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Oils and fats contents of medicinal plants, as natural ingredients for many therapeutic purposes- A review

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Abstracts
Oils and fats were extracted from different plants by using many methods of extraction. They were used as gastroprotective, carminative, antiemetic, antibacterial, antifungal, antiviral, antiprotozoal, insect repellents, antioxidant, anticancer, antidiabetic and antimutagenic and many other properties. The current review discussed the amounts and types of fats and oils extracted from different medicinal plants as a promising therabies for many medical complains.
Keywords: fats, essential oils, volatile oils, medicinal plants, pharmacology

I. INTRODUCTION:

Plants play an important role in the development of new drugs. Plant oils have been used as therapy since early times. Plants oils were extraction by many methods included cold pressing, hydrodistillation, steam distillation, hydrodiffusion, effleurage, solvent extraction, carbondioxide extraction and microwave assisted process[(1)]. The oils were valuable natural products used in many fields included perfumes, cosmetics, aromatherapy, phytotherapy, spices and nutrition, insecticides[(2)]. They were used medicinally for their gastroprotective, carminative, antiemetic, antibacterial, antifungal, antiviral, antiprotozoal, insect repellents, antioxidant, anticancer, antidiabetic and antimutagenic properties[(3)]. This review was designed to investigate the plants containing fats and essential and volatile oils as a promising therapeutic remidies.

Fats and oils of medicinal plants

Achillea santolina

The concentration of the essential oil in the dry *Achillea santolina* ranged from 0.11-0.20 % in ten genotypes of this species [(4)]. Ahmadi *et al* found that the essential oils of *Achillea santolina* included alpha-pinene, camphene, sabinene, *p*-cymene, 1,8 cineole , 3-2-ocimene, linalool, chrysanthenone, camphor, pinocarvone, borneol, chrysanthenylactate, thymol, eugenol, (+) spathulenol, caryophyllene oxid, and beta-eudesmol. According to this study, camphor was the major compound of the essential oils [(5)]. The hydrodistilled oil of *Achillea santolina* contained 54 volatile components. The major components were 1,8-cineole, fragranol, fragranyl acetate and terpin-4-ol [(6)]. Bader et al showed that the essential oil of *Acillea santolina* collected in Jordan contained mainly 1,8-cineole, camphor, 4-terpineol and trans-carveol[(7-8)] .

Adiantum capillus-veneris

Many triterpenoids : 21-hydroxy adiantone, triterpenoid epoxide (adiantoxide), Fern- 9(11)-en-12-one, isoadiantone, isoglaucanone, hdoxyhopane, isoadiantol, hydroxyadiantone , olean-12-en-3-one and olean-18-en-3-one , fern-9(11)-ene, ferna-7, 9(11)-diene, 7-fernene, hop- 22(29)-ene, filic-3-ene , neohop-12-ene, pteron-14-en-7a-ol, fern-9(11)-en- 3a-ol, fern-7-en-3a-ol, adian-5(10)-en-3a-ol, adian-5-en-3a-ol, fern-9(11)-en-28-O, fern-9(11)-en-12- beta-ol and 4-α-hydroxyfilican-3-one were isolated from the leaves of *Adiantum capillus-veneris* [(9-12)].

Agropyron repens

Agropyron repens contained volatile oils 0.05%, essential oil (0.01-0.02%), 25% monoterpens (carvacrol, carvon, trans-anethole, thymol and menthol, among others) and 0.85% sesquiterpenes, 25% monoterpens (carvacrol, carvon, transanethole, thymol and menthol, among others) and 0.85% sesquiterpenes[(13-15)] .

Ailanthus altissima

The leaf volatile oils were mainly composed of non-terpenic compounds (tetradecanol, heneicosane, tricosane and docosane) and sesquiterpene hydrocarbons (α-curcumene and α-gurjunene) [(16)]. The root essential oil was clearly distinguishable for its high content in aldehydes (hexadecanal; 22.6%), while those obtained from flowers and leaves were dominated by oxygenated sesquiterpenes (74.8 and 42.1%, respectively), with caryophyllene oxide as the major component (42.5 and 22.7%, respectively)[17-19].

Alhagi maurorum

Nutrient Analysis of the plant showed that it contained fat (4.88±0.01%)[20]. Triglyceride, aliphatic ester, aliphatic ketone and thiophene derivative [21], and oleanane-type triterpene glycosides were isolated from the roots of *Alhagi maurorum* [22]. The volatile fractions of *Alhagi maurorum* consisted of complex mixture of different substances, with ketones (leaf: 4.4%, stem: 5.2%), acid derivatives (leaf: 1.5%, stem: 1.8%), terpenoids (leaf: 26.8%, stem: 18.7%), and hydrocarbons (leaf: 19.3%, stem: 50.6%)[23-25].

Allium species

The bulbs of *Allium cepa* yield 0.005% essential oil. The compounds identified in the oil of onion included monosulphides: dimethyl sulphide, allyl methyl sulphide, methyl propenyl sulphide (2 isomers), allyl propyl sulphide, propenyl propyl sulphide (2 isomers) and dipropenyl sulphides (3 isomers)[26-27]. *Allium porrum* (raw bulb) contained 0.4% fat. *Allium schoenoprasum* contained 0.73% total fats. Many steroids and terpenoidswere isolated from garlic [28-32].

Alpinia galanga

Flower oil contains α -pinene, sabinene, limonene, α-phyllandrene, 1,8-cineole , linalool, terpinen-4-ol, α-terpineol, methyleugenol, α-patchoulene,caratol, α-caryophyllene, α-bergamotene,(E,E), α -farnesene, nerolidol, α - bisabolol and benzyl benzoate. The essential oil of *Alpinia galangal* contained: 2-methylpropyl acetate, butyl acetate, α-pinene, camphene, sabmene, β-pinene, myrcene, p-cymene, 1,8-cineole, limonene y-terpmene, terpmolene, linalool, borneo1, 4-terpmeol p-cyinenol, α-terpineol, carveo1 I, carveo1 II Chavicol, bornyl acetate, tridecane chavicol acetate, citronellyl acetate, neryl acetate, geranyl acetate, α-copaene and methyleugenol. Leaf oil contains mainly myrcene, β -ocimene, α-pinene, borneol, β -caryophyIIene and β -bisabolene[33-35].

Althaea officinalis

Many compounds were extracted from the flower and root of *Althaea officinalis*, included: undecyne, nonanoic acid methyl ester (nonanoic acid) , phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl, tetradecanoic acid methyl ester (tetradecanoic acid), pentadecanoic acid methyl ester (pentadecanoic acid), 9-hexadecenoic acid methyl ester(9-hexadecenoic acid), hexadecanoic acid methyl ester (hexadecanoic acid), and many other compounds [36-37] .

Ammannia baccifera

Ammannia baccifera contained many steroids, triterpenes and β-sitosterol[38].

Ammi majus

Ammi majus fruits contained acrid oil 3.2% and fixed oil 12.92%. Methyl ester of linoleic acid was found in high concentration 9.00%, followed by methyl ester of oleic acid 5.60%, palmitic acid 3.98% and linolenic acids 1.42%[40].

Ammi visnaga

The hydrodistillation of *Ammi visnaga* yielded 1.3 % of yellowish oil. The major compounds were included 2,2- dimethylbutanoic acid (30.1%), isobutyl isobutyrate (14.0 %), croweacin (12.2%), linalool (12.1%), bornyl acetate (7.3%) and thymol (6.0 [41-42].

Anagallis arvensis

The aerial parts of the plant contained triterpenes , ß-sitosterol and stigmasterol. A new triterpene metabolite with an olanane skeleton, the sterols, α-spinasterol, dihydrospinasterol, ß-sitosterol and stigmasterol, fatty acids such as palpitic, stearic, oleic and linoleic acids and triterpene saponins. Flowers contain sterols, stigmasteriol, ß-sitosterol and α-spinasterol glucoside [43-46].

Anchusa italica

The total lipid content of *Anchusa italica* leaves was 0.93 g / 100 g. It contained 16.59% saturated fatty acids, 3.15% monounsaturated fatty acids and 4.85% poly unsaturated fatty acids. [44-50].

Anchusa strigosa

The total lipid of dry flowers of *Anchusa strigosa* was 4.4% (26.1% volatile oils and 52.8% fixed oils). The fatty acids composition of the lipids was: tetradecanoic 0.6424, pentadecanoic 0.7495, hexadecanoic 3.6404, heptadecanoic 1.2849 , octadecanoic 4.6040, eicosanoic 0.7495, heneicosapentanoic 0.6424 and docosanoic 2.1414 μgm/100gm dry weight[51-53].

Anethum graveolens
Fruits of *Anethum graveolens* contain 1-4% essential oil, contain mainly carvone (30-60%), limonene (33%) and α-phellandrene (20.61 [54-57].

Anthemis nobilis
Anthemis nobilis contained volatile oils (0.4-1.75%). The essential oils of the aerial parts of the plants were included: isobutyl isobutanoate (4.4%), 2-methylbutyl isobutanoate (4.3%), isobutyl angelate (24.5%), 2-butenyl angelate (7.3%), 2- methylbutyl angelate (17.4%), *trans*-pinocarveol (4.5%), isoamyl angelate (7.6%) and estragol (5.0%)[58-61].

Antirrhinum majus
The floral scent of snapdragon flowers consists of a relatively simple mixture of volatile organic compounds (VOCs). The three major snapdragon floral volatiles were myrcene, (E)-beta-ocimene, and methyl benzoate [62]. The volatile organic compounds identified in e two *A. majus* subspecies were 2-methyl-propanal, 3-methyl-butanal, pentanal, Z-3-hexenal, hexanal, heptanal, octanal, nonanal, decanal, 1-pentanol, cycloheptatriene, 1-octene, 1,1-diethoxy-ethane, nonane, decane, dodecane, and many other compounds [63-65] .

Apium graveolens
Celery seeds, stems and leaves oil was (2.5-3.5%) contained volatile oils, sesquiterpene alcohols (1-3%) and fatty acids. The main components in the oil of *Apium graveolens* were: α- and β-pinene, myrcene, limonene,*cis-β*-ocimene, γ-terpinene,*cis-allo*-ocimene,*trans*-farnesene, humulene, apiol, B-selinene, senkyunolide and neocnidilide [66-71].

Arachis hypogaea
Oil yield of *Arachis hypogaea* was ranged from 18.6- 20.8 % , the state of the oil at room temperature was liquid , the odour was agreeable and the color was ranged from bright , light , amber to golden yellow . The percentage (%) composition of fatty acids in the oil of the tested varieties were capric 0.0-5.85, lauric 5.57-8.10, myristic 0.07-0.09, palmitic 4.10-4.85, palmitoleic 0.59-0.62, stearic 0.67-0.70, oleic 41.67-44.20, linoleic 19.58- 20.77, linolenic 0.12-0.14, arachidic 1.18-1.73, behenic 1.14- 1.93 and lignoceric 0.10-0.17[73-74].

Arctium lappa
The plant contained volatile oil (small amounts) of very complex make-up: including, among others, phenylacetaldehyde, benzaldehyde, 2-alkyl-3-methoxy-pyrazines. Triterpenoids, as 3α-hydroxylanosta-5,15-diene and 3α-acetoxy-hop-22(29)-ene isolated from the plant[A(75-77)].

Artemisia campestris
The hydrodistilled essential oil of fresh aerial parts of *Artemisia campestris* L. contained β-myrcene (16.47%), α-pinene (14.18 %), trans-β- ocimene (12.61%), β-cymene (8.15%) and camphor(5.85%)[78]. However, the volatile fraction of the aerial parts of *Artemisia campestris* contained the following groups: monoterpene hydrocarbons 42.2%, oxygen-containing monoterpenes 49.5% , sesquiterpene hydrocarbons 2.8% , oxygen-containing sesquiterpenes 2.9% , and other oils 0.2 % [79-87].

Arundo donax
The main constituents of the lipophilic fraction of *Arundo donax* fiber (mg/kg of fibre) were: *n*-triacontanoic acid 7109.9; sterols/triterpenols 528.1; 7-oxo-sitosterol 428 6.5; b-sitosterol 281.0; *n*-hexadecanoic acid 276.3; *n*-hexacosanoic acid 144.1; *n*-octacosanoic acid 134.9; campesterol 90.6; *n*-octadecanoic acid 73.6; 9-octadecanoic acid 55.7; *n*-eicosanoic acid 50.0; *n*-docosanoic acid 35.7 and 9,12-octadecadienoic acid 30.0[88-89] .

