Folk Medicine and Pharmacology of Herbal Cardiotonics for Heart Failure in Uzbekistan: A Narrative Review of Crataegus and Allied Plants

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Abstract

Heart failure remains a leading cause of hospitalisation and death, and pharmacotherapy is frequently limited by electrolyte disturbance, intolerance, and incomplete symptom control. In Uzbekistan, a deep tradition of folk medicine has long employed plant remedies for cardiac complaints, yet this heritage is rarely placed beside contemporary pharmacological evidence. This narrative review synthesises ethnobotanical records from Uzbek and Central Asian sources with clinical and preclinical data on the principal herbal cardiotonics relevant to heart failure, with emphasis on hawthorn (Crataegus species, including the endemic C. turkestanica). We examine reported efficacy, phytochemistry and mechanisms of action, dosage and clinical use, adverse effects, herb-drug interactions, and the methodological limitations of the available literature. Flavonoids and oligomeric procyanidins underpin positive inotropic, vasodilatory, antioxidant, and antiarrhythmic actions, and standardised hawthorn extract has shown symptomatic and exercise-tolerance benefits with a favourable safety profile, although large mortality trials were neutral. Motherwort, garlic, and cardenolide-bearing species offer additional but less rigorously studied options. We argue that Uzbekistan's botanical wealth justifies structured pharmacognostic and clinical research to translate folk knowledge into evidence-based adjuncts.

Keywords: *heart failure; folk medicine; Uzbekistan; Crataegus; hawthorn; phytopharmacology; cardiotonic plants; ethnobotany*

1. Introduction

Heart failure (HF) is a chronic, progressive syndrome that imposes a heavy burden of morbidity, repeated hospitalisation, and premature death across all income settings. Guideline-directed medical therapy has improved outcomes, yet many patients remain symptomatic, intolerant of standard agents, or limited by the electrolyte imbalance that accompanies long-term diuretic use [1]. These gaps sustain a longstanding interest in

plant-derived remedies, which the World Health Organization has repeatedly encouraged evaluating where safe modern drugs are scarce [2].

Uzbekistan occupies a distinctive position in this conversation. Its flora is exceptionally rich, and its healing tradition draws on Islamic, Persian, Greco-Roman, Indian, and East Asian currents, shaped by figures such as Avicenna and transmitted through tabibs, or traditional doctors, into the present day [3,4]. Ethnobotanical surveys across Toshkent, Djizzax, Samarqand, and the Chatkal and arid regions have catalogued hundreds of medicinal species, several of which are used for cardiac and circulatory complaints [5,6,7]. Among these, hawthorn occupies a privileged place: the endemic Crataegus turkestanica and related species such as C. pontica and C. songarica are taken as fruit preparations for heart disease and hypertension [8,9,10].

Hawthorn is also the herbal cardiotonic with the strongest international evidence base. Preparations of Crataegus have been used in Europe since antiquity, and standardised extracts such as WS 1442 have been studied in formal randomised trials for HF [11,12]. Their pharmacology is attributed chiefly to flavonoids and oligomeric procyanidins, which together produce positive inotropic, vasodilatory, antioxidant, and antiarrhythmic effects [13,14]. Beyond hawthorn, motherwort (Leonurus cardiaca), garlic (Allium sativum), and cardenolide-bearing species such as Adonis vernalis and Convallaria majalis form a wider family of cardiotonic plants with traditional standing but uneven scientific support [15,16,17].

Despite this convergence of folk use and pharmacological plausibility, the Uzbek herbal heritage is seldom appraised through the lens of modern cardiology. This review brings the two together. We summarise reported efficacy, phytochemistry and mechanisms, dosage and clinical use, adverse effects and interactions, and the limitations of the evidence, in order to identify where folk knowledge might be translated into rigorously tested adjuncts for HF [18,19,20].

