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Review

A Review on the Potential Use of Medicinal Plants from the Apiaceae and the Rosaceae Families in Cardiovascular Diseases—Experimental Evidence and Traditional Applications

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Abstract: Cardiovascular diseases are the leading cause of mortality worldwide. The World Health Organization has presented alarming data stating that in 2019, 17.9 million people globally died due to cardiovascular diseases, constituting 32% of all deaths. Despite increasingly advanced pharmacological and procedural treatment methods for these diseases, there is still a quest for new therapeutic possibilities that promise even greater efficacy and safety. The overriding purpose of this study is to provide an insight into the traditional uses of species from the Apiaceae and Rosaceae families as well as to systematize knowledge regarding their scientifically proven cardiovascular activities (animal studies and clinical trials). The review is intended to indicate knowledge gaps for future studies concerning plants used in traditional medicine but without scientific research. As a result, various plant species from both Apiaceae and Rosaceae family have been collected and described based on their study that has proven their effectiveness and uses in cardiovascular diseases. Most of these plants have a hypotensive effect, followed by anti-hyperlipidemic, vasorelaxant, antithrombotic, and diuretic activity. These are the mechanisms that contribute to various cardiovascular diseases, such as heart attack, coronary heart disease, hypertension, and stroke.

Keywords: cardiovascular diseases; medicinal plants; Apiaceae; Rosaceae; traditional use

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1. Introduction

An extensive body of scientific literature suggests that cardiovascular diseases (CVDs) significantly contribute to global mortality and diminish the quality of life in developing countries.

The World Health Organization has published alarming data stating that in 2019, 17.9 million people globally died due to cardiovascular diseases, constituting 32% of all deaths [1]. Of this vast number of deaths, a staggering 85% were caused by sudden cardiac incidents and strokes. According to the World Heart Federation data [2] in 2021, the number of people affected by cardiovascular diseases exceeded half a billion.

Among the cardiovascular diseases and conditions causing significant increase in mortality in the population, the following should be listed: coronary artery disease [3], stroke [4], heart failure [5], peripheral artery diseases [6], arrhythmias [7], cardiomyopathies [8], valve defects [9], congenital heart defects [10], infective endocarditis [11], myocarditis [12], pericarditis [13], and rheumatic heart disease [14].

Among the diseases within the domain of cardiology, ischemic heart disease, particularly in its acute form—myocardial infarction—as well as heart failure and arterial hypertension, exacts the greatest toll. At the core of coronary artery disease lies the formation of atherosclerotic plaque, which leads to the narrowing of the vessel lumen, subsequently impairing blood flow and ultimately culminating in the obstruction of perfusion to the heart muscle, clinically manifested as a heart attack. Coronary artery disease and arterial hypertension are the most common causes of heart failure.

CVDs are diseases of multifactorial etiology, and thus, it is well established that reducing certain risk factors can prevent morbidity of heart disorders. The following behaviors should be avoided: tobacco use (smoking), harmful use of alcohol, unhealthy (high-fat and high-glycemic index) diet as well as physical inactivity leading to obesity. Moreover, the risk of CVDs increases with age, the presence of comorbidities such as diabetes, hyperlipidemia, dyslipidemia, chronic inflammation, and previous family history of heart attack [15,16].

Various branches of science, including medicinal chemistry, drug chemistry, cardiology, experimental pharmacology, and drug development supported by mathematical modeling incessantly search for new substances with potential therapeutic use in cardiovascular system's disorders. The investigation of novel molecules with efficacy against CVDs seems to be a great challenge due to the side effects of long-term clinical trials, and thus, the exploration of natural ingredients used in traditional medicine seems to be increasingly common. It is worth noting that in 2023, an article regarding the significant role of colchicine in the treatment of atherosclerosis and CVDs was published [17]. Colchicine is a strongly acting alkaloid extracted from plants belonging to the *Colchicum* genus (Colchicaceae). Taking into consideration the significant anti-inflammatory properties, colchicine is included in new recommendations concerning the treatment of atherosclerosis. The evidence described above confirms the importance of focusing the attention on natural resources. Plants contain significant amounts of miscellaneous phytochemicals and bioactive compounds with important health-promoting and medicinal values. The survey of plants used traditionally is of great importance for the effectiveness of treatment, with a view to using them in prevention and in polytherapy with existing chemical drugs.

Although the scientists have studied extensively many properties of various plants, a very small proportion of approximately 500,000 existing plant species have been subjected for biological activities. According to Wong et al. [18], over 2000 plant species possess a scientifically proven ability to reduce cardiovascular-related conditions.

In addition to the abovementioned colchicine, there are many substances of plant origin that have completely revolutionized the treatment in the field of cardiology, namely aspirin, amiodarone, reserpine, and digoxin. Aspirin, obtained from *Salix alba* bark extract (Salicaceae), was discovered in the 1890s by Bayer on the basis of salicin. Due to its significant antithrombotic activity, the application of aspirin in the treatment of vascular disorders reduced the mortality rate by 23% [19]. Amiodarone, an anti-arrhythmic drug playing a pivotal role in medicine, is of plant origin and was obtained from *Ammi visnaga fructus* (Apiaceae). Digoxin derived from *Digitalis purpureae folium* and *Digitalis lanatae folium* is widely used for the management of heart failure and atrial fibrillation. Reserpine obtained from *Rauvolfia serpentina* roots (Apocynaceae) belongs to the indole alkaloid group and is used in the treatment of high blood pressure. In addition, recent scientific reports indicate a significant role of phytocannabinoids obtained from *Cannabis sativa* (Cannabaceae) in multiple CVDs, which is related to their impact on the cannabinoid system associated with the cardiovascular system [20].

Apiaceae Lindl. (formerly known as Umbelliferae Juss.) is one of the largest plant families in the world, and as reported in databases such as The World Flora Online [21] and Plants of the World Online [22], it includes approximately 466 genera and 3820 species worldwide. Representatives of this family are commonly used as culinary vegetables, namely carrot (*Daucus carota* L.), parsley (*Petroselinum crispum* (Mill.) Fuss), celery (*Apium graveolens* L.), dill (*Anethum graveolens* L.), and fennel (*Foeniculum*

vulgare Mill.). Furthermore, the Apiaceae family is abundant with immensely popular aromatic plants which have a characteristic pungent smell resulting from the presence of essential oils or oleoresin, i.e., caraway (*Carum carvi* L.), cumin (*Cuminum cyminum* L.), coriander (*Coriandrum sativum* L.), and anise (*Pimpinella anisum* L.) [23].

The Rosaceae Juss. family is very large and, according to databases published on the Internet [21,22], encompasses approximately 108 genera and 5243 species. This is one of the most commercially important families, including ornamental plants (roses grown in gardens) and edible fruits such as apples (*Malus domestica* (Suckow) Borkh.), strawberries (*Fragaria ananassa* (Duchesne ex Weston) Duchesne ex Rozier), apricots (*Prunus armeniaca* L.), pears (*Pyrus communis* L.), peaches (*Prunus persica* (L.) Batsch), plums (*Prunus domestica* L.), and many others (e.g., *Amygdalus* L.).

The common features of both the Apiaceae and Rosaceae families are that they are widely used as culinary plants (edible vegetables and fruits), are readily available, and contain a lot of polyphenols. Given the widespread practical culinary applications of plants from the Apiaceae and Rosaceae families, considering them as curative plants has been slightly overlooked and underestimated. That said, we decided to design a review regarding these both plant families. To the best of our knowledge, this is the first study gathering experimental evidence and traditional applications of these plants.

2. The Aim of the Study

The overriding purpose of this study is to provide an insight into the traditional uses of species from Apiaceae and Rosaceae families as well as to systematize knowledge regarding their scientifically proven cardiovascular activities (animal studies and clinical trials). The review is intended to indicate knowledge gaps for future studies concerning plants used in traditional medicine but without scientific research. Folk medicine has paved the way for the discovery of novel molecules possessing the capacity to protect the cardiovascular system, thus the surveying of phytochemicals, plant extracts, and polyherbal formulations is of great significance.

3. Methods

To gather the data, the current overview collaborated with various international electronic databases including Scopus, Web of Science, Research Gate, Pubmed, Medline, SciFinder, Google Scholar, and Science Direct. Moreover, confirmation of botanical nomenclature of contained medicinal plants was performed using botanical databases such as The Plant List, eFlora of India, and The online Flora of Mexico (eFloraMEX). Gathered information encompass articles from scientific peer-reviewed journals, for instance, *Plants*, *Journal of Ethnopharmacology*, *Clinical Phytoscience*, *Phytotherapy Research*, *Biomolecules*, *Food Chemistry*, *International Journal of Botany Studies*, *Natural Products and Bioprospecting*, or *European Journal of Pharmacology*.

During the search, a combination of miscellaneous search terms was used, i.e., "plants in CVD disorders", "Rosaceae cardio", "Apiaceae cardio", "Clinical trials on *Crataegus*", "CVDs and plants", CVDs plants prevention", "Cardioprotective effect of Rosaceae", "Cardioprotective effect of Apiaceae", "cardiovascular diseases plant derivatives", "Therapeutic potential of *Ammi visnaga*", and others. Additionally, various Medical Subject Headings (MeSH terms) (hierarchically organized vocabulary controlled by the National Library of Medicine) were used. In order to view current and previous information related to a given topic, the following search formula was applied: "cardiovascular" [title/abstract/keyword] AND "plant" OR "extract" OR "phytochemical" [all fields] AND "CVD" OR "hypertension" OR "arrhythmia" [title/abstract/keyword].

No restrictions concerning the language of articles were imposed. Nevertheless, some non-English language reports with negligible knowledge were excluded. A literature search was performed without limiting publication years of articles. Final included papers were scrutinized taking into consideration such aspects as plant species, part of plant, extract, isolated compounds, mechanism of action, type of research, and method (Tables 1 and 2).

Table 1. Plant species of Apiaceae family with cardiovascular applications based on experimental evidence.

