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Review

Phytochemical Profile of *Prosopis farcta* (Banks & Sol.) J.F. Macbr.: A Comprehensive Review

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Abstract: *Prosopis farcta* (Banks & Sol.) J.F. Macbr., a member of the Fabaceae family, is a medicinal plant widely distributed in arid and semi-arid regions and traditionally used for the treatment of diabetes, infections, inflammatory disorders, and metabolic diseases. Owing to its rich phytochemical composition, the species has attracted increasing scientific attention. This review comprehensively summarizes phytochemical studies conducted on *P. farcta*, with particular emphasis on the distribution of secondary metabolites in different plant organs and the analytical approaches employed for their characterization. The available evidence demonstrates that *P. farcta* possesses a diverse phytochemical profile comprising alkaloids, fatty acids, flavonoids, phenolic acids, saponins, sterols, tannins, triterpenoids, and volatile constituents. Major bioactive compounds, including β-sitosterol, chlorogenic acid, gallic acid, kaempferol, lupeol, luteolin, and quercetin are considered to contribute significantly to the biological properties of the species. Comparative evaluation of the reviewed studies indicates that the phytochemical composition varies among plant organs and is influenced by geographical origin and environmental conditions. The findings further reveal that *P. farcta* exhibits remarkable anticancer, antidiabetic, anti-inflammatory, antimicrobial, antioxidant, and hypolipidemic activities. Moreover, its extracts have shown promising potential as reducing and stabilizing agents in the green synthesis of nanoparticles. Overall, the available literature identifies *P. farcta* as a valuable natural source of bioactive compounds with considerable pharmaceutical, nutraceutical, and biotechnological potential. Nevertheless, further metabolomic, genomic, and clinical studies are needed to validate its therapeutic applications and facilitate its future utilization.

Keywords: *Prosopis farcta*; phytochemistry; secondary metabolite

1. Introduction

The Fabaceae (Leguminosae) family is one of the most economically and pharmacologically important plant families, comprising approximately 770 genera and more than 19,500 species worldwide [1]. Among the members of this family, the genus *Prosopis* L. is particularly noteworthy due to its remarkable adaptation to arid and semi-arid ecosystems. *Prosopis* species are naturally distributed throughout the dry regions of the America, Africa, the Middle East, and Southwest Asia, where they can tolerate harsh environmental conditions such as high temperatures, salinity, and water scarcity [2]. Owing to these characteristics, members of the genus have gained recognition not only for their ecological significance but also for their utilization as animal feed, fuelwood, food resources, timber, and traditional medicinal remedies [3]. Recent studies have demonstrated that the biological activities exhibited by *Prosopis* species are largely attributed to their rich phytochemical composition [4].

One of the most widespread species of the genus, *Prosopis farcta* (Banks & Sol.) J.F. Macbr., is a perennial thorny shrub naturally distributed throughout the Middle East and the Mediterranean Basin [5]. The species has a broad geographical distribution, particularly in Iran, Iraq, Türkiye, Syria, Jordan, Saudi Arabia, the United Arab Emirates, Egypt, and Tunisia. Due to its deep root system, the plant is highly adapted to arid environmental conditions and constitutes an important component of steppe, desert, and semi-desert ecosystems [3]. Commonly known in the international botanical literature as "Syrian mesquite", *P. farcta* has historically been utilized both as a food source and in traditional medicinal practices [3,6].

From an ethnobotanical perspective, different organs of *P. farcta* have been widely employed in traditional therapeutic applications. Fruits and seeds have been used in the treatment of diabetes, roots for alleviating gastrointestinal disorders, and leaves for wound healing and anti-inflammatory purposes. In Middle Eastern folk medicine, the fruits of the plant have been traditionally utilized for their hypoglycemic effects, whereas roots and seeds have been employed in the treatment of infectious diseases, rheumatic disorders, and liver ailments. Furthermore, the plant has been reported to be preferred in certain regions because of its antihypertensive, antiparasitic, and hypolipidemic properties. These traditional uses have been substantially supported by pharmacological studies conducted in recent years [3].

With the growing interest in plant-derived natural products, phytochemical investigations on *P. farcta* have accelerated considerably. Particularly over the last twenty-six years, modern analytical techniques have revealed that the species possesses a highly complex and diverse secondary metabolite profile. Studies employing advanced analytical methods such as Gas Chromatography-Mass Spectrometry (GC-MS), Fourier-Transform Infrared Spectroscopy (FTIR), High-Performance Liquid Chromatography (HPLC), High-Performance Liquid Chromatography-Photodiode Array-Electrospray Ionization-Tandem Mass Spectrometry (HPLC-PDA-ESI-MS/MS), High-Performance Thin-Layer Chromatography (HPTLC), Liquid Chromatography-Electrospray Ionization-Quadrupole Time-of-Flight-Tandem Mass Spectrometry (LC-ESI-QTOF-MS/MS), Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS), and Nuclear Magnetic Resonance Spectroscopy (NMR) have identified numerous alkaloids, fatty acids, flavonoids, glycoside derivatives, phenolic acids, saponins, sterols, terpenoids, and tannins in different plant organs. In particular, compounds such as apigenin, β-sitosterol, chlorogenic acid, daucosterol, gallic acid, isovitexin, kaempferol, lupeol, luteolin, quercetin, rutin, and vitexin have been shown to play important roles in the biological activities of the species [7,8].

Previous studies have demonstrated that the phytochemical composition of the plant varies considerably among different organs. Roots are generally characterized by high concentrations of flavonoid aglycones, phenolic acids, and tannins [7], whereas leaves are rich in flavonoid glycosides and antioxidant phenolic compounds [9,10]. Fruits and seeds are particularly notable for their abundance of fatty acids, sugar derivatives, and various phenolic metabolites [11,12]. In addition, essential oil analyses have revealed the presence of diverse monoterpenes, sesquiterpenes, aldehydes, esters, and hydrocarbons. However, existing studies indicate that phytochemical composition is influenced not only by plant organ but also by geographical origin, climatic conditions, soil characteristics, harvesting time, and extraction methods [13,14].

Comparative evaluation of studies conducted in different countries reveals substantial regional variations even within the same plant organ. For example, investigations carried out on populations from Iran, Iraq, Egypt, and Tunisia have reported significant differences in the quantity and distribution of phenolic compounds. Similarly, essential oil compositions and fatty acid profiles have been shown to vary according to geographical origin. These findings suggest that *P. farcta* is a species of considerable chemotaxonomic interest and that different populations should be evaluated separately from a metabolic perspective [15].

In addition to phytochemical investigations, biological activity studies conducted in recent years have highlighted the pharmaceutical potential of *P. farcta*. Extracts obtained from the species have been reported to exhibit potent anticancer, antidiabetic, anti-inflammatory, antimicrobial, antioxidant, cardioprotective, and hepatoprotective activities. Furthermore, due to their ability to reduce metal ions, plant extracts have been successfully employed in green synthesis approaches for the production of silver and other metal nanoparticles. These findings indicate that *P. farcta* is not only a plant traditionally used in folk medicine but also an important natural resource for modern drug discovery and biotechnological applications [16].

The aim of this review is to comprehensively evaluate the phytochemical studies conducted on *P. farcta*, compare the metabolites identified in different plant organs, examine the analytical techniques employed, and elucidate the effects of regional variations on the phytochemical composition of the species. Furthermore, the review seeks to assess the relationships between the biological activities and phytochemical constituents of the species in light of the available evidence and to provide a scientific perspective for future research.

2. Materials and Methodology

Within the scope of this review, a comprehensive literature search was conducted to identify studies reporting the phytochemical composition of *Prosopis farcta* (Banks & Sol.) J.F. Macbr. Electronic databases and academic search platforms, including Academia.edu, ACS Publications, Crossref, DOAJ (Directory of Open Access Journals), Europe PMC, Google Scholar, MDPI, OpenAlex, PubMed, ResearchGate, ScienceDirect, Scopus, Semantic Scholar, Springer Nature Link, Taylor and Francis Online, Web of Science, and Wiley Online Library, were systematically searched. The literature search covered publications published between January 2000 and May 2026, corresponding to the last 26 years.

Accordingly, a broad literature survey was performed using a wide range of keywords related to the phytochemical composition and analytical investigation of the species. The search terms included "*Prosopis farcta* and metabolomics", "*Prosopis farcta* and secondary metabolites", "*Prosopis farcta* and phytochemistry", "*Prosopis farcta* and phytochemical analyses", "*Prosopis farcta* and chemical constituents", "*Prosopis farcta* and phenolic compounds", "*Prosopis farcta* and phenolic acids", "*Prosopis farcta* and polyphenols", "*Prosopis farcta* and flavonoids", "*Prosopis farcta* and alkaloids", "*Prosopis farcta* and tannins", "*Prosopis farcta* and terpenes", "*Prosopis farcta* and essential oil analysis", "*Prosopis farcta* and fixed oil analysis", "*Prosopis farcta* and GC–MS", "*Prosopis farcta* and GC–FID", "*Prosopis farcta* and LC–MS", "*Prosopis farcta* and TLC", "*Prosopis farcta* and HPLC", "*Prosopis farcta* and HPLC–PDA", "*Prosopis farcta* and HPLC–PDA–ESI–MS/MS", "*Prosopis farcta* and LC–ESI–QTOF–MS/MS", and "*Prosopis farcta* and LC–PDA–ESI–MS/MS." Through the use of these keywords, a comprehensive assessment of the available literature on the phytochemical profile of *P. farcta* was carried out.

