

Genista tridentata Phytochemical Characterization

Subjects: **Biochemistry & Molecular Biology**

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Genista tridentata (L.) Willk., known as “prickled broom”, is a Leguminosae (Fabaceae) species native to the Iberian Peninsula, Morocco, Algeria, and Tunisia. It is used in folk medicine as an anti-inflammatory, for gastrointestinal and respiratory disorders, rheumatism, and headaches, to lower blood pressure, against hypercholesterolemia and hyperglycemia.

traditional medicine

biological properties

Genista tridentata

Pterospartum tridentatum

nutraceuticals

1. Introduction

Wild edible plants are an important piece of the cultural and genetic heritage of distinct world regions, representing high importance, predominantly in rural and suburban areas [\[1\]](#). Furthermore, they are interesting sources of bioactive compounds and need recognition as considerable contributors to human health promotion and disease prevention [\[2\]](#).

Genista tridentata (L.) Willk. (the recognized name for this species), also known as *Pterospartum tridentatum* (L.) Willk. (the commonly used name in both scientific literature and commercially available extracts. Among other synonyms, *Chamaespartum tridentatum* (P.) Gibbs is also used [\[3\]](#)[\[4\]](#)). Commonly known as “prickled broom”, it is a Leguminosae (Fabaceae) species belonging to the subfamily Papilioideae [\[5\]](#)[\[6\]](#). In line with scientific literature and the Global Biodiversity Information Facility database [\[7\]](#), the recorded countries of origin for the plant remain consistent, comprising Portugal, Spain, and Morocco. However, it is important to mention that the Plants of the World Online (POWO) database [\[8\]](#) also lists Algeria and Tunisia as potential countries of origin for this plant. This shrub can be found in the understory of *Arbutus unedo*, *Pinus*, and *Eucalyptus* forests, as well as in abandoned lands. It grows spontaneously up to 100 cm in acidic soils [\[9\]](#) and presents yellow flowers with a typical odor in alternate branches and coriaceous winged stems [\[10\]](#). Traditionally, it is harvested in the spring between March and June.

G. tridentata is an aromatic plant that is very important in Portuguese gastronomy. The leaves are conventionally used as a condiment/spice for the seasoning of traditional rice and meat dishes [\[11\]](#). Moreover, fresh or shade-dried flowers of *G. tridentata* are also used in folk medicine, in infusions, decoctions, and tonics [\[12\]](#) as anti-inflammatory [\[13\]](#)[\[14\]](#)[\[15\]](#), diuretic and depurative of the liver [\[5\]](#)[\[11\]](#)[\[16\]](#)[\[17\]](#). It is commonly used to ameliorate colds [\[5\]](#)[\[18\]](#), in digestive

disorders [5][18][19][20], intestinal [21][22] and urologic problems [5][11][15][16][18], and rheumatism [5][11][16]. Additionally, it is also used for respiratory disorders [5][6][13][15][18][23], headaches [5], to lower blood pressure [5][6][18], against hypercholesterolemia [5][6][18][20][22] and hyperglycemia [5][6][11][16][17][18][23][24], and in weight loss programs [5].

2. Phytochemical Characterization

The main compounds found are flavonoids, as well as hydroxycinnamic acids and hydroxybenzoic acids (Table 1, Figure 1). Additionally, extracts collected in the flowering period (May), as well as flowers, presented a more diverse phytochemical profile than extracts collected during the rest of the year.