Plant Species	Tested Material	Cardiovascular Activity	Experimental Model	Concentration Used	References
Alepidea amatymbica	fresh rhizomes/hexane, dichloromethane, and methanol extracts	hypotensive, vasorelaxant, diuretic	male Wistar rats	20 mg/kg b.w. (body weight)	[24]
Ammi visnaga	fruits	hypotensive, negative chronotropic effect	dogs	intravenous administration of khellin (20–30 mg/kg)	[25]
Ammi visnaga	seeds/water infusion	increasing HDL cholesterol level	50-year-old man	10 g seeds boiling in 200 mL of water for 10 days twice daily	[26]
Ammi visnaga	fruits (visnagin)	vasorelaxant (suppresses vascular smooth muscle contraction, dilates peripheral and coronary vessels, increases coronary circulation)	male Wistar rats	intravenous administration of visnagin (0.3–5 mg/kg)	[27]
Ammi visnaga	fruits (visnadin)	vasorelaxant, bronchodilatory, spasmolytic	male Wistar rats	10^{-6} M–10^{-4} M	[28]
Ammi visnaga	fruits (visnadin)	increasing coronary blood flow	isolated guinea pig hearts	60.0 μg/mL and 120.0 μg/mL of visnadin	[29]
Ammi visnaga	fruits (visnadin, dihydrosamidin, khellin, samidin)	positive inotropic effects on heart	dogs	4.7 mg/kg/day for 7 days intramuscularly	[30]
Ammi visnaga	seeds/aqueous extract	diuretic	male Wistar albino rats	500 mg/kg	[31]
Ammi visnaga	fruits/chloroform and methanol extract	inhibition of contractions of aorta induced by potassium chloride; calcium channel-blocking actions	rabbit and guinea pig aorta	31.6, 100, and 316 μg/mL	[32]
Ammodaucus leucotrichus	fruits/aqueous extract	hypotensive, vasorelaxant	rats, isolated thoracic aortas	60 and 100 mg/kg b.w. orally for 6 h or over 7 days	[33]
Anethum graveolens	powder and essential oils	hypolipidemic (cholesterol-lowering properties), cardioprotective	male Wistar rats	45, 90, and 180 mg/kg orally for 2 weeks	[34]
Angelica archangelica	roots/chloroform extract	calcium channel-blocking actions (activity significantly higher than verapamil); calcium-antagonistic (monitoring the suppression of depolarization-induced Ca^{2+} uptake in rat pituitary GH_4C_1 cells)	rat pituitary GH_4C_1 cell	2, 6, and 20 μg/mL	[35]

Table 1. *Cont.*

Plant Species	Tested Material	Cardiovascular Activity	Experimental Model	Concentration Used	References
Angelica archangelica	roots/twenty different extracts	calcium-antagonistic (monitoring the suppression of depolarization-induced Ca^{2+} uptake in rat pituitary GH_4C_1 cells)	clonal rat pituitary GH_4C_1 cells	2, 6, and 20 μg/mL	[36]
Angelica dahurica	roots/70% methanol extract	vasorelaxant (endothelium-independent pathway that involves blocking extracellular calcium influx through receptor-mediated Ca^{2+} channels and voltage-dependent calcium channel pathways)	male Sprague Dawley rats	0.03–1.0 mg/mL	[37]
Angelica furcijuga	roots/methanol extract	vasorelaxant	male Wistar rats	3–100 μM	[38]
Angelica keiskei	isolated xanthoangelol E	hypotensive	rabbits	0.05–1.0 mM	[39]
Angelica keiskei	roots/50% ethanol extract (ethyl acetate-soluble fraction)	vasorelaxant (suppresses phenylephrine-induced vasoconstriction in rat aortic rings)	male Wistar rats	100 μg/mL	[40]
Angelica pubescens	osthole	vasorelaxant	male Wistar rats	40–200 μM	[41]
Angelica sinensis	polysaccharides	cardioprotective (alleviates myocardial ischemia–reperfusion injury in rats through deceleration TLR4/NF-κβ)	male Sprague Dawley rats	50–100 mg/kg intragastric administration for 4 weeks	[42]
Apium graveolens	aerial parts/aqueous and ethanol extract	hypotensive, negative chronotropic, and inotropic effect	Wistar albino rats and rabbits	0.5–15 mg/kg	[43]
Apium graveolens	whole plant/aqueous extract	vasorelaxant (endothelium dependent vasorelaxation)	male Sprague Dawley rats	not given	[44]
Apium graveolens	isolated apigenin	vasorelaxant (by inhibiting Ca^{2+} influx, leading to blocked aortic ring contractions)	Wistar rats	not given	[45]
Apium graveolens	seeds/hexan, methanol, water-ethanol extracts	hypotensive	male Wistar rats	300 mg/kg intraperitoneally	[46]
Apium graveolens	seeds/80% ethanol extract	hypotensive	human	1.34 g/day for 4 weeks	[47,48]
Apium graveolens	stems and leaves/aqueous extract	hypolipidemic (cholesterol-lowering properties)	Wistar rats	10 g/day for 4 weeks	[49]

Table 1. *Cont.*

Plant Species	Tested Material	Cardiovascular Activity	Experimental Model	Concentration Used	References
Carum carvi	seeds/aqueous extract	diuretic (*Carum carvi* extracts boosted urinary Na^+ and K^+ levels, while furosemide only raised Na^+ levels and diminished urinary K^+ levels)	male Wistar rats	not given	[50]
Centella asiatica	whole plant/aqueous extract	cardioprotective (reduces increased serum levels of myocardial marker enzymes in rats with cardiomyopathy)	male albino Wistar rats	200 mg/kg b.w. orally	[51]
Centella asiatica	aerial parts/methanol extract (EtOAc, n-BuOH, and water soluble phases)	anti-thrombotic (prevent blood coagulation)	male Wistar ST rats	orally twice a day at intervals of 6 h for 14 days (4 mg/4 mL water/kg/day)	[52]
Centella asiatica	whole plant/ethanol extract	hypolipidemic (cholesterol-lowering properties)	male KM mice and male Golden Syrian hamsters	1000–1500 mg/kg intragastrically	[53]
Coriandrum sativum	leaves/Soxhlet extraction with multiple solvents	hypotensive	rabbits	100 µg/mL	[54]
Coriandrum sativum	fruits/70% methanol extract	hypotensive (cholinergic, Ca^{2+} antagonist), diuretic	Balb-C mice, Sprague Dawley rats and isolated guinea pig ileum, rabbit jejunum	1–30 mg/kg; 0.3–5.0 mg/mL; 100 mg/kg	[55]
Coriandrum sativum	seeds/methanol extract	reduce lipid peroxidation, hypolipidemic, cardioprotective (reduce markers of cardiac damage and myofibrillar failure), enhance endogenous antioxidants and ATPases	male Wistar rats	100, 200, and 300 mg/kg/day orally for 30 days	[56]
Coriandrum sativum	leaves/80% methanol extract	cardioprotective properties towards HL-1 cell lines	MTT assay, cell lines	50 µg/mL	[57]
Coriandrum sativum	seeds/80% methanol extract	hypotensive (reduces arsenic-induced hypertension by protecting the endothelium)	Wistar albino rats	500 mg/kg b.w.	[58]
Coriandrum sativum	seeds/70 % methanol extract	hypolipidemic (cholesterol-lowering properties)	rabbits	250 mg/kg b.w./day	[59]
Coriandrum sativum	seeds powder	hypotensive, hypolipidemic (cholesterol-lowering properties)	human	2 g/day	[60]

Table 1. *Cont.*

Plant Species	Tested Material	Cardiovascular Activity	Experimental Model	Concentration Used	References
Coriandrum sativum	seeds/methanol extract	cardioprotective	rats	80, 110, 140, 170, and 200 mg/kg b.w.	[61]
Coriandrum sativum	seeds/aqueous extract	cardioprotective, hypolipidemic	Meriones shawi rats	20 mg/kg	[62]
Coriandrum sativum	seed oil	hypotensive, antioxidant	determination of ACE inhibition activity	20–100 μg/mL	[63]
Coriandrum sativum	seeds	hypolipidemic	Sprague Dawley rats	10% of diet during a period of 75 days	[64]
Coriandrum sativum	seeds/aqueous extract	cardioprotective, hypolipidemic, improvement of left ventricle functions	Wistar albino rats	1 g/kg b.w.	[65]
Coriandrum sativum	coriander powder suspended in water	hypolipidemic (cholesterol-lowering properties)	male Wistar rats	1 g/kg b.w.	[66]
Coriandrum sativum	seeds/aqueous extract	antiarrhythmic	male albino rats	300 mg/kg b.w. orally for 16 days	[67]
Coriandrum sativum	whole plant	hypotensive	male Sprague Dawley rats	1.0–2.0 g/kg b.w. orally	[68]
Cuminum cyminum	seeds/methanol extract	hypolipidemic (cholesterol-lowering properties)	Sprague Dawley rats	2 mL/kg dose volume (two divided doses)	[69]
Daucus carota	whole plant/aqueous extract	vasorelaxant (endothelium dependent vasorelaxation)	male Sprague Dawley rats	not given	[44]
Daucus carota	aerial parts/ethanol extract (ethyl acetate and water fractions)	Calcium channel-blocking actions, hypotensive	Sprague Dawley rats; rabbit aorta and guinea pig atria	1–10 mg/kg intravenous administration in rats; in vitro: 10–200 μg/mL guinea pig atria and rabbit aorta	[70]
Daucus carota	aerial parts/ethanol extract	hypotensive (demonstrate similar direct relaxant effects on cardiac muscle and smooth muscle as blocking Ca^{2+} channels)	rabbit thoracic aorta, guinea pig paired atria, rats	10–100 mg/kg in rats; 0.3–5 mg/mL in guinea pig paired atria	[71]
Daucus carota	whole plant	hypolipidemic (cholesterol-lowering properties); increase in antioxidant status	male Wistar rats	a 3-week supplementation of the diet with carrot (15% dry matter)	[72]
Eryngium carlinae	aerial parts/ethanol extract	hypolipidemic	Wistar albino rats	30 mg/kg b.w. orally for 40 days	[73]
Foeniculum vulgare	leaves/aqueous extract	hypotensive	male albino Sprague Dawley rats	2–20 mg/kg i.v.	[74]

Table 1. *Cont.*

Plant Species	Tested Material	Cardiovascular Activity	Experimental Model	Concentration Used	References
Foeniculum vulgare	essential oils	anti-thrombotic	guinea pig plasma	30 mg/kg per day for 5 days	[75]
Ligusticum wullichii	tetramethylpyrazine	hypotensive, anti-thrombotic (prevent blood coagulation)	adult mongrel dogs	2–15 mg/kg i.v.	[76]
Petroselinum crispum	aerial parts/aqueous extract	hypotensive	rats, isolated thoracic aortic rings	rats: 160 mg/kg during 6 h for 7 days; rat isolated aortic rings: 0.02–2.5 µg/mL	[77]
Petroselinum crispum	leaves/aqueous and ethanol extracts	hypotensive (ethanol extract); strong inhibitory effect on the rate and amplitude of contraction	rats	0.33–10 mg/kg intravenous administration	[78]
Petroselinum crispum	leaves/aqueous extract	anti-thrombotic (prevent blood coagulation)	human blood, inhibitory effect of extract and isolated flavonoids on clotting formation and ADP-induced platelet aggregation	not given	[79]
Petroselinum crispum	seeds/methanol extract	hypolipidemic and antioxidant activity	male albino rats	20% *w*/*w* for 8 weeks	[80]
Petroselinum crispum	genins isolated from leaves	anti-thrombotic (prevent blood coagulation)	in vitro on human platelet aggregation and adhesion to a collagen-coated surface under physiologic flow conditions	0.3 mg/mL	[81]
Petroselinum crispum	leaves/aqueous extract	anti-thrombotic (influence on aggregation induced by thrombin, ADP, collagen, and epinephrine (in vitro) and on rat bleeding time and aggregation ex vivo	anti-platelet activity in rats, on platelet aggregation in vitro and ex vivo	3 g/kg orally	[82]
Petroselinum crispum	seeds/aqueous extract	diuretic	male Sprague Dawley rats	20 % *w/v*	[83]

Table 2. Plant species of Rosaceae family with cardiovascular applications based on experimental evidence.