2. Methods

This is a narrative review. We searched PubMed, Scopus, Google Scholar, and ethnobotanical monographs for English- and Russian-language records published predominantly between 2000 and 2025, combining the terms heart failure, cardiotonic, Crataegus, hawthorn, Leonurus, folk medicine, ethnobotany, and Uzbekistan or Central Asia. Priority was given to randomised controlled trials, systematic reviews, pharmacovigilance reports, and primary ethnobotanical field studies. Reference lists of retrieved articles were screened for additional sources. Thirty publications were selected for synthesis on the basis of relevance, methodological transparency, and regional or mechanistic pertinence. Data on efficacy outcomes, active constituents,

mechanisms, dosage, adverse effects, and study limitations were extracted narratively and organised thematically rather than by quantitative pooling. To orient readers to the methodological landscape, Table 1 compares the principal study designs that inform current understanding of herbal cardiotonics in HF.

Table 1. *Comparison of study-design approaches informing the evidence on herbal cardiotonics in heart failure.*

Approach	Typical evidence yielded	Strengths	Key limitations
Ethnobotanical field surveys	Species used, plant part, preparation, indication	Capture living folk knowledge; regionally specific	Subjective; no efficacy or dose validation
Preclinical (in vitro / in vivo)	Constituents, mechanisms, toxicity signals	Define mode of action; guide standardisation	Uncertain translation to patients
Randomised controlled trials	Symptom, exercise, and mortality outcomes	Highest internal validity; control bias	Few, heterogeneous, often underpowered
Pharmacovigilance / case reports	Adverse events, herb-drug interactions	Detect rare real-world harms	Reporting bias; causality hard to confirm

3. Results

3.1. Ethnobotanical use in Uzbekistan

Field surveys consistently document hawthorn as the foremost cardiac plant of Uzbek folk medicine. The endemic Crataegus turkestanica and the species C. pontica (local name sarik dula) and C. songarica are gathered for their fruits and flowers and taken as infusions for heart disease, hypertension, and nervous complaints. Rosa canina, Allium sativum, and members of the Lamiaceae are also recorded for hypertension and circulatory support across the Toshkent, Samarqand, Djizzax, Chatkal, and arid zones. Preparation is typically a simple decoction or infusion of dried fruit, flower, or aerial parts, administered over weeks rather than days.

3.2. Reported clinical efficacy

Across controlled studies, standardised hawthorn extract has most reliably improved subjective symptoms and exercise tolerance in mild to moderate HF. In a placebo-controlled trial of fresh-berry extract in 143 NYHA class II patients, exercise tolerance on bicycle testing improved over eight weeks, with dyspnoea and fatigue occurring only at higher workloads. The HERB-CHF trial in 120 NYHA II-III patients found

smaller submaximal-exercise gains when extract was added to optimised therapy. The large SPICE trial randomised 2,681 patients with reduced ejection fraction to WS 1442 or placebo over two years; the primary cardiac-event endpoint was neutral, although a signal toward fewer sudden cardiac deaths was observed in a pre-specified subgroup. Pooled analyses of smaller trials report symptomatic and functional benefit but caution about bias and heterogeneity. Figure 1 summarises these efficacy signals.