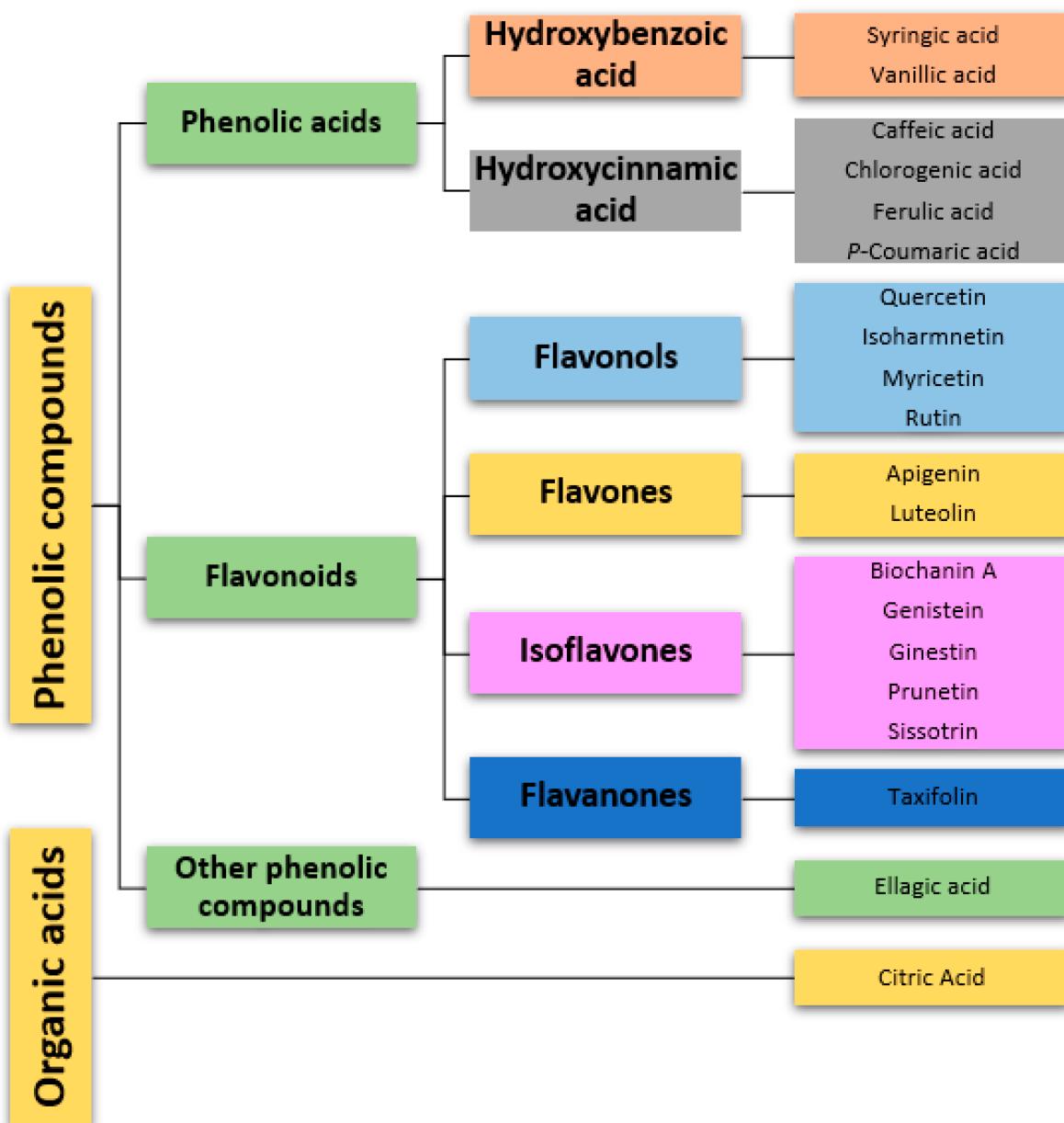


Figure 1. Classification of phytochemical compounds identified in *Genista tridentata*. Each distinct category is associated with a unique color.

Table 1. Major biologically active compounds were found in several samples of *G. tridentata* (X—detected; NA—not available; ND—not detected).