Plant Species	Tested Material	Cardiovascular Activity	Experimental Model	Concentration Used	References
Agrimonia eupatoria	aerial parts/aqueous infusion, EtOAc fraction	vasorelaxant, vasoprotective	human distal segments of internal thoracic arteries harvested from patients undergoing coronary revascularization	0.002–0.2 mg/mL	[84]
Agrimonia eupatoria	aerial parts/extract	hypotensive	cats	0.25–1.00 mL/kg i.v.	[85]
Alchemilla vulgaris	aerial parts/aqueous and methanol extracts	microvascular and blood pressure lowering	male Wistar albino rats	0.01–10 mg/mL	[86]
Alchemilla vulgaris	extract	arterial hypertension	male SHR and Wistar rats	300 mg/kg for 10 days	[87]
Crataegus	Stragol^{TM} herbal heart drop (standardized to 0.060 mg vitexin-2-rhamnoside)	hypolipidemic (LDL, total cholesterol, triglyceride lowering properties, reduction in atherosclerosis), cardioprotective	human	60 drops daily for 4 weeks	[88]
Crataegus spp.	aqueous extract	cardioprotective	isolated, perfused working rat heart during ischemia and reperfusion	0.01 and 0.05%	[89]
Crataegus spp.	isolated flavonoids (luteolin-7-glucoside, hyperoside, rutin)	cardioprotective (tonic action on cardiac myocytes), positive inotropic effect, positive chronotropic effect, growth of coronary blood flow	Langendorff-perfused isolated guinea pig hearts	10^{-7} to 5×10^{-4} mol/L	[90]
Crataegus aronia	whole plant/aqueous extract	antiplatelet effect (preventing proliferation after vessel injury, modified the bleeding and the closure time, defined by the level of PFA-100 and thromboxane B2)	male albino Wistar rats	100, 200, 500, 1000, and 2000 mg/kg orally once a day for 7 days	[91]
Crataegus curvisepala	leaves and flowers/ethanol and aqueous extract	hypotensive	human	not given	[92]
Crataegus laevigata	micronized flower and leaf preparation	hypolipidemic (total cholesterol, LDL, non-HDL lowering properties), ↓ neutrophil elastase	human	400 mg three times a day	[93]
Crataegus laevigata	powdered whole plant	hypolipidemic (intravascular cholesterol-lowering properties)	Zebrafish	not given	[94]

Table 2. *Cont.*

Plant Species	Tested Material	Cardiovascular Activity	Experimental Model	Concentration Used	References
Crataegus laevigata	flowering tops (Faros® 600 [LI 132, Lichtwer Pharma, Berlin] extract 3:1, standardized to 2.2% flavonoids)	hypotensive (decrease diastolic blood pressure)	human	1200 mg of extract orally once a day for 16 weeks	[95]
Crataegus mexicana	leaves/methanol; 60% ethanol; acetone, aqueous, acetic acid (AWAc, 80:18.5:1.5), and acetone, methanol, aqueous, acid acetic (AMWAc, 40:40:18.5:1.5) extracts	vasorelaxant	male Wistar rats	not given	[96]
Crataegus meyeri	flowering tops/chloroform, ethylacetate and methanol (70%) extracts	hypotensive, antiarrhythmic (decrease in the incidence and severity of ischemia-related arrhythmias)	male Wistar rats	1 mg/kg/min	[97]
Crataegus microphylla	leaves/methanol extract	vasorelaxant (prevents vasospasm, iNOS expression), anti-inflammatory (Plasma levels of TNF-α, IL-6)	male Sprague Dawley rats	100 mg/kg orally	[98]
Crataegus monogyna	leaves and stems/50% ethanol extract, and tablet-derived extract prepared from Heartcare® tablets standardized to 18.75% oligomeric procyanidins (Nature's Way Products, Inc., Springville, UT, USA)	negative chronotropic activity (decrease in heart rate through muscarinic receptor triggering)	female adult mouses	0.2 mg/mL	[99]
Crataegus orientalis	leaves/50% ethanol extract	anti-thrombotic	Swiss albino mice	100, 200, and 300 mg/kg	[100]
Crataegus oxyacantha	flowers	improved heart working capacity	human	not given	[101]
Crataegus oxyacantha	HeartCare hawthorn extract tablets (Nature's Way, Springville, UT, USA)/50% ethanol extract	cardioprotective (reduces apoptotic incidence in myocardial ischemia–reperfusion injury by regulating Akt and Hif-1 signaling pathways)	male Sprague Dawley rats	100 mg/kg b.w.	[102]
Crataegus oxyacantha	fruits/ethanol extract	antioxidant (diminish LPO damage, boost activities of antioxidant enzymes), inhibit ADP-stimulated oxygen uptake rate and respiratory coupling coefficient; cardioprotective	male albino Wistar rats	0.5 mL/100 g b.w. orally for 30 days	[103]

Table 2. *Cont.*

Plant Species	Tested Material	Cardiovascular Activity	Experimental Model	Concentration Used	References
Crataegus oxyacantha	fruits/ethanol extract	antioxidant (diminish LPO damage and enzymes of Kreb's cycle, support mitochondrial antioxidant status)	male albino Wistar rats	0.5 mL/100 g b.w. orally for 30 days	[104]
Crataegus oxyacantha	leaves and stems or dried berries/ 50% ethanol extract	antiarrhythmic	neonatal mice	30–300 µg/mL	[105]
Crataegus oxyacantha	standardized hawthorn extract WS 1442	hypotensive, antiarrhythmic, improved heart working capacity, improvements in clinical symptoms (fatigue, palpitations, exercise dyspnea) and in exercise tolerance test	human	one tablet of the extract (84.3 mg of procyanidin per tablet) twice daily for 24 weeks	[106]
Crataegus oxyacantha	fruits/ethanol extract	reduce histological and enzymes changes in the liver of isoproterenol-induced myocardially infarcted rats	male albino Wistar rats	0.5 mL/100 g b.w. orally for 30 days	[107]
Crataegus oxyacantha	fruits/50% ethanol extract	hypolipidemic (LDL lowering properties), antioxidant, reduction in creatine kinase and LPO	male albino Wistar rats	0.5 mL/100 g b.w. orally for 60 days	[108]
Crataegus oxyacantha (Hawthorn, two species)	leaves, berries, and flowers/12% ethanol extract	positive inotropic effect (increase Ca2þ transport and impact on the Naþ/Kþ-ATPase in cardiomyocytes), initiation of robust calcium transients and calcium overload	rats	not given	[109]
Crataegus pinnatifida	not given	hypotensive, vasorelaxant (resulting from nitrous oxide stimulation)	rabbits	not given	[110]
Crataegus pinnatifida	leaves/70% ethanol extract	hypolipidemic (triglyceride and free fatty acid lowering properties)	male Wistar rats and ddY mice	125, 250, and 500 mg/kg	[111]
Crataegus spp.	leaves and flowers/70% methanol extract (LI 132)	antiarrhythmic	male Wistar rats	3-month oral pretreatment with 2% *Crataegus* extract	[112]
Crataegus spp.	leaves and flowers/50% ethanol extract WS® 1442	vasorelaxant (elicit endothelium-dependent relaxation of coronary artery rings via Src/PI3-kinase/Akt-dependent eNOS phosphorylation)	porcine coronary artery rings	300 µg/mL	[113]

Table 2. *Cont.*

Plant Species	Tested Material	Cardiovascular Activity	Experimental Model	Concentration Used	References
Crataegus spp.	leaves and flowers/70% methanol extract (LI 132)	improved heart working capacity (clinical assessment; symptom score)	human	3 × 100 mg per day	[114]
Crataegus spp.	leaves and flowers/ WS® 1442 extract	vasorelaxant (induces endothelium-dependent vasodilation mediated through NO phosphorylation of eNOS at serine 1177)	male Wistar rats and isolated human vessel preparations	5–100 µg/mL	[115]
Crataegus spp.	leaves and flowers/ WS® 1442 extract	hypotensive, negative chronotropic effect, an increase in the ejection fraction of the heart	human	not given	[116]
Crataegus spp.	leaves and flowers/95% ethanol, methanol, and 70% acetone extracts of WS® 1442	activated a decrease in endothelial hyperpermeability	human	not given	[117]
Crataegus spp.	leaves and flowers/ 45% ethanol extract of WS® 1442	decelerates intimal hyperplasia induced by balloon catheter in the rat carotid artery (direct impact on PDGFR-β)	male Sprague Dawley rats	300 mg/kg	[118]
Crataegus spp.	leaves and flowers/ 45% ethanol extract of WS® 1442	cardioprotective	human	not given	[119]
Crataegus spp.	leaves and flowers/ WS® 1442 extract	reduction in sudden cardiac death	murine and human embryonic stem cells	5–200 µg/mL	[120]
Crataegus spp.	leaves and flowers/ WS® 1442 extract	cardioprotective—reduces the incidence of cardiac mortality and echocardiographic parameters	human	two film-coated tablets of 450 mg of WS 1442® per day for 24 months	[121]
Crataegus spp.	leaves and flowers/ WS® 1442 extract	remodels left ventricular and prevents myocardial dysfunction in early cardiac hypertrophy caused by pressure overload	male Sprague Dawley rats	130 mg/kg/day for 4 weeks	[122]
Crataegus spp.	leaves and flowers/ WS® 1442 extract	negative chronotropic activity, hypotensive	human	1 capsule twice a day for 8 weeks	[123]

Table 2. *Cont.*

Plant Species	Tested Material	Cardiovascular Activity	Experimental Model	Concentration Used	References
Crataegus spp.	leaves and flowers/ 70% methanol extract (LI 132)	antiarrhythmic (extends the duration of action potential and postpones the return to V_{max})	male guinea pigs	10 mg/L	[124]
Crataegus spp.	leaves and flowers/ WS® 1442 extract	vasoprotective	mouses	10 µg/mL	[125]
Crataegus spp.	leaves and flowers/ 70 % methanol extract (LI 132)	positive inotropic effect on the amplitude of contraction comparable to isoprenaline and ouabain	rats	30–180 µg/mL	[126]
Crataegus spp.	leaves and flowers/ 70% methanol extract (LI 132)	hypotensive, negative chronotropic effect, improved heart working capacity	human	1 capsule (200 mg) three times a day for 8 weeks	[127]
Crataegus spp.	leaves and flowers/ 45% ethanol extract WS® 1442	positive inotropic effect (cAMP-independent mechanism; sodium pump; intracellular Ca^{2+} concentration), improves force-frequency relationship in failing human heart muscle	human	0.1 and 100 µg/mL	[128]
Crataegus spp.	leaves and flowers/ WS® 1442 extract	improved heart working capacity of patients with heart failure	human	450 mg or 900 mg WS 1442 once a day for 16 weeks	[129]
Crataegus spp.	leaves and flowers/ WS® 1442 extract	vasorelaxant	male Wistar rats	10 or 100 mg/kg	[130]
Crataegus spp.	leaves and flowers/ WS® 1442 extract	improved heart working capacity	human	900 mg WS 1442 for 8 weeks	[131]
Crataegus spp.	leaves and flowers (5:1) WS® 1442 extract	hypotensive, negative chronotropic effect (proven clinical efficacy in patients with congestive heart failure (NYHA class II).	human	240 mg/day	[132]
Crataegus spp.	leaves and flowers/ WS® 1442 extract (Crategutt forte, Willmar Schwabe Pharmaceuticals, Karlsruhe, Germany)	lack of evidence supporting symptomatic or functional benefits in patients with heart failure	human	450 mg orally twice a day	[133]