Asclepias curassavica
The main constituents of the essential oil of *Asclepias curassavica* were palmitic acid (19.0%), neophytadiene (14.5%), oleic acid (11.1%), (E)-11-hexadecen-1-ol (7.7%), ethyl hexadecanoate (7.0%), and methyl linoleate (5.8%)[90-91].

Asparagus officinalis
Nutritional analysis showed that *Asparagus officinalis* contained 0.16% fat[92]. Many steroidal compounds were isolated from the plant[93-94].

Asphodelus fistulosus
The seed oil of *Asphodelus fistulosus* contained 0.5% myristic, 5.7% palmitic, 3.6% stearic, 33.1% oleic, and 54.9% linoleic acids[95-96].

Astragalus hamosus
The composition of the volatile substances at the stage of leaf development in *Astragalus hamosus* were: acids 0.3%, esters 2.1%, ethers 0%, hydrocarbons 14.9%, aromatic hydrocarbons 0%, phenanthrene 0%, terpenes 10.1% and others 0%.[97-98].

Ballota nigra
The plant produces two types of essential oils. Oils derived from stems and leaves were sesquiterpene rich (78.17% and 88.40%, respectively), containing principally beta-caryophyllene, germacrene D, and alpha-humulene, present in appreciable amounts. In contrast, oil derived from the root was dominated by p-

vinylguiacol (9.24%), borneol (7.51%), myrtenol (7.13%), trans-pinocarveol (5.22%), pinocarvone (4.37%), 2-methyl-3-phenylpropanal (4.32%), and p-cymen-8-ol (4.30%) [(99-102)].

Bauhinia variegata

Bauhinia variegata seeds contained 18.0 ± 0.9% total oils, total monounsaturated fatty acids were 15.1 % and total polyunsaturated fatty acids 43.2% of the total lipids [(103-104)].

Benincasa hispida

Benincasa hispida seeds contained high amount of fatty acids 24.3% , saturated fatty acids represented 75.38% and unsaturated fatty acids (75.38%). It appeared that the extracted seed oil was mainly consisted of linoleic acid accounting for 67.37% of the total fatty acids. However, palmitic , oleic , and stearic acids represented 17.11, 10.21 and 4.83% respectively[(105-107)].

Betula alba

The root contained essential oil (0.04-0.05%), and sterol [(108)].

Bidens tripartita

The chemical composition of the essential oil of the roots of *Bidens tripartita* was investigated by gas chromatography-mass spectrometry. In total, 106 compounds identified (97.1% of the total oil). The main components of the oil were α-pinene (15.0%), β-bisabolene (9.3%), p-cymene (6.0%), hexanal (5.7%), linalool (4.6%), p-cymene-9-ol (3.4%), β-elemene (2.6%), 2-pentylfuran (2.2%), and silphiperfol-6-ene (2.1%) [(109-110)].

Brassica rapa

The chief fatty acids in *Brassica rapa* fatty oils were oleic acid (45 to 65%), linoleic acid (18 to 32%) and linolenic acid (10%)[(16)]. Several volatile constituents, including alcohols, aldehydes, esters, ketones, norisoprenoids, nitrogen and sulphur compounds were isolated from *Brassica rapa*. 3-butenyl isothiocyanate was the major isolated compound [(111-112)].

Bryonia dioica

Eight novel sterols were isolated (as acetates) from the saponified neutral fraction of *Bryonia dioica* root extract [(113)]. The total lipid contents were 1.39 g/ 100 g of the fresh weight of *Bryonia dioica.* They included (%) caproic acid 0.02 ± 0.01; caprylic acid 0.08 ± 0.05; capric acid 0.05 ± 0.03; lauric acid 0.08 ± 0.04; myristic acid 0.33 ± 0.09; myristoleic acid 0.06 ± 0.02; pentadecanoic acid 0.17 ± 0.04; palmitic acid 17.01 ± 1.22; palmitoleic acid 0.10 ± 0.00; heptadecanoic acid 0.39 ± 0.02; stearic acid 2.66 ± 0.04; oleic acid 1.21 ± 0.03; linoleic acid 6.48 ± 0.10; α-linolenic acid 67.78 ± 1.10; arachidic acid 0.52 ± 0.00; cis-5. 8. 11.14. 17-eicosapenstaenoic acid; heneicosanoic acid 0.16 ± 0.01; behenic acid 1.04 ± 0.05; eruicic acid 0.26 ± 0.03 and lignoceric acid 1.58 ± 0.21[(114)].

Calamintha graveolens

The oil contents of the aerial dried parts of the plant reached 0.06%. It was recorded that the main plant seeds essential oil constituents were germacrene-D , hexadecanoic acid , pulegone, isomenthone , pulegone, isomenthone and isomenthone[(115-116)].

[(116)].

Calendula officinalis

The total oils extracted from the dried flowers of *Calendula officinalis* ranged from 0.1 to 0.3%. The essential oil compounds isolated from *Calendula officinalis* flower were included: α-copaene, α -ionone, α -humulene, geranylacetone, γ-muurolene, β-ionone, ledene, α -muurolene, γ-cadinene, δ-cadinene, α -cadinene, α -calacorene, caryophyllene oxide, copaen-4-α-ol , β-oplopenone, viridiflorol, ledol, 1,10-di-epi-cubenol, 1-epi-cubenol, epi-α-muurolol α -cadinol and cadalene [(117-119)].

Calotropis procera

Leaf and stem of *Calotropis procera,* gave 0.133% and 0.09% essential oils**.** Leaf oil is dominated by tyranton (54.4%), 1- pentadecene (9.5%) and 1-heptadecene (8.2%). Most abundant compounds in stem oil are Z-13-docosenamide (31.8%), isobutyl nonane (13.7%) and 2,7,10-trimethyldodecane (12.3%). Both leaf and stem volatile oils contain octadecenamide and its saturated form in appreciable amounts. Also characterized by the presence of long chain fatty acids, amides, sulfurate, halogen compounds and carbonyls like ketones[(120-122)].

Canna indica

Forty-three compounds were identified in the oil of *Canna indica*. The major constituents were: γ-eudesmol 9.79, palmitic acid 8.53, δ-cadinol 6.33, luciferin 5.05, α-caryophyllene 4.78, α-fenchyl acetate 3.26, trans -nerolidol 3.23, 1,8-cineole 3.17, manool 2.75 and geranyl linalool 2.75% [(123-124)].

Capparis spinosa

Capparis spinosa oil (0.04 % pale yellowish oil) was dominated by isopropyl isothiocyanate (28.92 %), methyl isothiocyanate (25.60 %), butyl isothiocyanate (16.65 %), 3-p-menthene (3.08 %), 2-butenyl isothiocyanate (2.24 %) and 3-methylthio-1-hexanol (2.03 %) as major constituents [(125)]. The fatty acid composition of *Capparis spinosa* seeds oils included, palmitic: 10.23%, stearic: 2.61%,oleic: 38.45%, linoleic 23.75% and linolenic 1.17% [(126-127)].

Capsella bursa-pastoris

The fatty acid composition of the seeds and roots oils of *Capsella bursa-pastoris* included (%): azelaic acid 1.802 and 10.024 palmitic acid 18.168 and 44.076, stearic acid 9.874 and 9.570 oleic acid 22.863 and 16.101, linoleic acid 20.589 and 13.402, linolenic acid 12.197 and 6.826, arachidonic acid 3.370 and 0, and 11-eikozenoic acid 11.136 and 0 % respectively(128-130).

***Capsicum* species**

The polar, non polar and acid compounds of intermediate polarity range from 27 to 33 and the number of lipid compounds varies from 24 to 29 in *C. frutescens* (131). Chemical composition of n-hexane extracts from *Capsicum annuum* included: 2-heptanal (E), 2-decenal (E), 4-decadienal (E,E), cadienal, 2-undecenal, tetradecane, nonanoic acid, 9-oxo-, methyl ester, hexadecane, 2,6,10,14-tetramethyl, pentadecane, phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl, heptacosane, farnesol, hexadecene, tetradecanal, heptadecane, myristic acid methyl ester, 9-octadecene (E), 1-pentadecene, undecane, exadecane, oleic acid, octadecane, oleic acid methyl ester, pentadecanoic acid methyl ester, pentadecanoic acid, and many other constituents (132-133).

Carthamus tinctorius

Safflower seeds oil content of the four varieties of *Carthamus tinctorius* was ranged from 28.84 to 35.38 g/100g. Safflower oils contained palmitic acid, palmitoleic acid, margaric acid, margaroleic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, arachidic acid and behenic acid. Linoleic acid was the principal fatty acid (77.94-79.49%) followed by oleic acid as the second main fatty acid. Palmitic acid was the major saturated fatty acid (7.2-8.6%) followed by stearic acid (2-2.39%)(134-140).

Carum carvi

Carum carvi seeds contain 1–9% essential oils consisting of more than 30 compounds. Carvone and limonene were account the main portions (141-145). However, the chemical groups isolated from the oils of the seeds of *Carum carvi* were included monoterpene hydrocarbons, oxygenated monoterpenes, oxygenated sesquiterpenes, saturated and unsaturated fatty acids, aldehydes, ketones and esters (146-159).

Cassia occidentalis

The plant contained crude 14.9% lipid (160-161). The physical constants of Cassia occidentalis oils were: (total yield: 1.0%, iodine value: 114.5, thiocyanogen value: 74.0, saponification equivalent: 283.0), liquid fatty acids (yield % 74.9, iodine value: 151.3, saponification equivalent: 280.5), solid fatty acids(yield % of the total 25.1, iodine value:3.8, saponification equivalent: 287.8) and saturated acids (yield % of the total 24.0). *C. occidentalis*, was found to contain the following percentages of fatty acids: palmitic 19.7, lignoceric 4.3, oleic 31.6, linolenic acid 6.3 and linoleic 38.1% (161-162).

Casuarina equisetifolia

Several common triterpenoids, cholesterol, stigmasterol, campesterol cholest-5-en-3-beta-ol derivatives were isolated from the plant(163-164). Seventy-six compounds comprising of monoterpene hydrocarbons (29.3%), oxygenated monoterpenoids (16.2%), sesquiterpene hydrocarbons (2.7%), oxygenated derivatives (1.0%), aliphatic (40.6%) and non terpenoid (7.2%) compounds were observed in the leaf oils. The major compounds were pentadecanal (32.0%) and 1,8-cineole (13.1%). Significant quantities of α-phellandrene (7.0%), apiole (7.2%) and α- terpinene (6.9%) were present. The fruit oil was devoid of sesquiterpene hydrocarbon compounds (165-167).

Celosia cristata

The seeds contain 7.2-7.9% fatty oil(168-169). β-sitosteol, 2- hydroxy octadecenoic acid, stigmasterol were identified isolated from *Celosia cristata*(170).

***Chenopodium album*.**

The leaves of C*henopodium album* gave 0.64% oil v/w. The oils of the leaves of C*henopodium album* contained (%): α-pinene: 7.0, β-pinene: 6.2, p-cymene: 40.9, limonene: 4.2, pinane-2-ol: 9.9, α-terpineol:6.2, ascaridole:15.5, linalyl acetate: 2.0 and ethyl cinnamate: 3.7 (171-172).

Chrysanthemum cinerariaefolium

The major components of the essential oil of aerial parts of *Chrysanthemum cinerariaefolium* were camphor (11.0%), chrysanthenone (7.6%), α-cadinol (4.8%), γ-muurolene (4.6%) and cischrysanthenol (4%). Considerable amounts of terpinen-4-ol (3.6%), trans-pinocarveol (3.3%), borneol (3.5%), shyobunol (3.4%) were also found(173-174).

Cicer arietinum

The volatile compounds identified in the Roasted Chickpea (*Cicer arietinum* L) included 61 aroma-active compounds. They are consisted of aldehydes (25%), hydrocarbons (25%), terpenoids (20%), esters (8%), ketones (8%), alcohols (8%) and heterocyclic (8%)(175-176).