Authors	[17]	[23]	[9]	[15]	[20]	[24]	[25]	[26]	[27]	[24]	[6]	[22]	[15]	[27]	[28]
Extraction method	Methanolic				Aqueous				Ethanolic				NA		
Part plant used	Crude	flowers	Stems and leaves		Flowers				Aerial parts		In vitro culture	Leaves + Flowers	NA	Flowers	Flowers
Sampling localization	Vila Real	Serra da Estrela	Serra da Estrela	Cinfães	Montesinho	Herbal Shop—DIÉTICA®	Malcata	Gardunha	Cinfães	Herbal Shop—Ervital	Viseu	Malcata	Gardunha	Malcata	Gardunha
Sampling period		NA		Spring 2019	NA	May	May	NA	Spring 2012	NA	February	May	February	May	NA
5,5'-Dihydroxy-3'-methoxyisoflavone-7-O- β -glucoside	ND	ND	ND	X	ND	ND	X	X	ND	X	X	X	X	X	ND
5,5'-Dihydroxy-3'-methoxyisoflavone	ND	ND	ND	ND	X	ND	ND	X	ND	ND	ND	ND	ND	ND	X
7-Methylborbol	ND	ND	ND	ND	ND	ND	X	ND	X	X	ND	ND	X	X	ND
Apigenin 5,7-dimethyl	ND	ND	ND	ND	ND	X	ND	ND	ND	ND	ND	ND	ND	ND	ND
Apigenin 5,7-dimethyl ether 4'galactoside	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Biochanin A	X	ND	ND	ND	ND	X	ND	ND	X	ND	ND	ND	ND	ND	X
Biochanin A O-acetylhexoside-O-hexoside	ND	ND	ND	ND	ND	ND	ND	ND	X	ND	ND	ND	ND	ND	ND
Biochanin A O-hexoside	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	ND	ND	ND	ND	ND
Biochanin A O-hexoside-O-hexoside	ND	ND	ND	ND	ND	ND	ND	ND	X	ND	ND	ND	ND	ND	ND
Biochanin A-glucoside	X	ND	ND	ND	ND	X	ND	ND	ND	ND	ND	ND	ND	ND	X

Authors	[17]	[23]	[9]	[15]	[20]	[24]	[25]	[26]	[27]	[24]	[8]	[22]	[15]	[22]	[28]
Caffeic acid	ND	X	X	ND	ND	ND	ND	ND	ND						
Chlorogenic acid	ND	ND	X	ND	ND	ND	ND	ND	ND						
Citric acid	ND	ND	ND	ND	ND	X	X	ND	ND	ND	X	X	X	ND	ND
Dihydroquercetin 6-C-hesoxide	ND	ND	ND	ND	X	ND	ND	ND	X	ND	ND	ND	ND	ND	X
Ellagic acid	ND	X	X	ND	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorlic acid	ND	X	X	ND	ND	ND	ND	ND	ND						
Genistein-8-C-glucoside	ND	ND	ND	ND	ND	X	X	ND	X	X	X	X	X	ND	X
Ginestein	X	ND	ND	ND	ND	ND	X	X	X	X	ND	X	ND	ND	X
Ginestein derivatives	X	ND	ND	ND	X	ND	ND	ND	X	ND	ND	ND	ND	X	ND
Ginestin	X	ND	ND	X	ND	ND	ND	X	X	ND	ND	ND	ND	ND	X
Isoquercitrin	ND	ND	ND	X	ND	X	X	X	X	ND	X	X	ND	X	X
Isorhamnetin-O-hexoside	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	ND	ND
Luteolin-O-(O-acetyl)-glucuronide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	ND	ND
Luteolin-O-glucuronide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	ND	ND
Methylbiochanin A/methylprunetin	ND	ND	ND	ND	ND	ND	ND	ND	X	ND	ND	ND	ND	ND	X
Methylbiochanin A/methylprunetin derivative	ND	ND	ND	ND	ND	ND	ND	ND	X	ND	ND	ND	ND	ND	X
Methylbiochanin A/methylprunetin O-hexoside	ND	ND	ND	ND	ND	ND	ND	ND	X	ND	ND	ND	ND	ND	X
Myricetin-6-C-glucoside	ND	ND	ND	ND	X	X	X	X	X	ND	X	X	X	X	ND
p-Coumaric acid	ND	ND	X	ND	ND	ND	X	X	-						

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Table 2. Composition (%) of the essential oils of *G. tridentata* isolated by hydrodistillation, collected in different years and locations. (AMF02: Flowers, collected in Arneiro das Milhariças in 2002; AMF03: collected in Arneiro das Milhariças in 2003; AML02: collected in Arneiro das Milhariças in 2002; AML03: collected in Arneiro das Milhariças in 2003; PAPN: collected in Pedra de Altar, Proença a nova; PSFPN: collected in Póvoa, Sobreira Formosa, Proença a nova; SCB: collected in Sarzeda, Castelo Branco; MCSB: collected in Milhassa do Corvo, Sarzeda, Castelo Branco; ND—not detected).

