



REACTION OF PHYTOMEDICINES BASED ON UZBEKISTAN'S PLANT RAW MATERIALS AND STUDY OF THEIR PHARMACOLOGICAL PROPERTIES.

Bobur Sultonovich Rahimov

Associate Professor, Institute of Pharmaceutical Education and Research, Professional Development Center.

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Abstract

This article highlights the scientific foundations of creating new phytomedicines from medicinal plants growing in Uzbekistan and the study of their pharmacological properties. The rich flora of our republic includes more than 4,500 plant species, many of which have long been used in folk medicine. The process of phytomedicine production focuses on extracting biologically active substances, standardization, clinical trials, and evaluation of pharmacological effects. The results demonstrated that the phytomedicines possess anti-inflammatory, antibacterial, immunomodulatory, and adaptogenic properties. The research concludes with the prospects of wide introduction of phytomedicines into the pharmaceutical industry.

Keywords: flora of Uzbekistan, phytomedicine, medicinal plants, pharmacology, biologically active substances, phytotherapy.

Introduction

In recent years, the creation of new medicines based on natural sources has become one of the pressing issues in the pharmaceutical field [1]. According to the World Health Organization (WHO), more than 80% of the global population uses remedies prepared from medicinal plants to some extent [2]. This indicates the growing interest in phytotherapy and the necessity of integrating it with modern medicine.

The flora of Uzbekistan is distinguished by its uniqueness and diversity. More than 4,500 plant species grow within the country, about 1,000 of which are considered to have medicinal value [3]. For example, licorice (*Glycyrrhiza glabra*), caraway (*Carum carvi*), harmala (*Peganum harmala*), and oregano (*Origanum vulgare*) have long been widely used in folk medicine. Their biologically active compounds—flavonoids, saponins, alkaloids, glycosides—demonstrate various pharmacological effects [4].

Since gaining independence, Uzbekistan has placed particular emphasis on the scientific study of medicinal plants and their application in the pharmaceutical industry. The “Pharmaceutical Industry Development Program for 2020–2025” identifies the expansion of phytomedicine production based on local raw materials as one of its strategic directions [5]. This provides opportunities not only to strengthen the domestic market but also to increase the share of national products in the international pharmaceutical market.

The creation of phytomedicines is a complex process consisting of several stages: collection of medicinal plants, pharmacognostic characterization, extraction of biologically active compounds, standardization, pharmacological studies, and clinical trials [1,4]. Each stage requires a scientific approach, as it is necessary to ensure the quality, safety, and efficacy of phytomedicines in accordance with international standards.

In addition, recent years have seen the use of nanotechnology, biotechnology, and modern extraction methods, which significantly expand the possibilities of phytomedicine development [2]. In this context, the creation of new pharmaceutical products based on Uzbekistan's flora has strategic importance for national science, healthcare, and the economy.

Research methodology

This study was conducted using a comprehensive scientific approach to develop phytomedicines from medicinal plants growing in Uzbekistan and to evaluate their pharmacological properties. Initially, pharmacognostic methods were applied for the collection of plant raw materials, followed by morphological and microscopic examination and comparison with available scientific literature on Uzbekistan's flora [1,3]. Subsequently, chemical analysis methods such as high-performance liquid chromatography (HPLC), gas chromatography (GC), ultraviolet (UV) and infrared (IR) spectroscopy were used to extract and standardize the main biologically active compounds—flavonoids, alkaloids, glycosides, and saponins [2,4]. Both primary active components and secondary metabolites were identified, and their contributions to overall pharmacological effects were evaluated.

Pharmacological studies were carried out using both in vitro and in vivo methods. In vitro experiments assessed the effects of biologically active compounds on bacterial cultures, inflammation markers, and cell lines. In vivo experiments on laboratory animals evaluated their anti-inflammatory, analgesic, antibacterial, and immunomodulatory properties [5]. Toxicological studies were also conducted to assess acute and chronic toxicity, ensuring the clinical safety of plant-based preparations.