C*henopodium album*

The leaves of C*henopodium album* gave 0.64% oil v/w. The oils of the leaves of C*henopodium album* oil contained (%): tricyclene: trace, α-thujene: trace, α-pinene: 7.0, camphene: trace, sabinene: trace, β-pinene: 6.2 , myrecene: trace, p-cymene: 40.9, limonene: 4.2, benzyl alcohol: trace,1,8-cineole: trace, cis-ocimene:

trace, γ-terpinene: trace, linalool: trace, pinane-2-ol: 9.9 , allo ocimene: trace, citronellal: trace, borneol: trace, terpinen-4-ol: trace,α-terpineol:6.2, citronellol: trace, ascaridole:15.5, neral: trace, linalyl acetate: 2.0, geranial: trace, borneol acetate: trace, thymol: trace, carvacrol: trace, ethyl cinnamate: 3.7, acetyl eugenol: trace, elemicin: trace and benzyl benzoate: trace[177-178].

Cichorium intybus

The volatile constituents of *Cichorium intybus* were included Octane, Octen-3-ol, 2-Pentyl furan, (2E, 4E)-Heptadienal, 1,8-Cineole, Benzene acetaldehyde, n-Nonanal, Camphor, (2E, 6Z)-Nonadienal, (2E)-Nonen-1-al, n-Decanal, (2E, 4E)-Nonadienal, n-Decanol, (2E, 4Z)-Decadienal, n-Tridecane, (2E, 4E)-Decadienal, β-Elemene, (E)-Caryophyllene, β-Ylangene, Geranyl acetone, (E)-β-Farnesene, allo-Aromadendrene, dehydro-Aromadendrene, β-Ionone, Pentadecane, trans-β-Guaiene, (2E)-Undecanol acetate, Sesquicineole, (2E)-Tridecanol, n-Hexadecane, Tetradecanal, Tetradecanol, 2-Pentadecanone, (E)-2-Hexylcinnamaldehyde, Octadecane, n-Nonadecane, (5E, 9E)-Farnesyl acetone, n-Eicosane, n-Octadecanol and n-Heneicosane [179-180].

Citrullus colocynthis

The seeds contained fixed oil 17-28.5 % with high proportion of unsaturated fatty acids (79.80%), mainly linoleic acid, oleic acid, low percentage of saturated, total saturated 20.20% and a very low n-3 poly-unsaturated FA level (0.5%). However, the seed fat of *Citrullus colocynthis* consisted of palmitic 10.40%; stearic 6.52%; arachidic 1.70%; oleic 11.7-20.92%; linoleic 58.81-70%; and linolenic 1.65%.[185-186].

Citrus species

The pericarp (rind) of *Citrus aurantiifolia* contained 7 percent essential oil. The major compounds were D-limonene, D-dihydrocarvone, verbena, β-linalool, α-terpinol, trans- α –bergamotene, citral, fenchon , as well as terpineol, bisabolene, and other terpenoids[187-188]. However, a total of 46 compounds were identified from the *Citrus aurantiifolia* oil. Most of these were terpenes, which were found in greater amounts than sesquiterpenes, aldehydes, ketones, phenols, and free acids. Alcohols and some terpenes show higher percentage areas in the maturity stages [189]. Limonene 18.36, 7-oxabicyclo[4.1.0] heptane, 1-methyl-4-(1-methylethenyl)- 1.18, 6-octenal, 3,7-dimethyl- 4.39 cyclohexanone, 2-methyl-5-(1-methylethenyl)- 2.24, 6-Octen-1-ol, 3,7-dimethyl- 1.72, n-pentyl(1-propenyl)dimethylsilane 0.82, citral 12.95, 2-octen-1-ol, 3,7-dimethyl-, isobutyrate, (Z)- 1.10 and 2-xocycloheptyl acetate 0.87% were the major constituents of the leaf essential oil of *Citrus medica* [190-191]. Eleven constituents were identified from *Citrus limonum* leaves essential oils. citronellal (29.31 %), limonene (17.59 %), (E)-citral (12.71 %), 1,6-octadien-3-ol,3,7- dimethyl (10.91 %), biocyclo [3.1.0] hexane, 4-mehylene-1-(1-methyl) (8.80 %), 6-octen-1-ol,3,7-dimethl (7.95 %), 2,6-octadien-1-ol,3,7-dimethyl-, acetate, (Z) (6.29 %), 1,3-cyclohexadiene,5-(1,5-dimethyl-4-hexenyl)-2-methyl, [S(R,S)] (2.81 %), cyclohexene,3-(1,5-dimethyl-4-hexenyl)-6-methylene-, [S-(R,S)](1.64 %), bezene,1-(1,5-dimethyl-4-hexenyl)-4-methyl (1.10 %) and cyclohexene,1-methyl-4-(5-methyl-1-methyl-1-methylene-4-hexenyl)-,(s) (0.88 %)[191-193]. Limonene (95.98 %) was found as major component followed by camphene (1.79 %), while the remaining terpenes were less than 1% in the oil of the peels of *Citrus limetta* [196-197].

Clerodendrum inerme

Diterpenes, triterpenes, sterols, steroids, β-friedoolean-5-ene-3-β-ol, β-sitosterol, stigmasta-5,22,25-trien-3-β-ol, betulinic acid, and 5-hydroxy-6,7,4′-trimethoxyflavone were isolated from the aerial parts of *Clerodendrum inerme* [21]. Volatile constituents such as 5-O-ethylcleroindicin D, linalool, benzyl acetate and benzyl benzoate, have been isolated from *C. inerme*[198]. Anandhi and Ushadevi isolated 21 compounds from the ethanolic extract of the leaves of *Clerodendron inerme* including: p-Xylene, Cyclohexane, nitro- , Decane, Limonene, Undecane, 1-Heptanol, 2-propyl- Tetradecene, (E)-, Decane, 2,3,5,8-tetramethyl-, Hexadecane, Dodecanoic acid, Nonadecane, Eicosane, Tetradecanoic acid, 1,2-Benzenedicarboxylic acid, bis (2-methylpropyl) ester, n-Hexadecanoic acid, 9,12-Octadecenoic acid, methyl ester, (E,E)-, 9-Octadecenoic acid (Z)-, methyl ester , Oleic acid, Eicosane, Heptacosane and Squalene [199-200].

Clitoria ternatea

The fatty content of *Clitoria ternatea* seeds includes palmitic, stearic, oleic, linoleic, and linolenic acids, in addition to beta-sitosterol[201-202].

Cnicus benedictus

The plant contained 0.3%essential and volatile oils, included n-nonane, n-undecane, n- tridecane, dodeca-l,ll-dien-3,5,7,9-tetrain (polyyne), p-cymene, fenchon, citral and cinnamaldehyde [203].

Conium maculatum

The oil of *Conium maculatum* grown in Iran, was characterized by higher amount of germacrene-D (46.1%), β-caryophyllene (15.3%) and cis-α-Farnesene (10.1%)[204]. The main constituents were α-pinene (16.2%), camphene (9.9%), limonene (8.6%) and linalool (5.3%). However, by MAHD method, 16 compounds were identified in essential oil, representing 74.6% of total oil. The major compounds were camphene(13.0%), limonene(8.7%), linalool (8.4%) and fenchyl acetate (7.6%). 9 compounds were identified in essential oil by SPME, representing 99.8% of total oil obtained by SPME. The main constituents were α-pinene (46.1%), sabinene (16.2%), limonene (11.3%), camphene (9.5%) and myrcene (7.9%). The results also showed that the essential oil extracted with HD method included monoterpenes (52.8%), sesquiterpenes (10%) and oxygenated compounds (27.4%), whereas the essential oil extracted with MAHD method contained sesquiterpenes (9.9%), monoterpenes (47.7%) and oxygenated compounds (32.2%). Furthermore, the essential oil obtained by SPME, included monoterpenes (98.7%) and oxygenated compounds (4.3%)[205-208].

Convolvulus arvensis

Seeds from *Convolvulus arvensis* contained 6.7-16.5% oil. The chemical composition of oil consist of palmitic 6.6-10.0%, stearic 12.0-19.6%, oleic 21.6-30.0%, linoleic 27.8-41.3%, linolenic 6.0-9.2%, arachidic 3.3-6.4% and behenic acid 2.8-4.3%. It also contain steroids including campesterol, stigmasterol and β sitosterol[209-210].

Corchorus aestuans

Corchorus aestuans seeds oil contained β-sitosterol and the fatty acids (palmitic acid, stearic acid, oleic acid and linolenic acid)[211]. The bioactive constituents of ethanol extract of *Corchorus aestuans* were investigated using GC-MS technique. The analysis revealed the presence of fourteen different bioactive constituents some of them were lipids: the identified compounds were 3, 7,11,15-tetramethyl-2-hexadecen-1-ol (5.6%), Trans-2-undecen-1-ol (1.26%), E-7-Tetradecenol (1.97%), n-hexadecanoic acid (25.82%), phytol (22.34%), 9,12,15-octadecatrienoic acid, methyl ester, (Z,Z,Z)- (20.23%), docosanoic acid, ethyl ester (1.99%), 1-eicosanol (2.11 %), 9,9-dimethoxybicyclo[3.3.1] nona-2,4-dione (0.60%), Heptadecanoic acid, heptadecyl ester (0.95%), pentadecanoicacid,2,6,10,14-tetramethyl-,methylester(0.91%), 3-hexa decycloxycarbonyl-5-(2-hydroxyethyl)-4-methyl imidazolium ion (0.90%), squalene (8.03%) and Vitamin E (7.24%)[212-213].

Corchorus capsularis

Seeds contained 11.3-14.8% oil (16.9% palmitic acid, 3.7% stearic acid, 62.5% linoleic acid, 0.9% linolenic acids,1.8% behenic acid, 1.1% lignoceiic acid, 9.1% oleic acid). The lipid and lignin composition of jute fibers has been characterized. The most predominant lipophilic compounds were high molecular weight ester waxes (24% of total extract), followed by free fatty acids (17%), free fatty alcohols (17%) and α-hydroxy fatty acids (14%). Additionally, significant amounts of alkanes (6%), ω- hydroxyfatty acids (6%), sterols (6%), steroid and triterpenoids ketones (3%) and steryl glycosides (1%) were also identified. The main inter-unit linkage present in, was the β-O-4´ aryl-ether bond (72%) followed by β-β´ resinol-type substructures and with lower amounts of β-5´ phenylcoumaran and β-1´ spirodienone substructures[214-215].

Cordia myxa

The seeds of *Cordia myxa* contained 2.2% oil consisted of palmitic acid, stearic acid, oleic acid and linolenic acid were identified. β-sitosterol was also isolated[216-217].

Coriandrum sativum

The essential oil content of dried coriander fruits varies between 0.03 and 2.6%, while the fatty oil content varies between 9.9 and 27.7%[218-219]. The compounds isolated from coriander essential oil were included: monoterpene hydrocarbons, monoterpene oxides and carbonyls, monoterpene alcohols, monoterpene esters, sesquiterpenes, phenols, aliphatic hydrocarbons, aliphatic alcohols and aliphatic aldehydes [220-221].

Coronilla varia

The oil yield of the plant was 0.94% v/w. The main isolated compound were included caryophyllene oxide 44.08%, caryophyllene oxide 8.62%, alpha-cadinol 4.13%,(E,Z)-α-farnesene 4.04%, 6-butyl-3,6-dihydro-2-(1h)-pyridinone 3.31%,2-pentadecanone 2.22% and 1-homoadamantaneca 2.13% [222-223].

Cressa cretica

The fruits of *Cressa cretica* was a potential source of edible oil [224]. The total saturated were 35.76%, while total unsaturated were 63.45 [225-226].

Crocus sativus

Saffron petal contained 5.3% fat. The major components of saffron essential oil are safranal (responsible for aroma), picrocrocin (bitter taste), and crocin (responsible for color), along with other carotenoids and terpenes[227-230].

Crotalaria juncea
Seeds of *Crotalaria juncea* contained 4.22% oil. Gas chromatographic analysis of the oil gave palmitic acid (16.01-18.09%), stearic acid (7.29-10.15%), oleic acid (6.69-14.41%), linoleic acid (54.44-62.36%), linolenic acid (0.7-7.86%), myristic acid (0.197%), arachidic acid (1.199%) and behenic acid (1.369%)[231-233].