Table 2. *Cont.*

Plant Species	Tested Material	Cardiovascular Activity	Experimental Model	Concentration Used	References
Crataegus spp. *(Hawthorn, C. oxyacantha)*	leaves and flowers/ethanol and aqueous extract (standardized to 50 mg oligomeric procyanidin per 250 mg extract)	unproven effectiveness on brachial artery flow mediated dilation	human	1000, 1500, and 2500 mg orally twice a day	[134]
Crataegus tanacetifolia	leaves/aqueous extract	hypotensive	male Wistar albino rats	100 mg/kg/day	[135]
Eriobotrya japonica	leaves/aqueous extract	cardioprotective (impaired cardiac hypertrophy and myocardial function)	age-matched spontaneously hypertensive rats and normotensive control Wistar–Kyoto rats	100 and 300 mg/kg twice/week	[136]
Fragaria ananassa	fruits/freeze-dried strawberry (FDS)	anti-inflammatory (reduce CRP), antioxidant (reduce MDA), diminish glycosylated hemoglobin (HbA1c)	human	2 cups of FDS beverage (50 g of FDS is equivalent to 500 g of fresh strawberries) daily for 6 weeks	[137]
Fragaria vesca	leaves/aqueous extract	vasorelaxant	male guinea pigs and male Wistar rats	0.06, 0.6, 6, 60 mg/100 mL	[138]
Malus domestica	fruits/aqueous extract	anti-thrombotic, calcium channel blocking activity	guinea pig ileum and human blood	1, 5, and 10 mg/mL	[139]
Malus sylvestris	fruits	hypolipidemic	female Wistar albino rats	2 g/day	[140]
Prunus amygdalus	fruits	hypolipidemic (total cholesterol, LDL, LDL/HDL lowering properties), diminish apolipoprotein B/A1 ratio (indicator of atherosclerotic cardiovascular disease)	human	56 g of almonds a day	[141]
Prunus amygdalus	fruits	hypolipidemic (oxidized LDL-C lowering properties), anti-inflammatory (reduction IL-6, TNF-α, and CRP), no significant change in ICAM-1 (intracellular adhesion molecule) and VCAM-1 (vascular adhesion molecule)	human	56 g of almonds a day	[142]
Rosa damascena	flowers/70% ethanol extract	hypotensive	male Wistar rats	250, 500, and 1000 mg/kg	[143]
Rubus idaeus	fruits/methanol extract	vasorelaxant	male New Zealand rabbits	25 μL	[144]

Table 2. *Cont.*

Plant Species	Tested Material	Cardiovascular Activity	Experimental Model	Concentration Used	References
Rubus idaeus	whole red raspberry	vasorelaxant	obese Zucker rats (OZR)	8% *w*/*w* for 8 weeks	[145]
Rubus idaeus (*European red raspberry*)	raspberry ketone—red raspberry constituent	cardioprotective (respecting PPAR alpha)	male Wistar albino rats	50, 100, and 200 mg/kg	[146]
Rubus idaeus (*Xinjiang red raspberry*)	fruits/95% ethanol extract and its fractions (petroleum ether, ethyl acetate, butanol)	hypotensive (dose-dependent lower elevated blood pressure action in SHR, related to increased NO activation), cardioprotective (correct vascular endothelial dysfunction)	male spontaneously hypertensive rats and Wistar–Kyoto rats	100 mg/kg/day for 5 weeks	[147]

↓—reduction.

Furthermore, in order to estimate traditional applications, plant species, country, vernacular name, and traditional use were extracted from the abovementioned sources (Tables 3 and 4).

Table 3. Traditional applications of plant species from Apiaceae family in cardiovascular diseases.

Plant Species	Country	Vernacular/Local Name	Application	References
Alepidea amatymbica	sub-Saharan Africa	Igwili/Umvuthuza, Ikhathazo	hypotensive (powder of rhizome and fruits), obesity	[148]
Ammi visnaga	Marocco (north-central region)	Bachnikha	diabetes	[149]
Ammodaucus leucotrichus	Morocco	not given	hypotensive cardiac diseases (fruits and seeds)	[150]
Ammodaucus leucotrichus	Marocco (north-central region)	Kamoun soouf	cardiac diseases	[149]
Anethum graveolens	Iran	dillweed	hypolipidemic (aerial parts)	[34]
Angelica pubescens	China	not given	hypotensive (tinctures or decoctions of this plant cause a short-lived antihypertensive response)	[41]
Apium graveolens	Marocco (north-central region)	Kraffess	cardiotonic, renal diseases	[149]
Apium graveolens	Mauritius	not given	hypotensive (decoction of leaves)	[151]
Apium graveolens	Lebanon	Krafs	hypotensive (fresh juice of shoots and leaves, 1 cup twice/week)	[152]
Apium graveolens	India	not given	anti-thrombotic (prevent blood coagulation), cardioprotective	[153]
Centella asiatica	India	not given	anti-thrombotic (prevent blood coagulation)	[154]
Centella asiatica	India	not given	hypotensive	[155]
Coriandrum sativum	India	not given	diuretic	[154]
Coriandrum sativum	India	Kasbour, Coriander, Cilantro	hypotensive, cardiac diseases	[156]
Coriandrum sativum	Thailand, Songkhla province	Phak chi la	hypotensive (boil fresh materials/drink 1–2 tablespoons after breakfast and dinner a day)	[157]
Coriandrum tordylium	India	Kasbour, Coriander, Cilantro	hypotensive, cardiac diseases	[156]
Cuminum cyminum	India	not given	anti-thrombotic (prevent blood coagulation), hypotensive	[154]
Cuminum cyminum	Marocco (north-central region)	Kamoun	cardiac diseases	[149]
Daucus carota	Mexico	Zanahoria	cardiotonic	[158]
Eryngium carlinae	Mexico	Chichicahoaztic	heart pain	[158]
Eryngium creticum	Lebanon	Kers Aanni	hypotensive (juice of young shoots and leaves, 1 or 2 cup/day)	[152]
Ferula narthex	Mexico	Asafetida	cardiotonic	[158]
Foeniculum vulgare	Marocco (north-central region)	Nafaa	renal diseases, diabetes	[149]
Foeniculum vulgare	Lebanon	Choumar	hypotensive (decoction of seeds, 2 cups/day)	[151]
Lichtensteinia lacera	South Africa	iQwili, Kaalmoes, Kalmiswortel	hypotensive (boiling and infusions obtained from leaves, bulbs, stems)	[148]
Ligusticum wallich	China	not given	hypotensive, sedative	[159]
Ligusticum wullichii	China	not given	cardiac diseases (treating vascular disorders)	[160]
Ligustium wollichii	China	not given	hypotensive	[161]
Pastinaca sativa	Marocco (north-central region)	Maâdanous	hypotensive	[149]
Petroselinum crispum	India	not given	hypotensive	[154]
Petroselinum crispum	Mauritius	Persil	hypolipidemic (cholesterol-lowering properties; decoction and juice of leaves)	[162]
Peucedanum galbanum	sub-Saharan Africa	Droedas	hypotensive (infusion of leaves)	[163]
Centella asiatica	India	Brahmi	blood purifier (whole plant)	[164]
Coriandrum sativum	Marocco	not given	diuretic (oral administration of plant parts)	[165]
Coriandrum sativum	Iran	not given	diuretic (the whole plant parts)	[165]

Table 4. Traditional applications of plant species from Rosaceae family in cardiovascular diseases.

Plant Species	Country	Vernacular/Local Name	Application	References
Cerasus vulgaris	Marocco (north-central region)	Sferjel	diabetes	[149]
Crataegus orientalis	Turkey	Alıç, Kırmızı Alıç, Koyun Alıcı, Deli Alıç	cardiac diseases, vasorelaxant, cardiotonic (decoction of fruits)	[166]
Crataegus laevigata	England	not given	hypotensive (herbal practitioners in the England use leaves, flowers and berries in combination with prescribed medications)	[95]
Crataegus laevigata	sub-Saharan Africa	Aubepine	hypotensive, hypolipidemic (cholesterol-lowering properties)—infusions obtained from leaves and flowers	[148]
Crataegus mexicana	Mexico	Tejocote	cardiotonic	[158]
Crataegus monogyna	Serbia	not given	hypotensive and cardiac sedative (tea); regulation of heartbeat (tincture from crashed fruits—20 mg of fruits in 100 mg of alcohol)	[167]
Crataegus monogyna	Spain	not given	hypotensive, cardiac diseases	[168]
Crataegus oxyacantha	European and Chinese medicine	not given	cardiotonic, hypotensive, antiarrhythmic, congestive heart failure	[169]
Crataegus pinnatifida	China	not given	cardioprotective (reducing the risk of CVD), hypolipidemic (anti-atherosclerosis)	[15]
Crataegus pinnatifida	China	not given	xardiotonic, enhance blood circulation (consumed raw or cooked)	[111]
Eriobotrya japonica	sub-Saharan Africa	not given	hypotensive (infusion of leaves)	[148]
Filipendula ulmaria	not given	not given	diuretic, hypolipidemic (anti-atherosclerosis), anti-thrombotic (prevent blood coagulation)	[170]
Fragaria vesca	Marocco (north-central region)	Fraiz berri	renal diseases, diabetes	[149]
Hawthorn (*Crataegus* spp.)	Germany	not given	cardiac diseases (hydroalcoholic extracts, leaves with flowers)	[130]
Leucosidea sericea	South Africa	Umtshitshi	hypotensive	[148]
Leucosidea sericea	Lesotho	Cheche	hypotensive	[171]
Malus domestica	Indian traditional medicine	not given	hypotensive, cardiac diseases	[154]
Malus domestica	sub-Saharan Africa	Pomme	hypolipidemic (cholesterol-lowering properties of fruits and juice)	[148]
Malus sylvestris	Spain	not given	cardiac diseases, strengthen blood vessels	[172]
Prunus spinosa	Central and Eastern Europe	not given	diuretic, hypolipidemic (anti-atherosclerosis)	[173]
Rosa damascena	Bangladesh (Barendra and Shamatat region)	Golap	cardiac diseases (leaves and fruits)	[174]
Rubus idaeus	China (Xinjiang region, the Tianshan and the Altai Mountains)	not given	hypotensive (local Mongolian herdsmen use roots for elevated blood pressure reduction)	[147]

4. Discussion

4.1. Activities

4.1.1. Antihypertensive, Lower Elevated Blood Pressure

One of the plants with proven antihypertensive effect is *Coriandrum sativum* (Apiaceae). This characteristic is associated with the leaves of *C. sativum*, which are rich in flavonoids. Specifically, they exhibit an angiotensin-converting enzyme (ACE) inhibition mechanism, as demonstrated in vitro by Hussain et al., where its IC_{50} value was determined to be 28.91 μg/mL [54]. Flavonoids found in *C. sativum* leaves, including quercetin (**10**), rutin (**11**), apigenin (**1**), and luteolin (**8**) [175], have been identified and have individually and in crude extracts exhibited hypotensive effects through various mechanisms [165]. One potential mechanism involves the management of hypertension by inhibiting ACE, which controls the production of nitric oxide (NO) through the regulatory mechanism of the renin–angiotensin–aldosterone system (RAAS), with ACE inhibition playing a crucial role in regulating blood pressure [54]. Some flavonoids inhibit ACE activity by chelating with the zinc ion at the enzyme's active site [165] (Figure 1). This underscores the cardioprotective effect of *C. sativum* extract mediated by this class of polyphenols.

