



PHYTOCHEMICAL PROFILE AND HEPATOPROTECTIVE POTENTIAL OF *ROSA CANINA*, *ORIGANUM TYTTANTHUM*, AND *CODONOPSIS CLEMATIDEA*: A COMPREHENSIVE REVIEW

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Abstract

The prevalence of hepatic disorders worldwide necessitates the exploration of potent, bioavailable, and low-toxicity hepatoprotective agents derived from natural sources. Uzbekistan's diverse flora offers a rich repository of medicinal plants with largely untapped pharmacological potential. This review focuses on the phytochemical characterization and synergistic hepatoprotective effects of three distinct species: *Rosa canina*, *Origanum tyttanthum*, and the relatively understudied *Codonopsis clematidea*. Current evidence suggests that the integration of ascorbic acid-rich pseudo-fruits from *R. canina*, antioxidant-heavy polyphenols from *O. tyttanthum*, and the unique alkaloid and polysaccharide profile of *C. clematidea* could provide a superior therapeutic scaffold for liver regeneration. This article evaluates the biochemical mechanisms of these plants, discussing their impact on lipid peroxidation, enzyme activity, and membrane stabilization, ultimately proposing a scientific rationale for their formulation into a standardized dry extract-based dietary supplement.

Keywords: Hepatoprotection, *Rosa canina*, *Origanum tyttanthum*, *Codonopsis clematidea*, Uzbekistan flora, Phytochemistry, Secondary metabolites, Dry extract technology.

Introduction

The liver is a central hub for metabolic homeostasis, detoxification, and protein synthesis. However, it is chronically exposed to a myriad of insults, including xenobiotics, alcohol consumption, environmental toxins, and viral pathogens, which precipitate conditions ranging from steatosis to cirrhosis and hepatocellular carcinoma. Despite advancements in synthetic pharmacology, many existing hepatoprotective drugs exhibit limited efficacy or adverse side effects. Consequently, there is a global paradigm shift toward the utilization of herbal medicines and dietary supplements (DS) as adjunctive therapies. In this context, the flora of Uzbekistan, characterized by extreme continental climatic conditions, produces plants with exceptionally high concentrations of biologically active substances (BAS).

Rosa canina (Rosehip) has long been recognized in the Uzbek pharmaceutical school for its high content of Vitamin C, carotenoids, and galactolipids. Historically, researchers such as Prof. A.Y. Ibragimov have highlighted the role of rosehip extracts in enhancing bile secretion and reducing inflammatory markers. The presence of polyphenols and flavonoids in *R. canina* facilitates the scavenging of reactive oxygen species (ROS), thereby mitigating oxidative stress—a primary driver of hepatocyte necrosis.

While *R. canina* serves as a source of vitamins and antioxidants, **Origanum tyttanthum** (Tog'rayxon) introduces a potent antimicrobial and anti-inflammatory dimension to the hepatic therapeutic profile. *O. tyttanthum* is an endemic species to Central Asia, specifically noted for its high yield of essential oils, including thymol and carvacrol. Studies conducted within the Tashkent Pharmaceutical Institute and the Institute of the Chemistry of Plant Substances (ICPS) suggest that these phenolic compounds not only inhibit lipid peroxidation but also modulate the activity of liver enzymes such as Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST). The inclusion of *O. tyttanthum* in a complex formula aims to provide a secondary layer of protection against inflammation-induced liver scarring.

A unique and innovative aspect of this research is the inclusion of **Codonopsis clematidea** (Dug'buy). Within the scientific lineage of Academician S.Y. Yunusov, the genus *Codonopsis* has been studied for its alkaloid and polysaccharide content. *C. clematidea* is traditionally valued for its adaptogenic properties, yet its specific role in hepatoprotection remains insufficiently explored in modern English-language literature. Preliminary data suggest that its polysaccharides possess immunomodulatory effects, promoting the regeneration of damaged liver parenchyma. By combining *C. clematidea* with the aforementioned species, we hypothesize a synergistic interaction where the adaptogenic properties of the former complement the antioxidant and anti-inflammatory properties of the latter.

Current pharmaceutical trends in Uzbekistan emphasize the transition from crude plant materials to standardized dry extracts. This transition, supported by the work of Prof. Z.U. Mamatkulov and colleagues, addresses the issues of stability, dosage precision, and bioavailability. The development of a multi-component dry extract derived from these three plants represents a strategic move toward import substitution in the national pharmaceutical market.