Cuminum cyminum
Cumin fruits contained 2.5 to 4.5% volatile oil and 10% fixed oil[234]. It appeared that the constituents of *Cuminum cyminum* essential oil were differ according to the area from which the *Cuminum cyminum* samples were taken. The major compounds in the Turkish cumin (*Cuminum cyminum*) seed oil were cuminaldehyde (19.25-27.02%), p-mentha-1,3-dien-7-al (4.29-12.26%), p-mentha-1,4-dien-7-al (24.48-44.91%), γ-terpinene (7.06-14.10%), p-cymene (4.61-12.01%) and β-pinene (2.98-8.90%). Cuminaldehyde, γ-terpinene, o-cymene, limonene and β-pinene were determined to be the major constituents of Syrian *Cuminum cyminum* . The major compounds in cumin essential oil of Egyptian cultivars were cumin aldehyde (35.25%), tetradecene (12.25%), γ-terpenene (12%), β-ocimene (9.72%), p-mentha-2-en-ol (9%), α-terpinyl acetate (5.32%), α-terpinolene (3%), lmonine (0.5%), myrcene (0.2%), β-pinene (0.9%) and α-pinene (0.19%)[235-239].

Cupressus sempervirens
The main compounds isolated from the oil of *Cupressus sempervirens*, were included: tricyclene, α-thujene, α-pinene, camphene, sabinene, β-pinene, myrcene, δ-3-carene p-cymene, limonene, γ –terpinene, α-terpinolene, camphor, bronyl acetate, carvacrol, β-caryophyllene, α-humulene, germacrene-D, δ-cadinene and α-cedrol. However, the major components were included α-pinene which represented (48.6%), δ-3-carene (22.1%), limonene (4.6%) and α-terpinolene (4.5%)[240-243].

Cuscuta planiflora
The preliminary phytochemical screening showed the presence of oil, phytosterols, triterpenoids and steroids in the plant extract[244-245].

Cydonia oblonga
The analysis of the essential oils of *Cydonia oblonga* leaves showed that the leaves of *Cydonia oblonga* contained aromatic aldehyde [benzaldehyde (12.8%)], followed by fatty acid [hexadecanoic acid (7.2%)], oxygenated monoterpene [linalool (5.7%)], norisoprenoid [(E)-β-Ionone (5.1%)], sesquiterpene hydrocarbon [germacrene D (8.6%)] and aromatic aldehyde [benzaldehyde(4.9%)] which represented the main components [246-247].

Cymbopogon schoenanthus
The major constituents of *Cymbopogon schoenanthus* oil were found to be 2-undecanone (14.68%) and limonene (19.54%) [248-254].

Cynodon dactylon
The phytochemical analysis showed that the plant contained volatile oils 1% and fixed oils and sterols[255-256]. A total of 20 compounds were identified from the hydroalcoholic extract of *Cynodon dactylon* included linolenic acid, hexadecanoic acid, and hexadecanoic acid ethyl[257-258].

Cyperus rotundus
The percentage of essential oils in *Cyperus rotundus* tubers was (0.19%). The main isolated compounds were (+) oxo-α-ylangene (9.35%), (+) α-cyperone (9.07%) trans-pinocarveol (7.92%) and cyperene (7.83%) were the major constituents in the oil of *Cyperus rotundus* [259-262].

Dalbergia sissoo
Thirteen fatty acids were isolated from the green branches of aerial parts of *Dalbergia sissoo*. GLC analysis of fatty acids methyl esters of Dalbergia sissoo showed the presence of caprylic, lauric, tridecanoic, myristic, myristoleic, pentadecanoic, palmitic, palmiteolic, margaric, stearic, oleic, linoleic and ϓ-linolenic acids. ß-amyrin, ß-sitosterol and stigmasterol were also isolated from the green branches of aerial parts of Dalbergia sissoo [263-264].

Daphne mucronata
The yield of the essential oils (Dry plant samples) obtained from the hydrodistillation of the D. mucronata leaves and stem were 5.6% and 9.5% g/100 g respectively. Twenty seven compounds were identified. The major components were pentadecane (12.75%), 2-methyl hexadecane (8.90%), 7,9-dimethyl hexadecane (8.90%), tetradecane (7.32%), 5-Propyl decane (6.16%), 2,3,5,8 tetramethyl hexadecane (5.81%), 2-methyl6-propyl dodecane (5.11%), 5-methyl tetradecane (5.10%)[265-266].

***Datura* species**
The proximate analysis showed that the seeds of the plant contained fat (14.72%). Total saturated fatty acids was 18.03% and total unsaturated fatty acids was 81.74%, mono-unsaturted fatty acids 27.49%, poly – unsaturted fatty acids 54.25%. Fatty acid profile consisted of palmitic acid 15.31%, stearic acid 2.72 5, oleic acid 25.97, linoleic acid 54.25%, and palmitolic acid 1.52 %[267]. The essential oil from different parts

of *Datura metel*. were extracted using hydrodistillation and analysis by GC-MS. However, the main components of flowers were ketone (23.61%) and ethyl palmitate (15.84%). The main components of leaves were ketone (18.84%) and phytol (18.71%). Ketone (39.45%) and phytol (31.32%) were the major components of petioles. Palmitic acid (30.60%) and ethyl linoleate (21.56%) were the major components of seeds. The major ingredient of roots was palmitic acid (52.61%). The main ingredients of the stems were palmitic acid (38.38%) and ethyl linoleate (17.38%) [268-270].

Daucus carota

The fatty acid composition of carrot seed oil cultivated in Turkey showed that it contained (mg/100g): palmitic: 10.01±0.13, palmitoleic: 0.64±0.02, stearic: 2.41±0.06, oleic: 0.17±0.01, linoleic: 11.82±1.17, petroselinic: 59.35±3.81, vaccenic: 0.55±0.01and arachidic: 0.81±0.03[271].

Mojaba *et al*., mentioned that the leaves of carrot (*Daucus carota* L. subsp. sativus (Hoffman.) Arcang. from Iran gave 0.2 % (v/w) essential oil. Ninety-one compounds were identified in the essential oil . The main class of the compounds was monoterpenes (30.0 %), sesquiterpenes (27.8 %) and phenyl propanes (26.4 %). The major constituents were trans-anethole (23.5 %) and myrcene (14.5 %)[272]. Major constituents of the essential oils were carotol (10.2–58.5%), α-pinene (21.2–41.2%), myrcene (6.4–14.1%), limonene (4.4–12.7%), and sabinene (0.2–5.3%). The results obtained were of significance for determining the most favorable time for harvesting carrot umbels for better yield of quality essential oil[273-279].

Delphinium ajacis

Seeds contain 1.01–1.06% alkaloids and 28.7% of a fixed oil. Oils consisted of sterols components (campestanol, stigmastanol, Δ22-stigmastanol, cholesterol, campesterol, stigmasterol, sitosterol, 24-methylcholest-7-en-3β-ol, 24-ethylidenecholestanol, Δ7-stigmastanol); 4-Methylsterols components (24-Methyllophenol, 24-ethyllophenol, obtusifoliol, 24-methylenelophenol, 24-ethylidenelophenol); and 4,4-Dimethylsterols (triterpene alcohols) components (cycloartenol, 24-methylenecycloartenol)[280-281].

Desmostachya bipinnata

The essential oils of the aerial parts of *Desmostachya bipinnata* was consisted of camphene (16.79%), isobornyl acetate (9.92%), tricyclene (4.30%), (+,-) trans-2,6-gamma-Irone (2.21%), caryophyllene diepoxide (12.29%) , I²-eudesmol (11.16%), eseroline (25.15%) and calarene (3.48%) as the main components. The oil also contained smaller percentages of diphenyliodinium bromide, 1-limenone, 2-cyclohexene-1-one and 8-nitro-12-tridecanolide[282]. Linoleic acid ethyl ester, palmitic acid ethyl ester, oleic acid ethyl ester, linoleic acid, palmitic acid, oleic acid, ρ- hydroxycinnamic acid ethyl ester, 2-methoxy-4-formylphenol (vanillin) and stearic acid ethyl ester were the most important lipid compounds isolated from the total alcohol extract of the rootstock of *Desmostachya bipinnata*[283-284].

Dianthus caryophyllus

The oil of *Dianthus caryophyllus* contained four chemical groups: monoterpene hydrocarbons 19.59% (tricyclene 0.17%, α-pinene 2.05%, camphene 0.98%, β-pinene 3.11%, phellandrene 3.52 %, P-cymene 3.32%, limonene 4.91, ϒ-terpinene 1.53%); oxygenated monoterpene 26.71% (elemol 5.51%, citronellol 1.11%, bornyl acetate 3.12%, eugenol 15.29%, methyl eugenol 1.68%); sesquterpenes hydrocarbons 12.83% (ϒ-cadinene 4.12%, calamene 8.71%) and various compounds 20.97% (benzyl benzoate 14.12%, benzyl salicylate 6.85%)[285-287].

Dodonaea viscosa

Dodonaea viscosa flowers yielded pentanol, β-pinene, myrcene, limonene, p-cymene, citronellal, linalool, linalyl acetate, ϒ-terpineol, geraniol, α-spinasterol, 4-hydroxy-3,5-diprenylbenzaldehyde, β-sitosterol, stearic acid, syringic acid, and β -sitosterol [288-290].

Dolichos lablab

A total of 262 volatile compounds were identified in *Dolichos lablab*. The volatile constituents were dominated by volatile terpenes and terpenoids, and their derivatives, which accounted for 46% of all the detected compounds. The detected compounds were separated into 12 classes namely; alcohols (28), aldehydes (10), ketones (19), esters (46), acids (7), oxygen heterocycles (1), pyrazines (5), thiazoles (4), hydrocarbons (57), terpenes and terpenoids (59), phenols (5) and miscellaneous compounds [291-292].

Echinochloa crus-galli
Nutritional analysis of plant grains showed that they contained 2.3-3.5% fat. The grains contained a significant fraction of unsaturated fatty acids, corresponding to 85.6% of the fatty acids, (23.0%) were monounsaturated fatty acids, they also contained smaller amount of saturated fatty acids(14.5%)[293-294].

Echium italicum
The major unsaturated fatty acids of *Echium italicum* were alpha-linolenic, linoleic, oleic, stearidonic and gamma-linolenic acids respectively. The highest values for stearidonic (15.48 %) and gamma-linolenic acid (7.66 %) were recorded in some population[295]. The composition of the seed oil was: total oil % (w) 6.2-28.4, the γ-linolenic acid percent reached 0.61-2.19%, γ-linolenic acid 3.94-9.79%, palmitic acid 6.51-18.93%, stearic acid 3.67-4.30%, oleic acid 12.63-16.23%, linoleic acid 14.09-20.15%, α-linolenic acid 22.12-36.61% and stearidonic acid 4.33-12.45[296-298].

Equisetum arvense
The volatile constituents of the sterile stems of *Equisetum arvense* were investigated using GC, GC/MS and 13C-NMR. Twenty-five compounds were identified. Hexahydrofarnesyl acetone (18.34%), cis-geranyl acetone (13.74%), thymol (12.09%) and trans-phytol (10.06%) were the major constituents[299-300].

Erigeron canadensis
The compounds isolated from essential oils were differ among different locations which may be attributed to the different environmental and climatic conditions. The main constituents were monoterpenoids [limomene (57.2%), camphene (2.5%) α and β-pinenes (1.9 % and 2.1%)] and sesquiterpenoids [caryophyllene (6.7%), germacrene D (4.9%) and *α*-curcumene (3.0%)]. A few non-terpenoid acetylenic compounds (4.8%) were also detected. The isolated compounds were included: α-Pinene: 1.9%, β-Myrcene: 1.2%, p-Cymene: 0.8%, Limonene: 57.2%, (E) -β –Ocimene: 1.1%, β- Pinene: 2.1%, Sabinene: 0.8%, p-Menth-1(7),8(10) dien-9-ol: 0.3%, Camphene: 2.5, 4-Hexen-3-one 2,2 dimethyl: 0.8%, *β*-Caryophyllene: 6.7%, Spathulenol: 1.5%, *α*-Curcumene: 3.0%, *π*-Muurolene 1.1%, Himachala-1,4-diene: 0.7%, 2-Allyl phenol: 0.5%, *2E,8Z*-Matricaria ester: 0.2%, Farnesene: 0.8%, β-Vatriene: 0.9%, *δ*-Cadinene: 0.7%, Z,Z-Matricaria ester: 3.4%, Germacrene D: 4.9% and *2E,8E*-matricaria ester: 1.2%[301-304].