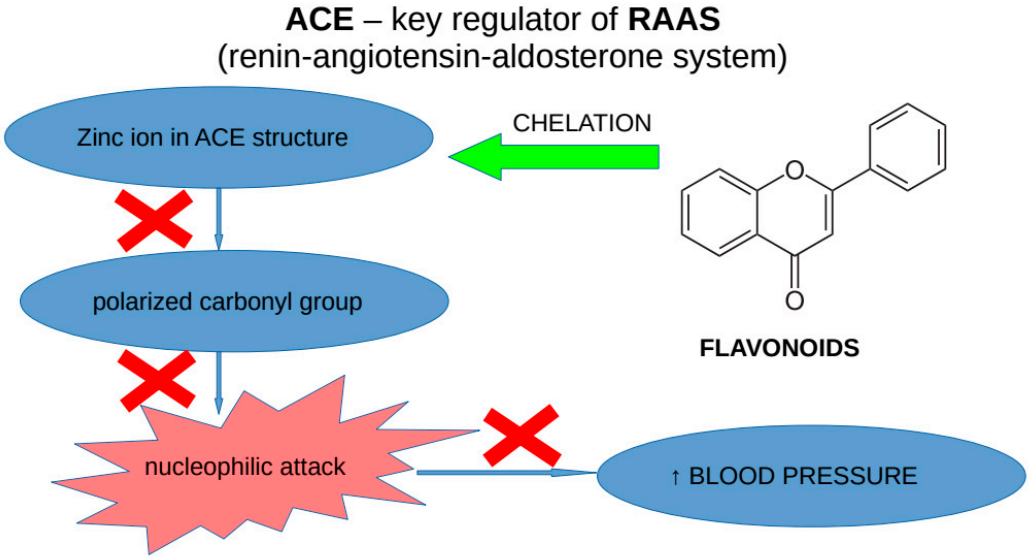


Figure 1. The role of flavonoids in regulation of blood pressure via chelation with the zinc ion located on the active site of ACE (angiotensin-converting enzyme); ↑—increase in blood pressure.

Moreover, studies investigating the antihypertensive effect of crude *C. sativum* extract in anesthetized rats have shown it induces relaxation of arterial contractions, thereby reducing blood pressure [55]. This effect is attributed to the combined cholinergic and calcium channel-blocking effects of coriander's bioactive compounds [165].

According to data collected from the scientific literature, the following plants from the Apiaceae family have shown hypotensive effect: *Alepidea amatymbica*, *Ammi visnaga*, *Ammodaucus leucotrichus*, *Anethum graveolens*, *Angelica keiskei*, *Apium graveolens*, *Carum copticum*, *Coriandrum sativum*, *Daucus carota*, *Ligusticum wallichii*, and *Petroselinum crispum* [24,25,33,39,46,58,60,63,68,70,71,76–78].

In addition, representatives of Rosaceae with antihypertensive activity are: *Crataegus* spp., *Crataegus curvisepala*, *Crataegus laevigata*, *Crataegus meyeri*, *Crataegus meyeri*, *Crataegus oxyacantha*, *Crataegus pinnatifida*, *Crataegus tanacetifolia*, *Agrimonia eupatoria*, *Rosa damascena*, and *Rubus idaeus* [85,95,97,110,132,135,143,147].

4.1.2. Vasodilator, Vasorelaxant, and Anti-Vasospasm

Abnormal vasoconstriction can cause an increase in blood pressure, which can cause hypertension. Anti-vasospasm drugs promote vasodilation to provide straightforward blood flow through vessels. Relaxing vascular smooth muscle contributes to treatment of hypertension [176].

Several plant species from the Apiaceae and Rosaceae families have shown vasorelaxant activity. Plants from the Apiaceae include the following: *Alepidea amatymbica*, *Ammi visnaga*, *Ammodaucus leucotrichus*, *Angelica keiskei*, *Angelica dahurica*, *Angelica furcijuga*, *Apium graveolens*, *Daucus carota*, and *Heracleum sphondylium* L. [24,27,33,37,38,40,41,44,45,177]. Plants from Rosaceae family with vasorelaxant properties are as follows: *Agrimonia eupatoria*, *Rubus idaeus*, *Fragaria vesca*, *Crataegus* spp., *Crataegus microphylla*, *Crataegus mexicana*, and *Crataegus pinnatifida* [84,96,98,130,138,144,145].

Moreover, it is worth noting that scientific reports indicate the vasorelaxant properties of volatile terpenes, terpenoids, and alkaloids present in various plants [178].

4.1.3. Calcium Channel-Blocking Actions

Calcium channel-blocking actions are exhibited by plants from the Apiaceae family, namely *Ammi visnaga*, *Angelica archangelica*, and *Daucus carota*.

Rouwald and co-workers [32] point out that compounds with calcium-antagonistic effectiveness are presented in several groups of phytochemicals, such as alkaloids, coumarins,

lignans, and terpenes. What is more, the abovementioned alkaloids as well as volatile terpenes and terpenoids possess hypotensive and vasorelaxant activities. Nonvolatile terpenes and terpenoids exhibit anti-inflammatory, hypoglicemic, hypotensive, and vasculoprotective properties. Additionally, flavonoids (**1**–**13**), anthocyanins (**14**–**15**), and other polyphenols have a health-promoting effect in cardiovascular complications via cytoprotective, antioxidant, and anti-inflammatory action [178].

Interestingly, in 2023, Ali and co-workers [139] conducted a study revealing excellent calcium channel-blocking activity of *Malus domestica* (Rosaceae).

4.1.4. Diuretic

The diuretic effect participates in the antihypertensive function by enhancing the elimination of electrolytes in the excreted urine.

In accordance with data gathered from the scientific research literature, the following plants from the Apiaceae family demonstrate diuretic effects: *Alepidea amatymbica*, *Ammi visnaga*, *Carum carvi*, *Coriandrum sativum*, and *Petroselinum crispum* [24,31,50]. Moreover, the widely application as diuretic agent of *Coriandrum sativum* is confirmed by data collected from the reports concerning traditional medicine [55]. The authors observed that in groups treated with coriander crude extract, a mild increase in the urine output was at the dose of 30 mg/kg (5.1 mL), while a significant diuretic effect was caused by the dose of 100 mg/kg (6.47 mL). The onset of diuretic effect was 3–4 h with *C. sativum* crude extract.

4.1.5. Cardioprotective

Polyphenols, especially flavonoids (**1**–**13**), possess cardioprotective capacity [165]. As far as Rosaceae family is concerned, *Crataegus oxyacantha*, *Crataegus* spp., *Eriobotrya japonica*, and *Rubus idaeus* (European red raspberry) show cardioprotective effectiveness. Many studies have been conducted towards heart-protective properties of *Crataegus* extracts. It is worth noting that a randomized, placebo-controlled, double-blinded study designed by Holubarsch et al. [121] revealed that the administration of 900 mg WS® 1442 special extract per day for 24 months diminishes heart-related mortality and echocardiographic patterns. Another study demonstrated that 50% water/ethanol extract of *Crataegus oxyacantha* diminishes apoptotic incidence in myocardial ischemia–reperfusion injury via adjustment of Akt and Hif-1 signaling pathways in vivo [102]. The action of *Rubus idaeus* is connected with PPAR alpha pathway [146] as well as the improvement of vascular endothelial dysfunction [147].

Among Apiaceae, *Coriandrum sativum*, *Anethum graveolens*, and *Angelica sinensis* can be distinguished. Polysaccharides from *Angelica sinensis* (in doses of 50 mg/kg and 100 mg/kg) in in vitro and ex vivo studies (Sprague Dawley rats, cardiomyocytes derived from neonatal cell culture) revealed cardioprotective effect [42]. The same activity showed powder and essential oil (daily oral doses of 45, 90, and 180 mg/kg) of *Anethum graveolens* in vivo (male Wistar rats) in the research conducted by Hajhashemi and Abbasi [34]. The largest number of studies on the heart-protective properties of representatives of the Apiaceae family concerned *Coriandrum sativum* (water and methanol extracts).

4.1.6. Anti-Thrombotic (Prevent Blood Coagulation), Antiplatelet, Inhibits Platelet Aggregation, Anticoagulation

The process of blood coagulation is a complex procedure in which various zymogens are involved. Proteolysis converts proenzymes into active enzymes that contribute to the generation of thrombin and the transformation of fibrinogen into fibrin. Factor VII (FVII) binds to uncovered tissue factor (TF), resulting in the formation of thrombin with procoagulant properties. The primary role of anticoagulant is suppressing thrombin and fibrin production. Cardiovascular disease and thrombosis are closely linked to platelets and other mediators [176].

In vivo, both *F. vulgare* essential oil and anethole, when orally administered in a subacute treatment to mice (at a dose of 30 mg/kg/day for 5 days), exhibited notable

antithrombotic effects by preventing paralysis induced by intravenous injection of collagen-epinephrine (with 70% and 83% protection, respectively). At the antithrombotic dosage, they did not exhibit prohemorrhagic side effects, unlike acetylsalicylic acid, which was used as a reference drug [75].

The inhibitory activity towards clotting formation and platelet aggregation was assessed for the aqueous extract of *Petroselinum crispum* flavonoids (apigenin and apigenin-7-*O*-glucoside), and oxypeucedanin hydrate [79]. The authors observed a strong antiplatelet aggregation activity was observed for the aqueous extract of *P. crispum* (IC_{50} = 1.81 mg/mL), apigenin (IC_{50} = 0.036 mg/mL) and apigenin-7-*O*-glucoside (IC_{50} = 0.18 mg/mL).

In accordance with the gathered studies, few plants from the Apiaceae family possess anticoagulant activity, namely *Foeniculum vulgare, Petroselinum crispum, Angelica pubescens, Centella asiatica*, and *Ligusticum wallichii* [41,75,79]. What is more, *Crataegus aronia, Crataegus orientalis*, and *Malus domestica* (Rosaceae) show this potential [91,139,167].

4.1.7. Antiarrhythmic

Arrhythmia is characterized by abnormal and irregular heart rate and rhythm. Among the conditions associated with arrhythmias tachycardia and bradycardia can be distinguished [179]. Mahleyuddin and co-authors [165] reported that active ingredients responsible for antiarrhythmic effect are polyphenols which control the heart rate via binding to beta-adrenergic receptors as well as decelerate the action potential of myocytes (negative chronotropic effect).

Based on reported studies, *Coriandrum sativum* is a plant from the Apiaceae family possessing scientifically proven antiarrhythmic action. According to Rehman et al. [67], *C. sativum* normalizes electrocardiogram (ECG) and adjusts cardiovascular biomarker values such as creatine kinase-MB fraction (CK-MB), alanine transaminase (ALT), aspartate transaminase (AST), and lactate dehydrogenase (LDH). This activity is associated with the presence of polyphenolic compounds. Importantly, the anti-tachycardia effectiveness of *C. sativum* was similar to that of propranolol.

