) were established.

Keywords: *Picris hieracioides* L, herba, antioxidant activity, flavonoids, hydroxycinnamic acids.

#### INTRODUCTION

The impact of various adverse environmental factors contributes to a decrease in the body's defenses, including a decrease in the activity of its antioxidant systems. As a result, the concentration of free radicals in the body increases, which can lead to various pathological processes, such as cardiovascular, oncological, diabetes, hypertension, obesity, atherosclerosis, and others. The pathogenesis of these diseases is antioxidant (antioxidant) stress, which consists in the excess content of free radicals. In this regard, the problem of preventing these pathologies, the search for drugs that could slow down or completely prevent the development of these diseases, is relevant. Antioxidants necessary for the normal functioning of the body could act as such drugs. Antioxidants have the ability to inhibit free radical reactions that damage cells. They are characterized by the presence of antioxidant properties, which are based on their ability to participate in the regulation of oxidative processes in the human body [1, 2, 3].

Recently, for these purposes, medicinal plant raw materials are increasingly used, which include various biologically active substances, including phenolic compounds that exhibit antioxidant activity [4, 5]. Medicinal plant raw materials are characterized by low toxicity, mild effect on the body. It is especially effective in chronic diseases, providing the necessary effectiveness and duration of treatment. In this regard, the study of biologically active substances in plants is carried out in parallel with the study of antioxidant activity and the establishment of its dependence on the content of biologically active substances.

The aim of the work was to study the antioxidant activity and the content of phenolic compounds in the grass hawkweed.

#### MATERIALS AND RESEARCH METHODS

The object of our study was the hawk throat herb, harvested in 2016 in the vicinity of the city of Kursk during the period of mass flowering of the plant, which was dried and crushed. The plant was harvested along the Tuskar River on the slopes of the mountains. When harvesting raw materials, the upper part of the plant was cut off no more than 20 cm. It was dried by the air-shadow method, spreading the raw materials in one layer. The dried raw materials were crushed, sieved and used for research.

To study the antioxidant activity, samples of hawk-throat herb were extracted five times with the appropriate extractants in a ratio of 1:10, based on the SP XIII edition: they were heated in a boiling water bath for 15 minutes and then cooled for 45 minutes [6]. As extractants were used: purified water, water-alcohol mixtures, ethyl alcohol 96%. This definition is based on the determination of antioxidant activity by the chemical reaction between potassium permanganate and reducing substances contained in extracts from the plant under study [7, 8]. The resulting extracts were titrated to the reaction mixture containing potassium permanganate. The content of antioxidant activity was calculated in terms of flavonoid compounds: quercetin, cynaroside, rutin with previously established antioxidant activity [8].

To establish the relationship between antioxidant activity and the content of phenolic compounds, the content of flavonoids and hydroxycinnamic acids was determined. The content of flavonoid compounds in the obtained extracts was determined by spectrophotometry based on the reaction of complex formation with aluminum chloride at a wavelength of 395 nm [9]. The content of flavonoids was calculated in terms of luteolin-7-glucoside (cynaroside). The content of the sum of hydroxycinnamic acids was determined by direct spectrophotometry at a wavelength of 328 nm in terms of chlorogenic acid [10].

#### RESULTS AND DISCUSSION

The results of the studies showed that all the extracts obtained by us extract antioxidant substances and have antioxidant activity (Table 1).

Table 1

Antioxidant activity of water and water-alcohol extracts of throat herb hawkweed

Extractant	Antioxidant activity, mg/kg			Content amounts flavonoids, %	Content amounts of hydro cinnamon acids, %
	in the re- four for routine	in recalculation for cynaroside	V recalculation for quercetin		
Water purified	23.20±0.86	23.03±0.85	13.77±0.51	0.16 ± 0.001	1.93±0.08
Alcohol ethyl, 30 %	26.26 ± 1.13	26.07 ± 1.33	15.58±0.67	0.25±0.01	1.95±0.09
Alcohol ethyl, 50 %	27.97 ± 1.35	27.76 ± 1.34	16.59±0.79	0.26 ± 0.01	2.20±0.10
Alcohol ethyl, 70 %	36.12 ± 1.67	35.86 ± 1.66	21.43±0.99	0.43 ± 0.02	2.48 ± 0.11
Alcohol ethyl, 96 %	13.02±0.63	12.93±0.63	7.72±0.37	0.23±0.01	0.56 ± 0.02

However, the results of the study of antioxidant activity show different activity depending on the extractant used. In the obtained results, the relationship between antioxidant activity and the content of phenolic compounds (flavonoids, hydroxycinnamic acids) in the studied extracts is clearly traced. It has been established that extracts obtained using 70% ethyl alcohol have the maximum antioxidant activity, their antioxidant activity indicators vary from  $21.43 \pm 0.99$  mg/kg (in terms of quercetin) to  $36.12 \pm 1.67$  mg/kg (in terms of rutin). It was found that during extraction with ethyl alcohol 70%, the maximum amount of phenolic compounds is extracted: the content of the sum of flavonoids is  $0.43 \pm 0.02\%$ , and the sum of hydroxycinnamic acids is  $2.48 \pm 0.11\%$ .

The lowest antioxidant activity was found for the extract obtained with 96% ethyl alcohol. Its antioxidant activity ranges from  $7.72 \pm 0.37$  mg/kg (calculated as quercetin) to  $13.02 \pm 0.63$  mg/kg (calculated as rutin). At the same time, the content of hydroxycinnamic acids is also minimal ( $0.56 \pm 0.02\%$ ), which is explained by the fact that hydroxycinnamic acids are little extracted with ethyl alcohol 96%. The content of flavonoids is  $0.23 \pm 0.01\%$ , which is somewhat higher than when extracted with purified water, which can also be explained by the fact that flavonoids will be better extracted with ethyl alcohol 96% compared to water. Antioxidant activity when using purified water as an extractant is much higher than when using ethyl alcohol 96%. This is apparently due to the fact

#### CONCLUSIONS

1. The total antioxidant activity of aqueous and hydroalcoholic extracts from hawk throat herb. It was revealed that the water-alcohol extract obtained using 70% ethyl alcohol as an extractant has the maximum antioxidant activity. In the same extract, the maximum amount of phenolic compounds was found.

2. The value of antioxidant activity is significantly related to the content of phenolic compounds with a positive correlation.

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