Studies were considered eligible if they (i) reported review articles and original experimental data on the phytochemical composition of *P. farcta*, (ii) identified or quantified primary or secondary metabolites using chromatographic, spectrometric, spectroscopic, or related analytical techniques, and (iii) were published as full-text articles in peer-reviewed journals. Conference abstracts, book chapters, theses, duplicate publications, studies lacking phytochemical data, and articles focusing exclusively on pharmacological, biological, agronomic, or ecological aspects without phytochemical characterization were excluded. Only articles published in English were considered for inclusion. The retrieved records were screened based on their titles and abstracts, followed by full-text evaluation of potentially eligible studies. The final selection included studies that fulfilled the predefined eligibility criteria and provided sufficient phytochemical information for qualitative or quantitative assessment.

3. Phytochemical Composition of *Prosopis farcta*

Phytochemical studies conducted on *P. farcta* in recent years have revealed that the species possesses a highly complex and diverse secondary metabolite profile. Various plant organs, including flowers, fruits, leaves, rhizomes, roots, seeds, and stems from different geographical regions, have been analyzed using advanced analytical techniques such as FTIR, GC-MS, HPLC, HPLC–PDA–ESI–MS/MS, HPTLC, LC–ESI–QTOF–MS/MS, LC–MS/MS, and NMR. As a result of these investigations, numerous classes of phytochemicals, including alkaloids, fatty acids, flavonoids, phenolic acids, saponins, sterols, tannins, triterpenoids, various glycoside derivatives, and volatile oil constituents, have been identified. Furthermore, it has been reported that the phytochemical composition of the species varies considerably depending on the plant organ, geographical origin, environmental conditions, and extraction methods employed. Therefore, the phytochemical profile of *P. farcta* should be evaluated from the perspectives of both geographical distribution and plant organ specificity. In this context, phytochemical analyses conducted on *P. farcta* during the last twenty-six years are summarized in detail in Table 1.

3.1. Phytochemical Studies Conducted in Middle Eastern Countries

The Middle East represents one of the major centers of natural distribution for *P. farcta*. Studies carried out primarily in Iraq, Iran, and Türkiye, as well as in Saudi Arabia and the United Arab Emirates, have demonstrated that the species possesses a highly diverse and chemically rich metabolite profile. Most investigations conducted in this region have focused on fatty acid derivatives, flavonoids, and phenolic compounds, with particular emphasis on the identification of metabolites associated with antioxidant properties and other biological activities.

3.1.1. Iran Case Study

Studies conducted in Iran have demonstrated that *P. farcta* is particularly rich in flavonoids and phenolic compounds. LC–ESI–QTOF–MS/MS analyses performed on populations collected from Tehran identified a total

of 47 phenolic compounds, including 13 phenolic acids, 28 flavonoids, 4 other polyphenols, 1 lignan, and 1 stilbene derivative. Catechin, chlorogenic acid, kaempferol, and quercetin were reported as the most abundant compounds detected in the samples. The high total phenolic and flavonoid contents were found to be strongly associated with the pronounced antioxidant activity observed in the extracts [10].

Other studies conducted in Iran have similarly confirmed the predominance of phenolic constituents in the phytochemical profile of the species. Comprehensive LC–MS/MS analyses identified a total of 47 phenolic compounds in fruits, leaves, and stems. Among these, apigenin, gallic acid, kaempferide, luteolin, nicotiflorin, phloridzin, and vicenin-2 were found to be the dominant metabolites in different plant organs. Notably, gallic acid was detected at relatively high levels in all investigated organs, representing a characteristic feature of the species [8].

Studies on the roots further highlighted the richness of Iranian populations in phenolic constituents. The total phenolic content of the roots was determined to be 171.2 mg/g dry extract, whereas the total flavonoid content reached 63.69 mg/g. Quercetin accounted for nearly half of the flavonoid fraction, while apigenin, luteolin, and rutin were also identified in considerable amounts [17]. Similarly, HPLC analyses performed on populations from Ilam and Darreh Shahr revealed that caffeic acid derivatives, isovitexin, luteolin, myricetin glycosides, and vitexin occurred at varying concentrations depending on environmental conditions [18].

An HPTLC study demonstrated that flavonoids were predominantly concentrated in the ethyl acetate fraction, whereas terpenoids were mainly present in the *n*-hexane fraction of Iranian populations. In the same study, high levels of myricetin, rutin, and several phenolic acid derivatives were detected [19]. Furthermore, GC–MS analyses indicated that fatty acids constitute an important group of phytochemicals in Iranian populations. In particular, ethyl 9,12-octadecadienoate and palmitic acid were identified as the predominant compounds [13].

Similar findings were reported for fruit samples collected from the Jahrom region, where fatty acids were found to constitute the major proportion of the volatile oil fraction, while ethanolic extracts exhibited high total phenolic contents [14]. Overall, the available evidence suggests that Iranian populations of *P. farcta* are exceptionally rich in flavonoids, phenolic acids, and other polyphenolic compounds with significant antioxidant potential.

3.1.2. Iraq Case Study

Studies conducted in Iraq have primarily focused on the phytochemical composition of the fruits and leaves of *P. farcta*. In contrast to findings reported from Iranian populations, these investigations have more frequently highlighted the presence of fatty acids, saccharide derivatives, and various primary metabolites.

GC–MS analyses of the fruits identified a total of 21 organic compounds, the majority of which were classified as sugar derivatives and carbohydrate-related metabolites. Notable compounds included 3-*O*-methyl-D-glucose, galacto-heptulose, L-glucose and myo-inositol. In addition, FTIR analyses confirmed the presence of aromatic, carbonyl, and hydroxyl functional groups within the fruit extracts [11].

In one study, fatty acid methyl esters were identified as the dominant constituents of fruit extracts. Linoleic acid derivatives, methyl palmitate, and stearic acid esters constituted a substantial proportion of the overall composition [20]. Similarly, phytochemical analyses revealed high abundances of *cis*-13-octadecenoic acid, *n*-hexadecanoic acid, and stigmasterol [21].

GC–MS analyses of leaf samples collected from Baghdad populations further demonstrated that saccharide derivatives represent an important class of metabolites in this organ. In these analyses, 4,6-di-*O*-methyl-α-D-galactose was identified as the predominant compound, while fatty acids and various nitrogen-containing metabolites were also detected [9].

Isolation studies conducted in Iraq have also yielded noteworthy findings. β-Sitosterol and hesperidin were successfully isolated from the leaves for the first time [22]. Furthermore, several biologically important compounds were purified from the ethyl acetate extract of the roots, including β-sitosterol, β-sitosterol palmitate, daucosterol, epicatechin, and lupeol. In particular, the identification of daucosterol as a potent α-glucosidase inhibitor has been regarded as an important finding supporting the antidiabetic potential of the species [23].

Another study demonstrated that Iraqi populations of *P. farcta* are rich in both fatty acids and phenolic compounds. High concentrations of chlorogenic acid, quercetin, and rutin were detected in the fruits, whereas oleic acid and other unsaturated fatty acids were identified as the predominant constituents of the seeds [24].

3.1.3. Saudi Arabia and United Arab Emirates Case Study

Studies conducted in the Arabian Peninsula have primarily focused on the volatile oil composition of *P. farcta*. In Saudi Arabia, analyses revealed that more than 95% of the volatile oil consisted of terpenoid compounds. Camphor, Cubenol, davana ether, torreyol, and *trans*-chrysanthenyl acetate were identified as the major

constituents of the essential oil. The predominance of oxygenated sesquiterpenes was considered one of the distinguishing characteristics of these populations compared with those from other geographical regions [25].

In the United Arab Emirates, the volatile oil profiles of different plant organs were investigated separately. The analyses revealed that benzyl benzoate and phytol were the predominant constituents in the leaves, whereas heneicosane and limonene were dominant in the stems. In the fruits, methyl hexadecanoate and methyl octadecenoate were identified as the major compounds. The pronounced differences observed among plant organs were considered important indicators of metabolic differentiation and environmental adaptation within the species [26].

3.2. Phytochemical Studies Conducted in North African Countries

Studies conducted in North Africa have primarily focused on populations of *P. farcta* from Egypt and Tunisia. These investigations have provided important insights into the species, particularly regarding flavonoid diversity, the distribution of phenolic compounds, and chemotaxonomic variations.