- Positive Inotropic Effects on Heart

As far as positive inotropic effects on heart are concerned, *Ammi visnaga* fructus due to the presence of samidin (**35**) and khellol glucoside [30] shows this ability.

As can be concluded from the information gathered in Table 2, extracts from *Crataegus* spp. possess significant positive inotropic effects due to the cAMP-independent mechanism, increase Ca2þ transport, and have an impact on the Naþ/Kþ-ATPase in cardiomyocytes or a digitalis-like effect on the NaqrKq-ATPase in human heart muscle tissue.

Moreover, chloroform, ethylacetate, and methanol extracts from *Crataegus meyeri* show antiarrhythmic properties in vivo in male Wistar rats [97].

- Negative Chronotropic Effect

Khellin (**36**) obtained from *Ammi visnaga* fructus administrated in a dose of 20–30 mg intravenously to dogs shows negative chronotropic effect [25].

The water and ethanol extracts from *Petroselinum crispum* leaves exhibit a powerful inhibitory effect on the rate and amplitude of heart contraction in rats (in vivo) [78].

WS® 1442 *Crataegus* extract possesses proven clinical efficacy in patients with congestive heart failure (NYHA class II) regarding a negative chronotropic effect [132].

Water and ethanol extracts from leaves and stems of *Crataegus monogyna* diminish the contraction frequency in cardiomyocytes of neonatal murine through the activation of muscarinic receptors [99].

4.1.8. Hypolipidemic (Cholesterol-Lowering Properties), Antihyperlipidemic, and Hypocholesterolemic Activity

Heart diseases are accompanied by various comorbidities, such as atherosclerosis, and thus, cholesterol-lowering properties of plant extracts with a cardiological effect are of great importance. Although lipid disorders in most cases do not provide visible symptoms, they

contribute to a significant increase in the risk of cardiovascular disorders. Among patients with a previous history of myocardial infarction, reducing the risk of subsequent heart events is crucial, so LDL level should be below 55 mg/dL (1.4 mmol/L) [178].

Few plants from the plant family of Apiaceae possess antihyperlipidemic activity, namely *Apium graveolens*, *Anethum graveolens*, *Centella asiatica*, *Coriandrum sativum*, *Daucus carota*, *Cuminum cyminum*, *Eryngium carlinae*, and *Petroselinum crispum* [34,49,53,64,69,72,73,80]. It has been proven that the daily oral administration of *Anethum graveolens* essential oil to rats at doses of 45, 90, and 180 mg/kg for 2 weeks significantly, and in a dose-dependent manner, reduced total cholesterol, triglyceride, and low-density lipoprotein cholesterol (LDL-C). AGEO also significantly increased high-density lipoprotein cholesterol (HDL-C) [34]. It has been reported that the hypolipidemic effect of *Centella asiatica* is caused by the large amounts of triterpenes it contains—asiatic acid and madecassic acid [53]. Moreover, according to [26], the water infusion of *Ammi visnaga* seeds enhances HDL cholesterol level.

The hypolipidemic plant species from the Rosaceae family are as follows: *Crataegus laevigata*, *Crataegus oxyacantha*, *Crataegus pinnatifida*, *Malus sylvestris*, and *Prunus amygdalus* [93,94,108,111,140–142].

4.1.9. Antioxidant Activity

An extensive body of literature discusses the topic of antioxidant activity of plants belonging to the Apiaceae and Rosaceae families. Responsible for these properties are compounds such as flavonoids (**1**–**13**), anthocyanins (**14**–**15**), and other polyphenols [178].

Chaudhary and co-workers [63] reported that active compounds obtained from *Coriandrum sativum* seeds (Apiaceae) show significant antioxidant activity tested by DPPH method, namely the following: coriander oil IC_{50}: 67.2 ± 18.2 µg/mL; linalool (**29**) IC_{50}: 94.0 ± 17.1 µg/mL; fennel oil IC_{50}: 83.6 ± 17.1 µg/mL; and anethole (**30**) IC_{50}: 111.1 ± 13.5 µg/mL. What is more, Nicolle et al. [72] established that *Daucus carota* possesses antioxidant activity in vivo (male Wistar rats). The researchers examined the effects of a 3-week supplementation of rat diets with carrot (15% dry matter) on antioxidant status. The consumption of carrots improved antioxidant status significantly. It led to a notable decrease in urinary excretion of thiobarbituric acid reactive substances (TBARS), reduced TBARS levels in the heart, increased plasma levels of vitamin E, and showed a tendency to enhance the ferric reducing ability of plasma (FRAP) compared to the control group. The carrot-enriched diet provided carotenoid antioxidants: 5.1 mg β-carotene, 1.6 mg α-carotene, and 0.25 mg lutein per 100 g of diet. Methanol extract obtained from *Petroselinum crispum* seeds revealed antioxidant activity in vivo (male albino rats) in a study conducted by El Rabey and co-workers [80]. The authors investigated the antioxidant and hypolipidemic effects of supplementing the diet of hypercholesterolemic male rats with a 20 % (*w*/*w*) extract of parsley seeds for 8 weeks, potentially providing hepatocardioprotection.

Crataegus oxyacantha fruits (ethanol extract, 0.5 mL/100 g orally for 30 days) showed antioxidant ability through increasing activities of antioxidant enzymes in vivo (male albino Wistar) [103]. *Fragaria ananassa* fruits demonstrate antioxidant activity via reducing the MDA level in vivo (randomized, double-blind, placebo-controlled trial on diabetic patients treated with the plant or placebo) [137].

Nevertheless, the antioxidant effect of plants from the Rosaceae and Apiaceae families is a very extensive topic and definitely requires a separate publication.

4.2. Individual Plants

4.2.1. *Crataegus* (Hawthorn) sp.

Among all the plant species discussed in this review, *Crataegus* sp. seems to be the most thoroughly and extensively studied plant, both in humans and animals, in vivo and in vitro.

The meta-analyses of randomized, placebo-controlled, double-blind trials on *Crataegus* extracts revealed that this plant demonstrates significant effectiveness compared with

placebo as a supportive drug for chronic heart failure. Among health-promoting effects towards treatment for chronic heart failure, hypotensive properties as well as improvement in the exercise capacity of the heart (reduction in dyspnea and fatigue) can be distinguished. The German Commission E accepted hawthorn extracts to treat patients with stage II heart failure (in accordance with the New York Heart Association) [180,181].

According to the intervention review by Pittler and co-workers [182], which included randomized, placebo-controlled, double-blind trials, parameters such as heart working capacity (physiologic outcome of maximal workload, exercise tolerance, shortness of breath and fatigue) have been improved. Moreover, *Crataegus* showed hypotensive activity and enhanced an index of cardiac oxygen consumption.

So far, nearly all clinical trials and most pharmacological studies have been conducted with special extracts WS® 1442 and LI 132. Extract LI 132 is obtained from leaves and flowers of *Crataegus* sp. extracted using 70% methanol. As far as extract WS® 1442 is concerned, it is obtained from leaves and flowers (dried whole or cut flower branches) of the following species: *Crataegus monogyna* Jacq., *C. laevigata* (Poir.) (syn. *C. oxyacanthoides* Thuill., *C. oxyacantha* Auct.), *C. pentagyna* Waldst. et Kit. ex Willd., *C. nigra* Waldst. et Kit., and *C. azarolus* L. [129,183]. The efficacy and safety of *Crataegus* extract WS 1442 in comparison with a placebo was investigated in patients with chronic stable heart failure [129]. In accordance with the requirements of the European *Pharmacopoeia*, WS 1442 is the dry ethanol 45% (*w*/*w*) extract (drug-to-solvent ratio 4–6.6:1) standardized to a content of 17.3–20.1% of oligomeric procyanidins (OPCs) [119]. OPCs are the main active ingredients of WS 1442 extract and possess significant effectiveness towards cardiological diseases. In addition, WS 1442 contains considerable amounts of flavonoids (hyperoside (**6**), rutin (**11**), vitexin (**12**)), phenol carboxylic acids (**16**–**28**), and triterpenoids (**38**–**39**) [120]. As Loew reported [184], standardized *Crataegus* extracts reveal miscellaneous cardioprotective properties, such as positive chronotropic and inotropic effects, as well as positive dromotropic with simultaneous negative bathmotropic effects. Moreover, these extracts enhance coronary and myocardial perfusion and diminish peripheral resistance.

Preparations combining hawthorn extract and magnesium are very popular. Scientific research shows that the combination of these substances effectively strengthens the heart, regulates blood circulation, and protects blood vessels, without showing any side effects [185,186].

A randomized clinical trial of the Diuripres® dietary supplement, containing magnesium, standardized extract of orthosiphon, hawthorn and hibiscus, showed that this supplement has a positive effect on blood pressure, good vascular condition, and metabolic parameters [187].

4.2.2. *Rubus idaeus*

This edible plant demonstrates vasorelaxant, cardioprotective, and hypotensive activities. This effect may be related to the presence of catechin (**2**), ellagic acid (**21**), pelargonidin-3-rutinoside (**15**), and cyanidin diglucoside (**14**) [188]. Relatively new studies from 2018 [146] and 2021 [145] show that this representative of Rosaceae family shows vasorelaxant and cardioprotective (respecting PPAR alpha) properties.

4.2.3. *Ammi visnaga*

Ammi visnaga (L.) Lam. (Apiaceae) is a plant of particular significance. The primary constituents of this plant are the furanochromone compounds khellin (**36**) and visnagin (**37**), both of which feature a 4-pyrone structure. The research on the khellin scaffold led to the discovery of two pioneering molecules, amiodarone and sodium cromoglycate (cromolyn sodium), which obtained FDA approval in 1985 and 2001, respectively [189]. The invention of amiodarone (in the 1960s) has revolutionized cardiovascular therapy. Amiodarone, from a chemical point of view, is the analog of khellin (**36**). This plant-derived anti-arrhythmic drug is widely used in the pharmaceutical field. *Ammi visnaga* is an ancient Egyptian

curative plant with cardioactive properties resulting from the content of visnadin (**34**), samidin (**35**), khellin (**36**), and visnagin (**37**) [19].

The chloroform and methanol extract (1 mg/mL) of *Ammi visnaga* fruits shows calcium channel-blocking actions and inhibits aortic contractions caused by potassium chloride (in vitro and ex vivo research; rabbit and guinea pig aorta) [32].

It is worth mentioning that many studies regarding *Ammi visnaga* activity date back to the 1990s and need to be repeated using new and up-to-date techniques, which creates perspective for future studies.

4.2.4. *Coriandrum sativum*

Coriandrum sativum deserves special attention because of the significant number of studies that have confirmed its hypotensive, hypolipidemic, antiarrhythmic, and cardioprotective activity. According to Alotaibi and co-authors [188], these abilities can be connected with such compounds as quercetin (**10**), kaempferol (**7**), vanillic acid (**28**), and ferulic acid (**22**).

Various studies have consistently demonstrated the cardioprotective and cardiotherapeutic effects of quercetin, particularly in the treatment of atherosclerosis. Numerous biological mechanisms of quercetin have been identified, including the inhibition of reactive oxygen species formation by blocking nicotinamide adenine dinucleotide phosphate (NADPH) oxidase, the prevention of atherosclerotic plaque formation by upregulating nitric oxide synthase enzyme, and the inhibition of plaque formation in endothelial cells by downregulating levels of metalloproteinase-1 (MMP-1) [189].