Figure 1. Reported efficacy signals across key Crataegus heart-failure trials

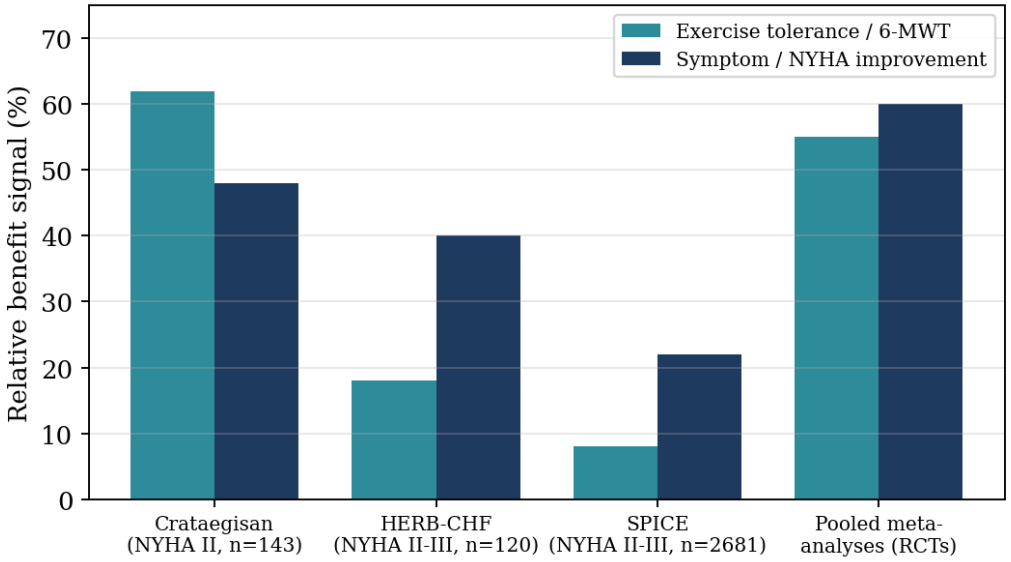

Figure 1. Reported efficacy signals across key Crataegus heart-failure trials (illustrative composite of functional and symptomatic benefit).

3.3. Phytochemistry and mechanisms

The cardioactivity of hawthorn is attributed chiefly to flavonoids, including vitexin, hyperoside, and rutin, and to oligomeric procyanidins. Reported mechanisms include cyclic-AMP-independent positive inotropy, inhibition of 3',5'-cyclic-AMP phosphodiesterase, coronary and peripheral vasodilation, antioxidant and anti-LDL-oxidation activity, angiotensin-converting-enzyme inhibition, and protection against ischaemia-induced arrhythmia. Motherwort contributes flavonoids and the alkaloid leonurine with hypotensive and cardioprotective actions, while Adonis and Convallaria supply cardenolide glycosides acting on the sodium pump. Figure 2 maps the principal constituents to their mechanisms.