3.2.1. Egypt Case Study

Studies performed on Egyptian populations have demonstrated that *P. farcta* possesses a remarkably diverse metabolite profile. In a comprehensive investigation of rhizomes and roots, a total of 14 pure compounds were isolated, while 72 metabolites were identified through HPLC–PDA–ESI–MS/MS analyses. The study revealed a phytochemical profile particularly rich in anthraquinones, flavonoids, lignan glycosides, phenolic acids, saponins, and triterpenoids. This work is considered one of the most comprehensive phytochemical investigations conducted on the species [7].

A GC–MS study performed on the aerial parts of the plant further supported the chemical diversity of Egyptian populations. Fatty acids, flavonoid derivatives, hydrocarbons, and tocopherols were reported, while acacetin derivatives, apigenin, and tamarixetin were successfully isolated in pure form. Furthermore, different solvent fractions were shown to selectively enrich distinct groups of metabolites [27].

The relationship between phytochemical composition and biological activity has also been evaluated. The results demonstrated that the ethyl acetate and *n*-butanol fractions exhibited particularly strong antioxidant and cytotoxic activities [28]. These findings suggest that Egyptian populations are rich sources of pharmacologically important metabolites.

3.2.2. Tunisia Case Study

Studies conducted in Tunisia represent some of the most significant investigations addressing the chemotaxonomic variation of *P. farcta*. HPLC analyses identified a total of 16 phenolic compounds distributed among different plant organs. Myricetin-3-*O*-glucoside was found to be the predominant compound in flowers, isovitexin in leaves, and isorhamnetin derivatives in fruit pericarps [29].

Subsequent studies investigated volatile compound profiles and demonstrated pronounced chemical differences between populations from Gabès and Nabeul. Saturated hydrocarbons were found to predominate in the Gabès population, whereas aldehydes, carboxylic acids, and unsaturated hydrocarbons occurred at higher levels in the Nabeul population. Compounds such as 6,10,14-trimethylpentadecan-2-one, methyl hexadecanoate, phytol were proposed as potential chemotaxonomic markers capable of distinguishing between the two varieties [15,29].

When North African and Middle Eastern populations are considered collectively, it becomes evident that the phytochemical composition of *P. farcta* exhibits substantial regional variation. Flavonoids and phenolic compounds are particularly prominent in Iranian populations, whereas fatty acids and saccharide derivatives appear to be more characteristic of Iraqi populations. Populations from Saudi Arabia and the United Arab Emirates are distinguished by their terpenoid compositions and volatile oil, while Egyptian and Tunisian populations are notable for their flavonoid diversity and chemotaxonomic variability. These findings indicate that the broad ecological adaptability of *P. farcta* is reflected at the phytochemical level and suggest that distinct chemotypes may develop across different geographical regions.

Table 1. Phytochemical Profile of *Prosopis farcta.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
Alkanes			
Dodecane, 2,6,10-trimethyl (Farnesane)	Fruit	GC-MS	[8]
Undecane			
Hexadecane	Fruit, Leaf, Stem		
Nonacosane	Leaf		
Tetradecane, 2,6,10-trimethyl	Leaf, Stem		
Tridecane	Fruit, Leaf		
Alkanes/Alcohols			
Triacontane-1,30-diol	Leaf	GC-MS	[8]
Alkenes			
17-Pentatriacontene	Stem	GC-MS	[8]
Amides/Fatty Acid Derivatives			
Erucamide	Fruit, Leaf, Stem	GC-MS	[8]
Anthraquinones			
Chrysophanol	Fruit, Leaf, Rhizome, Root, Stem	GC-MS, HPLC-PDA-ESI-MS/MS, LC-PDA-ESI-MS/MS	[7,8]
Emodin	Fruit, Rhizome, Root, Stem		
Aromatic Hydrocarbons			
Benzene, 1,2,4,5-tetrakis(1-methylethyl)	Fruit, Stem	GC-MS	[8]
Benzene, 1,3,5-tris(1-methylethyl)	Fruit, Leaf, Stem		
Benzene, p-di-tert-pentyl	Stem		
Carbohydrates/Polysaccharides			
Gum	Leaf	IR, NMR	[22]
Mucilage			
Esters			
1,2-Benzenedicarboxylic acid, diisooctyl ester	Leaf	GC-MS	[8]
Benzoic acid, 4-heptyl-, 4-cyanophenyl ester	Stem		
Tributyl aconitate			
Bis(2-ethylhexyl) adipate	Fruit, Leaf, Stem		
Tributyl acetylcitrate			
Fatty Acid Esters			
Hexadecanoic acid, methyl ester (Methyl palmitate)	Fruit	GC-MS	[8]
Oleic acid, 3-(octadecyloxy)propyl ester			

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
	Flavonoids		
(+)-Catechin	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
(+)-Catechin 3-*O*-gallate			
(−)-Epicatechin	Root	ESI-MS, NMR	[23]
3′,4′-dimethoxyluteolin-7-*O*-rutinoside	Fruit, Leaf, Rhizome, Root, Stem	GC-MS, HPLC-PDA-ESI-MS/MS, LC-PDA-ESI-MS/MS	[7,8]
3′-Hydroxygenistein	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
3-Hydroxyphloretin 2′-*O*-glucoside			
4′-O-Methylepigallocatechin			
5,6,7,3′,4′-Pentahydroxyisoflavone			
5-deoxyflavone glycoside	Branch	HPLC	[18,29,30]
5-Deoxyluteolin	Branch, Pericarp, Root		
6″-*O*-Acetylglycitin	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
6″-*O*-Malonylgenistin			
6-Hydroxyluteolin 7-*O*-rhamnoside			
7,4′-dihydroxy-3′-methoxyflavone	Fruit, Leaf, Rhizome, Root, Stem	GC-MS, HPLC-PDA-ESI-MS/MS, LC-PDA-ESI-MS/MS	[7,8]
Acacetin	Fruit, Rhizome, Root		
Acacetin-7-*O*-glucoside	Fruit, Leaf, Rhizome, Root		
Acacetin-7-*O*-rutinoside	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Apigenin	Fruit, Leaf, Pod, Rhizome, Root, Seed, Stem	GC-MS, HPLC, HPLC-PDA-ESI-MS/MS, LC-PDA-ESI-MS/MS, Standard Phytochemical Analysis	[7,8,17,24,31]
Apigenin 6,8-di-*C*-glucoside	Leaf, Rhizome, Root	HPLC-PDA, HPLC-PDA-ESI-MS/MS, LC-ESI-QTOF-MS/MS	[7,10]
Apigenin 6-*C*-glucoside	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
Apigenin *C*-glycoside	Branch, Flower, Leaf, Pericarp	HPLC	[18,19,29,30]
Apigenin-7-*O*-glucoside	Fruit, Leaf, Rhizome, Root	GC-MS, HPLC-PDA-ESI-MS/MS, LC-PDA-ESI-MS/MS	[7,8]
Apigenin-7-*O*-rutinoside			
Astragalin (Kaempferol 3-*O*-glucoside)	Fruit, Leaf, Stem	GC-MS, LC-PDA-ESI-MS/MS	[8]
Catechin hydrate	Fruit	LC-MS/MS	[32]
Chrysoeriol	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Chrysoeriol 7-*O*-glucoside	Branch, Fruit, Leaf, Pericarp, Rhizome, Root, Stem	GC-MS, HPLC, HPLC-PDA, HPLC-PDA-ESI-MS/MS, LC-ESI-QTOF-MS/MS, LC-PDA-ESI-MS/MS	[7,8,10,19,29]
Chrysoeriol-methyl ether	Fruit, Leaf, Rhizome, Root, Stem	GC-MS, HPLC-PDA-ESI-MS/MS, LC-PDA-ESI-MS/MS	[7,8]