Wang and co-authors [190] reported that 10 mg/kg of quercetin (**10**) administered via intraperitoneal injection 5 min before reperfusion in male Sprague Dawley rats provoked cardioprotection via the activation of the PI3 K/AKT signaling pathway and adjusted the expression of Bcl-2-associated death promoter and apoptosis regulator BAX proteins. Suchal and co-authors [191] provides information regarding anti-inflammatory and anti-apoptotic activity of kaempferol (**7**). This compound, given via i.p. injection in the dose of 20 mg/kg per day for 15 days to male albino Wistar rats, diminished the level of inflammatory markers (TNF-a, IL-6, NF-kB) as well as the expression of pro-apoptotic proteins such as Bax and cas-3 through the regulation of the MAPK pathway. Moreover, properties related to normalize heart function and diminishing oxidative stress can be observed.

The anti-atherosclerotic properties of kaempferol was studied in a rabbit model of cholesterol-induced atherosclerosis, focusing on endothelial cells. It has been proven that kaempferol acted through downregulating TNF-α and enhancing antioxidant capacity [192]. Another study investigated the impact of kaempferol on heart failure in diabetic rats. The results indicated a reduction in cardiac apoptosis with kaempferol treatment through the regulation of Nrf2 (nuclear factor kappa-light-chain-enhancer of activated B cells) and Akt/GSK signaling pathways, thus confirming the cardioprotective effects of kaempferol [193].

MTT assay on cell lines revealed that 80% methanol extract obtained from C. sativum leaves possesses cardioprotective activity towards HL-1 cell lines in a dose-dependent manner up-to 50 μg/mL [57].

A single-blind, randomized, placebo-controlled clinical trial on 80 patients proved the hypotensive and hypolipidemic properties of *C. sativum* seeds (2 g per day) [60].

The research conducted by Patel et al. [56] is of vital significance, due to the fact that it demonstrated multidirectional effects of *C. sativum* seeds towards cardiovascular disorders. Methanol extract administrated to male Wistar rats in the doses 100, 200, and 300 mg/kg/day orally for 30 days reduced markers of myofibrillar failure (cardioprotective effect), diminished the lipid peroxidation and cholesterol level (antioxidant, hypolipidemic), and increased endogenous ATPases.

4.2.5. *Anethum graveolens*

Jalili and co-authors [192] designed the systematic review and meta-analysis of clinical trials regarding the effect of *Anethum graveolens* administration on reducing cardiovascular risk factors. The supplementation of *A. graveolens* (tablets containing 1.1 g powder of leaves and stems) significantly lowered the LDL level [194], which is one of the major causes of cardiac diseases and myocardial infarction. Research conducted by Hajhashemi and Abbasi [34] revealed that *Anethum graveolens* powder [10% (*w*/*w*)] and its essential oil (90 mg/kg/day) possess hypolipidemic and cardioprotective properties in vivo (male Wistar rats).

4.2.6. *Apium graveolens*

Two randomized, triple-blind, placebo-controlled, cross-over clinical trials conducted by Shayani Rad et al. [48] (with Shayani Rad as the first author) revealed that 80% ethanol extract of *Apium graveolens* seeds, together with its active ingredient 3-n-butylphthalide (**31**), possesses hypotensive activity. Furthermore, animals studies showed that extracts obtained by various solvents from *Apium graveolens* aerial parts and seeds, possess hypolipidemic [49] and hypotensive [43,46] activity. Additionally, vasorelaxation through inhibiting Ca^{2+} influx, leading to blocked aortic ring contractions was demonstrated by [45]. In this case, apigenin (**1**) is considered to be the active agent.

According to Buwa and co-workers [195], 25, 50 and 75 mg/kg/day of apigenin (**1**) administered via intraperitoneal injection for 14 days in adult male Wistar rats re-established membrane-bound enzymes and endogenous parameters, namely creatine kinase myocardial band (CK-MB), glutathione, SOD, catalase, and MDA) in a dose-dependent manner.

4.2.7. *Petroselinum crispum*

Water extract of *P. crispum* leaves turned out to be effective in animals and human studies towards preventing blood coagulation due to presence of polyphenols, apigenin (**1**), cosmosiin (**3**), and aglycone flavonoids (**1**–**13**) [79,81,82].

Moreover, water and ethanol extracts of *P. crispum* aerial parts possess hypotensive activity [77]. In vivo study using male albino rats revealed hypolipidemic and antioxidant activity of methanol extract obtained from *P. crispum* seeds [80].

P. crispum seeds (water extract) showed significant diuretic activity via decrease in Na^+-K^+ ATPase effect of renal cortex versus control (male Sprague Dawley rats) [83].

4.2.8. *Prunus amygdalus*

Two randomized, cross-over, controlled trials regarding diabetic and hyperlipidemic patients treated with the plant (**20**) or placebo (**20**) revealed the hypolipidemic and anti-inflammatory activity of *Prunus amygdalus* fruits applied at a dose 20% of total daily calories intake (approximately 56 g/day) [141,142].

4.3. Active Compounds Responsible for Activity in Cardiovascular Diseases

It is well established that representatives of the Apiaceae and Rosaceae families are abundant in miscellaneous active phytochemicals, in particular, a whole range of phenolic compounds [196].

The families Apiaceae and Rosaceae are very extensive taxonomic groups, encompassing a wide variety of plants that differ in both chemical composition and health-promoting properties, depending on the species as well as the parts of the plant. Some of them (carrots—*Daucus carota*, Apiaceae; apples—*Malus* spp., Rosaceae) are introduced into the diet from an early age, while other species can be inedible due to the high content of cyanogenic glycosides, characteristic of some species from the Rosaceae family. Nevertheless, the following classes of active compounds can be mentioned among the representatives of these families: phenolic compounds (e.g., flavonoids, phenolic acids, procyanidins), vitamins, triterpenes and sterols, fatty acids, essential oils, and coumarins (Apiaceae) [51,185,191,195]. Individual species differ significantly in terms of

the content of these chemical compounds; e.g., carrots are famous for their high content of vitamin A, apples contain a large amount of malic acid, and celery has a characteristic smell due to its high content of essential oils. The most important active compounds with scientific reports regarding activity in heart diseases, along with the appropriate structural formulas, are presented in Table 5. Interestingly, the literature review shows that most studies concern plant extracts, not isolated compounds, which creates space for further analyses for scientists.

Table 5. The chemical structures of compounds identified in the Apiaceae and Rosaceae families with therapeutic effects on the cardiovascular system (chemical name with assigned number), belonging to different groups: flavonoids (**1**–**13**), anthocyanins (**14**–**15**), phenolic acids (**16**–**28**), essential oil constituents (**29**–**31**), vitamins (**32**), fatty acids (**33**), coumarins (**34**–**37**), and triterpenoids (**38**–**39**).

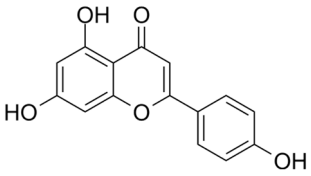
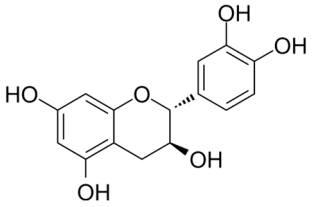
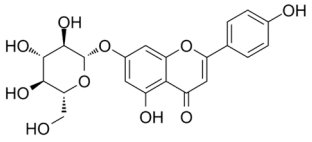
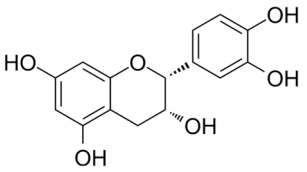
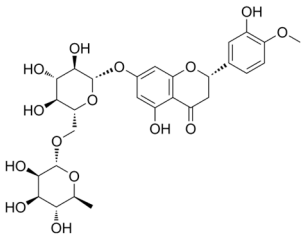
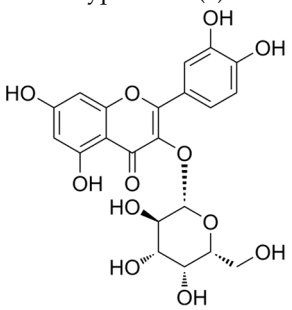
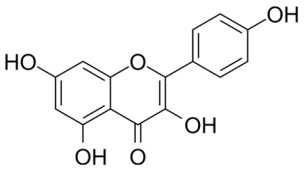
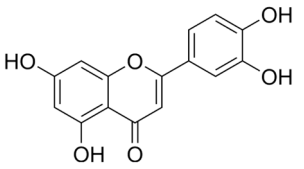
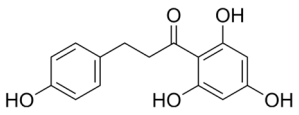
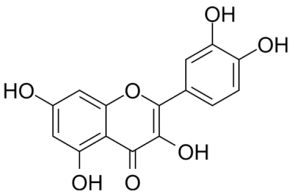
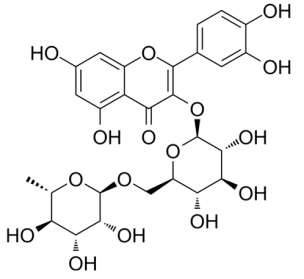
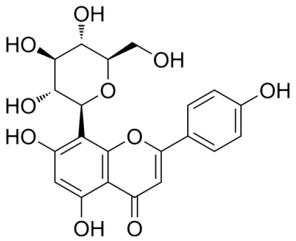
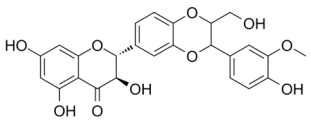
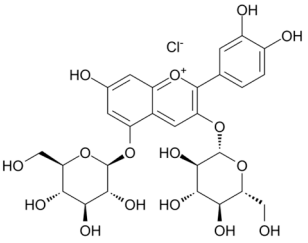
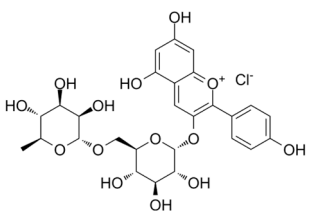
Apigenin (**1**)	Catechin (**2**)	Cosmosiin (**3**)
		
Epicatechin (**4**)	Hesperidin (**5**)	Hyperoside (**6**)
		
Kaempferol (**7**)	Luteolin (**8**)	Phloretin (**9**)
		
Quercetin (**10**)	Rutin (**11**)	Vitexin (**12**)
		
Silibinin (**13**)	Cyanidin diglucoside (**14**)	Pelargonidin-3-rutinoside (**15**)
		