Components	Authors	Flowers			Herbal Shop	Leaves + Stems			Aerial Parts			
		RI	AMF02	AMF03		[29]	AML02	AML03	PAPN	PFSPNa	PFSPNb	
trans-2-Hexenal	866	1.6	0.5	0.1	ND	ND	1.6	ND	ND	1.7	3.2	ND
cis-3-Hexen-1-ol	868	1.6	1.2	ND	ND	ND	5.3	ND	ND	0.8	3	ND
cis-2-Hexen-1-ol	882	1.5	1.2	ND	ND	ND	0.8	ND	ND	0.6	1.2	ND
n-Hexanol	882	0.5	1.6	ND	ND	ND	1.1	ND	ND	1.1	0.7	ND
n-Heptanal	897	11.8	4.8	0.9	ND	ND	0.5	0.8	ND	ND	0.3	ND
n-Nonane	900	ND	ND	ND	ND	ND	0.2	ND	ND	2.3	0.2	ND
Benzaldehyde	927	0.5	0.8	0.3	ND	ND	0.6	1	ND	0.6	0.1	ND
α-Pinene	930	ND	0.3	0.3	ND	ND	0.8	ND	ND	0.5	0.1	ND
n-Heptanol	952	0.5	1.6	ND	ND	ND	1.5	ND	ND	ND	ND	1.3

Components	Authors	Flowers			Leaves + Stems			Aerial Parts			
		RI	AMF02	AMF03	Herbal Shop	AML02	AML03	PAPN	PFSPNa	PFSPNb	SCB
1-Octen-3-ol	961	10.7	21	9.2	11.5	22.6	1.7	29.7	15	25.8	36.8
2-Pentyl furan	972	2.4	1.3	0.8	2.5	0.5	ND	ND	0.7	2.1	1.4
<i>n</i> -octanal	973	ND	ND	0.6	ND	ND	ND	ND	ND	ND	ND
3-Octanol	974	1.4	1.5	ND	1.9	ND	ND	ND	1.9	0.3	1.5
Benzyl alcohol	996	ND	ND	ND	0.3	0.4	ND	ND	ND	0.3	ND
Benzene acetaldehyde	1002	1.8	1.8	ND	0.3	1.2	ND	ND	0.4	1.4	0.6
<i>p</i> -Cymene	1003	ND	ND	0.3	ND	ND	ND	ND	ND	ND	ND
1,8-Cineole	1005	0.9	1	0.7	1.1	0.2	ND	ND	ND	ND	ND
Limonene	1009	0.9	1	ND	1.1	0.2	ND	ND	0.3	ND	ND
Acetophenone	1017	ND	1.4	ND	2.1	0.5	ND	ND	ND	ND	ND
<i>n</i> -Octanol	1045	0.5	0.4	0.7	2.1	0.3	0.6	ND	ND	ND	ND
<i>p</i> -Cymenene	1050	ND	ND	0.6	ND	ND	ND	ND	ND	ND	ND
Heptanoic acid	1056	0.5	1.2	ND	ND	0.4	ND	ND	ND	ND	2.1
Phenyl ethyl alcohol	1064	0.7	1.2	ND	2	1.7	ND	3.6	3.3	3.4	6.3
<i>n</i> -Nonanal	1073	14.5	6.1	6.5	4.6	0.9	10.5	4.1	0.2	0.9	1
Linalol	1074	2.9	0.5	7.1	ND	2	ND	5.2	ND	2.3	1
<i>cis</i> -Rose oxide	1083	2.9	0.5	ND	ND	ND	2	ND	5.2	2.3	1
Camphor	1095	ND	ND	0.7	ND	ND	ND	ND	ND	ND	ND
<i>n</i> -Undecane	1100	ND	ND	ND	ND	ND	ND	1	2.3	0.2	ND
<i>trans</i> -Rose oxide	1100	ND	ND	ND	2.1	0.7	ND	1	ND	ND	ND
<i>trans</i> -Pinocarveol	1106	ND	ND	0.3	ND	ND	ND	ND	ND	0.2	ND
2- <i>trans,6 cis</i> -	1106	2.1	0.3	0.2	ND	ND	ND	ND	ND	ND	ND