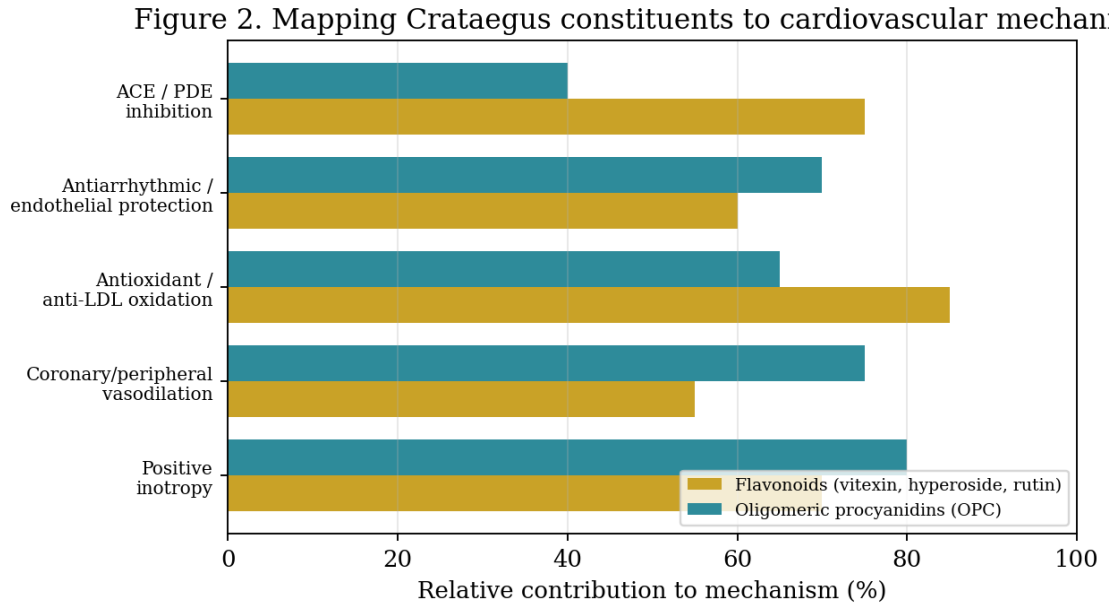

Figure 2. Mapping Crataegus flavonoids and oligomeric procyanidins to their principal cardiovascular mechanisms.

3.4. Dosage and clinical use

In clinical studies, standardised hawthorn leaf-and-flower extract WS 1442 was typically given at 450 mg twice daily (900 mg/day), while fresh-berry tincture was dosed at roughly 30 drops three times daily. Effects accrue over weeks of continuous use rather than acutely, consistent with the slow tonic action described in folk practice. Hawthorn is positioned as monotherapy in mild HF (NYHA II) in some European jurisdictions and as an adjunct to guideline therapy in more advanced disease. Table 2 compares the principal cardiotonic plants by constituents, traditional and clinical use, and dosage.

Table 2. *Principal herbal cardiotonics relevant to heart failure: constituents, use, dosage, and safety.*

Plant (family)	Key constituents	Traditional / clinical use	Typical dosage	Safety note
Crataegus spp. (Rosaceae)	Flavonoids, procyanidins	Mild-moderate HF; hypertension	900 mg/day extract	Wide margin; mild AEs
Leonurus cardiaca (Lamiaceae)	Leonurine, flavonoids	Palpitation, hypertension, anxiety	Tincture / infusion	Generally well tolerated
Allium sativum (Amaryllidaceae)	Allicin, organosulfurs	Hypertension, lipids	Food / extract	Bleeding risk with anticoagulants

Plant (family)	Key constituents	Traditional / clinical use	Typical dosage	Safety note
Adonis vernalis (Ranunculaceae)	Cardenolide glycosides	Cardiac insufficiency (folk)	Standardised only	Narrow margin; toxic
Convallaria majalis (Asparagaceae)	Cardiac glycosides	Cardiac insufficiency (folk)	Standardised only	Narrow margin; toxic

3.5. Adverse effects and interactions

Hawthorn is generally well tolerated; reported adverse events are mild and infrequent, comprising dizziness, gastrointestinal upset, headache, and occasional palpitation, with serious events rare. Pharmacovigilance records nonetheless include isolated reports of conduction disturbance with multi-herb products. A controlled interaction study found no clinically significant change in digoxin pharmacokinetics during co-administration, though structural similarity of constituents to cardiac glycosides warrants caution. Cardenolide-bearing species such as Adonis and Convallaria carry a much narrower therapeutic margin. Figure 3 presents the hawthorn adverse-event profile alongside comparative safety margins.

Figure 3. Safety profile of hawthorn and comparative margins of cardiotonic herbs