Table 5. *Cont.*

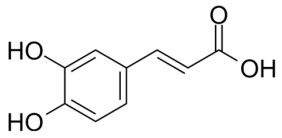
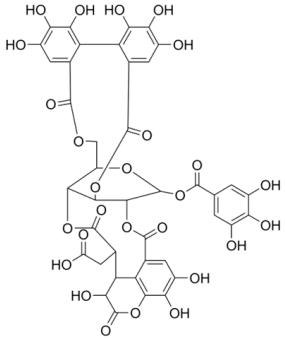
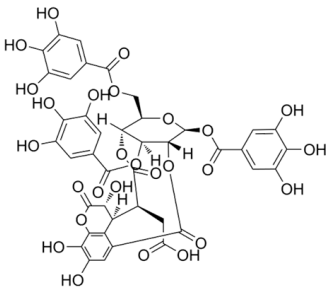
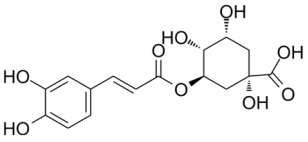
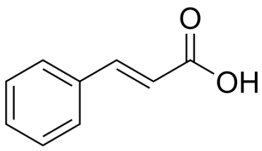
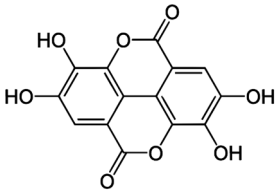
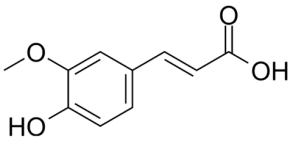
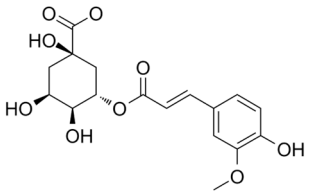
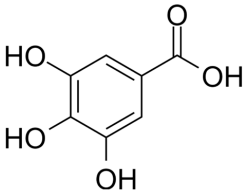
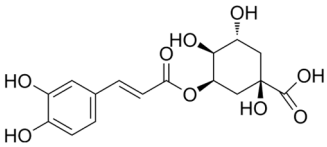
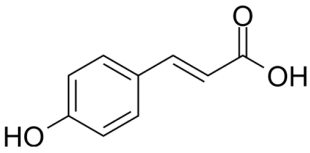
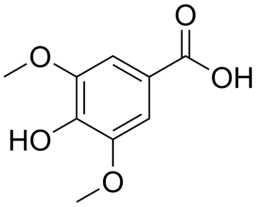
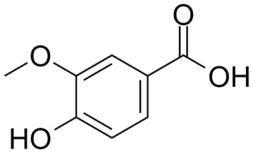
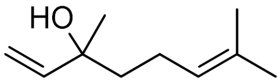
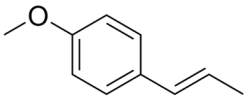
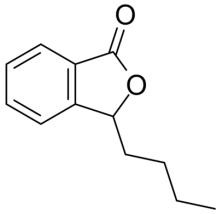
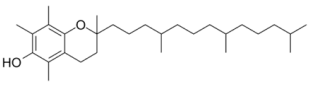
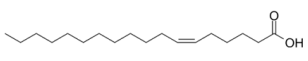
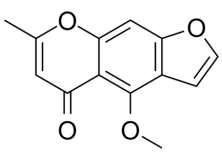
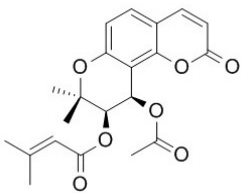
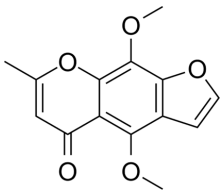
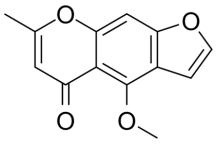
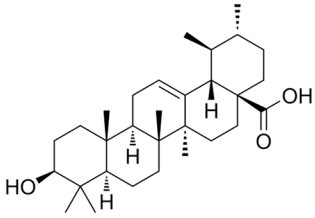
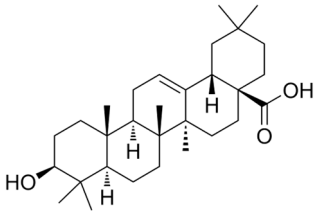
Caffeic acid (**16**)	Chebulagic acid (**17**)	Chebulinic acid (**18**)
		
Chlorogenic acid (**19**)	Cinnamic acid (**20**)	Ellagic acid (**21**)
		
Ferulic acid (**22**)	Feruloylquinic acid (**23**)	Gallic acid (**24**)
		
Neochlorogenic acid (**25**)	p-coumaric acid (**26**)	Syringic acid (**27**)
		
Vanillic acid (**28**)	Linalool (**29**)	Anethole (**30**)
		
3-n-butylphthalide (**31**)	Tocopherol (**32**)	Petroselinic acid (**33**)
		
Visnadin (**34**)	Samidin (**35**)	Khellin (**36**)
		

Table 5. *Cont.*

Visnagin (**37**)	Ursolic acid (**38**)	Oleanolic acid (**39**)
		

Information regarding scientifically proven cardioprotective effect of popular polyphenols against isoproterenol (ISO)-induced myocardial damage is extensive. Their effectiveness results from antioxidant, anti-inflammatory, antiatherosclerotic, and anti-apoptotic properties [18]. Tomou and co-authors report that members of the Rosaceae and Apiaceae families, such as *Crataegus pinnatifida* and *Petroselinum crispum*, contain high amounts of apigenin (**1**), quercetin (**10**), and silibinin (**13**), which have proven cardioprotective effects [197]. Another study from 2023 showed that the seeds of members of the Apiaceae family, namely *Coriandrum sativum*, *Petroselinum crispum*, *Carum carvi*, *Pimpinella anisum*, *Foeniculum vulgare*, *Cuminum cyminum*, and *Ammodaucus leucotrichus*, contained large amounts of valuable ingredients in the prevention of heart disease (especially in minerals, petroselinic acid (**33**), phytosterol, and tocopherol (**32**)) [198].

Rutin, one of the flavonoids present in the Apiaeae and Rosaceae families, stimulates the formation of NO in the vascular endothelium and at the same time inhibits the synthesis of 12-HETE (a compound impairing endothelial function). It also contributes to the inhibition of the synthesis of thromboxane A and the activity of phospholipase C. The anti-aggregation effect is also explained by the ability to inhibit the activity of enzymes such as phosphodiesterase and cyclooxygenase [199]. Rutin (**11**) administered orally in a dose of 40 and 80 mg/kg/day for 42 days to male albino Wistar rats increased the activity of SOD, catalase, and GSH in the heart in a dose-dependent manner. At the same time, a decrease in the level of thiobarbituric acid reactive substances and lipid hydroperoxide was noted [200].

Catechins belong to a group of polyphenols with various pharmacological effects, including antioxidant properties, the inhibition of lipid enzyme biosynthesis, vascular inflammation reduction, and others. Numerous scientific studies have highlighted the significant potential of catechins in mitigating cardiovascular diseases (CVDs) [201]. Anandh Babu et al. discovered a 39% reduction in aortic atherosclerotic arch lesions in 40 apolipoprotein E-deficient mice treated with catechin-rich water (50 µg/day) for 6 weeks compared to a placebo. Additionally, a 31% decrease was observed in low-density lipoprotein levels, along with reduced susceptibility to oxidation [202]. (-) Epicatechin (**4**) reduces the size of the infarction and leakage of cardiac markers. Furthermore, it stabilizes and protects the lysosomal membrane (20 mg/kg/day orally for 21 days, male albino Wistar rats) [203].

According to the information contained in [204], hesperidin (**5**) given in the dose of 100 mg/kg/day orally for 14 days (male albino Wistar rats) reduces left ventricular end-diastolic pressure as well as boosts the expression of Bcl-2 and peroxisome proliferator-activated receptor g.

The research conducted by Akila and Vennila [205] on male albino Wistar rats showed that chlorogenic acid (**19**) given orally in the dose of 10, 20, and 40 mg/kg/day for 19 days reduces the infarct extent, mononuclear infiltration, and severance of muscle fibers.

Moreover, it is well established that gallic acid (**24**) reduces the level of cardiac troponin T, aspartate and alanine transaminase, CK, creatine kinase myocardial band (CK-MB), lactate dehydrogenase (LDH), and increases the amount of glutathione peroxidase and superoxide dismutase (15 mg/kg of gallic acid/day for 10 days; male albino Wistar rats) [206].

5. Conclusions and Future Studies

An insightful review of the literature has led to the collection of information regarding experimental evidence of 18 plants from the Apiaceae family (*Alepidea amatymbica*, *Ammodaucus leucotrichus*, *Ammi visnaga*, *Anethum graveolens*, *Angelica archangelica*, *Angelica dahurica*, *Angelica furcijuga*, *Angelica keiskei*, *Angelica pubescens*, *Angelica sinensis*, *Apium graveolens*, *Carum carvi*, *Carum copticum*, *Centella asiatica*, *Coriandrum sativum*, *Daucus carota*, *Ligusticum wallichii*, *Petroselinum crispum*) and approximately 19 representatives from the Rosaceae family (*Agrimonia eupatoria*, *Crataegus* spp., *Crataegus aronia*, *Crataegus curvisepala*, *Crataegus laevigata*, *Crataegus mexicana*, *Crataegus meyeri*, *Crataegus microphylla*, *Crataegus monogyna*, *Crataegus oxyacantha*, *Crataegus orientalis*, *Crataegus pinnatifida*, *Crataegus tanacetifolia*, *Fragaria ananassa*, *Malus domestica*, *Malus sylvestris*, *Prunus amygdalus*, *Rosa damascena*, *Rubus idaeus*). At the same time, these families include 3820 and 5243 species, for Apiaceae and Rosaceae, respectively. Therefore, it can be concluded that a very small part of the species has been tested for cardiological properties.

Some of them are commonly used in traditional medicine, and at the same time have no scientific research in the direction of cardiological properties. Thus, untested species create a broad research perspective for scientists, especially considering that new pathways and therapeutic targets related to the complex etiopathogenesis of cardiovascular diseases are still being discovered, e.g., CB1R (cannabinoid receptor 1) and the endocannabinoid system, affecting blood pressure and heart contractility [207]. This creates new possibilities for the use of plant extracts, which are known for their multidirectional action against diseases with the pathomechanism conditioned by numerous reasons.

Among the Apiaceae family, the following species are widely using traditionally and at the same time have insufficient science-based (clinical) evidence: *Coriandrum tordylium*, *Eryngium creticum*, *Ferula narthex*, *Lichtensteinia lacera*, *Pastinaca sativa*, and *Peucedanum galbanum*.

As far as the Rosaceae family is concerned, species applied traditionally without sufficient scientific investigation (clinical research) are as follows: *Cerasus vulgaris*, *Filipendula ulmaria*, *Leucosidea sericea*, and *Prunus spinosa*.

Representatives of the Apiaceae and Rosaceae families are abundant in compounds possessing cardioprotective effects, and simultaneously, the lack of studies on their activity towards heart diseases can be observed, so this creates knowledge gaps and prospects for future research.

Numerous studies collected in our review were conducted a long time ago and need to be repeated using modern apparatus as well as current techniques. All the above clearly suggests that particular representatives of the Apiaceae and Rosaceae families can be promising therapeutic agents towards the amelioration of cardiovascular diseases. Taking into consideration that these plants are easily available and inexpensive as well as possess significant therapeutic potential, additional studies regarding clinical effectiveness are required. Providing an explanation of the mechanisms of action and specifying their safety and tolerability are the primary aspects to be considered in order to achieve a more promising curative approach. Animal studies as well as pharmacological and clinical trials are essential for determining the clinical effectiveness of plants used in monotherapy or polytherapy.

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