

ANTIOXIDANT ACTIVITY OF ENDEMIC MEDICINAL PLANTS OF UZBEKISTAN

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Аннотация

Была исследована антирадикальная активность эндемичных лекарственных растений Узбекистана (*Ajuga turkestanicus* L., *Rhodiola heterodonta* L. и *Leonurus turkestanicus* L.) -с использованием свободного радикала ДФПГ. Был проведен фитохимический скрининг экстрактов на содержание общих флавоноидов, общих сапонинов, общих терпеноидов, общих танинов и общих фенольных соединений.

Ключевые слова: вторичные метаболиты, традиционная медицина, здравоохранение

Abstract

The free-radical scavenging activities of endemic medicinal plants of Uzbekistan were investigated by DPPH assay. The crude ethanol extracts of *Ajuga turkestanicus* L., *Rhodiola heterodonta* L., and *Leonurus turkestanicus* L. were analyzed for their total flavonoids, total saponins, total terpenoids, total tannins and total phenols. The quantity of secondary metabolites in the extracts was measured.

Key words: secondary metabolites, traditional medicine, healthcare

Abstract

O'zbekistonning endemik dorivor o'simliklarining DFPG erkin radikali ingibirlash faoliyati o'rganildi. *Ajuga turkestanicus* L., *Rhodiola heterodonta* L. va *Leonurus turkestanicus* L.ning xom etanol ekstraktlari ularning umumiy flavonoidlari, umumiy saponinlar, umumiy terpenoidlar, umumiy tanninlar va umumiy fenollar uchun tahlil qilindi.

Kalit so'zlar: ikkilamchi metobolitlar, an'anaviy tibbiyot, sog'likni saqlash

Introduction

Plants have always been a common source of medicaments, either in the form of traditional preparations or as pure active principles [1]. It is thus reasonable for decision-makers to identify locally available plants or plant extracts that could usefully be added to the national list of drugs, or that could even replace some pharmaceutical preparations that need to be purchased and imported. The plant-derived drugs, sourced from endemic medicinal plants and their extracts, can provide safe and effective treatment options for various health conditions. Furthermore, the utilization of endemic medicinal plants and their extracts can also contribute to reducing dependence on imported pharmaceutical drugs, making healthcare more accessible and affordable for communities, especially in resource-limited settings. Natural compounds obtained from different medicinal and aromatic plants have gained respect as alternative treatments to synthetic drugs, as well as raw materials for different applications [2]. *Ajuga turkestanica* L., also known as Turkestan bugleweed, is a perennial herbaceous flowering plant native to Central Asia. Local herbalists traditionally prescribe it as a tonic. Interestingly, bodybuilding supplements containing extracts of *A. turkestanica* can be found online, although the anabolic effects in mammals remain

unclear and research results have been inconsistent. *Rhodiola heterodonta* is indeed an endemic medicinal plant of Uzbekistan, known for its antioxidant properties and bioactive compounds [3]. The diverse pharmacological activities of *Rhodiola* species, including *R. heterodonta*, make them valuable in traditional medicine and for potential drug discovery [4]. *Leonurus turkestanicus*, as an endemic plant of Uzbekistan, possesses medicinal properties that contribute to the country's rich herbal medicine heritage.

The aim of the present work was to investigate antioxidant and free-radical scavenging activity of endemic medicinal plants of Uzbekistan.

Materials and methods

The crude ethanol extracts of *Ajuga turkestanica* L. (AT) aerial part, *Rhodiola heterodonta* L. (RH) roots and *Leonurus turkestanicus* L. (LT) aerial parts were generously provided by Ltd BIOTON (Tashkent, Uzbekistan). Extracts were diluted in distilled water and then further tested for the presence of flavonoids [5], saponins [6], phenols [7], protein [8], terpenoids (steroids) [9], alkaloids [10], tannins [11], and cardiac glycosides [6]. The qualitative results are expressed as positive for the presence and negative for the absence of phytochemicals.

The quantity of following secondary metabolites was measured: total flavonoids (TFC) [12]; total saponins (TSC) [13]; total terpenoids (TTrC) [14]; total phenols (TPC) [15]; total tannins (TTC) [16].

Results and discussion

Our preliminary phytochemical analysis of crude ethanol extract of AT, RH and LT revealed the presence of some secondary metabolites such as flavonoids, saponins, phenols, tannins, and terpenoids. No traces of proteins, alkaloids or cardiac glycosides were detected.