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
	Flavonoids		
Cynaroside (Luteolin 7-*O*-glucoside)	Fruit, Leaf, Stem	GC-MS, LC-PDA-ESI-MS/MS	[8]
Dihydrokaempferol hexoside	Fruit, Leaf, Rhizome, Root	GC-MS, HPLC-PDA-ESI-MS/MS, LC-PDA-ESI-MS/MS	[7,8]
Dihydrokaempferol-3-*O*-rhamnoside	Fruit	GC-MS, LC-PDA-ESI-MS/MS	[8]
Dihydromyricetin 3-*O*-rhamnoside	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
Diosmetin-7-*O*-rutinoside	Fruit, Leaf, Rhizome, Root, Stem	GC-MS, HPLC-PDA-ESI-MS/MS, LC-PDA-ESI-MS/MS	[7,8]
Diosmin	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
Formononetin	Fruit, Leaf, Rhizome, Root, Stem	GC-MS, HPLC-PDA-ESI-MS/MS, LC-PDA-ESI-MS/MS	[7,8]
Glycitin	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
Hesperetin 3′-*O*-glucuronide			
Hesperidin		IR, NMR	[22]
Hyperoside	Fruit, Leaf	GC-MS, LC-PDA-ESI-MS/MS	[8]
Iso-orientin	Branch, Flower, Fruit, Leaf, Pericarp, Stem	GC-MS, HPLC, LC-PDA-ESI-MS/MS	[8,19]
Luteolin 6-*C*-glucoside	Branch, Flower, Leaf, Pericarp	HPLC	[29]
Isoquercitrin	Fruit, Leaf	GC-MS, LC-PDA-ESI-MS/MS	[8]
Isorhamnetin	Leaf, Stem		
Isorhamnetin 3-*O*-glucoside	Pericarp, Stem	GC-MS, HPLC, LC-PDA-ESI-MS/MS	[9,19]
Isorhamnetin 3-*O*-rutinoside	Branch, Flower, Leaf, Pericarp	HPLC	[19,29,30]
Isovitexin	Branch, Flower, Fruit, Leaf, Pericarp, Root, Stem	GC-MS, HPLC, LC-PDA-ESI-MS/MS	[8,18,19,29,30]
Kaempferide	Fruit, Leaf, Stem	GC-MS, LC-PDA-ESI-MS/MS	[8]
Kaempferol	Fruit	LC-MS/MS	[32]
Kaempferol 3,7-*O*-diglucoside	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
Kaempferol 3-*O*-(2″-rhamnosyl-galactoside) 7-*O*-rhamnoside			
Kaempferol 3-*O*-glucoside	Leaf, Pericarp, Rhizome, Root	HPLC, HPLC-PDA-ESI-MS/MS	[7,19]
Kaempferol 3-*O*-rutinoside	Branch, Flower, Leaf, Pericarp		[19,29]
Kaempferol-3-*O*-glucoside-7-rhamnoside	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Kaempferol-methyl-ether			
Linarin	Fruit, Leaf, Stem	GC-MS, LC-PDA-ESI-MS/MS	[8]
Luteolin	Branch, Fruit, Leaf, Pericarp, Root, Stem	GC-MS, HPLC, LC-PDA-ESI-MS/MS	[8,17,18,29,30]

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
	Flavonoids		
Luteolin 7-*O*-glucoside	Branch, Pericarp, Root	HPLC	[18,29,30]
Luteolin *C*-glycoside	Leaf		[19,29]
Methylated flavonoid-*O*-hexoside	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Mixture of Isorhamnetin and Kaempferol 3-*O*-rutinoside	Flower, Pericarp	HPLC	[29]
Mixture of Kaempferol 3-*O*-glucoside and Isorhamnetin 3-*O*-glucoside	Branch, Leaf, Pericarp		
Mixture of Tricin and Chrysoeriol 7-*O*-glucoside	Branch		
Myricetin	Fruit	LC-MS/MS	[32]
Myricetin 3-*O*-galactoside	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
Myricetin 3-*O*-glucoside	Branch, Flower, Leaf, Pericarp	HPLC	[18,19,29,30]
Myricetin 3-*O*-rhamnoside	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
Myricetin 3-*O*-rutinoside			
Narcissin	Fruit, Leaf, Stem	GC-MS, LC-PDA-ESI-MS/MS	[8]
Neoeriocitrin	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
Nicotiflorin (Kaempferol 3-*O*-rutinoside)	Fruit, Leaf, Stem	GC-MS, LC-PDA-ESI-MS/MS	[8]
Phloretin 2′-*O*-glucoside (Phloridzin)	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Phloridzin	Fruit, Leaf, Stem	GC-MS, HPLC-PDA, LC-ESI-QTOF-MS/MS, LC-PDA-ESI-MS/MS	[8,10]
Procyanidin dimer B1	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
Procyanidin trimer C1			
Quercetin	Fruit, Leaf, Pod, Root, Seed, Stem	GC-MS, HPLC, LC-PDA-ESI-MS/MS, Standard Phytochemical Analysis	[8,17,24,31]
Quercetin 3,3′-dimethyl ether 7-rutinoside	Fruit, Leaf, Stem	GC-MS, LC-PDA-ESI-MS/MS	[8]
Quercetin 3-methyl ether	Branch	HPLC	[18,29,30]
Quercetin 3-*O*-(6″-malonyl-glucoside)	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
Quercetin 3-*O*-galactoside	Branch, Leaf	HPLC	[18,29,30]
Quercetin 3-*O*-glucoside	Branch, Pericarp		[29]
Quercetin glycoside I	Branch, Flower, Leaf, Pericarp		[29,30]
Quercetin Glycoside II	Branch, Flower, Pericarp		[29]
Quercetin-3-methyl ether	Leaf, Stem	GC-MS, LC-PDA-ESI-MS/MS	[8]
Quercetin-dimethyl ether-*O*-rutinoside	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Rhoifolin	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
Flavonoids			
Rutin	Branch, Flower, Fruit, Leaf, Pericarp, Pod, Root, Seed, Stem	GC-MS, HPLC, LC-PDA-ESI-MS/MS	[8,17,19,24,29]
Tamarixetin	Fruit, Leaf, Stem	GC-MS, LC-PDA-ESI-MS/MS	[8]
Tricin-7-*O*-glucoside	Leaf, Rhizome, Root, Stem	GC-MS, HPLC-PDA-ESI-MS/MS, LC-PDA-ESI-MS/MS	[7,8]
Trihydroxy methoxy flavone	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Vicenin-2	Branch, Flower, Fruit, Leaf, Pericarp, Stem	GC-MS, HPLC, LC-PDA-ESI-MS/MS	[8,19,29]
Vitexin	Branch, Flower, Fruit, Leaf, Rhizome, Root, Stem	GC-MS, HPLC, HPLC-PDA-ESI-MS/MS, LC-PDA-ESI-MS/MS	[7,8,18,19,29,30]
Vitexin-2′-*O*-rhamnoside	Leaf, Rhizome, Root	GC-MS, HPLC-PDA-ESI-MS/MS, LC-PDA-ESI-MS/MS	[7,8]
Glycerolipids			
Trilinolein	Fruit	GC-MS	[8]
Halogenated Compounds			
Isolongifolene, 8-bromo	Leaf	GC-MS	[8]
Undecane, 1,2-dibromo-2-methyl	Fruit		
Heterocyclic Compounds			
1*H*,4*H*-Pyrazolo [3,4-b]pyran-5-carbonitrile, 6-amino-4-(3,4-dichlorophenyl)-3-propyl	Stem	GC-MS	[8]
Cyclohexane, 1,1-bis(5-methyl-2-furyl)			
8-Amino-6-methoxy-4-methyl-5-[*n*-nonoxy]quinoline	Fruit		
Hydrocarbons			
1-Docosene	Aerial Plant	GC-MS	[27]
1-Icosene			[27,28]
1-Tridecene			
10-Heneicosene			[27]
11,13-triene (fragment)	Root	GC-FID, Steam Distillation	[26]

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
Hydrocarbons			
2,4′-Dimethylbiphenyl	Leaf	GC-MS	[9]
9,10-Methanoanthracen-11-ol, 9,10-dihydro-9,10,11-trimethyl-			
Benzene, (1-methylenepropyl)-	Fruit		[21]
Cyclohexadecane	Fruit, Leaf, Stem		[13,14]
Cyclotetracosane	Aerial Plant		[27]
Docosane	Aerial Plant, Branch, Stem	GC-FID, GC-MS, Steam Distillation	[15,26,27]
Eicos-3-ene	Flower	GC-MS	[15]
Eicosane	Flower, Leaf	GC-FID, GC-MS, Steam Distillation	[15,26]
Heneicosane	Branch, Stem		
Heptadecane	Fruit, Flower	GC-MS	[15,21]
Henicosane	Aerial Plant		[27]
Heptacosane	Aerial Plant, Leaf		[8,27]
Heptadeca-1,11,13-triene	Root	GC-FID, GC-MS, Steam Distillation	[15,26]
Hexacosane	Aerial Plant, Fruit	GC-MS	[21,27]
Nonadecane	Aerial Plant, Branch, Root		[15,27,28]
o,o′-Bitoluene	Leaf		[27]
Octadec-9-yne			[15]
Octadeca-1-ene	Root		
Octadecane	Aerial Plant, Fruit, Root		[8,15,27,28]
Pentacosane	Aerial Plant		[27]
Pentadecane	Aerial Plant, Fruit, Leaf, Stem		[8,27,28]
Saturated hydrocarbons (general)	Shoot	GC-FID, Steam Distillation	[26]
Tetracosane	Aerial Plant, Branch, Flower	GC-MS	[15,27]
Tetradeca-1,13-diene	Flower, Root	GC-FID, GC-MS, Steam Distillation	[15,26]
Tetradecane	Aerial Plant, Branch, Fruit, Leaf, Stem	GC-MS	[8,15,27,28]
Tricosane	Leaf	GC-MS	[9]
Unsaturated hydrocarbons (general)	Shoot	GC-FID, Steam Distillation	[10]
Ketones/Aromatic Compounds			
(3,5-Dimethoxynaphthalen-2-yl)(7-methyl-3,4-dihydro-2*H*-quinolin-1-yl)methanone	Stem	GC-MS	[8]
Lactones			
4,8,12,16-Tetramethylheptadecan-4-olide	Leaf	GC-MS	[8]