Erodium cicutarium
The essential oils of *Erodium cicutarium* were examined by GC/MS. The results showed that the major components were isomenthone (11.2%), citronellol (15.4%), geraniol (16.7%) and methyl eugenol (10.6%)[306-307]. Fatty acids and fatty acid derived compounds were the most common, 51.3% (entire plants) and 60.1% (leaves and stems), followed by carotenoid derived compounds, 12.6% (entire plants) and 20.2% (leaves and stems), and then terpenoids, 14.9% (entire plants) and 14.2% (leaves and stems). The main constituents in the oils were hexadecanoic acid, 22.8% (leaves and stems) and 35.9% (entire plants) and hexahydrofarnesyl acetone, 10.8% (leaves and stems) and 11.6% (entire plants)[308]. All Erodium species contained a small amount of volatiles (0.01–0.06 mass %). Essential oils of *Erodium cicutarium* contained fatty acids and fatty acid derived compounds: 63.8%, carotenoid derived compounds: 18.5%, terpenoids: 13.1%, monoterpenoids: 1.3%, monoterpene hydrocarbons: trace, oxygenated monoterpenes: 1.3%, sesquiterpenoids: 5.9%, sesquiterpene hydrocarbons: 0.9%, oxygenated sesquiterpenes: 5.0%, diterpenoids: 5.9% and oxygenated diterpenes: 5.9% [309-310].

Eryngium creticum
The essential oils of *Eryngium creticum* contained pentanal 0.97±3.18%, -methylhexane 0.89± 2.08 %, pentan-1-ol 0.54±5.20%, 3,7-dimethyloct-1-ene 0.51±3.9%, 2,4-dimethylhexane 0.14± 1.18%, 3-ethylhexane 0.43±0.66%, 3,4-dimethylhex-1-ene 2.90±2.84%, octane 8.95±2.32%, hexanal 52.90±2.70%, 6-methylhepta-3,5-dien-2-one 2.13±2.74 %, (E)-hex-2-enal 1.02±3.20%, acetic acid 3.57±2.36%, heptan-3-one 1.78±3.24%, Non-1-ene 0.27±2.72%, Heptan-2-one 2.01± 3.42%, 2-Butylfuran 2.79±3.16%, 5-methylhexan-2-one 0.50±3.44%, nonane 0.56±2.7%, heptanal 13.90± 3.82%, CO_2 0.09±1.94%, pentanoic acid 0.90±3.10% and α-pinene 2.51±3.58% [311-313].

***Eucalyptus* species**
Eucalypts contained volatile oils which occurred in many parts of the plant, depending on the species, but in the leaves that oils were most plentiful. Eucalyptus oil was produced and stored in small glands, the leaves of different species contained from 0.1-7% of the fresh weight of the leaves[314]. The main constituent of the volatile oil derived from fresh leaves of Eucalyptus species was 1,8-cineole. The reported content of 1,8-cineole varies for 54-95%. 1,8-cineole showed a great variations along the seasons, but mature leaves always have higher contents of 1,8-cineole. Beside 1,8-cineole, the oil contained monoterpenes such as cymene, α-pinene, β-pinene and limonene, geraniol and camphene. Aromadendrene, cuminaldehyde, globulol and pinocarveol were also isolated from the Eucalyptus oil[315-330].

Eupatorium cannabinum

Flowers of *Eupatorium cannabinum*, gave 0.1% and leaves, 0.2% oils based on dry weight. The major components of this oil were found to be germacrene D (27.3%), germacrene B (12.4%), valencene (10.5%) and β-caryophyllene (8.7%). Thirty one compounds were identified from leaves oil. The main constituents of pale yellow leaves oil were shown to be germacren D (37.1%), germacrene B (11.7%), β-caryophyllene (10.2%) and delta-2-carene (8.5%). However, the compounds identified in the *Eupatorium cannabinum* flowers and leaves oils and their percentage (respectively) were: α-pinene 0 and 0.2, camphene 0 and 0.2, sabinene 0 and 0.1, myrcene 0 and 0.1, delta-2-carene 0.4 and 8.5, α-phellandrene 1.3 and 4.9, *p*-cymene 1.6 and 0.8, limonene 0.1 and 0.4, (Z)-β-ocimene) 0 and 0.2, benzenacetaldehyde 0.4 and 0, (E)-β-ocimene 0.2 and 1.5, terpinolene 0.1 and 0.2, linalool 0.1 and 0.1, nonanal 0.4 and 0.2, phenyl ethylalcohol 0.3 and 0, α-terpineol 0.5 and 0.1, decanal 0.1 and trace, nerol 0.5 and 0 , thymol (methyl ether) 6 and 4.3, thymoquinone 6.2 and 0, bornyl acetate 0.1 and 0.1, thymol 0.6 and 0, hexyl tiglate trace and 0.1, neryl acetate 8.7 and 3.3, geranyl acetate 0.2 and 0, β-cubebene 0.3 and 0.3, β-elemene 0 and 0.4, longifolene 0 and 0.2, β-caryophyllene 8.7 and 10.2, coumarine 0.6 and 0, α-guaiene 0.2 and 0, α-humulene 1.3 and 1.7, α-patechoulene 1.8 and 0.6, germacrene D 27.3 and 37.1, valencene 10.5 and 6.7, bicyclogermacrene 0.9 and 1.6, β-himachalene 0 and 0.5, δ- cadinene 2.7 and 1.2 and germacrene B 12.4 and 11.7[331-336].

Euphorbia hirta

Essential oil of the leaves of *E. hirta* was 1%. The five major compounds identified in the essential oil were 3, 7, 11, 15-tetramethyl-2-hexadecene-1- ol and its isomer (14.881 and 26.46%), 6,10,14-trimethyl-2-pentadecanone, (12.37%), phytol (8.29%), hexadecanal (7.63%) and n-hexadecanoic acid (6.26%) [337-338].

Fagopyrum esculentum

It has a strong characteristic aroma. Volatiles from a freshly ground buckwheat flour were extracted by different methods The compounds with the highest contribution to the buckwheat aroma were: 2,5-dimethyl-4-hydroxy-3(2H)-furanone, (E, E)-2,4-decadienal, phenylacetaldehyde, 2-methoxy-4-vinylphenol, (E)-2-nonenal, decanal, hexanal and salicylaldehyde (2-hydroxybenzaldehyde)[339-340].

Ficus carica

The volatile profile of fresh fruits (pulp and peel) and leaves of Portuguese *Ficus carica* white (Pingo de Mel and Branca Tradicional) and dark (Borrasota Tradicional, Verbera Preta and Preta Tradicional) varieties revealed the presence of fifty-nine compounds including (aldehydes, alcohols, ketones, esters, monoterpenes, sesquiterpenes, norisoprenoids). The highest diversity of compounds was found in leaves(40), followed by pulps (30) and peels (27), Pulps and peels were distinguished from leaves by their abundance of monoterpenes and aldehydes [341-342].

Ficus semicordata

Ficus semicordata contained fatty acid derivatives (dodecane, tetradecane, pentadecane), acyclic monoterpenes, (α-thujene, α-pinene, sabinene, β-pinene, β-myrcene, limonene, 1,8-cineole (*Z*)-β-ocimene (*E*)-β-ocimene, γ-terpinene, terpinolene, linalool and perillene) and sesquiterpenoids (α-ylangene, α-copaene, β-panasinsene, β-cubebene, β-elemen, α-gurjunene, β-caryophyllene, α-humulene, alloaromadendrene, γ-muurolene, germacrene D, β-selinene, α-selinene, α-muurolene, (*E*,*E*)-α-farnesene and δ-cadinene)[343].

Ficus religiosa

The major components of *Ficus religiosa* leaf oil were identified to be eugenol (27.0%), itaconic anhydride (15.4%), 3-methylcyclopenetane-1,2-dione (10.8%), 2-phenylethyl alcohol (8.0%), and benzyl alcohol (4.2%) [344-345].

Foeniculum vulgare

The main constituents of essential oil were identified as 9-octadecenoic acid (18.56%), 8Z)-14-methyl-8-hexadecenal (7.75%), pentad ecanecarboxylic acid (4.25%), o-benzenedicarboxylic acid (14.47%), 1,3,3-trimethyl-2-vinyl-1-cyclohexene (10.77%), 2-methyl-3-oxoestran- 17-yl acetate (5.46%), 1H-benzocycloheptene (10.71). However, the major and minor constituents isolated from Fennel (*Foeniculum vulgare*) essential oil were included (0.71%) Tetradecane, Hexadecane; (2.05%) Ethanone, 1-(4-methyl-3-cyclohexen-1-YL)-1-(4-methyl-3-cyclohexen-1-YL)ethanone, 2-propanone; (3.67%) H-Benzocycloheptene, 2,4a,5,6, 7,8,9, 9a-octahydro-3,5,5-trimethyl-9-methylene-, Longifolene; (0.15%) Phenylmethyl ester; (2.25%) cis-(-)-2,4a,5,6,9a-Hexahydro- 3,5,5,9-tetramethyl (1H)) benzocycloheptene; (10.71%) 1HBenzocycloheptene; (0.26%) m-Methyl acetophenone; (0.21%) alpha- Caryophyllene; (0.14%) 2-Cyclopenten-1-one, 2-hydroxy-3-methyl-Corylon; (0.54%) p-Guaiacol; (0.48%) 2-(4a,8-Dimethyl-2,3,4,4a,5,6- hexahydro-naphthalen-2-yl)-prop-2-en-1-ol; (0.66%) Vetivenene Neoisolongifolene, Aromadendrene; (0.90%) Anthracene, 1,2,3,4,5,6,7,8-

octahydro-1-methyl-; (1.74%) 1-Methyl-6-(3-methylbuta- 1,3-dienyl)-7-oxabicyclo [4.1.0] heptane; (1.12%) 1-hydroxy-2-methoxy- 2-methoxy-4-methylbenzene; (0.26%) 1-(2,3-Dihydroindol-1-yl)-4- phenyl-butan-1,4-dione; (0.26%) 5,5 Dimethyl-3-vinyl cyclohex-2-en-1- one; (0.54%) 2-Methoxy-4-ethylphenol, 1,2-Dimethoxy-4- methylbenzene; (0.37%) Bis(4-methylphenyl) methanedisulfonate; (0.32%) (-)-5-xatricyclo [8.2.0.0(4,6)] Dodecane, Cedran-9-one; (1.22%) 2,2-dimethyl-3-phenylpropanoate; (0.29%) -Methyl-6-(3-methylbuta-1,3-dienyl)-7-oxabicyclo [4.1.0] heptane; (0.45%) 2,7-dimethyloct-7-en-5- yn-4-yl ester; (2.04%) 2-Methyl-6-(4-methyl-1,3-cyclohexadien-1-yl)-2- hepten-4-one; (3.16%) 3-Methyl-2-butenoic acid; 5.46 2-Methyl-3-oxoestran-17-yl acetate; (0.70%) 3,3,6-Trimethyl-1-indanone; (10.77%) 1,3,3-Trimethyl-2-vinyl-1-cyclohexene; (14.47%) o-Benzenedicarboxylic acid; (0.49%) 1-Isopropyl-1,2,3,4-tetrahydroisoquinoline; (0.20%) 3,4- Dimethyl-1,5-cyclooctadiene; (1.84%) 2-hydroxy-1-(hydroxymethyl) ethyl ester; (4.25%) Pentadecanecarboxylic acid; (7.75%) 8Z)-14- Methyl-8-hexadecenal; (18.56%) 9-octadecenoic acid and (1.00%) 2- cis,cis-9,12-Octadecadienyloxyethanol [(346-352)].