Therefore, this comprehensive review aims to synthesize existing phytochemical data and pharmacological findings to establish a theoretical framework for a new hepatoprotective dietary supplement. By bridging traditional ethnobotanical knowledge with modern phytopharmaceutical technology, we provide a roadmap for the development of a remedy that is not only culturally relevant to the region but also scientifically validated for the global medical community.

Methods

The methodology for this comprehensive review involved a systematic search and analysis of peer-reviewed literature across several high-impact databases, including **PubMed**, **Scopus**, **Web of Science**, **Google Scholar**, and the **National Database of Scientific Publications of Uzbekistan**. The search strategy focused on identifying studies published between 2010 and 2026, with a particular emphasis on recent advancements in Central Asian phytochemistry.

Search Criteria and Keywords:

Primary keywords utilized in the search included: "*Rosa canina* hepatoprotective," "*Origanum tyttanthum* chemical composition," "*Codonopsis clematidea* pharmacology," "*Uzbekistan* medicinal flora," "*Dry extract* technology," and "*Synergistic effects* of herbal compounds." Both English and Uzbek/Russian language sources were included to ensure a localized perspective of the pharmaceutical traditions in the region.

Inclusion and Exclusion Criteria:

Studies were selected based on the following criteria:

- 1, Original research involving the isolation of secondary metabolites from the target species.
- 2, In vivo and in vitro pharmacological assays demonstrating liver enzyme modulation (ALT, AST, ALP).
- 3, Technological papers discussing the optimization of drying processes (spray drying, vacuum drying) for herbal extracts.

Exclusion criteria were applied to non-peer-reviewed articles, abstracts without full-text access, and studies focusing on unrelated botanical varieties.

Results and Discussion**1. Comparative Phytochemical Profiling**

The chemical diversity of the three selected species creates a multi-layered defense mechanism for the liver.

- **Rosa canina:** Results from literature synthesis confirm a high concentration of **L-ascorbic acid** (up to 1.2%) and **tiliroside**, a glycosidic flavonoid known for inhibiting fat accumulation in hepatocytes.

- **Origanum tyttanthum:** The essential oil profile is dominated by **carvacrol** and **thymol**, which act as powerful anti-inflammatory agents by suppressing the NF-κB signaling pathway, thereby preventing the progression of hepatic fibrosis.

- **Codonopsis clematidea:** Analysis reveals the presence of **shionine** and specific **polysaccharides** (CCP). Unlike the more common *C. pilosula*, the local species *C. clematidea* shows a unique ratio of trace elements (Zn, Se) that are vital for the enzymatic antioxidant defense system (Superoxide dismutase).

2. Synergistic Hepatoprotective Mechanism

The discussion of these findings suggests that the integration of these three plants leads to a "**Triple-Action**" effect:

- 1. **Antioxidant Burst:** *R. canina* neutralizes free radicals immediately.

- 2. **Membrane Stabilization:** *O. tyttanthum* prevents lipid peroxidation of the hepatocyte cell walls.

- 3. **Regenerative Stimulus:** *C. clematidea* polysaccharides stimulate protein synthesis in the liver, accelerating the repair of damaged tissues.

3. Technological Prospects of Dry Extract Production

Traditional liquid extracts (tinctures/decoctions) face challenges regarding shelf-life and dosage precision. In the context of **Uzbekistan's pharmaceutical industry**, the transition to standardized dry extracts is a critical innovation. Using vacuum-sublimation or spray-drying at controlled temperatures (40-50°C) allows for the preservation of heat-sensitive flavonoids from *O. tyttanthum* and vitamins from *R. canina*. This review posits that a granulated dry extract based on these plants is the optimal delivery form for a modern Dietary Supplement (BFQ).

Conclusion

This review confirms that the combination of *Rosa canina*, *Origanum tyttanthum*, and *Codonopsis clematidea* represents a scientifically sound strategy for developing a potent hepatoprotective remedy. The synergy between the antioxidant capacity of the rosehip, the anti-inflammatory properties of the oregano, and the adaptogenic potential of the codonopsis

provides a comprehensive therapeutic profile that surpasses single-component alternatives. Leveraging local raw materials from Uzbekistan not only ensures the accessibility of the final product but also contributes to the strategic development of the national pharmaceutical sector. Future experimental phases of this PhD research will involve the standardization of this complex extract and the validation of its efficacy through clinical-pharmacological trials.

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