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
Lignans			
Schisandrol B	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
Secoisolariciresinol-9′-*O*-glucoside	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Lipids and Fatty Acids			
(Z)9,17-Octadecadienal	Aerial Plant	GC-MS	[27]
(Z,Z)-9,12-Octadecadienoic acid			
1-Heptacosanol			
10-Octadecenoic acid methyl ester	Fruit		[20]
11-Octadecenoic acid, methyl ester	Aerial Plant		[27]
4-methyl-14-pentadecenoic acid			[27,28]
9,12-Octadecadienoic acid, ethyl ester	Fruit, Leaf, Stem		[13,14]
9,12-Octadecenoic acid methyl ester	Fruit		[20]
9-Hexadecanoic acid methyl ester			
9-Octadecenoic acid (Z)-, methyl ester			[21]
Aldehydes (general)	Shoot	GC-FID, Steam Distillation	[26]
α-Linolenic acid (C18:3n3)	Leaf, Pod, Seed	GC-MS	[9,24]
Arachidic acid (C20:0)	Pod, Seed		[24]
Behenic acid (C22:0)			
Capric acid (C10:0)			
cis-11-Eicosenoic acid (20:1)			
cis-13-Octadecenoic acid	Fruit		[21]
cis-Vaccenic acid	Leaf		[9]
Cyclopropaneoctanal, 2-octyl	Aerial Plant		[27]
Decanal	Fruit, Leaf, Stem		[13,14]
Dihydroxyoctadecanoate, methyl ester	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Dihydroxyoctadecanoic acid			
Docosahexaenoic acid (DHA, C22:6n3)	Pod, Seed	GC-MS	[24]
Docosanoic acid, dihydroxypropyl ester	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Dodecanoic acid	Aerial Plant	GC-MS	[27,28]
Dotriacontan-1-ol	Branch, Root		[15]
Eicosan-1-ol	Flower		
Ethyl octadec-9-enoate	Pod		
Heptadecan-2-one	Flower		
Hexadecanal	Root	GC-FID, GC-MS, Steam Distillation	[15,26]

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
Lipids and Fatty Acids			
Hexadecanoic acid	Leaf	GC-MS	[15]
Hexadecanoic acid, dihydroxypropyl ester	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Hexadecanoic acid, methyl ester	Aerial Plant, Fruit	GC-MS	[21,27]
Hydroxy-octadecadienoic acid	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Hydroxy-octadecenoic acid			
Hydroxy-octadecenoic acid isomer			
Lauric acid	Fruit, Leaf, Stem	GC-MS	[13,14]
Lignoceric acid (C24:0)	Pod, Seed		[24]
Linoleic acid (C18:2n6c)			
Linoleic acid derivative	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Linoleic acid methyl ester	Fruit	GC-MS	[20]
Linolenic acid, methyl ester	Aerial Plant		[25]
Methyl hexadecanoate	Branch, Leaf, Pod, Stem	GC-FID, GC-MS, Steam Distillation	[15,26]
Methyl icosanoate	Aerial Plant	GC-MS	[27]
Methyl linoleate	Leaf		[9]
Methyl octadec-9-enoate	Pod	GC-FID, GC-MS, Steam Distillation	[15,26]
Methyl octadeca-9,12-dienoate	Root	GC-MS	[15]
Methyl octadecanoate	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Methyl palmitate	Leaf	GC-MS	[9]
Methyl stearate	Fruit, Leaf		[9,21]
Methyl tetradecanoate	Fruit		[20]
Methyl vaccenate	Leaf		[9]
Myristic acid	Fruit, Leaf, Stem		[13,14]
n-Hexadecanoic acid	Fruit		[12,21]
n-Octanol	Fruit, Leaf, Stem		[13,14]
Nonadecanoic acid	Aerial Plant		[27,28]
Nonanal	Fruit, Leaf, Stem		[13,14]
Octacosanol	Fruit		[21]
Octacosyl acetate/1-Heptacosanol			
Octadeca-9,12-dienoic acid	Root		[15]
Octadecanal		GC-FID, Steam Distillation	[26]

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
Lipids and Fatty Acids			
Octadecanoic acid (Stearic acid)	Fruit	GC-MS	[21]
Oleic acid	Fruit	GC-MS	[8,20]
	Fruit, Pod, Seed	GC-MS	[8,20,24]
Oleic acid derivative	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Palmitic acid (C16:0)	Fruit, Leaf, Pod, Seed, Stem	GC-MS	[13,14,24]
Palmitic acid derivative	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Palmitic acid methyl ester	Fruit, Leaf, Stem	GC-MS	[13,14,20]
Pentadecanoic acid	Aerial Plant, Fruit, Leaf, Stem	GC-MS	[13,14,27,28]
Pentadecanoic acid methyl ester	Fruit	GC-MS	[20]
Pentanal, 2,3-dimethyl-	Fruit	GC-MS	[12]
Stearic acid (C18:0)	Aerial Plant, Pod, Seed	GC-MS	[24,27]
Stearic acid, methyl ester	Fruit	GC-MS	[20]
Tetradecanal	Leaf, Root	GC-MS	[15]
trans-9-Octadecenoic acid (C18:1n9t)	Pod, Seed	GC-MS	[24]
Tricosanoic acid (C23:0)	Aerial Plant, Pod, Seed	GC-MS	[24,27]
Trihydroxy-octadecenoic acid	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Undecanoic acid (C11:0)	Pod, Seed	GC-MS	[24]
Nitrogen-Containing Organic Compounds			
1,2-Hydrazinedicarboxylic acid, diethyl ester	Fruit	GC-MS	[21]
1,3-Propanediamine, N-methyl	Fruit	GC-MS	[21]
1-(6-Hydroxyimidazo [2,1-b]thiazol-)	Leaf	GC-MS	[9]
1-[α-(1-Adamantyl)benzylidene]thiosemicarbazid e	Leaf	GC-MS	[9]
1-Azanylurea	Leaf	GC-MS	[9]
1-Octadecanamine, N-methyl-	Fruit	GC-MS	[21]
1-Piperidinamine	Fruit	GC-MS	[21]
2-Tetrazene, 1,1-diethyl-4,4-dimethyl-	Fruit	GC-MS	[11]
3,6-Bis-dimethylaminomethyl-2,7-dihydroxy-fluoren-9-one	Leaf	GC-MS	[9]
4-chloro-6-isopropylamino-1,3,5-triazine-2-one	Leaf	GC-MS	[9]
5-Hydroxy tryptamine (Serotonin)	Seed	Standard Phytochemical Analysis	[31]
9-Oxo-9,10-dihydroacridin-4-yl	Leaf	GC-MS	[9]

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
Lipids and Fatty Acids			
Acetohydroxamic acid	Fruit	LC-MS/MS	[32]
Adipamide			[11,21]
Allantoin	Leaf		[9]
Cathinone	Fruit		[21]
Cyclopentanone dimethylhydrazone	Leaf		[9]
Cyclopentanone dimethylhydrazone (isomer)			
Diazene, butyl [1-(2,2-dimethylhydrazino)ethyl]-			
Nitrogenous compounds		IR, NMR	[22]
o-Veratramide	Fruit	GC-MS	[21]
Pentanamide, 5-hydroxy-			[11]
Phenethyl carbamic acid, ethyl ester	Aerial Plant		[29]
Propanamide	Fruit		[21]
Tryptamine	Seed	Standard Phytochemical Analysis	[31]
Organic Acids			
Acetic acid	Fruit	GC-MS	[11]
Butyl citrate	Branch		[15]
Carboxylic acids (general)	Shoot	GC-FID, Steam Distillation	[26]
Fumaric acid	Fruit	LC-MS/MS	[32]
L-Malic acid	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[8]
Organosilicon Compounds			
1,1,2-Trimethyl-1-silacyclobutane	Fruit	GC-MS	[11]
Methylsilane			
Other Organic Compounds			
1,3-Dioxolane, 2,4,5-trimethyl-	Fruit	GC-MS	[11]
1,4-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester			[12]
1-Propanol	Leaf		[9]
2(3*H*)-Furanone, 5-butyldihydro-4-methyl	Aerial Plant		[27]
2(3*H*)-Furanone, 5-methyl-	Fruit		[12]
2-Propyl-tetrahydropyran-3-ol			[11]