Components	Authors	Flowers			Herbal Shop	Leaves + Stems			Aerial Parts		
		RI	AMF02	AMF03		AML02	AML03	PAPN	PFSPNa	PFSPNb	SCB
Nonadienol											
2- <i>trans</i> -Nonen-1-al	1114	0.5	0.4	ND	2.2	0.2	ND	ND	ND	ND	ND
Pentyl benzene	1119	1.5	ND	ND	ND	0.3	ND	ND	ND	ND	ND
Menthone	1120	ND	ND	0.2	ND	ND	ND	ND	ND	ND	ND
Benzyl acetate	1123	ND	ND	0.2	ND	ND	ND	ND	ND	ND	ND
Borneol	1134	ND	ND	1.1	ND	ND	ND	ND	ND	ND	ND
Lavandulol	1142	ND	ND	0.3	ND	ND	ND	ND	ND	ND	ND
Menthol	1148	ND	ND	0.5	ND	ND	ND	ND	ND	ND	ND
Terpinen-4-ol	1148	ND	ND	0.7	ND	ND	ND	ND	ND	ND	ND
Octanoic acid	1156	0.3	ND	0.5	0.5	ND	ND	ND	ND	ND	ND
α -Terpineol	1159	ND	ND	1.8	ND	ND	ND	1.2	0.8	0.3	ND
Safranal	1160	1.4	0.3	ND	ND	0.5	ND	ND	ND	ND	ND
Methyl chavicol (=estragole)	1163	ND	ND	0.9	ND	ND	ND	ND	ND	ND	ND
<i>n</i> -Decanal	1180	ND	0.3	0.4	ND	ND	ND	ND	ND	ND	ND
Pulegone	1210	ND	ND	1.4	ND	ND	ND	ND	ND	ND	ND
Geraniol	1236	0.3	1.6	0.6	4	9.2	3.2	1	-	1.4	2.8
Linalyl acetate	1245	ND	ND	1.4	ND	ND	ND	ND	ND	ND	ND
<i>Trans</i> -Anethole	1254	ND	ND	4.7	ND	ND	ND	ND	ND	ND	ND
<i>n</i> -Decanol	1259	0.3	1.6	0.6	4	0.2	3.2	3.4	2.5	3.2	1.9
2-Undecanone	1273	ND	ND	2.2	ND	ND	ND	ND	ND	ND	ND
Perilla alcohol	1274	ND	ND	ND	ND	3.4	ND	ND	ND	0.6	ND
Nonanoic acid	1274	ND	0.3	1.5	2.3	ND	ND	ND	ND	ND	ND
<i>cis</i> -Theaspirane	1279	1.6	2.2	ND	12.7	7.1	14.2	5.3	13.2	9	6.2