Extracts were examined for their total flavonoids, saponins, tannins, phenols, and terpenoids content (Table 1). Total tannin content was estimated by epigallocatechin and expressed as 0.03 ± 0.000 (AT), 0.308 ± 0.0154 (RH) and $323,50 \pm 16,2$ (LT) $\mu\text{g/eq}$ epigallocatechin 100 mg/DW. The results were derived from a calibration curve of epigallocatechin ($y = 0.3629x + 0.2201$; $R^2 = 0.982$). Total phenolic content was estimated by gallic acid and expressed as 255 ± 10.75 (RH) and 77.12 ± 0.8 (LT) /eq gallic acid at 100 mg/DW. The results were derived from a calibration curve of gallic acid ($y = 0.00081x + 0.0151$; $R^2 = 0.985$). Total saponin content was estimated by glycyrrhizic acid and expressed as 3.028 ± 0.02 (AT), 0.441 ± 0.022 (RH) and $0,769 \pm 0,04$ (LT) $\mu\text{g/eq}$ glycyrrhizic acid acid 100 mg/DW. The results were derived from a calibration curve of glizzirizic acid ($y = 1.1807x + 0.2489$; $R^2 = 0.989$). Total flavonoid content was estimated by rutin and expressed as 0.02 ± 0.00 (AT), 192 ± 9.4 (RH) and $58,73 \pm 2,9$ (LT) mg/eq rutin 100 mg/DW. The results were derived from a calibration curve of rutin ($y = 0.0826x + 0.001$; $R^2 = 0.9776$). Total terpenoids content was estimated by ecdysterone and expressed as 0.82 ± 0.00 (AT) and 111 ± 6.55 (RH) $\mu\text{g/eq}$ ecdysterone 100 mg/DW. The results were derived from a calibration curve of ecdysterone ($y = 0.00081x + 0.0151$; $R^2 = 0.985$).

Table 1. Phytochemical screening of AT, RH, LT extracts.

	AT	RH	LT
Total flavonoids content (mg/eq rutin 100 mg/DW)	0.02 ± 0.00	192 ± 9.4	$58,73 \pm 2,9$
Total saponins content ($\mu\text{g/eq}$ glycyrrhizic acid acid 100 mg/DW)	3.028 ± 0.02	0.441 ± 0.022	$0,769 \pm 0,04$
Total tannins content	0.03 ± 0.000	0.308 ± 0.0154	$323,50 \pm 16,2$

($\mu\text{g}/\text{eq}$ epigallocatechin 100 mg/DW)			
Total phenolics content (mg/eq gallic acid at 100 mg/DW)	-	255 $\pm$ 10.75	77.12 $\pm$ 0.8
Total terpenoids content ($\mu\text{g}/\text{eq}$ ecdysterone 100 mg/DW)	0.82 $\pm$ 0.00	111 $\pm$ 6.55	-

Radical scavenging activity was observed by DPPH protocols. Table 2 summarizes the *in vitro* antioxidant capacity of AT, RH, LT expressed as IC₅₀ mg/ml.

Table 2. *In vitro* DPPH radical scavenging activity (n=10, mean $\pm$ SEM p<0.001).

DPPH, IC ₅₀ (mg/mL)		
<i>Ajuga turkestanica</i> L.	<i>Rhodiola heterodonta</i> L.	<i>Leonurus turkestanikus</i> L.
4.87 $\pm$ 0.03	0.0134 $\pm$ 0.00	4.2 $\pm$ 0.002

Compounds like phenolic compounds, flavonoids, tannins, and other secondary metabolites present in these plant extracts play a crucial role in their antioxidant and free radical scavenging activities. These findings highlight the potential of plant extracts in preventing oxidative stress-related diseases and promoting overall health and well-being. The efficient extraction of antioxidants from endemic plants and determining their antioxidant activity has posed a significant challenge for researchers in this field. However, recent studies have shown that the extent of antioxidant activities in these extracts is correlated with the amounts of phenolics and flavonoids present.

Conclusion

Our results suggest that extracts from various endemic plants possess significant antioxidant activities, which may contribute to their potential as sources of natural health-promoting compounds and as prophylactic agents in medicine. Further studies of the antioxidant activity of these plant extracts can provide insights into potential health benefits and contribute to the development of natural remedies and pharmaceuticals. Additionally, these studies contribute to the conservation of biodiversity by highlighting the value of endemic plants in medicine and health, and promote sustainable use of natural resources.

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