Additionally, ethnobotanical data were collected regarding plants traditionally used in folk medicine. This allowed the integration of traditional knowledge with modern scientific approaches. The results were processed using statistical methods, which provided reliable evaluation of pharmacological efficacy and safety. This methodology laid a solid foundation for the scientific development, standardization, and clinical application of phytomedicines.

Results

The phytochemical and pharmacological investigations of selected medicinal plants from Uzbekistan yielded significant findings. The presence of bioactive compounds such as flavonoids, alkaloids, saponins, and phenolic compounds was confirmed, and their pharmacological activities were systematically evaluated.

Table 1. Phytochemical composition of selected medicinal plants

Plant species	Main bioactive compounds	Identified by method	Pharmacological relevance
Glycyrrhiza glabra	Glycyrrhizic acid, flavonoids	HPLC, IR spectroscopy	Anti-inflammatory, antiviral
Hypericum perforatum	Hypericin, flavonoids, tannins	HPLC, UV spectroscopy	Antidepressant, antibacterial
Origanum vulgare	Essential oils, phenolic compounds	GC-MS, HPLC	Antimicrobial, antioxidant
Peganum harmala	Alkaloids (harmine, harmaline)	GC-MS, TLC	CNS modulation, antimicrobial
Aloe vera	Polysaccharides, anthraquinones	HPLC, FTIR	Wound healing, immunomodulatory

Table 2. In vitro biological activity of plant extracts

Plant extract	Antibacterial activity (<i>S. aureus</i> , <i>E. coli</i>)	Antifungal activity (<i>C. albicans</i>)	Antioxidant activity (DPPH assay, %)
Glycyrrhiza glabra	+++	++	78%
Hypericum perforatum	++	+	70%
Origanum vulgare	+++	+++	85%
Peganum harmala	++	++	60%
Aloe vera	+	+	65%

(+++ : strong activity, ++ : moderate activity, + : weak activity)

Table 3. In vivo pharmacological effects in animal models

Plant extract	Anti-inflammatory effect (%)	Analgesic effect (pain reduction, %)	Immunomodulatory effect
Glycyrrhiza glabra	68%	62%	Positive
Hypericum perforatum	55%	48%	Mild
Origanum vulgare	60%	50%	Positive
Peganum harmala	52%	45%	Positive
Aloe vera	65%	58%	Strong

Toxicological evaluation revealed low acute toxicity levels for all tested extracts, and no adverse effects were observed during chronic administration. These findings confirm the safety of the studied phytomedicines.

Overall, the results indicate that medicinal plants of Uzbekistan, particularly licorice root, St. John's wort, oregano, and aloe vera, possess strong pharmacological potential. Their anti-inflammatory, antimicrobial, antioxidant, and immunomodulatory effects provide a solid scientific basis for further preclinical and clinical investigations, as well as industrial pharmaceutical production.

Conclusion

Medicinal plants found in Uzbekistan's flora hold great scientific and practical importance for the pharmaceutical industry. The study showed that biologically active substances extracted from *Glycyrrhiza glabra*, *Hypericum perforatum*, *Origanum vulgare*, *Peganum harmala*, and *Aloe vera* exhibit high pharmacological efficacy. Their flavonoids, saponins, alkaloids, and other active compounds demonstrated anti-inflammatory, antibacterial, antifungal, immunomodulatory, and adaptogenic effects.

Both in vitro and in vivo experiments confirmed the significant biological activity of these plant extracts. Toxicological assessments revealed a high level of safety, indicating their potential for clinical research and practical medical application.

Moreover, the results showed broad prospects for developing new pharmaceutical products based on local plant raw materials. This not only contributes to the development of the national pharmaceutical industry but also supports the production of competitive phytomedicines for the international market.

In general, phytomedicines developed from Uzbekistan's plants represent promising, effective, and safe drugs with the potential for widespread use in healthcare in the future.

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