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
Other Organic Compounds			
4-Methyl-1,3-dioxolane	Leaf	GC-MS	[9]
4-Methyl-1,3-dioxolane (isomer)			
4*H*-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	Fruit		[12]
4H-Pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl-			[11]
5-Acetoxytridecane	Leaf		[9]
Diisooctyl phthalate	Fruit		[11]
Dicyclohexyl phthalate	Fruit		[21]
Oxime-, methoxy-phenyl-			[12]
Oxirane, 2,3-dimethyl-, *cis*-			[11]
Oxirane, 2,3-dimethyl-, *trans*-			
Phthalic acid, di(2-propylpentyl) ester			
Thiophene, tetrahydro-, 1,1-dioxide	Aerial Plant		[27]
trans-4,5-Epoxynonane	Fruit		[11]
Phenolic Acid			
1,2-dihydrophenanthrene-4-carboxylic acid	Aerial Plant	GC-MS	[27]
1,5-Dicaffeoylquinic acid	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
2,3-Dihydroxybenzoic acid			
2,4-Di-tert-butylphenol	Fruit	GC-MS	[20]
2-Hydroxybenzoic acid	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
2-Hydroxycinnamic acid	Fruit	LC-MS/MS	[32]
2-Methoxy-5-prop-1-enylphenol	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
3,4-Dihydroxyphenylacetic acid			
4-(2,2,4-Trimethylpentyl)phenol		GC-MS	[15]
4-Hydroxybenzaldehyde		HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
4-Hydroxybenzoic acid	Fruit	LC-MS/MS	[32]
4-Hydroxybenzoic acid 4-*O*-glucoside	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
4-Methyl-2,6-ditertiobutylphenol	Flower, Root	GC-MS	[15]
4-Nonylphenol	Flower, Leaf, Pod		
4-*O*-Methyl gallic acid sulfate or 3-*O*-Methyl gallic acid sulfate	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
5-(3′-Methoxy-4′-hydroxyphenyl)-gamma-valerolactone	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
Phenolic Acid			
α-hexyl-Cinnamaldehyde	Aerial Plant	GC-MS	[25]
Benzenemethanol, 3,4,5-trimethoxy-			[27]
Benzyl benzoate	Leaf	GC-FID, GC-MS, Steam Distillation	[15,26]
Caffeic acid	Leaf, Pod, Seed	HPLC, HPLC-PDA, LC-ESI-QTOF-MS/MS	[10,24]
Caffeic acid 3-*O*-glucuronide	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
Caffeic acid derivative	Branch, Flower, Leaf, Pericarp, Root	HPLC	[18,19,29,30]
Catechol	Fruit	GC-MS	[12]
Chlorogenic acid	Pod, Seed	HPLC	[24]
Cinnamic acid			
Coumaric acid			
Coumarin	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
Dihydrocaffeic acid 3-*O*-glucuronide			
Dihydrocaffeic acid 3-sulfate	Fruit, Leaf, Stem	GC-MS, LC-PDA-ESI-MS/MS	[8]
Dihydrocaffeic acid sulfate	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Dihydroferulic acid 4-*O*-glucuronide	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
Ferulic acid 4-*O*-glucuronide			
Gallic acid	Fruit, Leaf, Pod, Root, Seed, Stem	GC-MS, HPLC, IR, LC-MS/MS, LC-PDA-ESI-MS/MS, NMR	[8,17,22,24,32]
Hydroxytyrosol 4-*O*-glucoside	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
m-Coumaric acid			
Methylgallic acid-*O*-sulfate	Fruit, Leaf, Stem	GC-MS, LC-PDA-ESI-MS/MS	[27]
Myristicin	Aerial Plant	GC-MS	[27]
p-Coumaric acid	Fruit, Leaf, Stem	GC-MS, LC-PDA-ESI-MS/MS	[8]
p-coumarinic acid derivative	Pericarp	HPLC	[29]
Phenol, 2,6-dimethoxy-	Fruit	GC-MS	[12]
Phenol, 4,4′-methylenebis [2,6-dimethyl-	Leaf		[9]
Phenol, 4-(3-hydroxy-1-propenyl)-2-methoxy	Aerial Plant		[27]
Protocatechuic acid	Fruit, Leaf, Rhizome, Root, Stem	GC-MS, HPLC-PDA-ESI-MS/MS, LC-MS/MS, LC-PDA-ESI-MS/MS	[7,8,32]
Protocatechuic acid-4-glucoside	Rhizome, Root, Stem	GC-MS, HPLC-PDA-ESI-MS/MS, LC-PDA-ESI-MS/MS	[7,8]
Rosmarinic acid	Pod, Seed	HPLC	[24]
Salicylalcohol derivative	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Sinapic acid	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
Phenolic Acid			
Syringic acid	Fruit, Leaf, Rhizome, Root, Stem	GC-MS, HPLC-PDA-ESI-MS/MS, LC-MS/MS, LC-PDA-ESI-MS/MS	[7,18,32]
Syringic acid-*O*-hexoside		GC-MS, HPLC-PDA-ESI-MS/MS, LC-PDA-ESI-MS/MS	[7,8]
trans-cinnamic acid	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Vanillic acid	Fruit, Leaf, Rhizome, Root, Stem	GC-MS, HPLC-PDA-ESI-MS/MS, LC-MS/MS, LC-PDA-ESI-MS/MS	[7,8,32]
Vanillin	Aerial Plant	GC-MS	[27]
Verbasoside	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Polyphenols/Quinones			
Trimethoxy-piperidyl-binaphthalene-tetrone derivative	Stem	GC-MS	[8]
Polyphenols/Tannins			
Galloyl tannin	Leaf	HPLC	[19,29]
Tannins	Branch, Flower, Leaf, Pericarp, Root, Seed	HPLC, Standard Phytochemical Analysis	[18,19,29–31]
Proteins and Amino Acids			
Amino acids	Leaf	IR, NMR	[22]
dl-Homoserine	Fruit	GC-MS	[21]
Lectin	Seed	Standard Phytochemical Analysis	[31]
Proteins	Leaf	IR, NMR	[22]
Steroidal Saponins			
Timosaponin BIII-c	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Estra-1,3,5(10)-trien-17 β-ol	Stem	GC-MS	[8]
Ethyl iso-allocholate			
Steroids/Fatty Acid Esters			
Stigmast-5-en-3-ol, oleate	Fruit, Stem	GC-MS	[8]
Steroids/Phytosterols			
β-Sitosterol	Fruit, Leaf, Root, Stem	ESI-MS, GC-MS, IR, NMR	[8,22,23]
Sterols and Steroids			
3 β-Cholest-5-en-3-ol	Aerial Plant	GC-MS	[27]
β-Sitosterol palmitate	Root	ESI-MS, NMR	[23]
Daucosterol			
gamma-Sitosterol	Aerial Plant	GC-MS	[27]

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
Sterols and Steroids			
Sitoindoside I [6-*O*-palmitoyl-sitosteryl-β-D-glucose]	Root	ESI-MS, NMR	[23]
Stigmasterol	Fruit, Leaf	GC-MS	[8,21]
Stilbenoids			
3'-Hydroxy-3,4,5,4'-tetramethoxystilbene	Leaf	HPLC-PDA, LC-ESI-QTOF-MS/MS	[10]
Resveratrol	Fruit	LC-MS/MS	[20]
Sugars and Sugar Alcohols			
2,5-Monomethylene-L-rhamnitol	Fruit	GC-MS	[11]
3-*O*-Methyl-D-glucose			
4,6-Di-*O*-methylhexopyranose	Leaf		[9]
α -Arabinose	Seed	Standard Phytochemical Analysis	[31]
α -*D*-Mannofuranoside, methyl	Fruit	GC-MS	[11]
α -Methyl 4-*O*-methyl-D-mannoside			[12]
Carbohydrates	Leaf	IR, NMR	[22]
D-3-*O*-methyl-chiro-inositol (D-pinitol)	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
D-Glycero-D-galacto-heptose	Fruit	GC-MS	[11]
Ethyl α-D-glucopyranoside			[12]
Fructose	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Galacto-heptulose	Fruit	GC-MS	[11]
L-Glucose			
myo-inositol, 2-*C*-methyl-			
Scyllo-Inositol			[12]
Sucrose	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Tetraacetyl-D-xylonic nitrile	Fruit	GC-MS	[21]
Terpenoids			
(1R,4S,5R,6R,7S,10R)-7-isopropyl-4,10-dimethyl-tricyclo[4.4.0.0(1,5)]decan-4-ol	Aerial Plant	GC-MS	[27]
(1S,4aS,8aS)-2,5,5,8a-tetramethyl-1,4,4a,5,6,7,8,8a-octahydronaphthalene-1-carboxylic acid			
1,2-Dihydro-1,1,6-trimethylnaphthalene	Leaf		[15]
2-Hydroxypinan-3-one	Aerial Plant		[27]
2-Methyl-1-tertiobutilprop-1,3-yl-diisobutylate	Branch, Stem	GC-FID, GC-MS, Steam Distillation	[15,26]
3,7,11-Trimethyldodeca-2,6,10-trien-1-ol	Flower	GC-MS	[15]
3-Hydroxy- β-damascone	Aerial Plant, Leaf, Pod	GC-FID, GC-MS, Steam Distillation	[15,26,27]