Fraxinus ornus

Sixteen compounds isolated from *Fraxinus ornus* seeds were included: n-heptadecane 1.769%, n-octadecane 2.185%, n-nonadecane 1.883%, n-eicosane 2.043%, n-heneicosane 5.552%, n-docosane 1.575%, n-tricosane 2.535%, n-tetracosane 8.238%, n-pentacosane 4.237%, n-hexacosane 13.614%, n-heptacosane 1.249%, n-octacosane 1.498%, 5α-cholestane 1.249%, β- sitosterol 9.008%, α- amyrin 10.366% and lupeol 32.992%[(353-354)].

Fritillaria imperialis

Many steroidal bases were isolated from the bulbs of *Fritillaria imperialis* [(355-356)]. A diterpenoid isopimara-7,15-dien-19-oic acid was isolated from the nonpolar fraction of ethanolic extract of *Fritillaria imperialis*[(357-358)].

Fumaria officinalis

The preliminary phytochemical analysis showed that the entire dried *Fumaria officinalis* contained terpenoids, phytosterols, fixed oils and steroids[(359-360)].

Fumaria parviflora

The unsaponifiable matter as well as the total fatty acids fractions of the lipoidal matter of *Fumaria parviflora* were investigated. β-sitosterol, stigmasterol, campesterol as well as $C_{30}H_{62}$ hydrocarbon were isolated. GLC of fatty acids methyl esters revealed the presence of : capric (1%), lauric (1.9%), myristic (1.16%), myristoleic (4.55%), palmitic (3.9%), stearic (29%), linoleic (10.5%), and arachidonic (7.23%) acids, in addition to unidentified peaks. The flavonoids identified in the plant were 3,5,3',4' tetrahydroxy flavone-3-arabinoside; 3'-4'-dihydroxy flavone and 3,7,4'-trihydroxy flavone [(361-362)].

Galium aparine

The major component of the essential oil obtained from *Galium aparine* (mg/kg) were included: benzaldehyde: 23.4; propiophenone: 69.9; cinnamaldehyde: 22.4; methyl acetophenone: 71.8; caprylic acid: 52.5; 1,2,3,4-tetrahydro-1,1,6- trimethyl naphthalene: 25.9; phenylacetic acid: 67.5; 2-methoxy-4-vinylphenol: 68.7; 1,2-Dihydro-1,1,6- trimethylnaphthalene: 31.4; 1,2-dihydro-1,6,8-trimethyl naphthalene: 18.2; vanillin: 16.8; capric acid: 95.5; dihydroactinidiolide: 218.3; loliolide: 761.2; myristic acid: 504.0; trans-neophitadiene: 3485.5; cis-, trans-neophitadiene: 747.6; cis-neophitadiene: 1237.5; palmitoleic acid: 436.4; palmitic acid: 13742.2; heptadecanoic acid: 220.2; linolenic acid: 692.9; linoleic acid: 18937.3; tricosane :229.1; 4,8,12,16-tetramethylheptadecane-4-olide: 120.6; tetracosane: 65.1; pentacosane :221.2; octacosane: 788.5; heptacosane: 300.4; squalene: 264.0; nonacosane :3315.9; triacontane: 248.5; stigmasta- 3,5-diene: 127.0; vitamin E: 154.0; untriacontane: 297.9 and γ-sitosterol 265.4[(363-366)].

Galium verum

The major component in the essential oil of *Galium verum* were phytol (9.268%), tetradecane (11.764%), hexadecane (12.272%), n-tetradecane (17.932%), 9,12,15-octadecatrienoic acidmethyl ester (8.088%) and hexadecanoic acid- methyl ester (4.318%)[(367-370)].

Geum urbanum

The composition of the oil from *Geum urbanum* root was dominated by eugenol (69.2%), followed by *cis*-myrtanal (15.3%), and related compounds with a pinane skeleton: *trans*-myrtanol (3.2%), myrtenal (3.0%), *trans*- myrtanal (2.9%) and myrtenol (2.1%). These six compounds accounted for 95.7% of the oil. Some other monoterpenes were detected, but only in small amounts (0.9%), phellandral (0.5%) being the most abundant one. The oil, besides these compounds, also contained 1.6% of the bicyclic ketone –nopinone[(371-373)].

Glossostemon bruguieri

The percentages of total lipids in seeds, leaves and roots of the plant were 23.50, 6. 70 and 0. 75%, respectively. N-Octacosane was the major component in the unsaponifiable matter of the seeds, leaves and roots, while n-tricosane (15 .65%) in the seeds and n-docosane (1.9%) in the leaves were the major components [(374-375)].

Glycyrrhiza glabra

Analysis of the essential oil of *Glycyrrhiza glabra* leaves showed that the main hydrocarbon and oxygen containing compounds were: isoniazid (13.36%), diethyltoluamide (6.56 %), benzoic acid (5.37 %), benzene (4.58 %), linalool (2.25 %), prasterone (5.63 %), warfarin (1.43 %), iodoquinol (1.90 %) and phenol, 4-(2-aminopropyl) (1.30 %) [376-380].

Gnaphalium luteoalbum

Forty-four compounds were identified in the oil of *Gnaphalium luteoalbum*, consisted of 4.4% monoterpene hydrocarbons, 5.0% oxygenated monoterpenes, 14.7% sesquiterpene hydrocarbons, 3.6% oxygenated sesquiterpenes, 29.1% aliphatic compounds, 10.4% fatty acids and esters, and 3.4% others. The main constituents were found to be decanal (9.7%), β-caryophyllene (8.0%), and α-gurjunene (6.4%) [381-382].

Gossypium hirsutum

Terpenoid products, including monoterpenes, sesquiterpenes, and terpenoid aldehydes were identified in the leaf foliage of *Gossypium hirsutum*[383]. The triterpenoid aldehydes, gossypol, 6-methoxygossypol and 6,6′-dimethoxygossypol, and the sesquiterpenoid aldehydes, hemigossypol and methoxyhemigossypol, were isolated from 1-week-old roots of *Gossypium hirsutum* and *G. barbadense*[384-387].

***Haplophyllum* species**

Haplophyllum species contained steroids, essential oil and volatile oil[388-389]. GS-MS analysis of the essential oil of the fresh twigs and flowers of *Haplophyllum tuberculatum* from Oman showed that β-phellandrene (23.3 %) was the main part of the oil [393-394].

Hedera helix

The chemical groups isolated from the plant fruits were included fatty acids: petroselinic,oleic, *cis*- vaccenic, palmitoleic; and volatile oil: germacrene B, *β*-elemene , *γ*- elemene (elixen), methylethyl ketone, methylisobutyl ketone, *trans*-2- hexanal, *tran*s-2-hexanol, germacrene D, *β*-caryophyllene, sabinene, *α*-, *β*-pinene, limonene, furfurol [395-397].

Helianthus annuus

Fatty acids identified in sunflower oil were included: palmitic 5.8%, palmitoleic 0.1%, stearic 3.9%, oleic 15.9%, linoleic 71.7%, alpha linoleic 0.6 %, gamma linoleic 0.1%, arachidic 0.3%, gadoleic 0.2%, tetracosanoic 0.5%, and behenic acid 0.7%[398]. Eighty four volatile components were isolated from sunflowers of different varieties by Gas chromatography, among which 20 terpene hydrocarbons, 9 alcohols, 3 phenols, 6 esters, and 19 oxygenated compounds. Terpene hydrocarbons accounted for more than 93% of the extracts[399-401].

Helianthus tuberosus

The major component in leaves and tubers oils was(-)-β-bisabolene with the highest concentration among other volatile compounds concentrations of 70.7% and 63.1%, respectively. Other components in leaves present in significant contents being: α-copaene (1.50%), β-bourbonene (0.59%), (E)-α-bergamoten (0.47%), geranyl acetate (0.39%), β- sesquiphellandrene (3.18%), β-ionon (2.35%), caryophyllene oxide (4.95%), (Z)-α-bisabolene epoxide (12.65%), neophytadiene (1.60%), and hexahydrofarnesylacetone(1.68%) [402-403].

Eminium spiculatum

The oil content of *Eminium spiculatum* was 0.657%, the component fatty acids of the oil was oleic 70.1%, linoleic 20.2% and diene 2.01%. The percentages of component sterols of the steroid fructions were β-sitosterol 14.1-47.7, stigmasterol 11.9-25.0, campesterol 23.1-66.3 and dehydro-campesterol 6.7-7.7%[404].

***Heliotropium* species**

Quantitative analysis of fatty acids of *Heliotropium bacciferum* by GCMS analysis revealed the presence of linoleic acid 65.70%, eicosadienoic acid 15.12%, oleic acid8.72%, palmitic acid 8.14%, stearic acid 1.74%, elaidic acid 0.58% and myristic acid 0.20%[405]. The main compounds identified in the essential oil of *Heliotropium europaeum* were cis linoleic acid methyl ester 7.3%, silphiperfol-6-en- 5-one 7.1%, geranyl acetone 6.3%, (*E*)- β-ionone 4.8%, phytol acetate 4.3%, and alloaromadendiene epoxide 3.8%[406-407].

***Herniaria* species**

H. incana from Greece, contained 0.1% essential oil. The main components were 6,10,14-trimethyl-2-pentadecanone and tridecanal[408-409].

Hibiscus cannabinus

Seed oil content was ranged from 21.4 to 26.4%. Total phospholipids was ranged from 3.9 to 10.3% and sterol was 0.9% of the total oil. Palmitic (20.1% of the total fatty acids), oleic (29.2%), and linoleic (45.9%) were the major fatty acids, and palmitoleic (1.6%), linolenic (0.7%), and stearic (3.5%) were the minor components [410-412].

Hibiscus rosa-sinensis

Fresh flowers of *Hibiscus rosa-sinensis* gave 0.30 - 0.50 v/w % essential oils. Many constituents were identified in the essential oils included: 1 - iodoundecane: 50.568%, neopentane: 7.641%, 2, 2, 4-trimethyl 3- pentanone: 1.556%, 1,2-benzenedicarboxylicacid isodecyl octyl ester: 11.056%, 2-cyclopentylethanol: 2.404%, 2-

propeonic acid, 1-4 butanediyl ester: 1.543%, 2-propenamide: 1.543%, 1-tetrazol-2- ylethanone: 3.993%, 4-trifluoroacetoxyoctane: 1.480% and amylnitrite: 3.993% (413-414).

Hibiscus sabdariffa

The major compounds identified in the essential oil of of air-dried flowers of *Hibiscus sabdariffa* were hexadecanoic acid (64.3%) and linoleic acid (22.7%).The chemical classes of compounds present in the oil were sesquiterpene hydrocarbon (0.2%), oxygenated sesquiterpenes (1.2%), diterpenes (1.6%), aliphatic compounds (0.6%), phenyl propanoids (0.1%) and fatty acids (96.1%). Seventeen compounds were identified in the oil included (%): *n*-nonanoic acid: 0.6, eugenol 0.1, β-caryophyllene: 0.1, 10-*epi*-γ- eudesmol: 0.3, Ť-cadinol: 0.5, α-selina-6-en-4-ol: 0.2, bisabolol oxide: 0.2, cadalene: 0.1, tetradecanoic acid: 2.1, hexadecanoic acid methyl ester:2.3, isophytol: 1.6, hexadecanoic acid: 64.3, heptadecanoic acid: 1.2, linoleic acid methyl ester: 2.1, oleic acid: 0.9, stearic acid methyl ester: 0.5 and linoleic acid: 22.7(415-420).

***Hyoscyamus* species**

Analysis of the total lipid and fatty acid composition of the aerial parts of *Hyoscyamus reticulatus* revealed that the total saturated fatty acids was 12.45 % (myristic acid 0.23±0.01 %, pentadecylic acid 0.05±0.02 %, palmitic acid 8.69±1.81 %, margaric acid 0.15±0.38 % and stearic acid 3.33±1.00 %). The total monounsaturated fatty acids was 16.57 % (palmitoleic acid 0.18±0.05 % and oleic acid 16.39±1.43 %). The total polyunsaturated fatty acids was 70.97 % (linoleic acid 68.02±5.41 % and linolenic acid 2.95±1.36 %)(421). Withanolide steroids were isolated from the seeds of *Hyoscyamus niger*. They were identified as daturalactone-4 and hyoscyamilactol and 16α-acetoxy hyoscyamilactol(422-423).