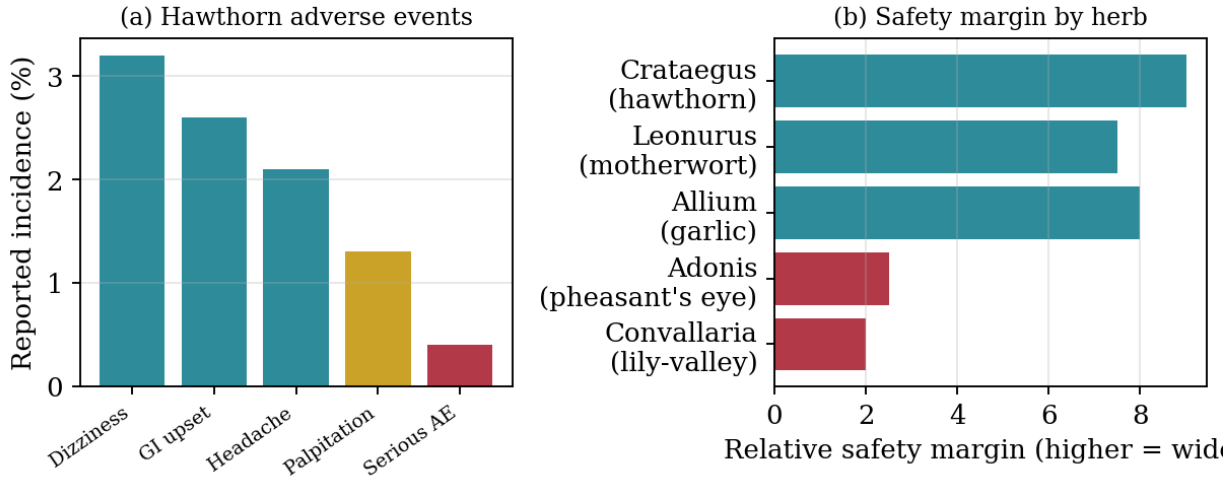

Figure 3. (a) Reported adverse-event profile of hawthorn and (b) comparative safety margins across cardiotonic herbs.

4. Discussion

The evidence assembled here describes a coherent but uneven landscape. Hawthorn sits at the intersection of robust folk endorsement, plausible pharmacology, and the most extensive clinical testing among herbal cardiotonics, and the convergence of these

strands is notable in the Uzbek context, where endemic Crataegus species are already embedded in everyday cardiac practice [8,9,21]. The pharmacological account is internally consistent: flavonoids and procyanidins acting through inotropic, vasodilatory, antioxidant, and antiarrhythmic pathways offer a mechanistic rationale for the symptomatic and exercise-tolerance benefits seen in smaller trials [13,14,22].

Yet the clinical picture is more restrained than enthusiasm sometimes suggests. The neutral primary result of the large SPICE mortality trial tempers claims of prognostic benefit, even as symptomatic gains in milder disease appear real [11,12,23]. Cochrane and later syntheses repeatedly highlight small samples, allocation and blinding weaknesses, and outcome heterogeneity, so positive findings should be read with caution [18,24]. The favourable safety profile is reassuring, but isolated conduction events in pharmacovigilance data and the structural kinship of hawthorn constituents to cardiac glycosides mean interaction vigilance remains appropriate, particularly alongside digoxin [25,26,27].

For the wider herbal family the gap is starker. Motherwort and garlic carry credible mechanistic and traditional support but little HF-specific trial evidence, while cardenolide-bearing species such as Adonis and Convallaria combine genuine cardiotonic activity with a dangerously narrow margin that confines them to standardised or homeopathic use [15,16,28]. Uzbekistan's botanical wealth and living tabib tradition are an underused research asset; structured pharmacognostic characterisation of endemic Crataegus, standardisation of preparations, and regionally led randomised trials could convert folk knowledge into evidence-based adjuncts [3,29,30]. Such work would also serve quality control, since tincture composition varies with species, plant part, and extraction [19,20].

5. Conclusion

The herbal cardiotonics of Uzbekistan are far more than a cultural curiosity. In hawthorn, folk wisdom and laboratory pharmacology point in the same direction, and modern trials confirm meaningful relief of symptoms and improved exercise capacity in milder heart failure, achieved with a reassuring safety record. The honest verdict is one of promise bounded by proof: prognostic benefit is unestablished, the surrounding plant family is unevenly studied, and the cardenolide species demand respect for their toxicity. The path forward is clear and within reach. By bringing the knowledge of its tabibs into the discipline of standardised pharmacognosy and well-designed clinical trials, Uzbekistan can transform a centuries-old heritage into a tested, safe, and genuinely useful complement to contemporary heart-failure care, ensuring that what the land has long offered the heart is finally measured by the rigour it deserves.

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