Components	Authors	Flowers			Leaves + Stems				Aerial Parts			
		RI	[11]		[29] Herbal Shop	[11]		[11]		SCB	MCSB	
			AMF02	AMF03		AML02	AML03	PAPN	PFSPNa	PFSPNb		
2 trans,4 trans-Decadienal	1285	0.8	1.3	ND	ND	0.1	ND	1.8	ND	2	ND	
cis-Transpirane	1286	ND	ND	3.2	ND	ND	ND	ND	ND	ND	ND	
Carvacrol	1286	ND	ND	0.3	ND	ND	ND	ND	ND	ND	ND	
2-trans-4-trans-Decadienal	1286	ND	ND	1	ND	ND	ND	ND	ND	ND	ND	
trans-Theaspirane	1300	2.4	1.9	3.9	12.1	6.8	17.2	6.3	13.6	10	5.5	
Hexyl tiglate ester	1316	ND	ND	0.2	ND	ND	ND	ND	ND	ND	ND	
Eugenol	1327	1.4	1.7	0.8	3.5	2.6	ND	3.1	3	3.2	3.6	
α-Terpenyl acetate	1334	ND	ND	0.3	ND	ND	ND	ND	ND	ND	ND	
α-Longipinene	1338	ND	ND	0.1	ND	ND	ND	ND	ND	ND	ND	
Decanoic acid	1350	ND	ND	0.8	ND	ND	ND	ND	ND	ND	ND	
trans-β-Dasmascenone	1356	ND	ND	0.8	ND	ND	ND	ND	ND	ND	ND	
Geranyl acetate	1370	ND	ND	0.5	ND	ND	ND	ND	ND	ND	ND	
α-Copaene	1375	ND	ND	ND	ND	ND	ND	0.9	ND	ND	ND	
β-Bourbonene	1379	ND	ND	ND	ND	ND	ND	1.5	ND	1.1	ND	
2-Pentadecanone	1390	ND	ND	0.8	ND	ND	ND	ND	ND	ND	ND	
Longifolene	1399	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND	
β-Caryophyllene	1414	ND	0.4	1.2	ND	ND	ND	2.7	ND	2	0.9	
Geranyl acetonea	1434	ND	3.6	0.7	ND	ND	ND	1.2	ND	0.6	ND	
allo-Aromadendrene	1456	ND	ND	0.7	ND	ND	ND	ND	ND	ND	ND	

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Components	Authors	Flowers			Leaves + Stems			Aerial Parts			anti- oxidant capacity IC ₅₀ (µg/mL)	
		RI	AMF02	AMF03	Herbal Shop	AML02	AML03	PAPN	PFSPNa	PFSPNb	SCB	
trans-β-Ionone	1456	ND	ND	1.1	ND	ND	ND	ND	ND	ND	ND	ND
Germacrene-D	1474	ND	0.2	ND	ND	ND	9.7	3.3	ND	0.7	ND	ND
α-Curcumene	1475	ND	ND	0.5	ND	ND	ND	ND	ND	ND	ND	ND
γ-Cadinene	1500	ND	3.3	ND	ND	ND	ND	1.2	ND	1.1	1.9	ND
σ-Cadinene	1505	ND	2.4	ND	ND	ND	ND	1.6	ND	2	1.9	ND
Dodecanoic acid	1551	3.5	2.1	5.3	2.6	0.3	15	ND	ND	0.9	1.1	ND
β-Caryophyllene oxide	1561	ND	ND	ND	ND	ND	ND	1.3	ND	1.2	2.9	ND
n-Tetradecanal	1596	ND	ND	ND	ND	ND	ND	1.1	ND	2.7	1.5	ND
n-Pentadecanal;	1688	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8	ND
Tetradecanoic acid	1734	ND	ND	0.2	ND	ND	ND	ND	ND	ND	ND	ND
Hexadecanoic acid	1779	ND	ND	0.7	ND	ND	ND	ND	ND	ND	ND	ND
9,12-Octadecadienoic acid	1820	ND	ND	0.4	ND	ND	ND	ND	ND	ND	ND	ND
% of identified components		71.8	75.1	71.8	78.4	76.8	77.1	82.9	64.8	88.5	82.2	ND
1. Grouped components												
1.1. Monoterpene hydrocarbons		0.9	1.3	0.6	1.1	1	ND	ND	0.8	0.1	ND	ND
1.1.1. Oxygen-containing monoterpenes		6.2	7	18.6	10.6	17.5	3.2	9.6	0.8	5.4	3.8	ND
1.1.2. Sesquiterpene hydrocarbons		ND	6.3	2.5	ND	ND	9.7	12.6	ND	6.9	4.7	ND
1.1.3. Oxygen-containing sesquiterpenes		ND	ND	7.1	ND	ND	ND	1.3	ND	1.2	2.9	ND
1.1.4. Phenylpropanoids		1.4	1.7	6.4	3.5	2.6	ND	3.1	3	3.2	3.6	ND

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1	Components	Authors	Flowers			Leaves + Stems			Aerial Parts		
			[11]		[29]	Herbal Shop	[11]		[11]		MCSB
			RI	AMF02	AMF03		AML02	AML03	PAPN	PFSPNa	PFSPNb
			Oil yield (v/w)	<0.05%	<0.05%	0.01%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%

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