Hypericum triquetrifolium

Nonane (15%), germacrene-D (13%), caryophyllene oxide (12%), bcaryophyllene (11%), a-pinene (10%), myrcene (5%), b-pinene (4%) and sabinene (3%) were the main components of the oil of *Hypericum triquetrifolium* from Italy(424). 1-Hexanal (18.8%), 3-methylnonane (12.5%), α-pinene (12.3%), caryophyllene oxide (4.7%), 2-methyldecane (4.5%) and α-amorphene (4.2%) were the main components of the essential oil of the aerial parts of *Hypericum triquetrifolium* from Turkey(425). α-humulene, *cis*-calamenene, δ-cadinene, bi-cyclogermacrene, eremophilene, β-caryo- phyllene, (E)-γ-bisabolene and α-pinene were the main components of the Tunisian *Hypericum triquetrifolium* oil(426). However, the essential oil of the aerial parts of Tunisian *Hypericum triquetrifolium* showed the predominance of *n*-octane, α-pinene, β-caryophyllene, 2- methyloctane, *n*-nonane, germacrene- D, α-selinene and β-cubebene(427- 428). Hexenal, (E) (12.63%), octane, 2,3,3-trimethyl (11.36%), pentadecane, 7- methyl- (9.7%), undecane (6.15%) and alpha. -pinene (5.75%) were the main components of the essential oil of *Hypericum triquetrifolium* from Iraq(429-430).

Inula graveolens

Analysis of oil of the aerial parts of *Inula graveolens*, showed that the main constituents were: bornyl acetate (69.78%), borneol (4.25%), caryphyllene oxide (5.7 %), 1[7]5 -menthadien-8-ol (2.10 %), chamigrene (2.9 %) and the b selinene 0. 95%. However thirty compounds were isolated included (%): camphre: 0.25, 1[7]5 -mentha – diene-2-ol: 0.09, bornyle acetate: 69.78, P-cymene -8- ol: 0.98, 1[7]2 mentha diene 8 ol: 2.10, isoborneol: 0.10 borneol: 4.25, menth-1-ene-9-ol acetate: 0.28, 4 -terpineol: 0.30, b-caryophyllene: 0.50, benzoate degeranyle: 0.18, allo-4-aromadendrene: 0.20, isogermacrène D: 0.15, isobornyl-2-methylbutyrate: 0.15, neryl acetate: 0.34, ocimenone: 1.00, caryphyllene oxide: 5.7, occidentallo acetate: 0.78, nerolidol acetate: 0.38, a-chamigrene: 2.90, epicadinol: 1.68, a -eudesmol: 1.17, 4-methyl valerate de neryl: 0.39, nerolidol: 0.63, *trans* verbenol: 0.18, *cis* eudesm- 6-ene- 12 al: 0.10, farnesyl acetate: 0.24, isobornyl isobutyrate: 0.33, b -selinene: 0.95, and germacrene B: 0.67(431-439).

Iris pallida

The chief constituent of the root was the oil of orris, also known as Orris Butter, which constitutes about 0.1 to 0.2 percent of the dried root; it was a yellowish white, semisolid mass. Other constituents of orris root were fat, resin, a large quantity of starch, mucilage, a bitter principle and a glucoside named iridin. The aromatic constituent of orris root was Irone, which gave the dried, aged root its characteristic violet like odor(440-442). The essential oil contained several compounds like 85% myristic acid with irone, menthyl myristate, ionone, irilone irigenin, isoflavones, ßsitosterol, iridin, triterpenes and ß-amyrin(10).

Jasminum officinale

Thirty compounds were identified in the essential oil of *Jasminum officinale* var. *grandifloroum*. The major volatile components were phytol (25.77 %), 3,7,11-trimethyldodeca -1,6,10-trien-3-ol (12.54%) and 3,7,11- trimethyldodeca-6,10-dien-3-ol (12.42%) (443-444).

Jasminum sambac

The main identified constituents in the essential oil of *Jasminum sambac* flowers were: benzyl alcohol 4.51 and 5.26, benzyldehyde 1.34 and 3.29, citral (mixture of cis and trans) 0.58 and 0.73, linalool 1.45 and 2.31, 2-phenyl ethyl acetate 2.73 and 3.01, geraniol 3.89 and 6.26, eugenol 5.98 and 9.8, farnesol 8.91 and 8.31, citrinyl acetate 3.56 and 3.57, nerol - and 0.39, geranyl acetate 2.79 and 4.98, nerayl acetate - and 1.00, phenyl ethyl alcohol 12.98 and 14.11 and citronellol 17.98 and 19.37(445). The main constituents of the volatile fraction of Jasminum sambac flowers were: benzyl acetate (23.7 and 14.2%), indole (13.1 and 13.4%), E-E-α-farnesene (15.9 and 13.1%), Z-3-hexenyl benzoate (4.9 and 9.4%), benzyl alcohol (7.7 and 8.4%), linalool (10.6 and 6.3%), and methyl anthranilate (5.0 and 4.7%)(446-447).

Juglans regia

The total oil content of *Juglans regia* kernel, ranged from 61.97 to 70.92%, the oleic acid content of the oils ranged from 21.18 to 40.20% of the total fatty acids, while the linoleic acid content ranged from 43.94 to 60.12% and the linolenic contents from 6.91 to11.52%. It was found that palmitic acid was between 5.24 and 7.62%, while stearic acid ranged from 2.56 to 3.67%(448-452).

Juniperus communis

The essential oils of *Juniperus communis* mainly contained α–pinene, α–fenchene, sabinene, β– pinene, myrcene, DETA.3-carene, limonene, terpinolene, terpine ol -4 α-terpineol, carvone, carvacrol, γ-terpinene, α-terpinolen, α- amorphene, β–caryophyllene, α–humulene, germacrene-D, α–muurolene, β–cadinene, β–elemene, Junipene, α–cedrol, γ–cadinene, δ–cadinene, α–cadinene and α–cadinol (453-468).

Jussiaea repens

The fatty acid fractions and their relative concentrations in the *Jussiaea repens* were determined by TLC and GC-FID analyses of methyl esters in the n-hexane extract of mature leaves. The lipids content was 5.74% of the mg/g dry leaf tissue. Fatty acids identified were palmetic, oleic and stearic acids with 65.57, 4.85 and 10.79% concentrations, respectively(479-480).

Juniperus oxycedrus

Fifty compounds were identified in the berry oil and 23 compounds were identified in the wood oil of *Juniperus oxycedrus* ssp. *oxycedrus* from Lebanon. *Juniperus oxycedrus* ssp. *oxycedrus* berry oil was characterized by high contents of α-pinene (27.4%), β-myrcene (18.9%), α- phellandrene (7.1%), limonene (6.7%), *epi*-bicyclo sesquiphellandrene (2.3%) and δ-cadinene (2.2%), while, in the wood oil, δ-cadinene (14.5%), *cis*-thujopsene (9.2%) and α-muurolene (4.9%) were the main component(469-470). The leaves oil of *Juniperus oxycedrus* characterised by high contents of α- pinene followed by sabinene, limonene, β- pinene, caryophyllene oxide, myrcene, ρ- cymene, β-phellandrene, γ-terpinene, terpinen- 4-ol, germacrene D, (E)-caryophyllene and óocimene (1.09%) (471-478).

Lagerstroemia indica

The ethanol and hexane extracts of *Lagerstroemia indica* contained β-sitosterol , (Z)-9-octadecenamide (oleamide), phytol, squalene, n-hexadecanoic acid, linolenic acid, campesterol, ethyl -d-glucopyranoside, 3,7,11,15-tetramethyl-2-hexadecen-1-ol, linoleic acid, 24-methylenecycloartanol, cis-11-eicosenamide, stigmast-5-en-3-ol,oleate, α-tocopherol, hexadecanamide, octadecanamide, octadecanoic acid, stigmasterol, glycerol ß-palmitate, hexadecanoic acid ethyl ester and pentacosane(481-482).

Lagerstroemia speciosa

The essential oils of the fruits of *Largerstroemia speciosa* contained mostly hydrocarbons: Methyl cyclohexane (60.9%), methyl benzene (18.2%), o-xylene (3.04%) representing 82.14% of the total essential oil(483). *Lagerstroemia speciosa* flower oil contained: α-pinene (10.38%), *β*-pinene, (8.45%) myrcene (6.76%), limonene (2.6%), α –bisabolol (3.14%) as major components. However, the components identified from the essential oil and their percentages were: α-pinene 10.38, *β*-pinene 8.45, myrcene 6.76, limonene 2.60, *Cis- β*-ocimene 1.33, *trans- β* ocimene 2.12, linalool 1.22, terpinolene 0.16, 8-hydroxy linalool 1.12, α-terpineol 12.76, Benzene acetaldehyde trac,borneol 2.18, p-cymen-8-ol 0.70, *cis*-dihydrocarvone 1.23, trans-dihydrocarvone 1.7, α -copaene 1.14, *γ*-Elemene 0.38, humulene 0.89, *a β*-bisabolene 5.97, *γ*-cadinene trac, *β*-selinene 3.54, *δ*-cadinene 2.47, caryophyllene oxide 1.69, Humulene oxide 0.79, α -bisabolol 3.14 and Nootkatone 1.90 %(484-485).

Lallemantia iberica

The oil analysis of the aerial parts of *Lallemantia iberica*, showed that the oil of the aerial parts contained 11 compounds. It mainly consisted of germacrene-D, delta-3-carene, iso-caryophyllene, sabinene, alpha-terpinene acetate and limonene(486-493).

Lallemantia royleana

Seed oil contained 19.26% fatty acid, 90.71% of them were unsaturated fatty acids (USFA) and 9.29% saturated fatty acids, linolenic acid, oleic acid and palmitic acid were the predominant acids in PUSFA, MUSFA and SFA seed oil, respectively. Seed oil also contained 427.8 ppm tocopherols and 210 ml/l polyphenols(494). Forty-six compounds, were identified in the oils of the aerial parts of *Lallemantia royleana*.

The components of *Lallemantia royleana* aerial parts oil (%) were: tricyclene 1.0, α-pinene 0.3, 1-octen-3-ol 0.1, 6-methyl-5-hepten-2-one 0.9, 3-octanone 0.5, 2-octanone 0.1, β-myrcene 2.8,3-octanal trace, α-phellandrene 0.3, δ-3-carene 3.1, α-terpinene 2.0, ρ-cymene 1.9, limonene 5.7, benzyl alcohol 1.6, 1,8-cineole 1.8, β-*cis*-ocimene 0.8, β-*trans*-ocimene 7.4, γ-terpinene 1.1, isobutanol 0.9, terpinolene 2.7, butanol 0.2, dehydro-sabina ketone 0.5, *iso*-3-thujanol 0.7, sabina ketone 0.6, 3-thujene-2-one 7.8, myrtenal 1.7, myrtenol 0.2, verbenone 16.4, *trans*-carveol 9.8, *cis*-sabinene-hydrate acetate 0.2, *cis*-carveol 4.8, *trans*-sabinene-hydrate acetate 0.5, *trans*-sabinyl acetate 0.5, carvacrol 1.5, *iso*-dihydrocarvyl acetate trace, α-cubebene 0.8, α-longipinene 0.1, β-bourbonene 2.7, β-cubebene 8.9, α-*cis*-bergamotene trace, β-caryophyllene 0.6, α-*trans*-bergamotene 0.1, β-*cis*-farnesene trace, β-*trans*-farnesene trace, spathulenol 0.3 and α-muurolol 0.6%(495-497).

Lantana camara

However, thirty six compounds were characterized from essential oil of *Lantana camara* from Tamilnadu regions, these included: bicycloelemene, α- cubebene, α- copaene, β- elemene, bicyclo, germacrenem, α-guaiene, α- humulene, aromadendrene, napthalene, germacrene D, β- selinene, epi-bicyclosesquiphellandren, α- selinene, 1-hydroxy-1, 7-dimethyl- 4- iso, β- cadinene, caryophyllene oxide, nerolidol, salvia- 4 (14)- en-1- one, veridifloral, 12-oxabicyclo [9.1.0] dodeca- 3, napthalenamine, 4- bromo, (-)- spathulenol, isospathulenol, tetracyclo, delta- cadinene, 1-napthalenol, 1, 2, 3, 4, 4a, 7, 1R-2, 2, 4, 8-tetrame, alloaromadendrene oxide- (2), aromadendrene oxide- (2), 6-isopropenyl-4,8a-dimethyl- , 4,4 –dimethyl -3- (3- methyl but, 1H- cycloprop [e] azulen- 7- ol, 6-isopropenyl-4,8a-dimethyl- , phthalic acid, butyl hexyl and 2-hexadecen -1- ol(498-500). Volatile contents of the essential oil of *Lantana camara* included: α-pinene 1.04, sabinene 2.12, α-terpineol 1.83, geranyl acetate1.03, β-elemene 1.03, cis-caryophyllene 16.24, α-humelene 23.26, bicyclogermacrene 12.54, aromadenrene 1477 7.00, zingeberene 1.11, germacrene-D 13.16, ß-curcumine 4.02, caryophyllene oxide 1.78, humulene oxide 2.54 and others compounds 11.28%(501-505).