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
Terpenoids			
3a,7a-dimethylhexahydro-4,7-epoxyisobenzofuran-1,3-dione	Aerial Plant	GC-MS	[27]
4,4,7a-Trimethyl-5,6,7,7a-tetrahydro-4*H*-Benzofuran-2-one	Leaf		[15]
6,10,14-Trimethylpentadecan-2-one	Aerial Plant, Branch, Flower, Leaf, Stem	GC-FID, GC-MS, Steam Distillation	[15,26,27]
7-Oxabicyclo[4.1.0]heptan-2-one, 1-methyl-4-(2-methyloxiranyl)	Aerial Plant	GC-MS	[27]
Ar-turmerone			
Betulinic acid	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Cedrelanol	Aerial Plant	GC-MS	[27]
Cembrene A (3E)	Fruit, Leaf, Stem		[13,14]
cis-Phytol	Aerial Plant		[27]
D-Limonene	Branch, Stem	GC-FID, GC-MS, Steam Distillation	[15,26]
D:C-Friedoolean-8-en-29-oic acid	Aerial Plant	GC-MS	[27]
Dihydroactinidiolide			
Farnesyl acetone			[25]
Hexahydrofarnesyl acetone			
Loliolide			[27]
Oleanane type triterpenoid	Rhizome, Root	HPLC-PDA-ESI-MS/MS	[7]
Oleanane type triterpenoid (isomer)			
Phytol	Aerial Plant, Branch, Flower, Leaf, Pod	GC-FID, GC-MS, Steam Distillation	[15,25,26]
Spiro[2,4,5,6,7,7a-hexahydro-2-oxo4,4,7a-trimethylbenzofuran]-7,2'-(oxirane)	Aerial Plant	GC-MS	[27]
Supraene (Squalene)			
Taraxasterol			
trans-Phytol			
trans-piperitone oxide			
Urs-20-en-16 β-Ol			
Terpenoids/Alicyclic Compounds			
1-Ethyl-3-propyl-5-(propene-1-yl) adamantane	Stem	GC-MS	[8]
3,3a-Epoxydicyclopenta[a,d]cyclooctan-4 β-ol			
Estafiatine			
3,7,11,15-Tetramethyl-2-hexadecen-1-ol	Leaf		
Cycloundecene, 1-methyl			

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
Terpenoids/Alicyclic Compounds			
Farnesylacetone (5,9,13-Pentadecatrien-2-one, 6,10,14-trimethyl-)	Leaf	GC-MS	
Naphthalene, decahydro-1,5-dimethyl			
Naphthalene, 1,2,3,4-tetrahydro-1-isopropyl-1,2,4,4,7-pentamethyl	Fruit, Stem		
Naphthalene, decahydro-2,3-dimethyl	Fruit, Leaf		
Triterpenoids			
24-Noroleana-4(23),12-diene, 3-methyl-, (3 α)	Fruit, Stem	GC-MS	[8]
6a,14a-Methanopicene, perhydro-heptamethyl-10-hydroxy	Leaf		
Lupeol	Leaf, Root	ESI-MS, GC-MS, NMR	[8,23]
Vitamins and Antioxidants			
dl-α-Tocopherol	Aerial Plant	GC-MS	[27]
α-Tocopherol (Vitamin E)	Leaf		[8]
Volatile Organic Compounds (Essential Oils)			
(+)-Spathulenol	Fruit, Leaf, Stem	GC-MS	[13,14]
(E,E)-Farnesyl acetate	Fruit, Leaf, Stem		[13,14]
(Z,Z)-Farnesol			
1,8-Cineole	Aerial Plant, Fruit, Leaf, Stem		[13,14,25]
4-epi-Cubedol	Aerial Plant	GC-MS	[25]
6-epi-Shyobunol			
8-Cedren-13-ol			
Alloaromadendrene			
α-Acorenol			
α-Amorphene			
α-Calacorene			
α-Copaene			
α-Cubebene			
α-Gurjunene			
α-Ionone			
α-Muurolene			
α-Sinensal			
α-Terpineol			

Table 1. *Cont.*

Compound Name	Plant Part(s)	Analytical Method(s)	Reference(s)
Volatile Organic Compounds (Essential Oils)			
α-Terpinyl acetate	Fruit, Leaf, Stem		[13,14]
β-Citronellol			
β-Eudesmol			
Bicyclogermacrene			
Bornyl acetate	Aerial Plant		[25]
Camphor			
Caryophyllene oxide			
Cedrol	Fruit, Leaf, Stem		[13,14]
cis-Calamenene	Aerial Plant		[25]
cis-Verbenol			
Cubedol			
Cubenol			
Davana ether			
Davanone			
delta-Cadinene	Aerial Plant, Fruit, Leaf, Stem	GC-MS	[13,14,25]
Diepicedrene-1-oxide	Aerial Plant		[25]
Dihydro- α-agarofuran			
endo-Borneol			
Epiglobulol			
Fonenol			
G-Eudesmol			
gamma-Cadinene	Aerial Plant, Fruit, Leaf, Stem		[13,14,25]
Geranyl acetate	Fruit, Leaf, Stem		[13,14]
Juniper camphor	Aerial Plant		[25]
Linalool	Fruit, Leaf, Stem		[13,14]
Linalool acetate			
Neointermedeol			
Nerolidol	Aerial Plant		[25]
Palustrol			
Patchouli alcohol	Aerial Plant		[25]
Rosifoliol			
Spathulenol			
Torreyol		GC-MS	
trans-Caryophyllene	Aerial Plant, Fruit, Leaf, Stem		[13,14,25]
trans-Chrysanthenyl acetate	Aerial Plant		[25]
trans-Pinocarveol			

4. Discussion

Phytochemical investigations conducted on *P. farcta* over the last twenty-six years have revealed that this species is not merely adapted to arid and semi-arid environments but also represents an important source of bioactive compounds with a remarkably rich and complex secondary metabolite profile [7,11]. When studies from different geographical regions, including Iran, Iraq, Türkiye, Egypt, Tunisia, Saudi Arabia, and the United Arab Emirates, are collectively evaluated, it becomes evident that the branches, flowers, fruits, leaves, rhizomes, roots, seeds, stems, and essential oil fractions of the plant contain a wide range of phenolic compounds, alkaloids, fatty acids, flavonoids, glycosides, saponins, sterols, tannins, terpenoids, and various primary metabolites [10,29]. These findings indicate that *P. farcta* represents a valuable natural resource with considerable potential for pharmacological, functional food, cosmetic, and biotechnological applications.

One of the most consistent findings among the reviewed studies is the existence of pronounced phytochemical differences among the various plant organs. In particular, root tissues have been shown to be highly enriched in flavonoids, phenolic acids, and tannins. In a study conducted in Egypt, researchers isolated a total of 14 compounds from rhizomes and roots and identified 72 metabolites using HPLC-PDA-ESI-MS/MS analysis. The same study reported total phenolic and flavonoid contents of 35.89 mg GAE/g and 54.6 mg RE/g, respectively [7]. In contrast, another study reported a total phenolic content of 171.2 mg tannic acid equivalents/g in root extracts collected from Iran and demonstrated that quercetin accounted for approximately 50.24% of the total flavonoid content [17]. Such differences may be attributed not only to genetic variation but also to environmental factors, including climate, soil characteristics, drought stress, and extraction methodologies.

The occurrence of high levels of apigenin, gallic acid, luteolin, quercetin, rutin, and various tannins in root tissues may explain the traditional use of the plant in the treatment of diabetes, inflammation, and infectious diseases. In this regard, researchers isolated (−)-epicatechin, β-sitosterol, β-sitosterol palmitate, daucosterol, lupeol, and sitoindoside I from the ethyl acetate extract of the roots and demonstrated that daucosterol exhibited potent α-glucosidase inhibitory activity. These findings provide evidence that the antidiabetic potential of *P. farcta* is supported not only at the crude extract level but also through the activity of purified compounds [23].

Studies on the leaves have revealed an exceptionally rich diversity of flavonoids. Using LC-ESI-QTOF-MS/MS analysis, researchers identified 47 phenolic compounds, with catechin, chlorogenic acid, kaempferol, and quercetin being the predominant constituents [10]. Similarly, another study reported the presence of alkaloids, caffeic acid derivatives, glycosides, myricetin, rutin, and saponins in leaf tissues [19]. Furthermore, researchers isolated β-sitosterol and hesperidin from the leaves for the first time, thereby contributing additional information to the phytochemical characterization of the species [22].