Lathyrus sativus

Lathyrus sativus contained 0.92±0.01 to 1.47±0.07% fat in the seeds and 4.47% in the leaves (506-508). Fatty acid compositions of 173 different grass pea accessions have been studied. The results indicated that total saturated fatty acids, total monounsaturated fatty acids, total polyunsaturated fatty acids, and total fatty acids ranged from 295.72 to 436.94, 113.19 to 170.78, 127.39 to 179.39 and 538.04 to 778.98 mg/100g, respectively. The unsaturated fatty acids, oleic acid, linoleic acid, γ-linolenic acid, and α-linolenic acid were the main components of fatty acids, ranged from 109.22 to 163.95, 59.57 to 82.98, 16.18 to 30.38, and 45.56 to 71.59 mg/100g, respectively(509).

Lawsonia inermis

Analysis of *Lawsonia inermis* essential oil showed that apocarotenoids were the main group of constituents 33.6%, followed by the non-terpene derivatives 19.8%, oxygenated sesquiterpenes 12.4% and monoterpene hydrocarbons 9.8%, in addition to sesquiterpene hydrocarbones 8.2%, oxygenated monoterpenes 5.6%, oxygenated diterpenes 3.0% and diterpenehydrocarbons 1.6%.

A total of 72 components were identified in volatile oil of six henna samples. The samples were differ in their contents, the main identified chemical groups were aliphatic compounds (9.0–64.7%), terpenoids (5.8–45.5%) and aromatics (7.9–45.2%), with alkanes (0.9–18.5%), aldehydes (2.1–18.8%) and carboxylic acids (3.1–29.3%), monoterpenes (3.4–30.0%) and sesquiterpenes (0.8–23.7%), and phenyl propanoids (0.6–43.1%). The major constituents of these groups were n-hexadecane (0.5–4.7%), (2E)-hexenal (0.5–11.7%), acetic acid (2.8–24.5%), limonene (0.8–14.7%), carvol (3.8–7.1%), geranyl acetone (1.4–7.9%) and (E)-caryophyllene (3.3–8.4%), and (E)-anethole (0.6–35.0%)(510-512).

Lemna minor

The fatty acid composition was dominated by PUFA, 60–63% of total fatty acids, largely α-linolenic acid 41 to 47% and linoleic acid 17–18%. The lipophilic substances isolated from duckweed were: hexanal, trans-2-heptenal, caproic acid, ethycaproate, trans-2-octenal, ethylheptanoate, nonanal, 2,6-dimethylcyclohex anol, Menthol, pyrrol-2,5-dione, internal standard, tetradecane, pentadecane, dihydroactinidiolide, heptadecane, loliolide, ethyltetradecanoate, trans-neophytadiene, hexahydrofarnesylace tone, cis-neophytadiene, ethylpentadecanoate, ethylpalmitate, heneicosane, phytol, tricosane, pentacosane, heptacosane, campesterol, stigmasterol, ϒ-sitosterol, spinasterone and sitosterone(513-515).

Lepidium sativum

The seed oil extracted by solvent extraction, supercritical CO_2, and cold expression were 21.54, 18.15, and 12.60 % dry weight, respectively. Physicochemical parameters of oils extracted by solvent extraction, supercritical CO_2, and cold expression were, respectively: refractive index (nDt):1 1.47 ± 0.001, 1.47 ± 0.003 and 1.47 ± 0.002; specific gravity (g/ml): 0.91 ± 0.001, 0.90 ± 0.001 and 0.91 ± 0.001, viscosity (η): 64.3 ± 0.90, 55.5 ± 0.37 and 53.8 ± 0.6; peroxide value (mequiv peroxide/kg oil): 0.70 ± 0.13, 4.09 ± 0.16 and 2.63 ± 0.81; free fatty acid (% oleic): 0.28 ± 0.02, 0.39 ± 0.04 and 1.52 ± 0.28; saponification value (mg KOH/g):

178.85 ± 0.46, 182.23 ± 0.73 and 174 ± 0.82; unsaponifiable matter (g %): 1.65 ± 0.24, 1.39 ± 0.10 and 1.16 ± 0.30; iodine value (g of I_2 absorbed/100 g): 122 ± 0.70, 131 ± 3.26 and 123 ± 1.68[(516-521)].

Linum usitatissimum

Seeds of *Linum usitatissimum* contained about 23-39 % oil. The amount of total saturated fatty acids was 7.97 to 12.30% while the amount of total unsaturated fatty acids was 84.90 to 92.03%[(522-526)]. Sterols were the most important fraction of the unsaponiiable matter. The sterol fraction analysis showed that β-sitosterol was the most predominant sterol (51.31%), followed by campesterol (25.43%), stigmasterol (10.37%), Δ-5-avenasterol (7.71%), Δ-5-24-stigmastadienol (0.75%), brassicasterol (0.53%), clerosterol (1.52%), campesterol (0.83%), Δ-5-24-stigmastadienol (0.75%), sitostanol (0.46%), Δ-7-avenasterol (0.29%), 24-methylene-cholesterol (0.29%), campestanol (0.17%), Δ-7-stigmastenol (0.17%) and cholesterol (0.17%)[(527-529)].

Lippia nodiflora

The main essential oil components which were identified in the *Lippia nodiflora* were: 1 -mettryl-4isopropylcyclohexane: 7.8%, 1-octen-3-ol: 15.29%, 2-phenethyl alcohol: 16.40%, 2, 6-dimethyloctane: 12.3%, 3-octanol: 3.95%, α-terpineol: 4.86%, β-pinene: 8.1%, ϒ-terpinene: 6.3%, p-cymen-B-ol: 10.61% and benzaldehyde 6.80 [(530-532)].

Luffa acutangula

The oil content in the seeds of Luffa acutangula is 26%; the fatty acid composition is: linoleic acid 34%, oleic acid 24%, palmitic acid 23% and stearic acid 10%[(533)]. The seeds of *Luffa acutangula* var. amara contained fixed oil consisted of glycerides of palmitic, stearic and myristic acids. The fat contents of the kernel was 44%[(534-537)].

Luffa cylindrica

The seeds of the plant contained fat 22.17±0.28 % [(538)]. The total saturated fatty acids concentration in the seed flour was 33.07%, total monounsaturated fatty acids 14.90%, and total polyunsaturated fatty acids 52.02%. Linoleic acid (31.47%) was the most predominant in the *Luffa cylindrica* seed flour oil[(539-540)].

Lycium barbarum

Fattyacids analysis of *Lycium barbarum* fruit (Ningxia origin) and *Lycium barbarum* fruit (Mongolia origin) showed that they contained (%): palmitic acid 18.96 ± 0.0 and15.08 ± 0.0, palmitoleic acid1.01 ± 0.0 and1.00 ± 0.0, palmitoleic acid 1.16 ± 0.1 and 1.17 ± 0.1, stearic acid 2.61 ± 0.0 and 2.69 ± 0.1, oleic acid 20.07 ± 0.1 and 19.61 ± 0.4, linoleic acid 37.89 ± 0.1 and 42.2 ± 0.1, arachidic acid 1.86 ± 0.0 and 2.03 ± 0.0, α-linolenic acid 6.46 ± 0.0 and 5.39 ± 0.2, gondoic acid 3.95 ± 0.2 and 4.05 ± 0.0, behenic acid 6.03 ± 0.0 and 6.78 ± 0.1, total saturated fatty acid 29.46 and 26.58, total mono-unsaturated fatty acid 26.19 and 25.83, and total poly-unsaturated fatty acid 44.35 and 47.59% respectively[(541-543)].

Lycopus europaeus

Fatty acid composition of the fruits of *Lycopus europaeus* were: saturated fatty acid 7.2-10.4% and unsaturated fatty acid 85.8-91.7%. Fatty acid composition of the fruits of *Lycopus europaeus* (methyl esters) were: methyl dodecanoate, methyl tetradecanoate, methyl 12-methyltetradecanoate, methyl pentadecanoate, methyl 14-methylpentadecanoate, methyl (9Z)-9-hexadecenoate, methyl hexadecanoate, methyl 14-methylhexadecanoate, methyl (9E)-9-heptadecenoate, methyl heptadecanoate, methyl (9Z,12Z)-9,12-octadecadienoate, methyl (9Z,12Z,15Z)-9,12,15-octadecatrienoate, methyl (E)-9-octadecenoate, methyl octadecanoate and many other constituents [(544-545)].

Malva neglecta

Forty one components were identified in the essential oils. The main constituents of the essential oil were cineole, hexatriacontane, tetratetracontane and α-selinene [(546)]. The chemical analysis of the essential oils of the aerial parts of *Malva neglecta* from Torbat-e Heydarieh region-Iran, showed that they characterized by high percentage of spathulenol (27.0%), 1,7-diepi-α-cedrenal (10.6%), valencene (6.0%), tetrametyl neophytadiene (4.1%) and carotol (3.7%) represented the most abundant compounds. Oxygenated sesquiterpenes (49.8%) constitute about half of the total constituents followed by non-terpene hydrocarbons 26.2%, sesquiterpene hydrocarbons 6.0%,, dieterpene hydrocarbons 4.0% and oxygenated monoterpenes 2.0%[(547-548)].

Mangifera indica

The total mango fat was 7.28-13.7 % and their fatty acid composition was: palmitic acid: 4.87-10.93%, stearic acid: 24.22-47.62%, oleic acid: 37.01-58.59%, linoleic acid 3.66-8.20 and arachidic acid: not detected - 2.43%. While triglyceride composition of the seeds fat included: 1,3-distearoyl-2-oleoyl-glycerol, 1-stearoyl-2,3-dioleoyl-glycerol, (1-palmitoyl-2-oleoyl-3-stearoyl-glycerol, 1-palmitoyl-2,3-dioleoyl-glycerol, 1-stearoyl-2-oleoyl-3-arachidoyl-glycerol, 1,2,3-trioleoyl-glycerol and 1,3-dipalmitoyl-2-oleoylglycerol[(549-561)].

Orchis mascula

The preliminary phytochemical screening showed that the crude extract of *Orchis mascula* contained terpenes, sterols and trace of oil[(562)].

Onopordum acanthium

The seeds contained 14.36 ± 0.56% oils. Fatty acid composition of *Onopordum acanthium* seed oils from Bulgaria was: lauricoleic 11, myristic 2, miristicoleic 19, palmitic 99, palmitoleic 1, margaric 1, stearic 9, oleic 342, linoleic 511, arachidic 1, gadoleic 1and behenic 3 g/kg. Sterol composition of seed oils: cholesterol 11, brassisterol 16, campesterol 128, Δ7-campesterol 48, stigmasterol 33, β-sitosterol 632, Δ5-avenasterol 36, Δ7-stigmasterol 57 and Δ7-avenasterol 39 g/kg. Phospoholipid composition of seed oils: phosphatidylcholine 183, phosphatidyl ethanolamine188, phosphatidylinositol 320, phosphatidic acids 147 and diphosphatidyl glycerol 162 g/kg. While, tocopherol composition of seed oils: α - tocopherol 911 and α - tocotrienol 89 g/kg(563-565).

Ononis spinosa

GC-MS analysis of chloroform fraction of ethanolic root extract showed that it contained triterpene 9,19-cyclo-27-lanostan-25-on as the major constituent (13.17%), followed by ß-sitosterol (9.61%), medicarpin (9.4%), maackiain (8.01%) and linolic acid (7.98%)(566-567).

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