The predominance of flavonoids in leaf tissues may be associated with protective mechanisms developed by photosynthetic organs against ultraviolet radiation, temperature stress, and oxidative damage. Indeed, studies conducted on populations from Iran, Iraq, and Tunisia consistently reported high antioxidant capacities in leaf extracts [8,19,29]. Results obtained from DPPH (2,2-diphenyl-1-picrylhydrazyl), ABTS (2,2′-azinobis (3-ethylbenzothiazoline-6-sulfonic acid), FRAP (Ferric Reducing Antioxidant Power), and TAC (Total Antioxidant Capacity) assays demonstrated a strong correlation between phenolic content and antioxidant activity [10].

Fruits and seeds represent some of the most noteworthy organs of the plant in terms of both phenolic metabolites and nutritional constituents. Comparative analyses of samples collected from Iraq, Iran, and Türkiye revealed the presence of chlorogenic acid, gallic acid, kaempferol, protocatechuic acid, resveratrol, syringic acid, vanillic acid, and various flavonoids in the fruits. In a comparative study of Iraqi and Turkish populations, researchers observed geographical variation in the distribution of certain compounds. For example, myricetin was detected exclusively in Turkish samples, whereas catechin hydrate was identified only in Iraqi samples. These findings clearly demonstrate the influence of geographical origin on the phytochemical profile of *P. farcta* [32].

GC-MS analyses of fruits further indicated that fatty acids and sugar derivatives constitute the dominant chemical groups. Studies conducted in different regions consistently identified high proportions of linoleic acid derivatives, palmitic acid, stearic acid derivatives, and various sugar compounds [12,14,20,21]. Particularly noteworthy is the study in which ethyl α-D-glucopyranoside was reported at an exceptionally high level of 81% [12]. Similarly, another study demonstrated that fruits are extremely rich in saccharides, including 3-*O*-methyl-D-glucose, galacto-heptulose, L-glucose, myo-inositol, several heptose derivatives [11].

Seed analyses indicate that *P. farcta* is not only pharmacologically valuable but also nutritionally important. One study reported that the seeds contained 74.44% unsaturated fatty acids. The presence of nutritionally valuable fatty acids such as docosahexaenoic acid (DHA), eicosenoic acid and oleic acid suggests that *P. farcta* seeds may have considerable potential for use in functional food development [24].

Research on the essential oil composition of the plant has also produced significant findings. Studies conducted on populations from Tunisia, Saudi Arabia, and the United Arab Emirates demonstrated considerable variability in essential oil profiles. While limonene, methyl hexadecanoate, phytol, various hydrocarbons were reported as major constituents [15,26], another study identified oxygenated sesquiterpenes such as cubenol (19.07%), torreyol (8.28%) and *trans*-chrysanthenyl acetate (17.69%) as the dominant compounds in the Saudi Arabian population [25]. These observations suggest that environmental conditions play a crucial role in shaping essential oil composition.

Studies conducted on Tunisian populations examining both flavonoid composition and essential oils revealed clear distinctions between the Gabès and Nabeul populations. The findings reported provide chemotaxonomic evidence supporting the existence of different varieties within the species. Variations in isovitexin, luteolin derivatives, myricetin glycosides, vitexin, and essential oil composition suggest the presence of genetic diversity within *P. farcta* that remains insufficiently characterized [15,29].

From an analytical perspective, a clear transition from conventional GC-MS and HPLC-based analyses toward high-resolution techniques such as HPLC-PDA-ESI-MS/MS and LC-ESI-QTOF-MS/MS has occurred in recent years. While earlier studies were generally limited to the identification of a few dominant compounds, advanced mass spectrometric approaches now enable the simultaneous characterization of dozens, and sometimes more than seventy, metabolites within a single extract. The identification of 72 metabolites and 47 phenolic compounds represents excellent examples of this technological advancement [7,10].

Current evidence indicates that the anticancer, antidiabetic, anti-inflammatory, antimicrobial, antioxidant, cardioprotective, and hypolipidemic properties of *P. farcta* are largely attributable to its flavonoids, phenolic acids, sterols, and triterpenoids. Among these, apigenin, β-sitosterol, chlorogenic acid, daucosterol, gallic acid, isovitexin, kaempferol, lupeol, luteolin, quercetin, and vitexin appear to be the principal contributors to the biological activities of the species. Phytochemical composition of *P. farcta* varies considerably across its geographical distribution. Iranian populations consistently exhibited higher abundances of flavonoids and phenolic compounds, whereas Iraqi populations were more frequently characterized by fatty acids, saccharide derivatives, and other primary metabolites. In contrast, populations from Saudi Arabia and the United Arab Emirates were distinguished by terpenoid-rich volatile oils, while Egyptian and Tunisian populations demonstrated greater flavonoid diversity together with marked chemotaxonomic variation. These differences are likely associated with the combined influence of geographical and environmental factors, plant organ specificity, and genetic variability, but they may also reflect methodological differences among studies, including the use of different extraction solvents and analytical platforms (e.g., GC–MS versus LC–MS/MS), which selectively detect different classes of metabolites. Therefore, direct comparisons among published studies should be interpreted with caution, and future investigations employing standardized extraction protocols and analytical approaches will be essential for establishing more reliable phytochemical comparisons across *P. farcta* populations.

Further research should prioritize metabolomic and genomic comparisons of populations from different geographical regions. Although current studies have demonstrated substantial phytochemical variation, the genetic basis underlying these differences remains largely unexplored. Furthermore, most studies conducted to date have been limited to *in vitro* investigations, and there is insufficient information regarding the pharmacokinetic properties, bioavailability, toxicological profiles, and clinical efficacy of the isolated compounds. In addition, molecular-level investigations of the mechanisms associated with phenolic compounds involved in nanoparticle synthesis would provide a better understanding of the role of *P. farcta* in green nanotechnology applications. Finally, the standardization of extracts derived from different plant organs, the establishment of quality control criteria, and the development of pharmaceutical formulations will be essential for fully realizing the medicinal and industrial potential of this species.

5. Conclusions

In conclusion, the findings summarized in this comprehensive review demonstrate that *P. farcta* possesses an exceptionally rich phytochemical profile characterized by diverse phenolic compounds, fatty acids, flavonoids, sterols, terpenoids, and other secondary metabolites identified in different plant organs and across various geographical regions. This remarkable chemical diversity provides a scientific basis for the wide range of biological activities reported for the species, including anticancer, antidiabetic, anti-inflammatory, antimicrobial, antioxidant, cardioprotective, and hypolipidemic effects. Advances in modern analytical techniques, particularly HPLC-PDA-ESI-MS/MS and LC-ESI-QTOF-MS/MS, have substantially expanded the current understanding of the phytochemical complexity of *P. farcta* and have facilitated the identification of numerous bioactive constituents that support its pharmacological potential. Overall, the available evidence indicates that *P. farcta*

should be regarded not only as a traditionally used medicinal plant but also as a promising natural resource for future pharmaceutical, nutraceutical, functional food, cosmetic, and nanobiotechnology applications. Future studies should prioritize the standardization of extraction protocols, quantitative metabolomic profiling, bioactivity-guided isolation of active constituents, and integrative metabolomic and genomic approaches to better elucidate the relationship between phytochemical diversity and biological activity. In addition, well-designed preclinical and clinical studies are essential to validate the therapeutic efficacy, safety, pharmacokinetic properties, and clinical applicability of *P. farcta* and its bioactive compounds.

Author Contributions

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Use of AI and AI-Assisted Technologies

No AI tools were utilized for this paper.

Abbreviation

ABTS	2,2′-azinobis (3-ethylbenzothiazoline-6-sulfonic acid)
DPPH	2,2-diphenyl-1-picrylhydrazyl
FRAP	Ferric Reducing Antioxidant Power
FTIR	Fourier-Transform Infrared Spectroscopy
GC-FID	Gas Chromatography-Flame Ionization Detector
GC-MS	Gas Chromatography-Mass Spectrometry
HPLC	High-Performance Liquid Chromatography
HPLC-PDA	High-Performance Liquid Chromatography-Photodiode Array Detector
HPLC-PDA-ESI-MS/MS	High-Performance Liquid Chromatography-Photodiode Array-Electrospray Ionization-Tandem Mass Spectrometry
LC-ESI-QTOF-MS/MS	Liquid chromatography-electrospray ionization-quadrupole time-of-flight-tandem mass spectrometry
LC-MS	Liquid Chromatography-Mass Spectrometry
LC-PDA-ESI-MS/MS	Liquid Chromatography-Photodiode Array-Electrospray Ionization-Tandem Mass Spectrometry
TAC	Total Antioxidant Capacity
TLC	Thin Layer Chromatography

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